2022 Wildfire Mitigation Plan Update

Pacific Gas and Electric Company®

February 25, 2022

PACIFIC GAS AND ELECTRIC COMPANY
2022 WILDFIRE MITIGATION PLAN

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

TABLE OF CONTENTS
(CONTINUED)

PACIFIC GAS AND ELECTRIC COMPANY
2022 WILDFIRE MITIGATION PLAN

LIST OF TABLES

LIST OF TABLES
(CONTINUED)

LIST OF TABLES
(CONTINUED)

PACIFIC GAS AND ELECTRIC COMPANY
2022 WILDFIRE MITIGATION PLAN

LIST OF TABLES
(CONTINUED)

LIST OF TABLES
(CONTINUED)

LIST OF TABLES
(CONTINUED)

PACIFIC GAS AND ELECTRIC COMPANY
2022 WILDFIRE MITIGATION PLAN

LIST OF FIGURES

LIST OF FIGURES
(CONTINUED)

LIST OF FIGURES
(CONTINUED)

LIST OF FIGURES
(CONTINUED)

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

EXECUTIVE SUMMARY

PACIFIC GAS AND ELECTRIC COMPANY
2022 WILDFIRE MITIGATION PLAN
EXECUTIVE SUMMARY

A. Introduction

Our stand is that catastrophic wildfires shall stop. In 2021, we made significant progress, but the wildfire risk continues to change and so our efforts must evolve also. Our 2022 Wildfire Mitigation Plan (WMP) reflects our learnings, new ideas and feedback from stakeholders including the Office of Energy Infrastructure Safety (Energy Safety), the California Public Utilities Commission (CPUC or Commission), our Federal Monitor, the Governor's operational observer, and other engaged stakeholders. Our WMP outlines our broad program to reduce wildfires, with many complementary parts that work together to boldly address this risk.

In 2020 and 2021, California had its 5th and 2nd driest water years, respectively, in the last century.[1] Climate scientists at the University of California, Los Angeles recently concluded that for the Western United States "2000-2021 [was] the driest 22-year period since 800 A.D., which is as far as the data goes back."[2] PG&E's entire service area experienced extreme and severe drought conditions through much of 2021 prior to the rainstorms that occurred in the latter part of the year.

California experienced unprecedented increases in the wildfire risk as a result of drought and the ongoing impacts of climate change. For example, on non-Red Flag Warning (RFW)[3] days in 2021, there was a more than 500 percent increase in acreage burned, as compared to the average acreage in the prior four years. Simply put, the wildfire threat is growing, and it is PG&E's mission to reduce the risk of this threat to keep our customers and communities safe. This means our programs must evolve commensurate with the risks.

As outlined in this 2022 WMP, we are deploying a comprehensive and multi-faceted wildfire safety strategy, utilizing programs and actions that have proven effective at reducing wildfire risk and expanding innovative programs and actions initiated in prior years, such as:

- **Moving Forward to Underground Powerlines and Harden Our System** – Aggressively moving forward with our program to underground 10,000 circuit miles of distribution lines in High Fire Threat Districts (HFTD)—which effectively eliminates the ignition risk for overhead lines that have been placed underground

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1 Water years run from October 1 to September 30. See Water Year 2021: An Extreme Year (ca.gov).

2 How Bad Is the Western Drought? Worst in 12 Centuries, Study Finds – The New York Times (nytimes.com).

3 A RFW indicates a level of wildfire risk from weather conditions, as declared by the National Weather Service.

and hardening additional miles with covered conductor or line removal using a risk-ranked approach to prioritize work. We will be working closely with federal, state and local agency partners, such as Cal Trans, as well as other stakeholders to build strong relationships and coordinate efforts for this innovative and bold program;

- **Expanding Enhanced Powerline Safety Settings (EPSS) to All Risk Areas** – Expanding the scope of EPSS, where we re-engineer electrical equipment settings to rapidly, automatically shut off power if an object comes into contact with a distribution line until we can patrol the line to ensure there is no wildfire ignition risk. These safety settings resulted in an 80 percent reduction in ignitions compared to the prior three-year average in our 2021 pilot program. In 2022, we will implement EPSS on all of our distribution lines in HFTD areas and High Fire Risk Areas (HFRA), as well as select non-HFTD areas that are adjacent to HFTD areas and HFRA. Much like the work we have done to improve the PSPS program, we will continue to adjust these safety settings, undertaking a more surgical approach to only activate the settings in areas most at risk and to limit reliability impacts to our customers;

- **Applying New Mitigation Technology** – Deploying equipment to reduce the potential for wildfire ignitions and mitigate wildfire impacts, such as Supervisory Control and Data Acquisition (SCADA)-enabled automated sectionalizing devices, single phase recloser sets, and advanced system sensors;

- **Continuing Aggressive Vegetation Management Practices** – Continuing our extensive vegetation management that is above and beyond regulatory requirements, such as our Enhanced Vegetation Management (EVM) program;

- **Performing Enhanced Inspections and Risk Modelling** – Conducting enhanced detailed inspections (i.e., inspections that include significantly more detail than traditional detailed inspections completed prior to 2020) of our facilities in HFTD areas and deploying the most up to date risk modeling capabilities to support our data-driven, risk-informed approach to wildfire mitigation;

- **Improving Situational Awareness** – Maximizing the use of cameras and weather stations to identify potential wildfire ignitions and risk and expand the situational awareness capabilities of PG&E, the California Department of Forestry and Fire Protection (CAL FIRE), first responders and the public; and,

- **Utilizing PSPS as a Final Safety Action** – Continuing to implement as a measure of last resort our data-driven, model-based Public Safety Power Shutoff (PSPS) protocols that resulted in more targeted and smaller PSPS events in 2021.

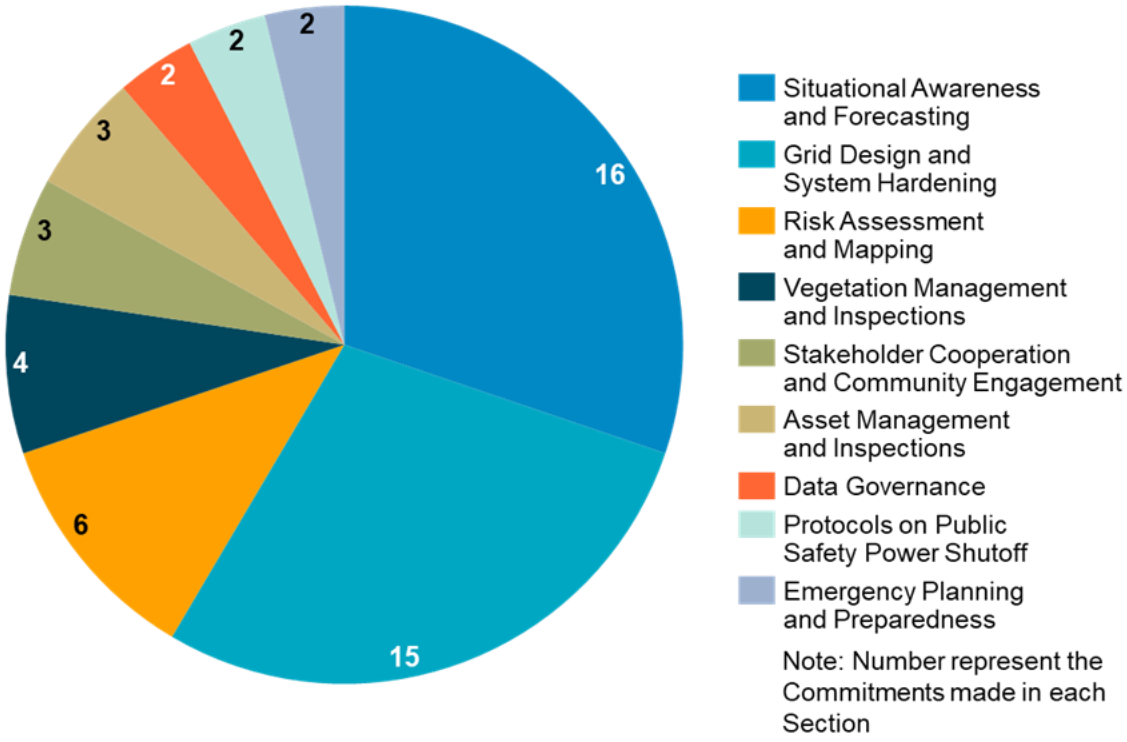
As with the 2021 WMP, our 2022 WMP includes multiple short- and long-term actions and programs critical to increasing safety and reducing risk. Thus, we carry forward our strategy of deploying a series of integrated programs designed to flex and evolve to meet the changing climate conditions and other learnings.

Below, we provide a summary of our WMP progress and additional steps taken in 2021, an overview of our 2022 WMP, and a discussion of the challenges ahead.

B. Overview of 2021 WMP Progress

The 2021 WMP included 53 commitments focused on wildfire mitigation activities such as risk modeling, system hardening, EVM, PSPS, and situational awareness. Despite the challenges posed by the COVID-19 pandemic, our team, including both PG&E coworkers and our contractor partners, was able to complete all of the commitments by year end 2021 and exceeded unit targets in a number of cases. From a timing perspective, 50 of the commitments were completed by the initial target date specified in the 2021 WMP. The remaining 3 commitments were completed later than the target date included in the 2021 WMP but were completed by the end of 2021. Our 53 commitments included a comprehensive set of wildfire mitigation programs developed to holistically address wildfire risks, as reflected in Figure PG&E-ES-1 below:

FIGURE PG&E-ES-1:
2021 WMP COMMITMENTS



In addition, many of our quantitative commitments were exceeded as shown in Figure PG&E-ES-2 below:

FIGURE PG&E-ES-2:
KEY QUANTITATIVE COMMITMENT RESULTS

Plan Area	Wildfire Mitigation Plan Commitment	Target	Actual	% of Plan
Situational Awareness and Forecasting	Enhancements to Weather Station Project (Installations and Optimization)	300	308	103%
	HD Cameras	135	153	113%
Grid Design and System Hardening	PSPS Mitigation – Temporary Distribution Microgrids	5	5	100%
	PSPS Mitigation – Substation Distribution Microgrids	8	9	113%
	Emergency Back-up Generation – PG&E Service & Materials Distribution Centers	23	24	104%
	Remote Grid	1	1	100%
	Distribution Sectionalizing (automated devices)	250	269	108%
	Transmission Switches	29	41	141%
	Distribution line legacy 4C controllers	81	81	100%
	Fuse Savers (Single phase reclosers)	70	71	101%
	Expulsion Fuse Replacement (non-exempt equipment)	1,200	1,429	119%
	Surge Arrester Replacements	15,000	15,465	103%
	System Hardening	180	210	117%
	Butte County Rebuild	23	24	104%
	System Hardening - Transmission Conductor	92	104	113%
Asset Management and Inspections	Distribution HFTD Inspections (poles)	480,749	480,749	100%
	Substation HFTD Inspections (substations)	142	142	100%
	Transmission HFTD Inspections (structures)	26,826	26,826	100%
	Infrared Inspections of Transmission Electric Lines and Equipment	4,215	4,211	100%
Vegetation Management and Inspections	EVM	1,800	1,983	110%
	VM Transmission Right of Way Expansion	200	218	109%

Note: We did not perform four miles of the infrared inspections of transmission electric lines due to the lines being de-energized at the planned time of inspection and not being re-energized until 2022. By the end of 2021, we had completed the 4,211 miles that were energized.

We also implemented improvements to our risk modeling and risk-informed planning, including:

- Deploying significant improvements in our risk modeling capabilities to inform our workplans on programs such as system hardening and EVM;
- Prioritizing risk-ranked repairs by evaluating maintenance tags using factors such as wildfire ignition likelihood and consequences and achieving a risk score reduction of 62 percent by the end of 2021 as a result of successful tag execution.
- Increasing the granularity of mitigation initiatives and corresponding Risk Spend Efficiency (RSE) scores so that we can provide the greater risk reduction for every customer dollar invested; and,
- Continuing to reduce the number of customers impacted by PSPS events, as we implemented enhanced PSPS protocols and modeling.

We also improved our execution by implementing:

- The Lean Operating System, a rigorous process that provides visibility to our commitments, engages our coworkers in daily and weekly operating reviews,

employs a set of problem solving tools that are used when metrics are not being achieved and lastly standardizes our work so that our outcomes are visible, controllable and predictable; and,

- The Wildfire Risk Governance Steering Committee, which centralized oversight of our wildfire mitigation programs.

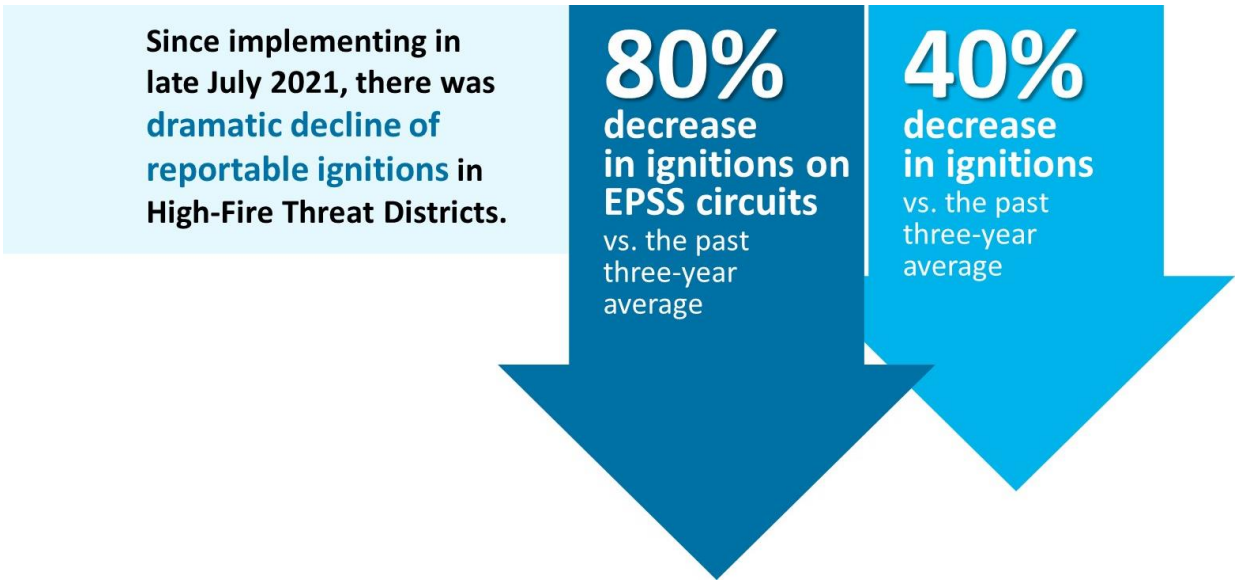
C. Additional Steps Taken During 2021

In July 2021, we also took two bold steps to implement programs that we believe will substantially reduce wildfire risks even further; one of which has already delivered dramatic results.

First, following an internal assessment and external benchmarking, we announced our 10,000-mile underground program to eliminate wildfire risk from overhead electric facilities. The undergrounding program is described in Section 7.3.3.16.

Second, we implemented EPSS on approximately 11,500 miles of distribution circuits, or 45 percent of the circuits in HFTD areas. Through EPSS, we addressed the evolving wildfire risk and dramatically decreased CPUC-reportable ignitions, as indicated in Figure PG&E-ES-3 below:

FIGURE PG&E-ES-3:
IGNITION REDUCTION ON EPSS ENABLED CIRCUITS AND OVERALL DECREASES IN HFTD AREA CPUC-REPORTABLE IGNITIONS AFTER EPSS ENABLED



Note: The reduction in CPUC reportable ignitions occurred between July 28, 2021 and October 20, 2021.

While EPSS resulted in fewer fire ignitions, increased public safety, and reduced the risk of a catastrophic wildfire, impacted customers in high fire threat areas also experienced more outages. To address outages and customer impacts, we re-engineered the sensitivity of devices to continue to provide ignition risk reduction

while reducing the likelihood of an outage.

In addition, we improved coordination between our devices to reduce the size of outages and coordination of patrol crews for faster restoration times. As a result, average customer outage duration on EPSS-enabled circuits decreased by 40 percent after these changes were implemented. Despite reductions in customer outages, we appreciate that we can certainly do more.

Given the significant ignition reduction and the criticality of reducing ignitions that could cause a catastrophic wildfire, we are expanding the EPSS program in 2022 to all 25,500 distribution line miles in HFTD and HFRA areas, as well as select non-HFTD areas in our service area. We recognize that EPSS may result in increased outages in 2022 and so we will be continuing our efforts to engineer the best technical solutions including taking additional operational actions to reduce outages and expanding customer support offerings. We will also be evaluating integrating EPSS and EVM, as well as other wildfire initiatives, so that these programs together most effectively mitigate wildfire risks and reduce customer outage impacts. The EPSS program is described in more detail below and in Section 7.3.6.8.

D. Overview of PG&E's 2022 WMP

Our 2022 WMP has three overarching goals, consistent with our established approach to wildfire risk reduction as shown in Figure PG&E-ES-4 below:

FIGURE PG&E-ES-4:
PG&E 2022 WMP GOALS

Each of our specific wildfire programs are in the service of these goals.[4] Below, we summarize these programs within each of the wildfire mitigation categories identified by Energy Safety.

1) **Risk Assessment and Mapping** – PG&E continues to advance our capabilities in wildfire risk modeling and the visualization of risk model outputs to enable better decision-making. Our 2021 and 2022 activities include:

[4] In the WMP, the terms initiative and program are used interchangeably. In this Executive Summary, we will use the term program for brevity and consistency rather than referring to "initiatives and programs."

TABLE PG&E-ES-1:
RISK ASSESSMENT AND MAPPING ACTIVITIES

2021	2022
In 2021, we enhanced our risk modeling to inform our wildfire mitigation activities by: • EXPANDING geographical coverage, adding input data sources, refining probability of ignition modules; • MODELING wildfire risk for transmission assets through the Wildfire Transmission Risk Model; • DEVELOPING an initial PSPS Consequence Model at a circuit level; and, • DEVELOPING spatial model views in our enterprise data management platform to inform EVM and System Hardening programs.	In 2022, we will continue building on this risk modeling foundation to effectively make risk-informed decisions in the planning and execution of wildfire risk reduction activities by: • DEVELOPING new modeling for ignition risk; • UTILIZING the PSPS Consequence Model; • INCORPORATING ingress/egress in risk modeling; and, • ACTIVELY PARTICIPATING in the risk modeling working group led by Energy Safety.

Additional details on our Risk Assessment and Mapping programs are provided in Section 7.3.1.

2) **Situational Awareness and Forecasting** – Our situational awareness and forecasting programs reduce the risk of wildfire by monitoring weather conditions and potential fire conditions through our network of weather stations, high-definition cameras and sensors, as well as state-of-the-art weather forecasting that is used by PG&E and other agencies. We will continue to make the information obtained from this technology available to CalFIRE, first responders, and the public. Our 2021 and 2022 activities include:

TABLE PG&E-ES-2:
SITUATIONAL AWARENESS AND FORECASTING ACTIVITIES

2021	2022
In 2021, we increased our situational awareness of potential wildfire ignitions and risk by: • INCREASING weather modeling inputs and outputs; • LAUNCHING two proof-of-concept pilots to evaluate the effectiveness of artificial intelligence and machine learning for high-definition cameras to detect wildfires; and, • INSTALLING an additional 308 weather stations and 153 high-definition cameras in our service area.	In 2022, we will continue to expand our situational awareness by: • REFINING the models that we use for situational awareness; • INSTALLING 100 additional weather stations and 98 high-definition cameras; and • DEPLOYING Distribution Fault Anticipation and Early Fault Detection technology and assessing Sensor IQ™ (SIQ) technology.

Additional details on our Situational Awareness and Forecasting programs are provided in Section 7.3.2.

3) **Grid Design and System Hardening** – PG&E's grid design and system hardening initiatives significantly reduce wildfire risks. Our comprehensive System Hardening program is a key strategy to mitigate wildfire risk caused by overhead assets. Our 2021 and 2022 activities include:

TABLE PG&E-ES-3:
GRID DESIGN AND SYSTEM HARDENING ACTIVITIES

2021	2022
In 2021, we advanced our system hardening and grid design efforts by: • COMPLETING 210 miles of distribution system hardening (which includes undergrounding, overhead hardening, microgrid and Remote Grid); • HARDENING or removing 104 miles of transmission lines; • SYSTEMATICALLY REPLACING equipment in HFTD areas that creates ignition risks, such as non-exempt fuses (more than 1,400) and surge arresters (more than 15,000); and, • LAUNCHING our plan to underground 10,000 miles of overhead distribution lines in HFTD areas.	In 2022, we are rapidly expanding our system hardening efforts by: • COMPLETING 470 circuit miles of system hardening work which includes overhead system hardening, undergrounding and removal of overhead lines in HFTD or buffer zone areas; • COMPLETING at least 175 circuit miles of undergrounding work, including Butte County Rebuild efforts and other distribution system hardening work; • REPLACING or removing 32 miles of transmission conductor to reduce ignition risk from those lines; • INSTALLING additional automated devices which allow us to sectionalize our grid and reduce the impact of PSPS events; and, • REPLACING equipment in HFTD areas that creates ignition risks, such as non-exempt fuses (3,000) and surge arresters (~4,500, all known, remaining in HFTD areas).

Additional details on our Grid Design and System Hardening programs are provided in Section 7.3.3.

4) **Asset Management and Inspections** – The asset information we obtain through inspection programs is essential to informing our operational risk models and "learn" over time to become more effective at predicting ignition risks. Inspection programs use multiple data gathering methods, including patrol, physical testing (e.g. intrusive pole), ground, aerial, infrared, and Light Detection and Ranging (LiDAR), among others. Our 2021 and 2022 activities include:

TABLE PG&E-ES-4:
ASSET MANAGEMENT AND INSPECTIONS ACTIVITIES

2021	2022
In 2021, we continued our enhanced inspection programs designed to reduce the potential for wildfire ignition from our electrical equipment by: • COMPLETING enhanced detailed inspections on all distribution poles and transmission structures in Tier 3 and Zone 1 HFTD areas and on approximately 33 percent of the Tier 2 HFTD and HFRA distribution poles and transmission structures; • COMPLETING supplemental ground and aerial inspections of 71 distribution substations, 33 transmission substations and 38 hydro substations; • USING infrared technology to identify potential risks not easily detectable, and LiDAR imaging to improve our knowledge about our assets; and, • UPGRADING our intrusive pole inspection Program's field hardware and software to enhance record keeping and data system integrations.	For 2022, our inspections and asset management programs will reduce wildfire ignition risk by: • CONTINUING our enhanced detailed inspection programs for distribution and transmission facilities; • COMPLETING supplemental ground and aerial inspections of 86 distribution substations, 43 transmission substations, and 52 hydroelectric substations to reduce potential ignition risks from these facilities located throughout HFTD areas; • CONTINUING to evolve the effectiveness of our inspection processes and procedures; and, • PERFORMING LiDAR data acquisition on distribution and transmission facilities.

Additional details on our Asset Management and Inspections programs are provided in Section 7.3.4.

5) **Vegetation Management and Inspections** – Our Vegetation Management program, components of which exceed regulatory requirements, is critical to mitigating wildfire risk. Our vegetation management team inspects and identifies needed vegetation maintenance on all distribution and transmission circuit miles in PG&E's service area on a recurring cycle through Routine and Tree Mortality Patrols, as well as Pole Clearing. Our EVM program goes above and beyond regulatory requirements for distribution lines by expanding minimum clearances and removing overhang in HFTD areas. Our 2021 and 2022 activities include:

TABLE PG&E-ES-5:
VEGETATION MANAGEMENT AND INSPECTIONS ACTIVITIES

2021	2022
In 2021, in addition to the work performed in our Routine, Tree Mortality and Pole Clearing programs, we were able to reduce the potential for vegetation caused ignitions by: • COMPLETING 1,983 miles of EVM work, 98 percent of which was focused on the highest 20 percent or risk-ranked Circuit Protection Zones; • EXPANDING 218 miles of transmission ROWs to reduce vegetation contact with our transmission facilities; and, • ENHANCING our vegetation management work verification and training to ensure the quality of work performed.	In 2022, we will continue to perform our vegetation management programs by: • PERFORMING 1,800 miles of EVM work; • COMPLETING detailed LiDAR inspections; • CONTINUING a pilot program to include an enhanced process to perform visual assessment of all sides of potential strike trees on routine vegetation management patrols in HFTDs. The pilot program will inform an implementation of this enhanced process on routine vegetation management patrols in HFTDs; and, • UNDERTAKING extensive work quality audits and reviews through our Quality Assurance Vegetation Management and Quality Verification Vegetation Management programs.

Additional details on our Vegetation Management and Inspections programs are provided in Section 7.3.5.

6) **Grid Operations and Protocols** – PG&E is focused on safely operating our electrical grid in a manner that reduces the risk of wildfire ignitions, including ongoing activities such as disabling reclosers and expanding programs, specifically EPSS. Our 2021 and 2022 activities include:

TABLE PG&E-ES-6:
GRID OPERATIONS AND PROTOCOLS ACTIVITIES

2021	2022
In 2021, we made our system safer through our grid operations by: • IMPLEMENTING EPSS on approximately 11,500 miles of distribution circuits in HFTD areas (45 percent of the circuits), which significantly reduced CPUC-reportable ignitions; • DISABLING automatic reclosers in HFTD areas prior to fire season and for the duration of the entire fire season; • UTILIZING our Safety and Infrastructure Protection Team (SIPT) to support fire prevention and mitigation activities, as well as "on call" status during the summer preparedness period and our Public Safety Specialists (PSS) to help inform our wildfire mitigation efforts; and, • IMPROVING the PSPS re-energization protocols by implementing "all clear zones" and refining external communications and customer notifications processes.	In 2022, we plan to expand our grid operations and protocols to reduce potential ignitions by: • EXPANDING EPSS to all HFTD and HFRA areas, as well as select non-HFTD areas adjacent to HFTD and HFRA to achieve significant ignition reduction we experienced in 2021; • ENGINEERING our equipment settings to reduce the reliability impacts of EPSS and providing support and extensive communication with impacted customers and communities; and, • CONTINUING other operational mitigations, such as disabling reclosing on all automatic devices within the HFTD and HFRA areas during fire season.

Additional details on our Grid Operations and Protocols programs are provided in Section 7.3.6.

7) **Data Governance** – Our data governance initiatives primarily support other WMP initiatives, which depend on access to accurate data for situational intelligence, analysis and insight, decision-making, and regulatory reporting. Our 2021 and 2022 activities include:

TABLE PG&E-ES-7:
DATA GOVERNANCE ACTIVITIES

2021	2022
In 2021, we continued to expand our data driven approach to wildfire mitigation by: • INCREASING our capacity to deliver new, high-quality data objects into Foundry; and, • DEVELOPING eight new wildfire-related analytic and situational intelligence products.	In 2022, we will be building on our data capabilities by: • EXPANDING the electric operations data available in our data platform; and, • DEVELOPING new analytic and situational intelligence products within the data platform, and maturing platform governance.

Additional details on our Data Governance programs are provided in Section 7.3.7.

8) **Resource Allocation and Methodology** – We have developed analytical tools to evaluate risk and risk mitigations and prioritize work to address our highest risks, particularly wildfires, more effectively. Our 2021 and 2022 activities include:

TABLE PG&E-ES-8:
RESOURCE ALLOCATION AND METHODOLOGY ACTIVITIES

2021	2022
In 2021, we developed a broader ability to analyze risk and use this analysis in our work planning by: • EXPANDING RSE scores to more risk mitigation and control programs; and, • ENGAGING with a third-party technical advising group to perform an assessment of RSE methodologies used in the 2021 WMP.	In 2022, we plan to continue expanding the use of our risk analyses by: • IMPLEMENTING the third-party technical advising group findings; • ESTABLISHING an RSE Governance Team; and, • ENHANCING our use of RSEs as an important tool to evaluate risk initiatives and key inputs into the overall decision-making process.

Additional details on our Resource Allocation and Methodology programs are provided in Section 7.3.8.

9) **Emergency Planning and Preparedness** – PG&E has developed an emergency response plan that is focused on protecting life and property and communicating information as quickly as possible to first responders, local and state authorities, and our communities and customers. Our highly-qualified workforce is trained on protocols to respond to any incident and restore power safely. In the event of a major emergency, we have a dedicated customer support team to assist impacted customers. Our 2021 and 2022 activities include:

TABLE PG&E-ES-9:
EMERGENCY PLANNING AND PREPAREDNESS ACTIVITIES

2021	2022
In 2021, we continued to enhance our emergency planning preparation by: • ADOPTING web-based training sessions for emergency support personnel training; • INCREASING the number of line workers to support service restoration; and, • INCREASING public awareness of emergency planning and preparedness information through our communications efforts.	In 2022, we intend to expand these capabilities by: • TRAINING all profiled employees on restoration protocols; • CONDUCTING field exercises for all impacted divisions; • DEVELOPING a communications and operations plan that engages external agencies for inclusion in after-action reviews; and, • CONDUCTING multi-channel awareness campaigns with a focus on customers impacted by PSPS and EPSS events and customers with access or functional needs.

Additional details on our Emergency Planning and Preparedness programs are provided in Section 7.3.9.

10) **Stakeholder Cooperation and Community Engagement** – Working with agencies and customers is an important part of our wildfire mitigation efforts. We recognize that a one-size-fits-all approach to engagement does not necessarily consider a community's specific priorities and needs. Our 2021 and 2022 activities include:

TABLE PG&E-ES-10:
STAKEHOLDER COOPERATION AND COMMUNITY ENGAGEMENT ACTIVITIES

2021	2022
In 2021, we worked effectively to communicate with our communities, customers, and local and state agencies by: • CONTINUING to focus on localized engagement; • INCREASING public awareness and support of utility wildfire mitigation activity by working closely with agencies and critical facilities to ensure they are informed of PG&E's emergency planning and preparedness resources and actions; and, • HOSTING over 390 meetings with agencies to share information related to PG&E's wildfire mitigation efforts.	In 2022, we will continue communicating critical wildfire and PSPS information and be better informed about customer and community needs by: • LISTENING to customers, community leaders, and community-based organizations to fully understand and respond to concerns and feedback about communications; • PARTICIPATING in various industry groups to benchmark and identify potential alternative solutions from industry leaders around the world; and • HOSTING events and meetings designed to inform and coordinate with local agencies and communities and our customers.

Additional details on our Stakeholder Cooperation and Community Engagement programs are provided in Section 7.3.10.

In addition to these mitigation categories, we will also continue to use our PSPS protocols as a final option when necessary to keep our customers and our communities safe. The more targeted, smaller, and shorter PSPS events in 2021 resulted from a combination of favorable weather conditions, enhancements to our electrical system, the incorporation of feedback from our customers and our communities, and continuous improvement based on lessons learned from past events. In 2021, these continuous improvements included enhancements to meteorology modeling that incorporated weather, tree overstrike, and equipment condition data into machine learning, PSPS Distribution Scoping Guidance Updates, Transmission PSPS Scoping Protocols, a PSPS Risk-Benefit Assessment, and our Re-energization Strategy and Protocols.

In 2022, we plan to continue to make progress to minimize customer impacts during PSPS events by focusing on three major areas: (1) customer support efforts; (2) restoration; and (3) mitigation initiatives. Additional details on our PSPS initiatives are provided in Section 8.

E. Challenges Ahead

We are working with tremendous urgency to reduce the risk of wildfires in our service area by implementing risk-informed and data-driven programs and mitigations. Looking ahead, the climate change challenges for California are significant and growing. As the United States Department of Agriculture (which includes the National Forest Service) Secretary Tom Vilsack recently noted in announcing a 10-year strategy to reduce wildfire risk in the Western United States:

> [O]ur experts expect the trend [of wildfires] will only worsen with the effects of a changing climate, so working together toward common goals across boundaries and jurisdictions is essential to the future of these landscapes and the people who live there.[5]

Changes in weather patterns combined with California's vegetation "debt" (i.e., the amount of burnable fuel on forest lands) further highlight the wildfire risk that California can expect will only increase for the foreseeable future.

These concerns are particularly true for PG&E's service area. Over half of PG&E's service area lies in HFTD areas identified by the Commission in 2018.[6] Roughly one-third of PG&E's total overhead assets, or approximately 5,500 line-miles of electric transmission and 25,500 line-miles of distribution assets lie within these HFTDs. In addition, PG&E has identified HFRAs (areas outside Tier 2 and Tier 3 HFTD areas) that represent areas where there are risk factors for potential wildfires. PG&E's HFTD and HFRA areas are identified in Figure PG&E-ES-5 below.

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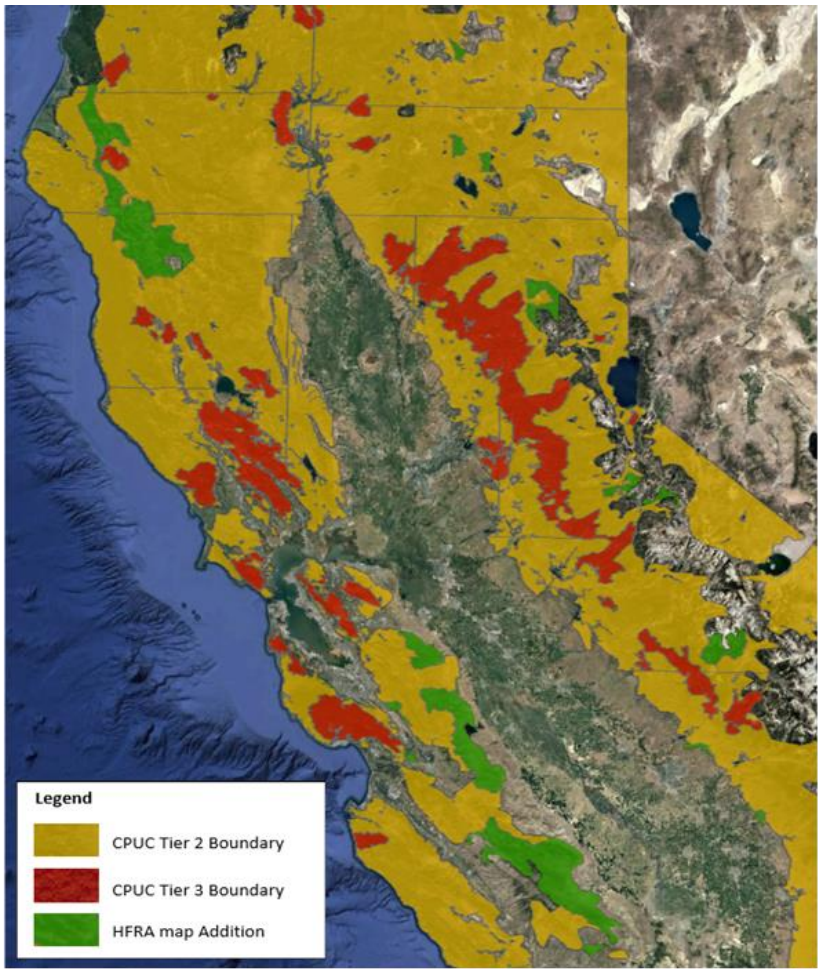
5 Available at: Secretary Vilsack Announces New 10-Year Strategy to Confront the Wildfire Crisis | USDA.

6 Available at: www.cpuc.ca.gov/firethreatmaps.

FIGURE PG&E-ES-5:
HFTD AND HFRA AREAS IN PG&E SERVICE AREA



The 2021 drought and wildfire season reinforced the importance of collaboration in wildfire mitigation. We appreciate the partnership with Energy Safety, the CPUC, local, state, and federal policymakers and legislators, stakeholders, our customers, and our communities to make every effort to reduce wildfire risk and end catastrophic wildfires.

F. Conclusion

The programs and initiatives described in this 2022 WMP provide a comprehensive, innovative and multi-faceted approach to wildfire risk reduction using the best tools, techniques, and technology available today and reflect the continuous evolution of our approach. The wildfire risk in our service area is changing rapidly, and we are moving boldly to address it. In such a rapidly changing environment we know we must be open to the ideas of others and feedback. We look forward to receiving more input from and working collaboratively with Energy Safety, the CPUC, local and state agencies, communities, and our customers and to achieve our stand that catastrophic wildfires shall stop.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 1

PERSONS RESPONSIBLE FOR EXECUTING THE WILDFIRE MITIGATION PLAN

1. Persons Responsible for Executing the Wildfire Mitigation Plan

Provide an accounting of the responsibilities of the responsible person(s) executing the plan, including:

1. Executive level with overall responsibility

2. Program owners specific to each component of the plan

Title, credentials, and components of responsible person(s) must be released publicly, but other contact information may be provided in a redacted file attached to the Wildfire Mitigation Plan (WMP) submission.

The following individuals have responsibilities for oversight, governance and execution of Pacific Gas and Electric Company's (PG&E) 2022 Wildfire Mitigation Plan (WMP). While hundreds of leaders, and thousands of employees and contractors, contribute to the WMP activities or have ownership or accountability for individual initiatives or other portions of the WMP, we have identified below the leaders who have general responsibility for the referenced sections of the 2022 WMP.

Executive-Level Owner With Overall Responsibility:

Sumeet Singh, Executive Vice President, Chief Risk Officer and Chief Safety Officer

- E-mail – [redacted]
- Telephone number – [redacted]

Program Owners for Each Component of Plan:

TABLE PG&E-1-1:
PROGRAM OWNERS FOR EACH COMPONENT OF PLAN

Section	Name	Title	E-Mail	Phone Number	Component
Section 1: Persons Responsible for Executing the Plan	Sumeet Singh	Executive Vice President, Chief Risk Officer and Chief Safety Officer	[redacted]		General Oversight and Management of WMP Activities
Section 2: Adherence to Statutory Requirements	Jay Leyno	Director, Community Wildfire Safety Program			All
Section 3: Actuals and Planned Spending	Jay Leyno	Director, Community Wildfire Safety Program			All
Section 4: Lessons Learned and Risk Trends	Jay Leyno	Director, Community Wildfire Safety Program			4.1 – Lessons Learned 4.6 – Progress Reporting
	Paul McGregor	Director, Electric Operations (EO) Risk Management and Analytics			4.2, 4.3, & 4.5 – Risk Understanding and Modeling
	Ali Moazed	Director, Data Management & Analytics			4.4 – Research
Section 5: Inputs to the Plan and Directional Vision	Jay Leyno	Director, Community Wildfire Safety Program			All Note: Operational teams support Section 5.4 on skilled resource details
Section 6: Metrics and Underlying Data	Jay Leyno	Director, Community Wildfire Safety Program			All Note: Various specific teams support data collection

TABLE PG&E-1-1:
PROGRAM OWNERS FOR EACH COMPONENT OF PLAN
(CONTINUED)

Section	Name	Title	E-Mail	Phone Number	Component
Section 7: Mitigation Initiatives	Jay Leyno	Director, Community Wildfire Safety Program	[redacted]		7.1.C & D – Wildfire Mitigation Strategy 7.2.A, B & D – WMP Implementation.
	Ali Moazed	Director, Data Management & Analytics			7.1.E – New or Emerging Technologies 7.3.7 – Data Governance
	Paul McGregor	Director, EO Risk Management and Analytics			7.1.A – PG&E's Approach to Managing Wildfire Risk 7.1.B – Risk Modeling Outcomes in Decision-Making and Mitigations 7.1.F – Risk 7.3.1 – Risk Assessment and Mapping
	Angie Gibson	VP, Emergency Preparedness & Response			7.3.2 – Situational Awareness and Forecasting 7.3.6 – Grid Operations and Protocols 7.3.9 – Emergency Planning and Preparedness

TABLE PG&E-1-1:
PROGRAM OWNERS FOR EACH COMPONENT OF PLAN
(CONTINUED)

Section	Name	Title	E-Mail	Phone Number	Component
	Mark Esguerra	Sr. Director, EO Asset Strategy	[redacted]		7.1.G – Grid Design and System Hardening Mitigations 7.1.H – Grid Design and System Hardening High-Level Maps 7.1.I – Asset Management and Inspections Geographic Information System (GIS) Layer (Distribution) 7.3.3 – Grid Design and System Hardening 7.3.4 – Asset Management and Inspections 7.3.8 – Resource Allocation Methodology
	Maria Ly	Director, Transmission, Substation & Storage Strategy			7.1.I – Asset Management and Inspections GIS Layer (Transmission/ Substation)
	Tracy Maratukulam	Director, Engagement, Strategy and Programs			7.3.10 – Stakeholder Cooperation and Community Engagement
	Steven Fischer	Sr Director, Vegetation Management Ops			7.1.J – Enhanced Clearances GIS Layer 7.3.5 – Vegetation Management and Inspections
	Eric Thomas	System Inspections Quality Control			7.2.C – Monitor and Audit Inspection Effectiveness

TABLE PG&E-1-1:
PROGRAM OWNERS FOR EACH COMPONENT OF PLAN
(CONTINUED)

Section	Name	Title	E-Mail	Phone Number	Component
	Matt Whorton	Director, Business Finance Electric Operations & Engineering Strategy	[redacted]		7.3.a – Financial Data
Section 8: Public Safety Power Shutoff (PSPS)	Shawn Holder	Director, Public Safety Power Shut Off			8.1 – Directional Vision for PSPS 8.2 – Protocols on PSPS 8.3 – Projected Changes to PSPS Impact 8.5 – PSPS-Specific Metrics 8.6 – Identification of Frequently De-Energized Circuits
	Robert Cupp	Director, Emergency Field Operations			8.2.4 – Re-Energization Strategy
	Tracy Maratukulam	Director, Engagement, Strategy and Programs			8.2.2 – Strategy to Minimize Public Safety Risk 8.2.5 – Customer, Agency, and External Communications 8.4 – Engaging Vulnerable Communities
Section 9: Appendix	Jay Leyno	Director, Community Wildfire Safety Program			All
	Paul McGregor	Director, EO Risk Management and Analytics			9.5 – PG&E Glossary of Models

1.1 Verification

Verification

Complete the following verification for the WMP submission:

(See Rule 1.11)

(Where Applicant is a Corporation)

I am an Officer of the applicant corporation herein and am authorized to make this verification on its behalf. The statements in the foregoing document are true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 25, 2022 at San Ramon, California.

(Date) (Name of city)

_____

Sumeet Singh, EVP, Interim Chief Safety Officer and
Chief Risk Officer

1.2 Initial Explanatory Notes and Comments

This section provides some initial explanatory notes and comments that will assist readers when reviewing our 2022 WMP.

(a) Consistency with 2022 WMP Guidelines Template

On December 15, 2021, Energy Safety issued the final version of the 2022 WMP Guidelines Template (2022 WMP Guidelines). The 2022 WMP Guidelines provided an outline for the 2022 WMP and tables for the utilities to complete as part of their submission. We have attempted to the best of our ability to provide the information requested by Energy Safety in the time allotted and in the manner requested in the 2022 WMP Guidelines. Due to the relatively condensed period between the issuance of the Guidelines and the submission of the 2022 WMP, there may be some areas where PG&E is unable to provide the requested data. Where data is unavailable, we have noted this in our 2022 WMP.

(b) Narrative Subparts

Some sections in the 2022 WMP are quite lengthy. In order to assist the reader, PG&E has added lettered subparts in these sections (e.g., (a), (b), etc.).

(c) Formatting and Additional Tables and Figures

To provide context to help understand the tables and narrative, we have included the instructions from the 2022 WMP Guidelines in *italics* at the beginning of each section and table in the 2022 WMP.

We are also providing additional tables to explain various additional data or calculations that PG&E performed to complete tables required in the Guidelines. We have included only the required tables, not the PG&E specific tables, in the excel files that it is posting with the 2022 WMP. The additional PG&E specific tables are identified in the following format in the narrative:

TABLE PG&E-SECTION#-TABLE#.

Similarly, where PG&E has provided figures to supplement the narrative, these PG&E specific figures are identified in the same format:

FIGURE PG&E-SECTION#-FIGURE#.

(d) Definition of Terms and Glossaries

We have used the Glossary provided in the 2022 WMP Guidelines as a reference source for terminology and have included it as Section 9.3 in our 2022 WMP. Some terms used in PG&E's 2022 WMP are not defined in the Guidelines Glossary. To provide clarity for readers, we have also included in Section 9.4 a PG&E-specific glossary.

(e) Model Glossary

There are a number of models referred to and discussed throughout the 2022 WMP. In order to assist the reader, PG&E is including a glossary of models in Section 9.5 listing the primary and component models referred to in the 2022 WMP with a brief description of each.

(f) Initiative v. Program

The 2022 WMP uses the terms "initiative" and "program" interchangeably to describe specific efforts that PG&E is making to reduce wildfire risk. PG&E has used the initiatives defined by Energy Safety in the 2022 WMP, but also at points refers to programs, which may be one or more initiatives.

(g) Definition of Transmission and Distribution

PG&E defines transmission voltage as being 60 kilovolt (kV) or above and has used this delineation for many years. Distribution is, therefore, defined as below 60 kV. Therefore, any references in the 2022 WMP to transmission refers to voltages at 60kV or above. Note that in some of the Energy Safety-provided tables or definitions transmission has been defined as 65kV or above. PG&E is unable to re-orient our data systems to use 65kV as the delineation between distribution and transmission.

(h) Ignition Data

The fire ignition data provided in the 2022 WMP, particularly Tables 7.1 and 7.2, is based on fire incident reports filed with the CPUC annually in accordance with D.14-02-015. The ignition data provided in these tables reflects preliminary data. PG&E's final 2021 fire ignition report is due on April 1, 2022 and 2021 data will be further reviewed in advance of that filing.

(i) Distinguishing Climate and Weather

The 2022 WMP Guidelines and other 2022 WMP materials, such as the Maturity Survey, reference "climate" and "weather" and in some cases use the two terms interchangeably. Meteorology (weather) and climatology (climate) are unique disciplines concerned with very different geographic and temporal granularities of natural phenomena. "Weather" refers to short period variation in the atmosphere at a given location. "Climate" refers to the condition of the atmosphere over a long period of time over a large area. Climate projections can be an important planning tool that provide the expected bounds for future operating conditions on a decadal scale; however, the nature of statistical projections makes climate data unsuitable for precisely predicting specific future outcomes. PG&E's Climate Resilience Team continues to coordinate with the PG&E's Community Wildfire Safety Program to identify opportunities where application of long-term climate projections would result in safer and/or more affordable outcomes. In general, the programs and planning reviewed in the WMP have time horizons ranging from months to a few years and as such are not meaningfully informed by climate projections. Thus, in our 2022 WMP and Maturity Survey responses, references to "climate" and "weather" are generally understood to be referring to shorter term weather trends, rather than long-term climate trends, unless the context of the Guidelines or Maturity Survey instructions makes clear otherwise.

(j) Cross-Referencing

We are mindful of the 2022 WMP Guidelines direction to include cross-referencing and hyperlinks to “minimize duplication of narratives.” Consistent with this direction, we have tried to include more cross-referencing of material to streamline the 2022 WMP.

(k) Referenced Documents

In the 2022 WMP Guidelines, Energy Safety requested electrical corporations post all documents referenced in their WMPs on a WMP-specific website. We have included on our WMP-specific website a document that lists the documents referenced in our WMP and provides links to where the materials can be obtained.

(l) Attachments

Throughout the 2022 WMP, there are references to attachments that are applicable to specific sections and provide additional materials. For ease of reference, we are including below a list of the attachments. In the text of the 2022 WMP, we refer to the attachment name and number. In the list below, we have also added the designation “CONF” which indicates whether an attachment is confidential or not. PG&E will provide on our website a public version of each attachment unless the attachment is confidential in its entirety, in which case the attachment will not be provided on our website:

List of Attachments:

- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.1_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.1_Atch02
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch02
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch03
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.3_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.1_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.1_Atch02_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2_Atch02_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02

List of Attachments (continued):

- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-09_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-09_Atch02
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-14_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 5.4.B_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 5.4.B_Atch02
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 5.5.A_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 5.5.D_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.E_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.F_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.H_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.I_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.J Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.J Atch02_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.3_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch01
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch02
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch03
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch04
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch05
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch06
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch07
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch08
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch09
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch10
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 8.2.4_Atch01_CONF
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 8.6_Atch01

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 2

ADHERENCE TO STATUTORY REQUIREMENTS

2. Adherence to Statutory Requirements

Section 2 comprises a "check list" of the Public Utilities Code (Pub. Util. Code) § 8386(c) requirements and subparts. The utility is required to both affirm that the Wildfire Mitigation Plan (WMP) addresses each requirement AND cite the section and page number where statutory compliance is demonstrated fully. Citations are required to use cross-referencing with hyperlinks.

Note: Energy Safety reserves the right to automatically reject a WMP that does not provide substantiation for statutory compliance or does not provide citations to appropriate sections of the WMP.

Table 2-1 provides an exemplar for the minimum acceptable level of information and citation for the statutory check list.

TABLE 2-1:
ILLUSTRATIVE CHECK LIST

Requirement	Description	WMP Section and Page Number
2	The objectives of the plan	Section 4.1, p. 13
11	Protocols for the de-energization of the electrical corporation's transmission infrastructure, etc.	Section 5 Overview, pp. 30--31

Table 2-2 provides the full list of statutory requirements. A table similar to Table 2-2 is required with the appropriate citation for each requirement. If multiple WMP sections address a specific requirement, then references to all relevant sections with a brief indication of information provided in each section must be provided. The table must include each section reference separated by semi-colon (e.g., Section 5, pp. 30-32 (workforce); Section 7, p. 43 (mutual assistance)) where appropriate, and associated hyperlinks to the referenced section.

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX

Requirement	Description	WMP Section and Page Number
1	An accounting of the responsibilities of person(s) responsible for executing the plan	Section 1, pp. 18-22
2	The objectives of the plan	Section 5.2, pp. 247-251 (the objectives of the plan); Section 5.3, pp. 252-287 (plan program targets)
3	A description of the preventive strategies and programs to be adopted by the electrical corporation to minimize the risk of its electrical lines and equipment causing catastrophic wildfires, including consideration of dynamic climate change risks	Section 4.2, pp. 57-67 (risk assessment); Section 4.2.B, pp. 69-73 (fuel condition assessment); Section 4.2.1, pp. 74-83 (evaluation of service territory risk); Section 4.3, pp. 84-95 (risk modeling regarding ignition risk); Section 4.5.1, pp. 113-127 (risk modeling generally); Section 7.1.A, pp. 310-313 (approaching to managing wildfire risk) Section 7.1.B, pp. 314-317 (use of risk modeling in decision-making and mitigation); Section 7.1.C, pp. 318-322 (major investments to mitigate wildfire risk); Section 7.1.F, pp. 330-331 (wildfire risk data); Sections 7.3.1 to 7.3.10, pp. 351-854 (initiative and program descriptions); Section 8.2, pp. 878-932 (PSPS strategy and protocols)

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
4	A description of the metrics the electrical corporation plans to use to evaluate the plan's performance and the assumptions that underlie the use of those metrics	Section 4.5.2, pp. 204-209 (calculation of key metrics); Section 6, pp. 303-307 and Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch01; Sections 8.1.1, pp. 858-862 and 8.1.4.1, pp. 868-872 (PSPS historical lookback and impact of mitigations) Section 8.5, p. 964 and Quarterly Data Request, Table 11 (PSPS metrics)
5	A discussion of how the application of previously identified metrics to previous plan performances has informed the plan	Section 4.1, pp. 49-56 (lessons learned informing 2022 WMP); Section 4.6 Additional Remedy 5.4.B, pp. 210-245 (Asset Management and Inspections-Corrective notifications) Section 6, pp. 303-307 and Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch01, Tables 1-12 (WMP metrics and underlying data); Section 7.1.F, pp. 330-331 (wildfire risk data showing wildfire risk); Section 7.1.H, p. 333 (prioritization of grid design and system hardening); Section 7.1.I, p. 334 (asset management and inspection plan for 2022); Section 7.1.J, pp. 335 (enhanced vegetation work 2020-2022);

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
		Section 7.3.6.8, pp. 730-739 (EPSS implementation informed by ignition metrics); Section 8.1.3, pp. 866-867 (lessons learned for PSPS); Section 8.1.4, pp. 868-877 (future plans for PSPS based on lessons learned and metrics)
6	Protocols for disabling reclosers and de-energizing portions of the electrical distribution system that consider the associated impacts on public safety. As part of these protocols, each electrical corporation shall include protocols related to mitigating the public safety impacts of disabling reclosers and de-energizing portions of the electrical distribution system that consider the impacts on all of the aspects listed in Pub. Util. Code 8386c	Section 7.3.6.1, pp. 705-706 (automatic recloser operations); Section 7.3.6.8, pp. 730-739 (EPSS protocols); Sections 8.2.1 to 8.2.3, pp. 879-893 (decisions to de-energize for PSPS)
7	Appropriate and feasible procedures for notifying a customer who may be impacted by the de-energizing of electrical lines, including procedures for those customers receiving a medical baseline allowance as described in paragraph (6). The procedures shall direct notification to all public safety offices, critical first responders, health care facilities, and operators of telecommunications infrastructure with premises within the footprint of potential de-energization for a given event	Section 7.3.9.2 to 7.3.9.3, pp. 790-801 (community outreach, public awareness, and customer support before, during and after wildfires, and customer support during emergencies) Section 7.3.10.1, pp. 812-842 (community engagement including PSPS); Section 7.3.10.3, pp. 847-849 (coordination with suppression agencies) Section 8.2.5, pp. 920-931 (customer communications re PSPS); Sections 8.4.1, 8.4.3 and 8.4.4, pp. 938-963 (community outreach efforts before and during PSPS events)

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
8	Identification of circuits that have frequently been de-energized pursuant to a de-energization event to mitigate the risk of wildfire and the measures taken, or planned to be taken, by the electrical corporation to reduce the need for, and impact of, future de-energization of those circuits, including, but not limited to, the estimated annual decline in circuit de-energization and de-energization impact on customers, and replacing, hardening, or undergrounding any portion of the circuit or of upstream transmission or distribution lines	Section 7.3.3.11, pp. 469-495 (grid design efforts to mitigate PSPS impacts); Sections 7.3.3.16 to 7.3.3.17, pp. 523-568 (undergrounding and system hardening which can reduce de-energization events); Section 7.3.6.8, pp. 730-739 (EPSS implementation); Section 8.3, pp. 933-935 (projected impacts on PSPS from wildfire mitigations); Section 8.6, pp. 965-1001 (identification of frequently de-energized circuits)
9	Plans for vegetation management	Section 7.1.J, pp. 335-335 (enhanced vegetation work 2020-2022); Sections 7.3.5.1 to 7.3.5.21, pp. 631-633
10	Plans for inspections of the electrical corporation's electrical infrastructure	Sections 7.3.4.1 to 7.3.4.16, pp. 569-573 (asset inspections); Sections 7.3.5.2 to 7.3.5.3, pp. 634-644 (distribution and transmission vegetation inspections); Sections 7.3.5.7 to 7.3.5.8, pp. 655-661 (remote sensing inspections); Section 7.3.5.17, pp. 681-688 (substation inspections); Section 7.3.5.21, pp. 702-704 (vegetation inspection guidelines).

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
11	Protocols for the de-energization of the electrical corporation's transmission infrastructure, for instances when the de-energization may impact customers who, or entities that, are dependent upon the infrastructure	Section 8.2.3.4, pp. 903-905 (PSPS protocols for transmission); Section 8.2.3.5, pp. 906-907 (outage impacts for transmission); Sections 8.2.3.6 and 8.2.3.7, pp. 908-914 (general timing for decisions and PSPS Risk-Benefit Tool)
12	A list that identifies, describes, and prioritizes all wildfire risks, and drivers for those risks, throughout the electrical corporation's service territory, including all relevant wildfire risk and risk mitigation information that is part of the Safety Model Assessment Proceeding and the Risk Assessment Mitigation Phase filings	Section 4.2, pp. 57-83 (risk drivers); Section 4.3, pp. 84-95 (ignition drivers); Section 4.5.1(a), pp. 117-127 (Enterprise Risk Model identifying risks and drivers)
13	A description of how the plan accounts for the wildfire risk identified in the electrical corporation's Risk Assessment Mitigation Phase filing	Section 4.2, pp. 57-83 (implementation of Safety Model Assessment Proceeding (S-MAP) settlement); Section 4.5.1(a), pp. 117-127 (S-MAP settlement and Enterprise Risk Model); Section 7.3.8.3, pp. 783-785 (Risk Spend Efficiency and RAMP proceeding)
14	A description of the actions the electrical corporation will take to ensure its system will achieve the highest level of safety, reliability, and resiliency, and to ensure that its system is prepared for a major event, including hardening and modernizing its infrastructure with improved engineering, system design, standards, equipment, and facilities, such as undergrounding, insulation of distribution wires, and pole replacement	Section 5.4.4, pp. 298-300 (training for grid hardening work); Section 7.1.H, pp. 333-333 (prioritization of grid design and system hardening); Sections 7.3.3.16 to 7.3.3.17, pp. 523-568 (undergrounding and system hardening initiatives and programs)

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
15	A description of where and how the electrical corporation considered undergrounding electrical distribution lines within those areas of its service territory identified to have the highest wildfire risk in a California Public Utilities Commission (Commission) fire threat map	Section 7.1.H, pp. 333-333 (prioritization of grid design and system hardening); Section 7.3.3.16, pp. 523-353 (undergrounding)
16	A showing that the electrical corporation has an adequately sized and trained workforce to promptly restore service after a major event, taking into account employees of other utilities pursuant to mutual aid agreements and employees of entities that have entered into contracts with the electrical corporation	Section 5.4, pp. 288-302 (workforce training and recruitment); Section 7.3.9.1, pp. 786-789 (workforce for service restoration and mutual assistance); Section 7.3.9.4, pp. 802-804, emergency preparedness training); Section 8.2.4, pp. 915-919 (PSPS restoration strategy)
17	Identification of any geographic area in the electrical corporation's service territory that is a higher wildfire threat than is currently identified in a Commission fire threat map, and where the Commission must consider expanding the high fire threat district based on new information or changes in the environment	Section 4.2.1, pp. 74-83 (service territory threat evaluation)
18	A methodology for identifying and presenting enterprise-wide safety risk and wildfire-related risk that is consistent with the methodology used by other electrical corporations unless the Commission determines otherwise	Section 4.2, pp. 57-83 (implementation of Safety Model Assessment Proceeding (S-MAP) settlement); Section 4.5.1(a), pp. 117-127 (S-MAP settlement and Enterprise Risk Model); Section 7.3.8.3, pp. 783-785 (Risk Spend Efficiency and RAMP proceeding)

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
19	A description of how the plan is consistent with the electrical corporation's disaster and emergency preparedness plan prepared pursuant to Section 768.6, including plans to restore service and community outreach	Sections 7.3.9.2 to 7.3.9.3, pp. 790-801 (community outreach and customer support before, during and after wildfires and customer support during emergencies); Section 7.3.9.4, pp. 802-804 (emergency plan); Section 7.3.9.5, pp. 805-808 (preparedness and planning for service restoration after emergency); Section 7.3.10.1, pp. 812-842 (community engagement to prepare for wildfire seasons, PSPS and EPSS).
20	A statement of how the electrical corporation will restore service after a wildfire	Section 7.3.9.1, pp. 786-789 (training and personnel for service restoration); Section 7.3.9.5, pp. 805-808 (preparedness and planning for service restoration after emergency)
21	Protocols for compliance with requirements adopted by the Commission regarding activities to support customers during and after a wildfire, outage reporting, support for low-income customers, billing adjustments, deposit waivers, extended payment plans, suspension of disconnection and non-payment fees, repair processing and timing, access to electrical corporation representatives, and emergency communications	Section 7.3.9.2, pp. 790-794 (community engagement before, during and after wildfires) Section 7.3.9.3, pp. 795-801 (customer support during emergencies); Section 7.3.10.1, pp. 812-842 (customer engagement for wildfire mitigation)

TABLE 2-2:
STATUTORY COMPLIANCE MATRIX
(CONTINUED)

Requirement	Description	WMP Section and Page Number
22	A description of the processes and procedures the electrical corporation will use to do the following: Monitor and audit the implementation of the plan. Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies. Monitor and audit the effectiveness of electrical line and equipment inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and Commission rules.	Section 4.1, pp. 49-56 (lessons learned); Section 4.6, pp. 210-246 (reporting on Remedies and Additional Issues identified by the Office of Energy Infrastructure Safety); Section 7.2.A, pp. 336-337 (monitor and audit WMP implementation); Section 7.2.B, pp. 338-340 (WMP deficiencies); Section 7.2.C, pp. 341-343 (monitor and audit inspection effectiveness) Section 7.3.4.14, pp. 619-623 (quality assurance and quality control (QA/QC) for inspections); Section 7.3.5.13, pp. 670-673 (QA/QC for vegetation management) Section 7.3.9.6, pp. 809-810 (protocols to learn from wildfire events)

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 3

ACTUALS AND PLANNED SPENDING FOR MITIGATION PLAN

3. Actuals and Planned Spending for Mitigation Plan

3.1 Summary of Wildfire Mitigation Plan Initiative Expenditures

Table 3.1-1 summarizes the projected costs (thousands of dollars) per year over the 3-year Wildfire Mitigation Plan (WMP) cycle, including actual expenditures for past years. In Table 3.1-2, break out projected costs per category of mitigations, over the 3-year WMP plan cycle. In reporting "planned" expenditure, use data from the corresponding year's WMP or WMP Update (i.e., 2020 planned expenditure must use 2020 WMP data). The financials represented in the summary tables below equal the aggregate spending listed in the mitigations financial tables reported quarterly. Nothing in this document is required to be construed as a statement that costs listed are approved or deemed reasonable if the WMP is approved, denied, or otherwise acted upon.

TABLE 3.1-1:
SUMMARY OF WMP EXPENDITURES – TOTAL
(THOUSANDS OF DOLLARS)

Year	Spend in thousands of $USD
2020 Planned	$3,224,295
2020 Actual	$4,461,564
2020 Difference	$(1,237,269)
2021 Planned	$4,898,624
2021 Actual	$4,797,380
2021 Difference	$101,245
2022 Planned	$5,963,795
2020-22 Planned (With 2020 and 2021 Actual)	$15,222,739

TABLE 3.1-2:
SUMMARY OF WMP EXPENDITURES BY CATEGORY
(THOUSANDS OF DOLLARS)

WMP Category	2020			2021			2022	2020-2022 Planned (w/2020 and 2021 Actuals)
	Planned	Actual	Difference	Planned	Actual	Difference	Planned	
Risk and Mapping	$5,311	$5,865	$(553)	$6,841	$8,651	$(1,810)	$7,804	$22,320
Situational Awareness	42,191	83,719	(41,528)	49,789	80,932	(31,143)	82,929	247,580
Grid Design and System Hardening	1,695,179	2,359,486	(664,308)	2,641,561	2,381,681	259,880	3,134,808	7,875,976
Asset Management and Inspections	216,529	302,693	(86,164)	266,904	273,073	(6,169)	281,294	857,060
Vegetation Management (VM)	846,018	1,422,090	(576,073)	1,507,398	1,751,067	(243,668)	1,980,005	5,153,162
Grid Operations	244,065	112,819	131,245	192,059	87,173	104,885	258,000	457,993
Data Governance	90,975	58,094	32,881	147,362	95,272	52,090	97,822	251,187
Resource Allocation	2,148	7,091	(4,944)	7,121	10,001	(2,880)	9,774	26,866
Emergency Planning	44,619	53,936	(9,318)	26,341	54,401	(28,060)	56,693	165,030
Stakeholder Cooperation and Community Engagement	37,261	55,769	(18,509)	53,248	55,129	(1,880)	54,667	165,565
Total	$3,224,295	$4,461,564	$(1,237,269)	$4,898,624	$4,797,380	$101,245	$5,963,795	$15,222,739

PG&E is providing the following additional information regarding the financial expenditure information provided above in Tables 3.1-1 and 3.1-2:

- Tables 3.1-1 and 3.1-2 span multiple cost recovery mechanisms including the General Rate Case (GRC), Transmission Owner (TO) rate case at the Federal Energy Regulatory Commission (FERC), Catastrophic Event Memorandum Account (CEMA), Fire Risk Mitigation Memorandum Account (FRMMA), Wildfire Mitigation Plan Memorandum Account (WMPMA), Microgrid Memorandum Account (MGMA), Emergency Consumer Protection Memorandum Account (ECPMA), Electric Program Investment Charge (EPIC), and Wildfire Mitigation Balancing Account (WMBA). Some of these costs have already been approved for inclusion in customer rates and some of these costs are still pending review or approval through cost recovery proceedings.

- While the primary work performed for wildfire risk mitigation is in High Fire Threat District (HFTD) areas, some work and financial costs associated with Non-HFTD areas have been included in the WMP expenditure information.

- Information regarding 2020[7] and 2021[8] "Planned" are from prior WMPs, which has the prior assumptions on cost grouping by initiatives. This will result in some differences from the 2020 and 2021 "Actual," which is based on the current 2022 WMP view.

- 2022 "Planned" costs are PG&E's best estimate for the proposed programs as of February 25, 2022. Further changes to 2022 budgets and work plans are possible and actual costs may vary substantially from these plans depending on actual work completion, conditions, and requirements.

- For the 2020 and 2021 "Actual" information, the population of work included in these financial data sets is aligned to the 2022 WMP scope and list of initiatives.

- Given program changes and as cost tracking evolves over time, high level assumptions were made in some cases to recreate 2020 "Actual" in the 2022 WMP initiative view. For example, in some cases, where data is hard to identify or lack granularity, we used 2021 or 2022 as proxies to recast for 2020.

- The 2022 forecast, for the most part, is tied to the PG&E Budget, which could include additional dollars for more work or units.

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7 Numbers are derived from the 2020 WMP (First Quarterly Report submitted on September 9, 2020).

8 Numbers are derived from the 2021 WMP-Revised (June 3, 2021).

3.2 Summary of Ratepayer Impact

For each of the years in Table 3.2-1, report the actual and projected cost increases to ratepayers due to utility related ignitions and wildfire mitigation activities engaged. For past years below, account for all expenditures incurred in that year due to utility related ignitions and wildfire mitigation activities. Below the table, describe the methodology behind the calculations.

Table 3.2-1 below provides the average portion of a customer's monthly bill related to utility-related ignitions (Row 1) and wildfire mitigation activities (Row 2) for a typical bundled residential non-CARE (California Alternate Rates for Energy) customer having an average monthly usage of 500 kWh (kilowatt-hours). Following Table 3.2-1, we provide an explanation concerning how the data in Table 3.2-1 was developed. Please note that the numbers in Table 3.2-1 reflect the year-over-year increase in the portion of a customer's monthly bill that is funding mitigation activities that reduce the risk of catastrophic wildfire risks or costs associated with utility-related ignitions.

TABLE 3.2-1:
WMP ELECTRICITY COST INCREASE TO RATEPAYERS

Outcome Metric Name	Annual Performance						Unit(s)
	Actual					Projected	
	2017	2018	2019	2020	2021	2022	
Increase in electric costs to ratepayer due to utility related ignitions (total)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.44 0.3%	Dollar value of average monthly rate increase attributable to utility-related ignitions per year (e.g., $0.44/month on average in 2022 across customers for utility-related ignitions occurring from 2017-in 2021)
Increase in electric costs to ratepayer due to wildfire mitigation activities (total)	$0.00	$0.00	$0.79 0.5%	$1.67 1.1%	$11.63 7.6%	$6.13 3.7%	Dollar value of average monthly rate increase attributable to WMPs per year

Note: PG&E understands that Table 3.2-1 should reflect year-over-year increases. Thus, the numbers included show the increase in the portion of a customer's monthly bill from one year to the next associated with utility-related ignitions or wildfire mitigation activities.

3.2.(a) Ratepayer Impact Due to Utility-Related Ignitions

This section addresses the first row in Table 3.2-1 regarding impacts from utility-related ignitions. For the 5-year period from 2017-2021 included in Table 3.2-1, PG&E reviewed wildfire response and recovery efforts where costs have been incurred and identified. We also reviewed advice letters related to the wildfire events that are added to the Wildfire Expense Memorandum Account (WEMA).[9]

For purposes of Table 3.2-1, PG&E is defining "utility-related ignitions" to be California Public Utilities Commission (CPUC or Commission)-reportable utility-related fire ignitions. This review resulted in the identification of 12 CPUC-reportable utility-related fire ignitions:

- 2017 – Railroad Fire, Atlas Fire, Cascade Fire, Redwood Fire, and Nuns Fire
- 2018 – Camp Fire
- 2019 – Camino Fire, Bethel Island Fire, and Kincade Fire
- 2020 – Zogg Fire
- 2021 – Dixie Fire and Fly Fire.[10]

PG&E interprets the category of "increase in electric costs to ratepayers due to utility-related ignitions" to include CEMA costs incurred for restoration activities during these catastrophic events.[11] These costs include repairing the damaged utility facilities and replacing equipment to restore service to customers.

For the period of 2017-2021, PG&E incurred approximately $1.3 billion in expenditures associated with these twelve utility-related ignitions. Excluding non-incremental overheads and amounts disallowed as a result of the CPUC's decision (Decision (D.) 20-05-019) in the Order Instituting Investigation (OII) into the 2017 Northern California wildfires and the 2018 Camp fire, the recorded adjusted amount associated with these twelve utility-related ignitions is $404 million for 2017-2021. None of these costs are or have been reflected in CPUC-jurisdictional rates to date.

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9 In accordance with D.18-06-029 issued by the CPUC, PG&E notifies the Commission via Tier 1 advice letter whenever a new event is added to the WEMA.

10 PG&E's investigation of the Kincade, Zogg, Dixie, and Fly Fires is ongoing. PG&E has included these fires for completeness because California Department of Forestry and Fire Protection (CAL FIRE) has either announced its determination that PG&E's facilities caused the fire or CAL FIRE is still investigating the cause.

11 We have not included liability insurance costs for purposes of the ratepayer impact estimate because we cannot quantify how much of these costs are due to utility-related ignitions. In addition, we are not including third-party claims costs that would be recovered through CPUC-jurisdictional rates as these costs may not be borne by customers. For example, customer rates did not include any third-party claims costs related to the 2017 fires and the 2018 Camp Fire. The recovery of third-party claims costs related to other wildfires is still uncertain and thus these costs are not included.

For CPUC-jurisdictional rates, PG&E is currently seeking recovery of recorded costs incurred through 2019 for the Camino Fire and Bethel Island Fire in the Wildfire Mitigation and Catastrophic Events (WMCE) Application (A.) 20-09-019. A proposed settlement agreement was filed in that proceeding in December 2021, which is pending CPUC approval.

For FERC-jurisdictional rates, PG&E included external legal fees and third-party claims costs for the Kincade Fire and the Zogg Fire in our Formula Rate Annual Update submitted to FERC on December 1, 2021 for Rate Year 2022. PG&E began collecting these costs in transmission rates on January 1, 2022.[12]

To calculate the ratepayer impact due to utility-related ignitions, we have included the associated revenue requirement amounts described below.

1) Revenue requirement of $0.011 million related to the 2019 Camino Fire and Bethel Island Fire included in the 2020 WMCE settlement described above. This revenue requirement is assumed to impact customer rates beginning in June 2022 through May 2024, consistent with the 2020 WMCE settlement agreement.

2) External legal fees and third-party claims costs of $44.5 million for the Kincade Fire and the Zogg Fire in the FERC rate. Beginning on January 1, 2022, these costs are being collected in electric transmission rates through the Formula Rate mechanism.

Table PG&E-3.2-1 summarizes the revenue requirement due to utility-related ignitions occurring in 2017-2021.

TABLE PG&E-3.2-1:
REVENUE REQUIREMENT – UTILITY RELATED IGNITIONS
(MILLIONS OF DOLLARS)

	2017	2018	2019	2020	2021	2022
Revenue Requirement	$0.0	$0.0	$0.0	$0.0	$0.0	$45.0

As a result, PG&E has estimated that the average monthly bill impact from utility-related ignitions costs occurring from 2017 through 2021 will be $0.44 in 2022. The bill impacts reflected in Table 3.2-1 (Row 1) are not representative of the bill increases customers will experience when these costs are implemented in rates. Rather, these bill impacts represent the portion of the total bill that would be associated with utility-related ignitions. The actual change to bills in any future period will depend on the changes in the total authorized revenue requirement and electric sales at the time of implementation.

[12] PG&E's inclusion of Zogg and Kincade fire related costs in the Annual Update has been protested by parties and those protests are currently pending before FERC.

3.2.(b) Ratepayer Impact Due to Wildfire Mitigation Activities

This section addresses the second row in Table 3.2-1 above regarding impacts from wildfire mitigation activities. PG&E incurred approximately $13.4 billion in expenditures associated with utility Wildfire Mitigation Plan (WMP) activities for the period of 2017-2021. These expenditures can be broadly categorized in five ways.

1) Costs totaling approximately $4.7 billion related to the wildfire mitigation activities approved in the 2017 GRC and the 2020 GRC, which include Enhanced Vegetation Management, system hardening program, situational awareness and public safety shut off program.

2) Costs totaling $3.9 billion recorded to the wildfire mitigation memorandum accounts (WMP Memorandum Account and Fire Risk Mitigation Memorandum Account). These costs include enhanced wildfire inspections, repair and replace, as well as microgrid programs.

3) Costs totaling approximately $2.9 billion related to transmission facilities including inspections of electric transmission facilities, system hardening, and enhanced controls.

4) Costs totaling approximately $1.8 billion related to distribution base programs. These costs are not included in the ratepayer impact calculations as these programs are related to non-mitigation activities.

5) Costs totaling approximately $0.1 billion related to Butte Rebuild, Emergency Consumer Protection Memorandum Account (ECPMA), and Electric Program Investment Charge (EPIC), which will be collected in future rates pending Commission approval of these programs through cost recovery proceedings.

Excluding non-incremental overheads and amounts disallowed as a result of the Wildfire OII D.20-05-019, the recorded adjusted amount for wildfire mitigation activities is approximately $12.3 billion for the period of 2017-2021. The specific wildfire mitigation activities reflected in existing rates are summarized below.

1) 2017 GRC Decision (D.17-05-013) – Approved $13.8 million of capital expenditures for electric distribution equipment replacement in 2019 for Tier 2 and 3 High Fire-Threat Districts. This amount was collected in rates in 2019.

2) 2020 GRC Decision (D.20-12-005) – Authorized PG&E to establish vegetation management (VM) and wildfire mitigation balancing accounts. PG&E is authorized to recover incurred costs up to the annual authorized cost cap of 120 percent for VM and up to 115 percent for wildfire mitigation through a Tier 2 advice letter filing. The following authorized amounts are included in existing rates or will be collected in rates:

    - 2020 – $657.6 million in expense for VM; $61.4 million in expense and $603.3 million in capital expenditures for wildfire mitigation. These amounts are amortized in customer rates beginning March 2021 until 2023.

- 2021 – $723.4 million in expense for VM; $63.6 million in expense and $930.9 million in capital expenditures for wildfire mitigation. These amounts are collected in customer rates in 2021-2023.

- 2022 – $795.7 million in expense for VM; $57.4 million in expense and $1,151.1 million in capital expenditures for wildfire mitigation. These amounts are collected in customer rates in 2022 through 2023/2024.

3) 2020 WMCE Application (A.20-09-019) – PG&E sought recovery of incremental recorded costs for wildfire mitigation activities incurred through December 2019 totaling $1.603 billion in the 2020 WMCE Application. A proposed settlement agreement was filed in that proceeding in December 2021 seeking approval of $1.038 billion in revenue requirement and a proposed decision on the settlement agreement is expected in the first quarter of 2022. For the bill impact calculation, PG&E has reflected the Commission's decision which granted an interim rate relief of $447 million of revenue requirement, to be collected over a 17-month period from January 2021 to May 2022. PG&E assumes the remaining revenue requirement associated with these costs, once approved, will be collected in rates over a 24-month period from June 2022 to May 2024, consistent with the settlement agreement.

4) PSPS Resiliency Strategies and Microgrid Order Instituting Rulemaking (Rulemaking 19-09-009) – PG&E incurred approximately $137 million in expense and $20 million in capital incremental costs in 2020 and approximately $127 million in expense and $17 million in capital incremental costs in 2021 associated with the Microgrids program tracked in the Microgrids Memorandum Account. These costs are related to the make-ready program, temporary generation program, and community microgrid enablement program. PG&E sought recovery of the 2020 recorded costs in the 2021 WMCE Application (A.21-09-008), which was filed in September 2021. None of these costs are or have been reflected in rates to date.

5) 2018 CEMA Application (A.18-03-015) – PG&E recorded $541 million of tree mortality and fire risk reduction expense incurred for the period of 2016 through 2019. PG&E sought recovery of 2016-2019 tree mortality expense in A.18-03-015. A proposed settlement agreement was filed in that proceeding in November 2021. The interim 2018 CEMA revenue requirement of $373 million authorized in D.19-04-039 associated with the 2016 and 2017 CEMA costs was fully collected in rates in 2019 and 2020. Of this interim rate relief amount, we assume $257 million is related to the recovery of the tree mortality and fire risk reduction expense. The remaining revenue requirement amount, following a final decision in that proceeding, is assumed to go into rates in 2022 and 2023.

6) FERC Formula Rate – PG&E incurred approximately $2.9 billion of expenditures for the period of 2017-2021, net of Wildfire OII disallowances (D.20-05-019), related to electric transmission wildfire mitigation activities. These costs will be recovered under the FERC Formula Rate mechanism. Our FERC rates are established through a Formula Rate annually (i.e., for a Rate Year) using actual costs data from the period two years prior to the Rate Year (i.e., 2017 actual costs are used for Rate Year 2019). For Operations and Maintenance expenses, the following amounts were included in rates:

- Rate Year 2019 – $0
- Rate Year 2020 – $16.6 million
- Rate Year 2021– $594.1 million
- Rate Year 2022 – $396.1 million

For capital costs, PG&E has included:

- Rate Year 2019 – $0
- Rate Year 2020 – $20.3 million
- Rate Year 2021 – $232.5 million
- Rate Year 2022 – $649.0 million

To develop an estimate of the ratepayer impact due to utility wildfire mitigation activities, PG&E converted the expenditures to revenue requirement from various decisions and applications discussed above. We have factored in cost of capital, depreciation, Assembly Bill 1054 equity rate base exclusion and other parameters in the revenue requirement calculation through 2022. We estimate a total revenue requirement of approximately $3.9 billion through 2022 associated with the $11.6 wildfire mitigation expenditures described above.

Table PG&E-3.2-2 below summarizes the revenue requirement by year for 2017 through 2022 due to wildfire mitigation activities.

TABLE PG&E-3.2-2:
REVENUE REQUIREMENT – WILDFIRE MITIGATION ACTIVITIES
(MILLIONS OF DOLLARS)

	2017	2018	2019	2020	2021	2022
Revenue Requirement	$0.0	$0.0	$51.4	$223.0	$1,467.3	$2,129.1

As described above, PG&E has made certain assumptions on the cost recovery periods in order to calculate monthly bill impacts through 2022 associated with wildfire mitigation activities. For costs that have been approved to go into rates, PG&E has reflected the recovery period as outlined in the decision. For costs contained in applications that have already been filed, PG&E has reflected the cost recovery periods proposed in those applications or subsequent settlement agreements. As a result, PG&E has estimated that the year over year increase in the portion of a customer's monthly bill that is funding wildfire mitigation activities occurring from 2017 through 2021 was $0.00 in 2017, $0.00 in 2018, $0.79 in 2019, $1.67 in 2020, $11.63 in 2021, and $6.13 in 2022. The actual change to bills in any future period will depend on the changes in the total authorized revenue requirement and electric sales at the time of implementation.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 4

LESSONS LEARNED AND RISK TRENDS

4. Lessons Learned and Risk Trends

4.1 Lessons Learned – How Tracking Metrics on the 2020 and 2021 Plans Informed the 2022 Plan Update

Describe how the utility's plan has evolved since the 2020 Wildfire Mitigation Plan (WMP) and 2021 WMP Update submissions. Outline any major themes and lessons learned from the 2020 and 2021 plans, and subsequent implementation of the initiatives. In particular, focus on how utility performance against the metrics used has informed the 2022 WMP Update. Include an overview map of the utility's service territory. If any of the lessons learned are derived from data, include visual/graphical representations of this/these lesson(s) learned.

At a high level, the lessons learned in 2021 from implementation of the 2021 WMP involve three key themes:

- Continued safety focus – We are continuing to reinforce and expand our situational awareness, customer outreach and support, and refine operational practices to both reduce wildfire potential and the customer impacts of our mitigation programs.

- Coordination and knowledge sharing – We are enhancing our risk modeling, fire consequence modeling, operational practices, and reporting (e.g., remediations for tracking and reporting identified by the California Public Utilities Commission (CPUC or Commission)), and working in coordination with our peer California utilities, academic community, industry experts, regulators, and other external partners.

- Refine focus areas to most effective core programs – We are continuing to evaluate the anchors of our Wildfire Mitigation work from system hardening and Enhanced Vegetation Management (EVM) and new programs such as Enhanced Powerline Safety Settings (EPSS) and undergrounding, driven by our analysis of risk reduction and the balance towards faster implementation and more permanent mitigation considering continuing challenges with climate change.

In addition to these high-level lessons learned, there were also a number of specific situations that resulted in lessons learned and actions taken to address those lessons. In our 2021 Revised WMP, we described lessons learned for five areas and our approach in 2021 for addressing these lessons learned.[13]

Below, we summarize our progress in 2021 on these 2020 lessons learned. We are also providing a summary of lessons learned in 2021 in a number of different areas and on a number of different issues, and how these lessons have informed our 2022 WMP.

Finally, in response to the request for an overview map of PG&E's service territory, we are providing Figure PG&E-4.1-1 below, which outlines PG&E's service territory, as well as the High Fire Threat District (HFTD) Tier 2 (orange) and Tier 3 (red) areas.

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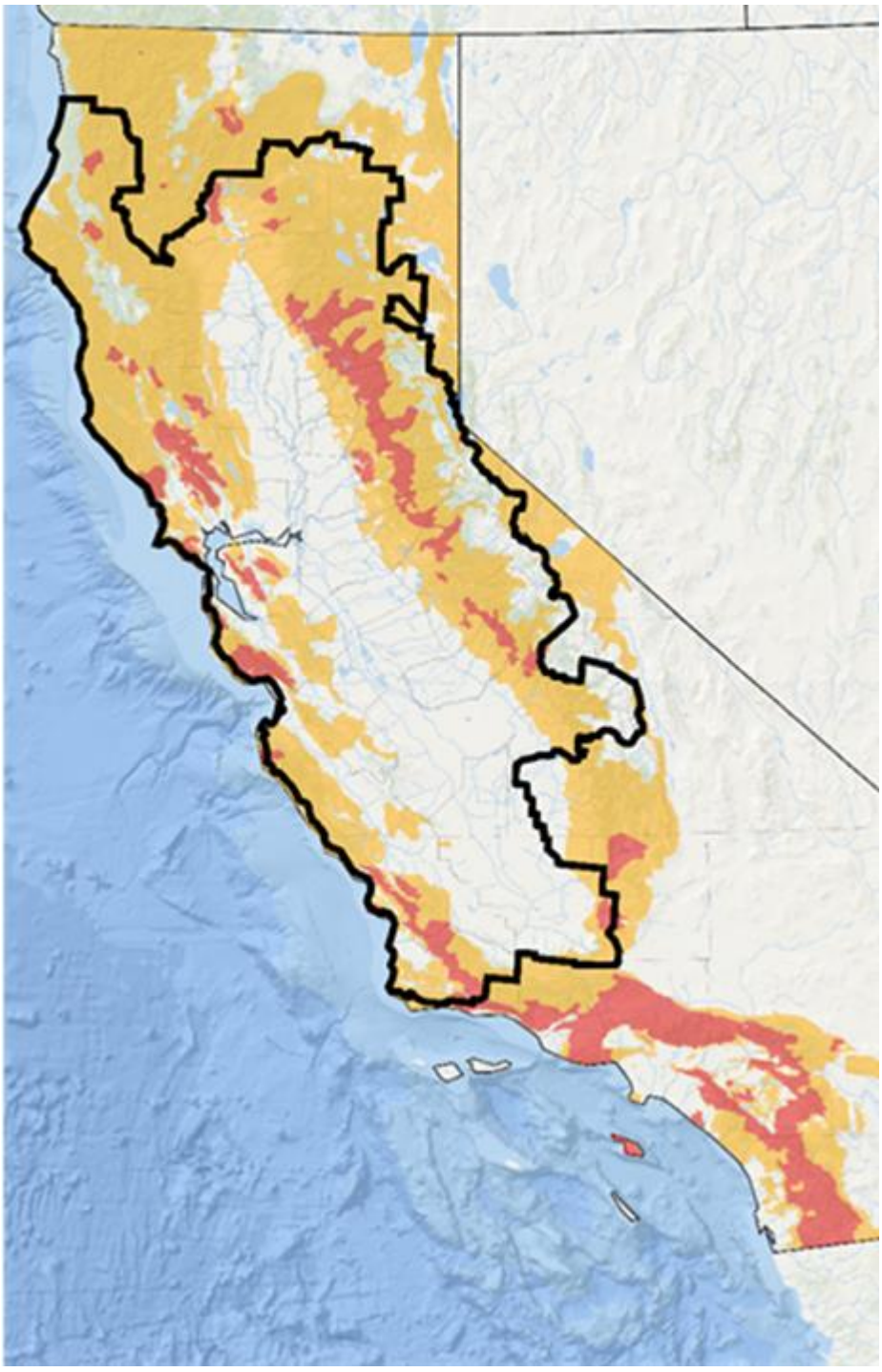
13 2021 Revised WMP, pp. 46-50.

FIGURE PG&E-4.1-1:
PG&E SERVICE TERRITORY AND TIER 2 AND TIER 3 HFTD AREAS



The remainder of this section includes:

Subsection (a): 2020 Lessons Learned and 2021 Progress

Subsection (b): Lessons Learned from Enhanced Oversight and Enforcement Process (EOEP)

Subsection (c): Lessons Learned from Self-Identified Issues

Subsection (d): Lessons Learned from the 2020 WMP Independent Evaluator (IE) Report

Subsection (e): Lessons Learned from EPSS Implementation

Subsection (f): Lessons Learned Regarding Environmental Remediation

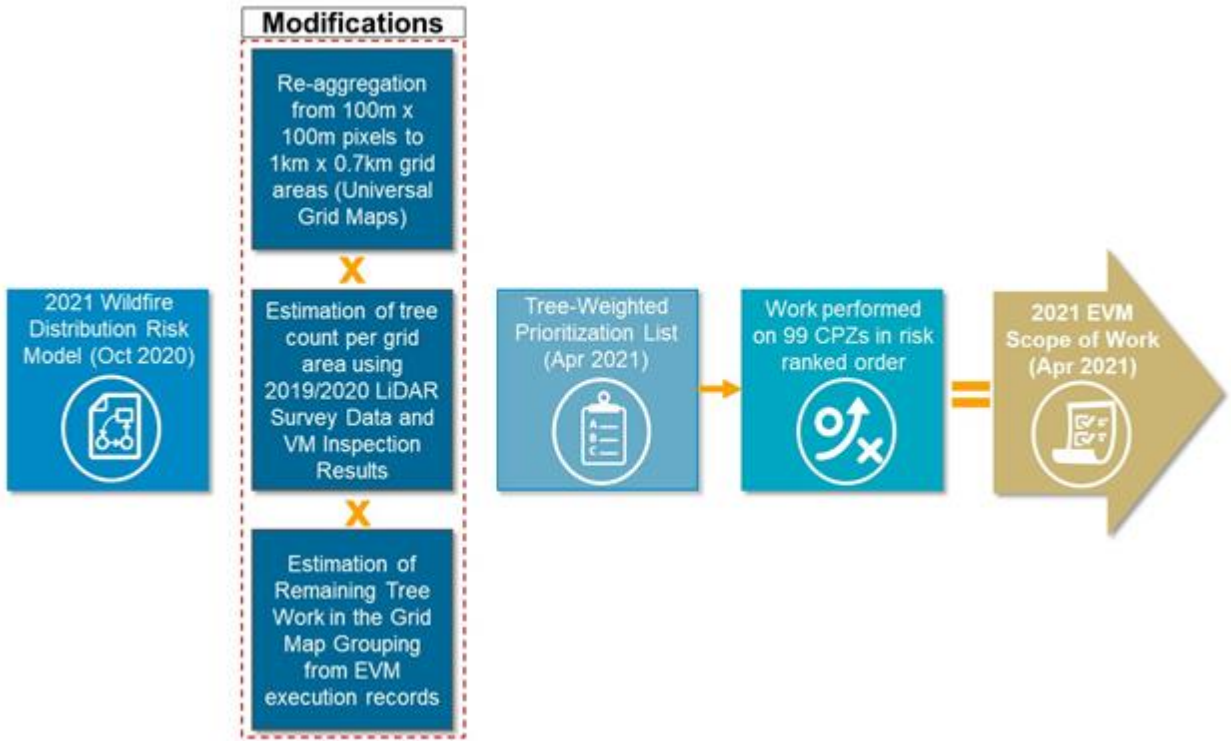
Subsection (g): Lessons Learned from Streamlining the 2022 WMP and Initiative Targets

(a) 2020 Lessons Learned and 2021 Progress

The 2021 WMP identified five areas for lessons learned in 2020: (1) EVM risk prioritization; (2) system inspection prioritization and execution; (3) vegetation management quality improvements; (4) risk modeling improvements; and (5) Public Safety Power Shutoff (PSPS) improvements. We made substantial progress on each of these areas in 2021 and plan to continue that progress in 2022. A brief description of the progress in each area is provided below:

- EVM Risk Prioritization – In 2021, we used the 2021 Wildfire Distribution Risk Model (WDRM) v2 and supplemented it with the most up-to-date LiDAR and inspection data and developed the 2021 EVM Scope of Work to prioritize the highest risk circuit segments (also referred to as circuit protection zones or CPZs). At a high level, the risk prioritization process for EVM in 2021 is reflected in Figure PG&E-4.1-2 below.

FIGURE PG&E-4.1-2:
DEVELOPMENT OF RISK PRIORITIZED 2021 EVM SCOPE OF WORK



As a result of this prioritization, PG&E performed almost 98 percent of our EVM work in 2021 on the top 20 percent of the highest risk circuit segments. For more information on our EVM Program see subsection (b) below and Section 7.3.5.2.

- System Inspection Prioritization and Execution – In 2021, PG&E's Asset Strategy groups developed playbooks to perform a full review of assets to validate that system inspections in the highest risk areas were prioritized for inspection before late summer peak of wildfire season. We also updated our asset records in our Asset Registry, including the work down of our as-built and mapping corrections backlog, to ensure that they are being assigned to prioritized maintenance plans. For more information on our System Inspection program improvements, see Section 7.3.4.3. PG&E continues to improve our timeliness of technology updates to align with training schedules and the start of inspection schedules.

- Vegetation Management Quality Improvements – In 2021, we significantly increased resources to validate the quality of vegetation management work, including adding contract resources and internal Work Verifiers, the creation of the Quality Control group to focus on active field observations, and an increase in Senior Vegetation Management Inspectors to provide additional real-time safety and compliance support in the field. For more information on our Vegetation Management Quality improvements, see Section 7.3.5.6.

- Risk Modeling Improvements – PG&E continued to improve our risk modeling capabilities, including implementing automated data intake, improved code execution and model spatial views, and post-model steps to workplan development.

These improvements now provide a repeatable and more transparent set of tools with which to use and review model results. Finally, improved data has refined the predictive power of the wildfire risk models. To improve the predictive power of the wildfire risk models, we have updated asset failure and 'risk events' data sets with another year of training data and improved data sets that characterize asset and climate conditions such as LiDAR, inspection data, meteorology, fuels, and soils. For more information on our risk modeling improvements, see Section 4.5.1.

- PSPS Improvements – In 2021, we implemented new PSPS protocols and processes that impacted the scoping of PSPS events and continued to implement programs that reduce the customer impacts of these events. These improvements resulted in better balancing the benefits of mitigating wildfire risks against the customer impacts from a PSPS event. Our improvements focused on the following areas: (1) meteorology modeling and distribution scoping improvements; (2) transmission scoping protocols; (3) risk-benefit tool; (4) mitigation initiatives; (5) re-energization strategy and protocols; and (6) programmatic improvements in communication, resources, and assistance to impacted customers and communities. For more information on our PSPS program improvements, see Section 8.1.

b. Lessons Learned from EOEP

In Resolution (Res.) M-4852, the CPUC placed PG&E in Step 1 of its EOEP process because of "insufficient progress with risk driven mitigation efforts", specifically with regards to EVM.[14] On May 6, 2021, in response to CPUC direction, we submitted our EVM Corrective Action Plan (CAP).[15] The EVM CAP specifically addressed shortcomings the CPUC identified in our EVM Program regarding risk prioritization of work. The EVM CAP included a detailed discussion of how PG&E will prioritize the highest risk circuit segments for work in 2021.[16] PG&E has provided three 90-Day Update reports to the CPUC regarding our progress on EVM work in 2021, as well as our 2022 EVM workplan.[17] PG&E has also participated in two CPUC-sponsored workshops regarding the EVM CAP.

Relevant to this section of the 2022 WMP, the EVM CAP included four lessons learned from 2020 regarding the EVM Program and specific actions that PG&E had implemented in 2021 to address these issues.[18] In summary, in our EVM CAP we identified lessons learned and remedies for each lesson learned concerning: (1) risk

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14 Res.M-4852 at p. 1.

15 *Enhanced Oversight and Enforcement Process Corrective Action Plan*, submitted May 6, 2021 (EVM CAP).

16 EVM CAP, pp. 11-15.

17 See 90-Day Reports submitted by PG&E on August 4, 2021, pdfa_planofreorganizationoii-2019_report-pge_20210804-public.pdf (ca.gov), November 4, 2021 (Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.1_Atch01), and February 2, 2022 (Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.1_Atch02).

18 EVM CAP, p. 7.

prioritization of EVM work; (2) consistency and clarity as to risk modeling used to inform EVM work; (3) goals focused on performing the highest risk work; and (4) centralized decision making and oversight regarding EVM work through the Wildfire Risk Governance Steering Committee (WRGSC). The EVM CAP provides more detail about each of these four lessons learned and changes that we implemented in 2021 to address these lessons learned.[19]

c. Lessons Learned from Self-Identified Issues

During 2021, PG&E submitted several notices to the CPUC regarding issues that we had self-identified. Some of these self-identification notices included lessons learned and PG&E's plans to address those lessons learned. In this section of the 2022 WMP, we are providing a summary of the lessons learned in the self-identification notices and references to materials that have more detailed discussions of the lessons learned and corrective actions taken.

On March 4, March 12, and May 20, 2021, PG&E identified issues related to enhanced inspections of hydroelectric substations in 2020. In our May 20, 2021 letter, we described corrective actions regarding our substation inspection process going forward including clear roles and responsibilities, a comprehensive inventory with programmatic oversight, a comprehensive and auditable maintenance and inspection program, and issues related to our ongoing CAP Program. PG&E's implementation of these corrective actions is described in more detail in the May 20, 2021 letter.[20]

On May 7, 2021, PG&E identified issues related to General Order (GO) 165 and WMP enhanced inspections for electric distribution poles. We indicated that certain GO 165 inspections had not occurred within the required compliance time and that certain poles in Tier 3 areas had not been inspected consistent with our 2020 WMP. In our self-identification letter, we provided a gap analysis and CAP including performing the required inspections, implementing controls for our inspection program, and strengthening our asset registry. PG&E's implementation of these corrective actions is described in more detail in the May 7, 2021 letter.[21]

On June 1, 2021, we self-identified issues related to accounting for the number of weather stations and high-definition cameras in prior WMPs. We indicated that some of the numbers in our WMP needed to be corrected and provided updated numbers. In our November 1, 2021 Progress Report, for Remedy PG&E-21-08, we indicated that as a result of lessons learned from this self-identified issue we have instituted "standardized counting procedures and the development of detailed WMP reporting and

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19 *Id.*

20 See Letter from Debbie Powell to Caroline Thomas Jacobs and Leslie Palmer dated May 20, 2021, pp. 3-4.

21 See Letter from Debbie Powell to Caroline Thomas Jacobs and Leslie Palmer dated May 7, 2021, pp. 4-5.

confirmation requirements across the entire Community Wildfire Safety Program portfolio to eliminate any future reporting ambiguity."[22]

d. Lessons Learned from the 2020 WMP IE Report

On June 30, 2021, Bureau Veritas North America (BV) issued its *Final Independent Evaluator Annual Report on Compliance* for the 2020 WMP (2020 WMP IE Report). PG&E provided our response to the 2020 WMP IE Report on August 16, 2021 (PG&E IE Report Response). The 2020 WMP IE Report described audits of PG&E and recommended areas of improvement in areas such as EVM, VM tag procedures, pole inspections, weather stations, High Definition cameras, fuse replacement installations, and sectionalizing devices. PG&E addressed these audit findings and provided our comments regarding areas for improvement in the PG&E IE Report Response.[23] For example, we addressed locations that BV indicated vegetation management work was not in compliance with our standards, corrected field records with prepopulated data for pole inspections, and performed field verifications of conditions identified in the 2020 WMP IE Report. These lessons learned and improvements that PG&E is planning to make are described in more detail in the PG&E IE Report Response.

e. Lessons Learned from EPSS Implementation

We implemented our EPSS program in 2021 by setting devices with faster trip settings and higher impedance fault detection. This allowed our equipment to automatically turn off more quickly if the system detected a problem, such as an object striking an overhead line. The EPSS program had significant benefits including an 80 percent reduction in CPUC-reportable ignitions on EPSS-enabled circuits as compared to a 3-year average. However, while EPSS significantly reduced ignition risk, it also adversely impacted customer service as a result of increased outages. We received feedback from customers and communities regarding the impact of EPSS. Some of the lessons learned from the initial EPSS program implementation include:

- Better defining and managing risk-informed criteria for where and when to enable EPSS and establishing more localized thresholds for activation and shut-off of EPSS devices
- Developing more optimized circuit settings
- Improving outage response times
- Centralizing data and reporting across enabled processes, systems, and tools
- Proactive customer engagement and outreach regarding EPSS
- Ongoing and regular reporting regarding EPSS impacts

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22 *Pacific Gas and Electric Company's Submission of 2021 Wildfire Mitigation Progress Report*, dated November 1, 2021, p. 22 (Progress Report).

23 PG&E IE Report Response, pp. 4-8.

f. Lessons Learned Regarding Environmental Remediation

In our Progress Report, we described lessons learned regarding environmental remediation.[24] With regards to working with agencies and local and state governments, we are continuing our work to obtain additional programmatic permits/agreements due to the success we have seen with our current agreements. This programmatic approach has provided a clear strategy for agencies, local and tribal governments, and PG&E to process the substantial amount of work around wildfire mitigation and system hardening. Through the development of these agreements, we have created standardization around work notification packages and nomenclature to describe the work. These agreements have also allowed us to help address the resource shortfall with many of these agencies and governments, by creating reimbursable agreements. The reimbursable agreements allow for the agencies and governments to hire additional staff to address PG&E's workload. These agreements have also created a more constructive and collaborative relationship between our agency and government partners and PG&E as there is more engagement between PG&E and our agency and government partners' leadership. This enables us to work through challenges when they arise due to the stronger lines of communication that have been built in the development and rollout of these agreements.

g. Lessons Learned from Streamlining the 2022 WMP and Initiative Targets

Since the WMP process began, the complexity and scope of the WMPs has expanded significantly. We are mindful of Energy Safety's direction to streamline WMP reporting and so, in the 2022 WMP we developed a template for each initiative in Section 7.3 so similar information is provided for each Initiative.

In addition, in preparing our 2022 WMP, we also benchmarked against Southern California Edison Company's (SCE) and San Diego Gas & Electric Company's (SDG&E) 2021 WMPs. Specifically, we reviewed the number of initiative targets that SCE and SDG&E adopted and reported on in their 2021 WMPs, as well as the overall length and structure of their WMPs. This was helpful to better align with the utilities on our approach to initiative targets.

As a result of these efforts, we have reduced the number of our initiative targets. We have identified our quantitative and qualitative Initiative Targets for 2022 in Tables 5.3-1(a) and 5.3-1(b), respectively. The Initiative Targets are also repeated in the specific initiative descriptions in Section 7.3. We believe that these changes are consistent with Energy Safety's direction regarding streamlining the 2022 WMP.

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[24] Progress Report, p. 74.

4.2 Understanding Major Trends Impacting Ignition Probability and Wildfire Consequence

Describe how the utility assesses wildfire risk in terms of ignition probability and estimated wildfire consequence, including use of Multi-Attribute Risk Score (MARS) and Multi-Attribute Value Function (MAVF) as in the Safety Model and Assessment Proceeding (S-MAP)[25] and Risk Assessment Mitigation Phase (RAMP), highlighting changes since the 2020 WMP and 2021 Update. Include description of how the utility distinguishes between these risks and the risks to safety and reliability. List and describe each "known local condition" that the utility monitors per GO 95, Rule 31.1, including how the condition is monitored and evaluated.

We substantially updated our wildfire risk modeling and risk assessment tools in for the 2021 WMP and intend to continue to make improvements in 2022. Section 4.5.1 provides an overview of the updated risk models that we will be using in 2022, as well as our process for evaluating and validating these models. This Section 4.2 explains the use of established risk modeling tools (i.e., MAVF and MARS), explains PG&E's Bow Tie analysis, describes how PG&E distinguishes between wildfire risks and other safety and reliability risks, and describes known local conditions.

(a) Use of MAVF and MARS

Pursuant to Decision (D.) 18-12-014, PG&E implemented the S-MAP Settlement Agreement in 2019, including the development of an MAVF and Risk Bow Tie for Wildfire analysis. PG&E employs an MAVF to combine all potential consequences of the occurrence of a risk event and create a single measurement of value known internally as MARS.[26] An MAVF consists of the following components:

- Attributes
- Ranges
- Natural Units
- Weights
- Scaling Function

D.18-12-014 also provides six principles to use in determining the MAVF components: Attribute Hierarchies, Measured Observations, Comparison, Risk Assessment, Scaled Units, and Relative Importance.

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25 Updates to S-MAP are currently being considered in Rulemaking (R.) 20-07-013 – Order Instituting Rulemaking to Further Develop a Risk-based Decision-making Framework for Electric and Gas Utilities.

26 D.18-12-014, p. 17, 2018 S-MAP Revised Lexicon: *MAVF*.

The key components of the MAVF that PG&E used for assessing wildfire related risks, and how we adhere to the principles, are shown in Table PG&E-4-2.1 below and are described in the discussion following the table.

TABLE PG&E-4.2-1:
KEY COMPONENTS OF MAVF

Attribute	Range	Natural Units	Weight	Scaling Function
Safety	0 – 100	Equivalent Fatalities (EF)/Event	50%	Non-Linear
Electric Reliability	0 – 4 Billion	Customer Minutes Interrupted (CMI)/Event	20%	Non-Linear
Gas Reliability	0 – 750,000	Customers affected/event	5%	Non-Linear
Financial[(a)]	0 – $5 Billion	$/event	25%	Non-Linear

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(a) Pursuant to D.18-12-014 and D.16-08-018, utility shareholders' financial interests are to be excluded from the General Rate Case (GRC) and RAMP risk evaluation and risk mitigation considerations.

- Ranges – Pursuant to D.18-12-014, the smallest observable value of an Attribute is the low end of the range, and the largest observable value is the high end of the range. PG&E interprets the largest observable value to be a reasonable value informed by historical events and plausible large consequence scenarios. In our analysis and risk framework, event consequences are not capped at the high end of the range, but rather, the range is a specification required in setting the MAVF weights.
  - The high end of the Safety Attribute Range, set to 100, is an order of magnitude value informed by recent events.
  - The high end of the Electric Reliability Range (4 Billion CMI) was based on the most severe reliability impact from a single event of 3.6 billion CMI from the October 26, 2019 PSPS event.
  - The Gas Reliability high end is based on a scenario of an outage at a critical gas facility.
  - The Financial Attribute's high end represents a financial loss commensurate with an Energy Crisis - type event.
- Natural Units – EF is defined as the sum of Public, Employee and Contractor Fatalities and Serious Injuries per event occurrence. Serious Injuries are defined as situations that require hospitalization of an individual pursuant to existing Federal

and State reporting guidelines.[27] Fatalities and Serious Injuries are converted to EFs using the multiplicative factors 1.00 and 0.25, respectively. The conversion rate from Serious Injury to EF is based on information available from Federal sources.[28]

- Weights – Attribute Weights were assigned to reflect a relative importance of moving each Attribute from its least desired level (i.e., Upper Bound) to its most desirable level (i.e., zero), following the MAVF Principle 6 – Relative Importance.[29] For example, the Attribute Weights reflect PG&E's view that it is twice as valuable to move the Safety Attribute from 100 to 0 EFs as it is to move the Financial Attribute from $5 billion to $0. Assigning 50 percent weight to the Safety Attribute is in line with PG&E's emphasis on safety and is also consistent with the S-MAP Settlement Decision's requirement for a minimum 40 percent weighting for Safety.[30]

- Scaling Function – The Non-Linear Scaling Function is used to convert each Attribute from its Natural Unit to Scaled Units.[31] It consists of the following segments, with each segment intended to represent events that are either operational (i.e., encountered in the course of regular operations), critical or catastrophic.

  - For natural units from 0 to 1 percent of the Range (operational/moderate events): Linear function from 0 to 0.1 Scaled Units.

  - For natural units from 1 percent to 10 percent of the Range (critical events): Quadratic function from 0.1 to 5 Scaled Units.

  - For natural units from 10 percent to 100+ percent of the Range (catastrophic events): Linear function from 5 to 100+ Scaled Units.

For the 2022 WMP, PG&E has changed the MAVF Scaling Function by removing the cap on Scaled Units.

D.18-12-014 directs utilities to use Expected Value when calculating the Consequence of Risk Event (CoRE) and use the scaling function to capture aversion to extreme

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27 Pipeline and Hazardous Materials Safety Administration §191.3 Definitions: Incident (see also: 49 CFR § 191.3 - Definitions. | CFR | US Law | LII / Legal Information Institute (cornell.edu).

28 See "Treatment of the Values of Life and Injury in Economic Analysis," Table 2-3, Federal Aviation Administration (FAA) Office of Aviation Policy and Plans, Updated September 2016, (available at: https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/econ-value-section-2-tx-values.pdf.

29 D.18-12-014, Attachment A, Step 1A, No 7. MAVF Principle 6 –Relative Importance. p. A-6.

30 D.18-12-014, p. 66.

31 D.18-12-014, pp. 17-18; 2018-S-MAP Revised Lexicon: Scaled Unit of an Attribute: a value that varies from 0 to 100.

outcomes or indifference over a range of outcomes. Under PG&E's Non-Linear Scaling Function, the risk score, as measured by Scaled Units, will be low for operational events, but increases quadratically as critical events approach catastrophic (but low probability) levels. Once catastrophic levels are attained the function assigns 10 times higher score for each potential increase in Natural Units when compared to operational events. This captures aversion to critical and catastrophic outcomes and gives higher priority to controls and mitigations that affect them.

In PG&E's risk modeling, Attribute levels (e.g., the financial consequence of a risk event) are assumed to be uncertain and are represented by well-defined probability distributions. PG&E uses Monte Carlo simulations of risk events based on these probability distributions to generate consequence levels in Natural Units, convert Natural Units into Scaled Units using the Range and Scaling Function. The Expected Value of Scaled Units are then used to compute Attribute CoRE by applying the Attribute Weights and Scaler of 1000. Then Attribute CoRE values for each Attribute are summed together to derive CoRE. CoRE values are then multiplied to Frequency of a Risk Event to get Risk Scores, consistent with the Risk Assessment principle.

Overall, the S-MAP conforming risk assessment methodology has not changed substantially since the 2021 WMP. However, there have been a few important changes to the Wildfire Bow Tie analysis including:

- HFTD Distribution tranches were updated to incorporate the circuit segment and HFTD Tier level results of the 2021 WDRM v2 to provide more granularity in the risk assessment,

- The impact of climate change was assumed to amplify the consequence of all ignitions rather than increase the percentage of ignitions occurring when a Red Flag Warning (RFW) is in place.

These changes are described in more detail in Subsection (b) below.

(b) Wildfire Risk Assessment and Bow Tie Analysis

Consistent with D.18-12-014, PG&E assesses wildfire risk and estimated wildfire consequences in a Bow Tie analysis. The updated Bow Tie analysis provides the risk scores by drivers for 2022 which are reflected in Table PG&E-4.2.2.

TABLE PG&E-4.2-2:
WILDFIRE RISK DRIVERS

Wildfire Risk Score for 2022									
	HFTD				Non-HFTD				
Drivers	Distribution	Transmission	Substation	HFTD Total	Distribution	Transmission	Substation	Non-HFTD Total	Grand Total
Vegetation Contact	14,019	130	0	14,148	95		0	95	14,243
Equipment / facility failure	7,452	296	14	7,762	112	2	0	114	7,876
Contact from object	668	299		967	40	3		43	1,010
Wire-to-wire contact	322			322	1			1	322
Unknown	187	25		212	4	0		4	216
Other	127	8		135	1			1	136
Utility work / Operation	23			23	0			0	23
Vandalism / Theft	6	8		15	1	0		1	15
Contamination	14			14	1	0		1	15
CC - Seismic Scenario	10			10	0			0	10
Grand Total	**22,827**	**766**	**14**	**23,608**	**255**	**5**	**0**	**260**	**23,868**

% Risk									
	HFTD				Non-HFTD				
Drivers	Distribution	Transmission	Substation	HFTD Total	Distribution	Transmission	Substation	Non-HFTD Total	Grand Total
Vegetation Contact	58.7%	0.5%	0.0%	59.3%	0.4%	0.0%	0.0%	0.4%	59.7%
Equipment / facility failure	31.2%	1.2%	0.1%	32.5%	0.5%	0.0%	0.0%	0.5%	33.0%
Contact from object	2.8%	1.3%	0.0%	4.1%	0.2%	0.0%	0.0%	0.2%	4.2%
Wire-to-wire contact	1.3%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	1.4%
Unknown	0.8%	0.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.9%
Other	0.5%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%
Utility work / Operation	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Vandalism / Theft	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Contamination	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
CC - Seismic Scenario	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grand Total	**95.6%**	**3.2%**	**0.1%**	**98.9%**	**1.1%**	**0.0%**	**0.0%**	**1.1%**	**100.0%**

Baseline Frequency for 2022									
	HFTD				Non-HFTD				
Drivers	Distribution	Transmission	Substation	HFTD Total	Distribution	Transmission	Substation	Non-HFTD Total	Grand Total
Equipment / facility failure	28	3	0	32	139	2	0	141	173
Contact from object	22	6		28	101	7		108	136
Vegetation Contact	74	1	0	74	61		0	61	135
Unknown	6	0		6	10	1		11	17
Wire-to-wire contact	9			9	1			1	10
Other	3	0		3	4			4	7
Vandalism / Theft	0	0		0	2	0		2	2
Contamination	0			0	1	0		2	2
Utility work / Operation	1			1	0			0	1
CC - Seismic Scenario	0			0	0			0	0
Grand Total	**143**	**10**	**0**	**153**	**319**	**11**	**0**	**330**	**483**

% Frequency									
	HFTD				Non-HFTD				
Drivers	Distribution	Transmission	Substation	HFTD Total	Distribution	Transmission	Substation	Non-HFTD Total	Grand Total
Equipment / facility failure	5.8%	0.7%	0.0%	6.6%	28.7%	0.4%	0.1%	29.2%	35.8%
Contact from object	4.5%	1.2%	0.0%	5.7%	20.9%	1.5%	0.0%	22.4%	28.1%
Vegetation Contact	15.2%	0.1%	0.0%	15.3%	12.6%	0.0%	0.0%	12.6%	27.9%
Unknown	1.2%	0.1%	0.0%	1.3%	2.1%	0.1%	0.0%	2.2%	3.6%
Wire-to-wire contact	1.8%	0.0%	0.0%	1.8%	0.3%	0.0%	0.0%	0.3%	2.0%
Other	0.6%	0.0%	0.0%	0.7%	0.7%	0.0%	0.0%	0.7%	1.4%
Vandalism / Theft	0.1%	0.0%	0.0%	0.1%	0.4%	0.0%	0.0%	0.4%	0.5%
Contamination	0.1%	0.0%	0.0%	0.1%	0.3%	0.1%	0.0%	0.4%	0.5%
Utility work / Operation	0.2%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.2%
CC - Seismic Scenario	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grand Total	**29.5%**	**2.2%**	**0.0%**	**31.7%**	**66.0%**	**2.2%**	**0.1%**	**68.3%**	**100.0%**

Table PG&E-4.2-2 shows that:

- 95.6 percent of Wildfire Risk comes from HFTD distribution
- 3.2 percent of the Wildfire Risk comes from HFTD transmission
- 59.7 percent of the risk is from vegetation contact
- 33.0 percent of the risk is from equipment / facility failure

It also shows that the vegetation contact driver is the highest contributor for the risk for HFTD distribution but equipment / facility failure driver is higher contributor for transmission and non-HFTD distribution. Figures PG&E-4.2-1, PG&E-4.2-2, and PG&E-4.2-3 show associated Bow Tie visuals for the PG&E electric service territory, HFTD distribution, and HFTD transmission, to show breakdown of risk score as multiplication of frequency and consequence for different driver and outcome.

FIGURE PG&E-4.2-1:
WILDFIRE RISK BOW TIE ANALYSIS
(PG&E SERVICE TERRITORY; OVERHEAD CIRCUITS ALL VOLTAGE CLASSES)

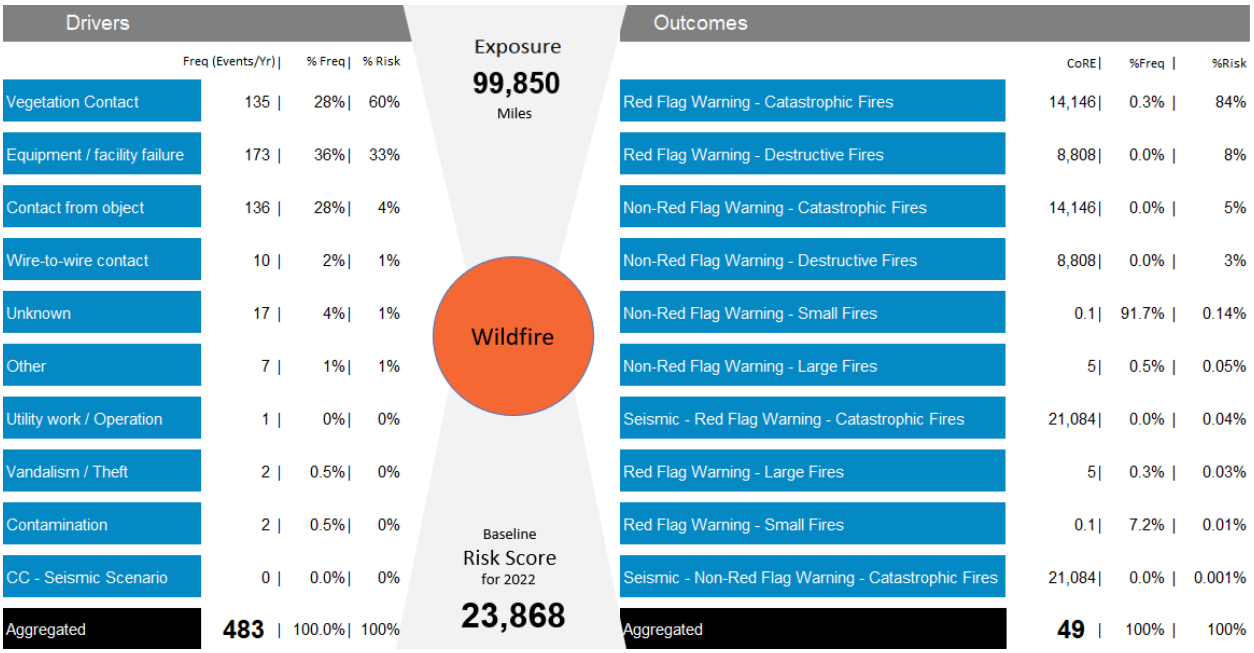


FIGURE PG&E-4.2-2:
WILDFIRE RISK BOW TIE ANALYSIS
(PG&E HFTD ONLY; DISTRIBUTION VOLTAGE OVERHEAD CIRCUITS)

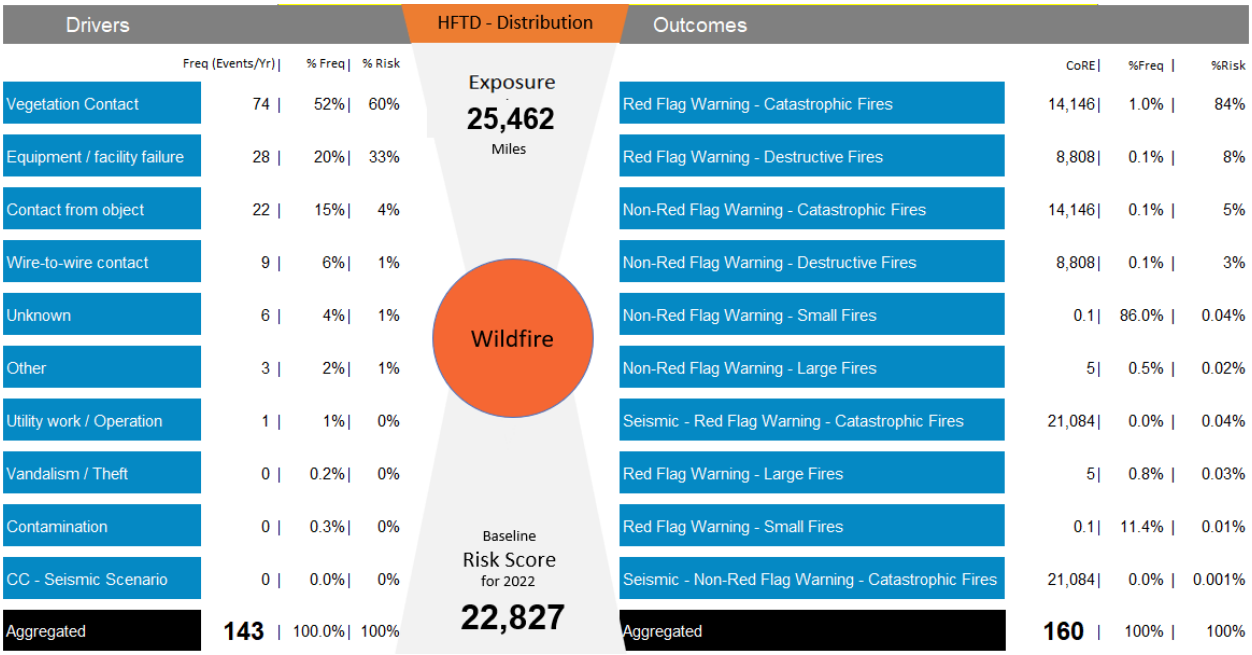
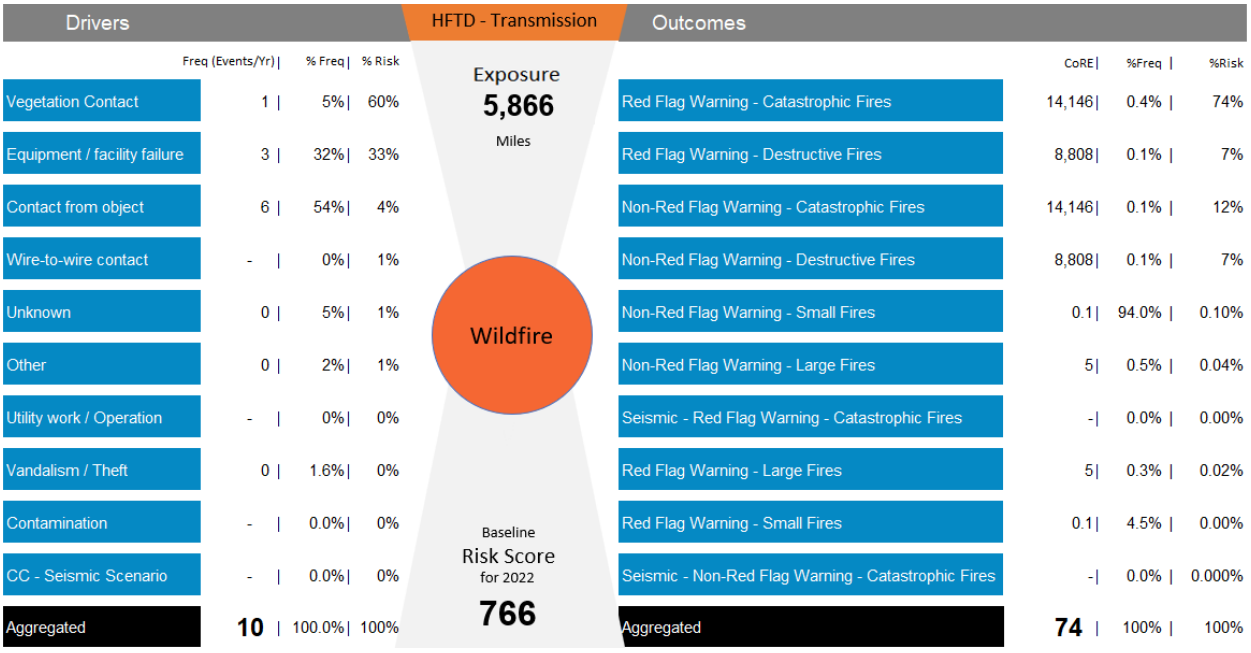


FIGURE PG&E-4.2-3:
WILDFIRE RISK BOW TIE ANALYSIS
(PG&E HFTD ONLY; TRANSMISSION VOLTAGE OVERHEAD CIRCUITS)



PG&E provides a summary below of the elements of the Bow Tie analyses as shown in Figures PG&E-4.2-1, PG&E-4.2-2, and PG&E-4.2-3 above:

1. Drivers-Ignition Frequencies – Shown on the left of the visuals above, the current S-MAP conforming Bow Tie is derived from normalizing the ignitions by Transmission and Distribution overhead line miles of exposure reported annually to the CPUC. In accordance with D.14-02-015, PG&E annually reports to the CPUC fire incidents that may be associated with PG&E facilities and that meet the following conditions: (a) a self-propagating fire of material other than electrical and/or communication facilities; (b) the resulting fire traveled greater than one linear meter from the ignition point; and (c) PG&E has knowledge that the fire occurred. The S-MAP conforming model discussed in detail in PG&E's 2023 GRC Testimony used ignitions reported to the CPUC for years 2015 through 2020.[32] PG&E is still finalizing the 2021 reportable ignition data in preparation for our annual report, thus data from 2015 through 2020 was used in the model. However, the frequencies in the above analysis reflect the estimated impact of mitigations implemented in 2021

2. Total Exposure – Shown in the center of the visuals above across all Tranches: 99,850 circuit miles of overhead Transmission and Distribution voltage conductor covering PG&E's service territory. Since the 2020 RAMP Report, PG&E has received feedback from Energy Safety, Safety Policy Division (SPD), and various stakeholders that the level of tranching was not adequate to represent the risk profiles of PG&E's system. In response to this feedback, for the Wildfire Risk Bow Tie Analysis used in the 2022 WMP, PG&E has incorporated the results of the 2021 WDRM v2 to further delineate wildfire risk across PG&E's distribution system in HFTD at a more granular level summarizing into 25 tranches (compared to 3 tranches used in 2020 RAMP Report and 2021 WMP). PG&E also further differentiated transmission tranches by voltage levels.

3. Outcomes-Wildfire Consequences – There is a wide range of potential public safety risks resulting from a fire ignition associated with PG&E assets. In the overwhelming majority of cases, fire ignitions do not end up a large wildfire because they are extinguished quickly and/or do not propagate far. However, in some cases, ignitions can result in larger wildfires. PG&E uses fire incidents from the California Department of Forestry and Fire Protection (CAL FIRE) database to estimate the safety and financial consequences of wildfire. For each fire incident, the CAL FIRE dataset provides the location, size, number of destroyed/damaged structures, and the number of fatalities/injuries. Reliability consequences are estimated by using distribution customer minutes for outages that were associated with CPUC reportable ignitions and known fires associated with those outages. PG&E is providing a more granular outcomes of consequences, as shown on the right side of the Bow Tie, on ignitions in terms of three variables:

    a. The size/destructiveness of the fire that resulted from the ignition. PG&E's categorization of fire size is based on the following definitions:

        - Catastrophic – A fire that destroys 100 or more structures, and results in a serious injury and/or fatality.

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32 PG&E 2023 GRC Exhibit 4 page 3-14 through 3-23

- Destructive – A fire that destroys 100 or more structures but does not result in a serious injury or fatality.

- Large – A fire that burns 300 or more acres but does not meet the definition of a Destructive or Catastrophic fire.

- Small – A fire that burns fewer than 300 acres.

b. Whether the ignition took place on a day and in an area in which a RFW was in place or not. RFW is a forecast warning issued by the National Weather Service (NWS) in the United States to inform the public, firefighters, and land management agencies that conditions are ideal for wildland fire combustion and rapid spread.[33] The potential consequences of ignitions are higher when an RFW is in effect.[34]

c. For catastrophic fires, only, whether the catastrophic fire is associated with a seismic event.

The wildfire risk of the entire system is the sum of the risk scores over all tranches. The risk score for each tranche is the sum of risk scores for each combination of driver and outcome for the tranche based on the product of the frequency of a risk event associated with the driver and outcome, and consequence of that outcome. In the Bow Tie Analysis used in 2022 WMP, PG&E incorporated lessons learned from analyzing ignition data that indicated a different likelihood of an ignition resulting in a RFW outcomes for a different driver. Based on PG&E's 2015 – 2020 CPUC reportable ignitions, the percentage of ignitions occurring when a RFW is in effect is the highest for vegetation contact driver, followed by equipment / facility failure, and then all other drivers. CoRE values for RFW is higher than CoRE values for non-RFW due to higher chance of resulting in large, destructive and catastrophic outcomes. Thus, this change resulted in higher CoRE value for vegetation contact driver compared to one for equipment failure driver, and higher CoRE value for equipment failure driver compared to one for the rest of the drivers.

(c) How PG&E distinguishes between wildfire risks and other safety and reliability risks

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33 Precise temporal and spatial mapping analysis of RFW conditions is conducted by utilizing RFW GIS shapefiles from: https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml. (as of June 16, 2020).

In a February 19, 2020 letter to PG&E providing feedback on information that PG&E provided in workshops held on January 13, 2020 and February 4, 2020, TURN recommended that "for clarity" PG&E use "Fire Weather *Conditions* instead of *Warning*" when classifying outcomes. At the time of the workshop, PG&E used the term "Fire Weather Warning" to refer to elements of the NWS RFW. PG&E's use of RFWs to categorize outcomes is appropriate because it is a simple, objective metric from a trusted third-party (NWS) that serves as a reasonable proxy for fire weather conditions.

34 PG&E's WDRM assumes that starting in 2023 the probability that an ignition occurs at a location and day that RFW is in effect will increase in 5-year increments based on the Cal-Adapt Wildfire Data.

Wildfire risk is one of the risks in the PG&E's Corporate Risk Register. All risks in the PG&E's Corporate Risk Register have associated safety, reliability, and/or financial consequences. The safety, reliability and financial consequences of each risk are modeled separately and combined into a risk score using the MAVF.

We have defined Wildfire Risk as PG&E assets or activities that may initiate a fire that is not easily contained, endangers the public, private property, sensitive lands or environment. In the Wildfire Risk Bow Tie Analysis, PG&E currently defines the risk event as the CPUC-reportable ignition from PG&E's electric transmission, distribution, and substation assets, and safety, reliability and financial consequence resulting from a CPUC-reportable ignition is captured.

We also include non-wildfire consequences from a failure of electric assets such as:

- Failure of Electric Distribution Overhead Assets
- Failure of Electric Distribution Underground Assets
- Failure of Electric Distribution Network Assets
- Failure of Electric Transmission Overhead Assets
- Failure of Electric Transmission Underground Assets
- Failure of Electric Transmission Substation Assets
- Failure of Electric Distribution Substation Assets
- Third Party Safety Incident risk

The asset failure risks define a risk event as a failure of assets not caused by third parties and captures the non-wildfire safety, reliability, and financial consequence from failure of assets. For example, a failure of asset resulting in a CPUC-reportable ignition is included in the frequency of asset failure risk events, but the consequences for those events are set to zero in the asset failure risks because those are captured in the wildfire risk. Asset failure risks also do not consider failures caused by wildfire from PG&E's CPUC-reportable ignitions, since the consequences from those failures are captured through wildfire risk consequences from the associated CPUC-reportable ignition.

PG&E includes failure of assets caused by third parties in the Third Party Safety Incident risk. Thus, non-wildfire safety, reliability and financial consequence of a failure of assets caused by third party vehicular contact with PG&E's pole or guy wire, and third-party contact with intact electric assets are classified to Third Party Safety Incident risk, not in the asset failure risks. On the other hand, wildfire risk includes an CPUC-reportable ignition caused by third party drivers.

(d) List and Description of "Known Local Conditions" as That Term is Used in GO 95, Rule 31.1

GO 95, Rule 31.1 directs PG&E to design, construct and maintain a facility in accordance with accepted good practice for the intended use and known local conditions. PG&E's Overhead Design Manual contains the standards and methodologies for designing and assessing facilities according to the known local conditions such as mechanical loading, geographic location, and HFTD and non-HFTD areas. As such, PG&E has specific design standards as it relates to HFTD areas. Additionally, our inspection and maintenance procedures and practices are adjusted for Tier 2 and Tier 3 areas within HFTD. PG&E developed our S-MAP conforming Bow Tie for the wildfire risk by creating separate tranches for HFTD and non-HFTD areas. The higher risk scores and Risk Spend Efficiency (RSE) values for mitigations in the HFTD areas enables prioritization of wildfire mitigation initiatives in HFTD areas. For additional information on PG&E's evaluation of HFTD areas, including the development of our HFRA Map identifying risk areas beyond HFTDs, please see Section 4.2.1.

4.2.A. Contribution of Weather to Ignition Probability and Estimated Wildfire Consequences

A) Describe how the utility monitors and accounts for the contribution of weather to ignition probability and estimated wildfire consequence in its decision -making, including describing any utility--generated Fire Potential Index or other measure (including input variables, equations, the scale or rating system, an explanation of how uncertainties are accounted for, an explanation of how this index is used to inform operational decisions, and an explanation of how trends in index ratings impact medium--term decisions such as maintenance and longer--term decisions such as capital investments, etc.).

To understand the real-time to short-term weather and fire risk (hour to week ahead), PG&E's Meteorology and Fire Science department utilizes real-time weather station data and weather model data from multiple models. These weather model data are utilized to drive dead fuel moisture (DFM) and live fuel moisture (LFM) models, which together with other data, feed into PG&E's Fire Potential Index (Utility FPI or FPI) Model and Ignition Probability Weather (IPW) Model. The weather, LFM, and DFM data are also used in our fire spread model application, to dynamically simulate the potential spread and consequences of fire. For longer-term decisions and work planning, such as for System Hardening and EVM, we utilize climatological weather datasets and fire spread simulations across a range of historical fire weather days to inform investment decisions where the risk is highest over the long term. Additional details on the numerous elements of PG&E's weather, fuels, outage and fire potential index forecasting can be found in Sections 4.2.B, 4.5.1(f), 4.5.1(g), 7.3.1.5, 7.3.2.1.1, 7.3.2.1.2 and 8 of the 2022 WMP.

4.2.B. Contribution of Fuel Conditions

B) Describe how the utility monitors and accounts for the contribution of fuel conditions to ignition probability and estimated wildfire consequence in its decision--making, including describing any proprietary fuel condition index (or other measures tracked), the outputs of said index or other measures, and the methodology used for projecting future fuel conditions. Include discussion of measurements and units for live fuel moisture content, dead fuel moisture content, density of each fuel type, and any other variables tracked. Describe the measures and thresholds the utility uses to determine extreme fuel conditions, including what fuel moisture measurements and threshold values the utility considers "extreme" and its strategy for how fuel conditions inform operational decision--making.

PG&E has deployed methods to predict DFM and LFM on the PG&E-AWS cloud. The DFM method is capable of predicting the moisture content of multiple DFM fuel classes (i.e., DFM 1hr, DFM 10hr, DFM 100hr, DFM 1,000hr) at 2 × 2 km spatial resolution, hourly temporal resolution, out 129 hours. PG&E has also deployed a method to predict LFM at a resolution of 2 × 2 km, for Chamise and Manzanita plant species. These are machine learning methods developed using National Fuel Moisture Database observations. In 2020 and 2021, PG&E partnered with Atmospheric Data Solutions and Technosylva to develop the next generation of LFM and DFM Models. In 2021, these models were extended to provide 129 hours of forecast data, providing a longer lead time than previously available. The DFM Model PG&E deployed is a customized version of the Nelson DFM model utilized in the NFDRS 2016 model version.

Figure PG&E-4.2-4 below is an example hour output from the DFM 10hr fuel class.

FIGURE PG&E-4.2-4:
HOUR OUTPUT FOR 10 HOUR DFM MODEL

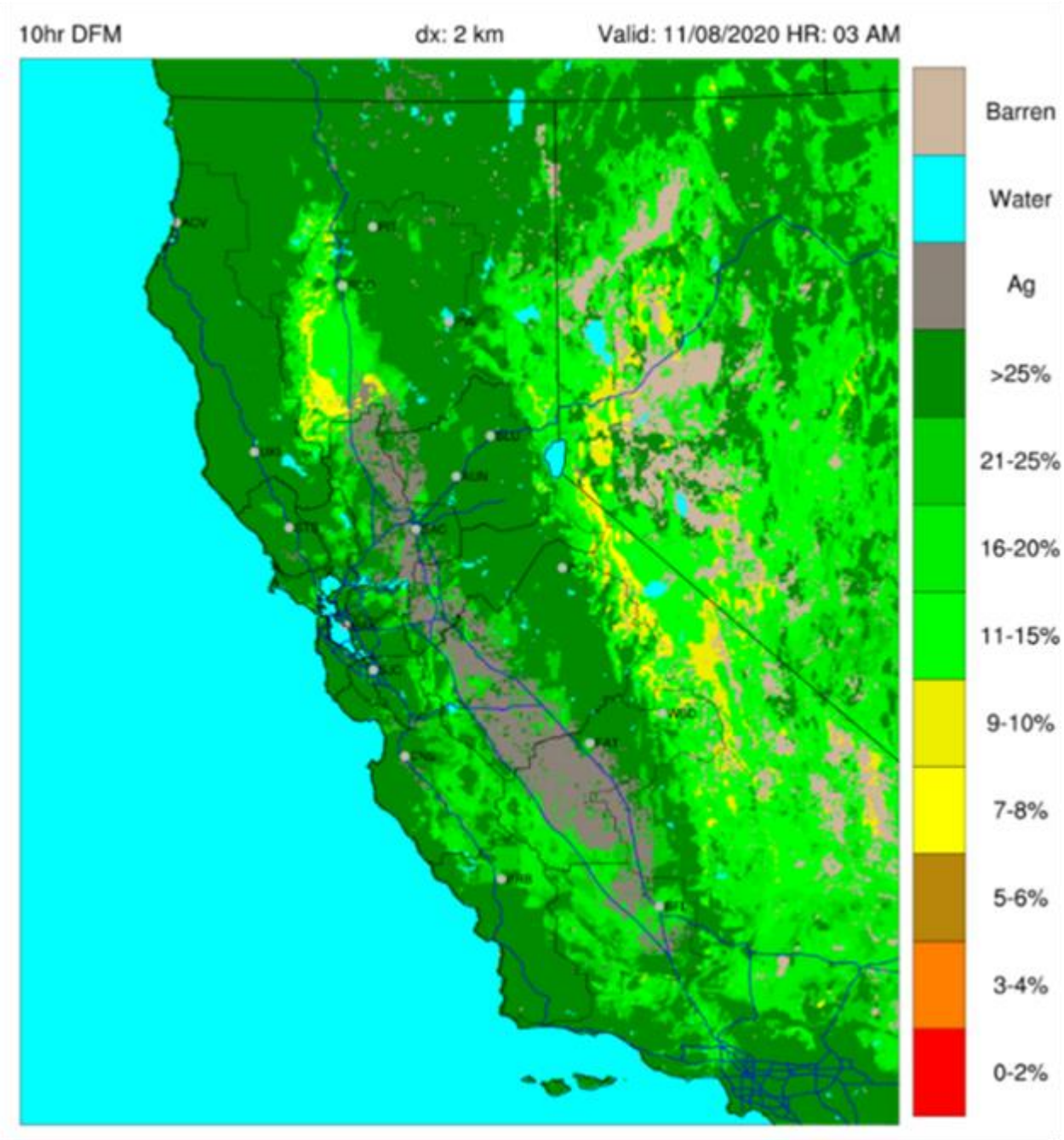
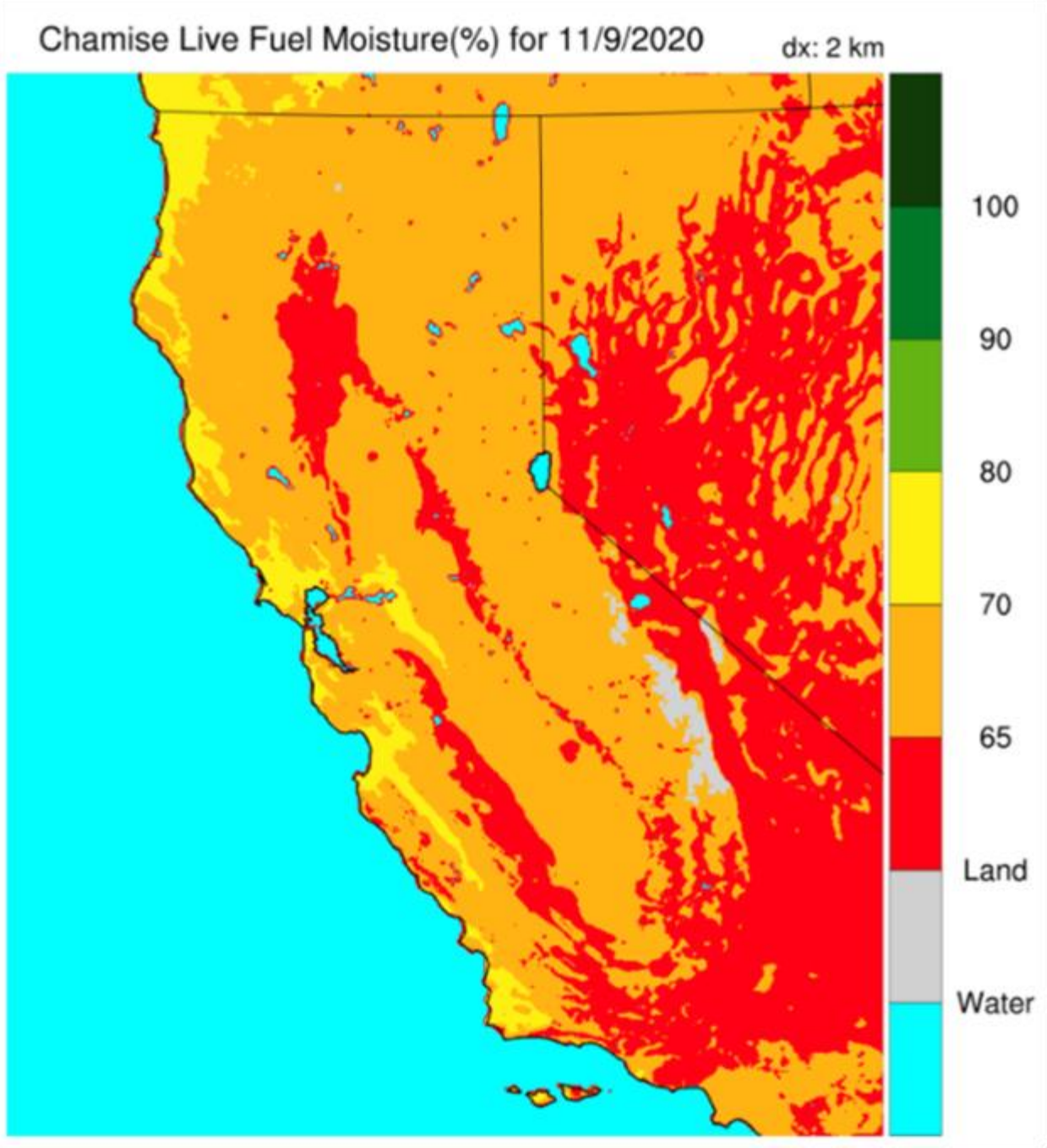


Figure PG&E-4.2-5 below is an example hour output from the LFM Model for chamise.

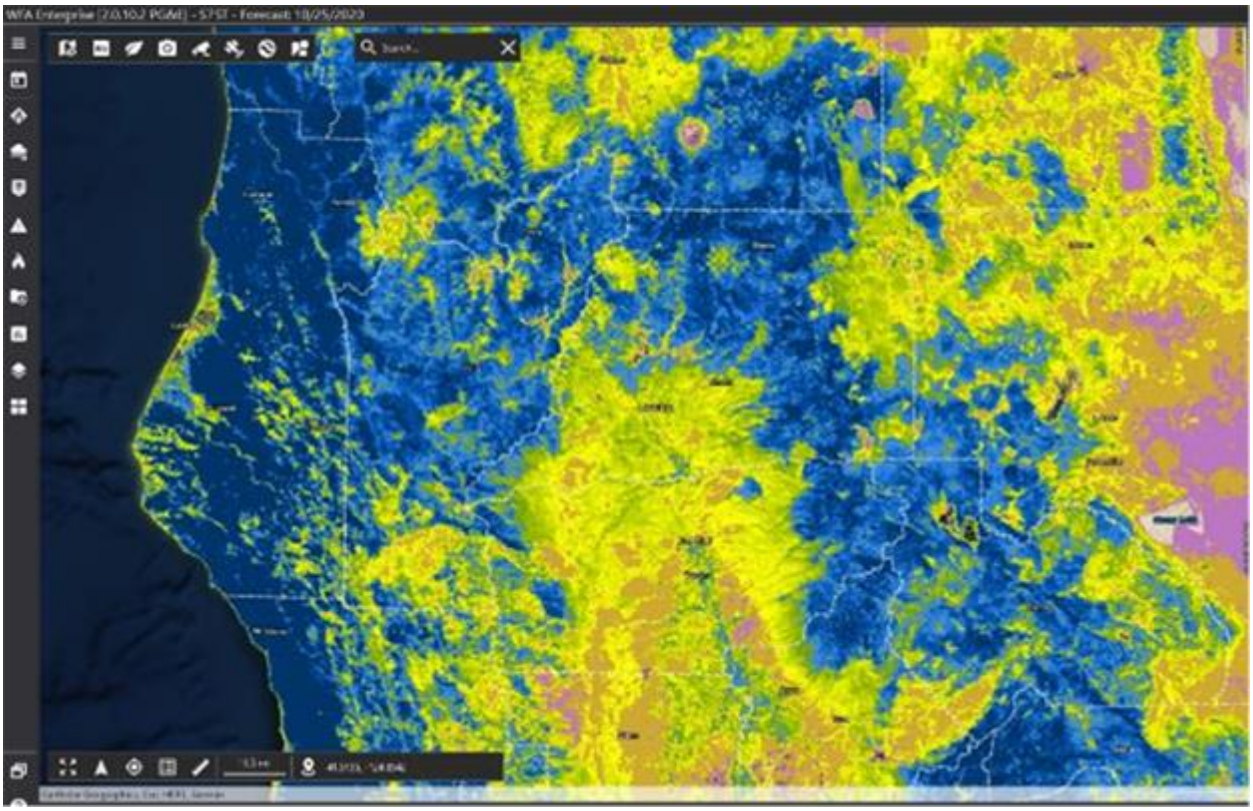
FIGURE PG&E-4.2-5:
HOUR OUTPUT FROM LFM MODEL



In addition to creating new forecast models, PG&E created a 30+ year climatology of DFM and LFM Model output at hourly, 2 x 2 km resolution as well. These robust historical datasets allow PG&E meteorologists and data scientists to evaluate the DFM and LFM conditions present during historical fires.

PG&E also sought to create new LFM Models using remotely sensed satellite data. We partnered with Technosylva to deploy LFM woody and LFM herbaceous fuel models that take advantage of recent Moderate Resolution Imaging Spectroradiometer (MODIS) satellite measurements and indices such as the Normalized Difference Vegetation Index (NDVI). Figure PG&E-4.2-6 below is an example NDVI output is presented. These models were built using machine learning techniques and were trained against National Fuel Moisture Database observations.

FIGURE PG&E-4.2-6:
EXAMPLE OF NORMALIZED DIFFERENCE VEGETATION INDEX OUTPUT



LFM models developed and deployed are trained on field observations. PG&E is taking steps to bolster these observations and provide them to the public. These observations can help validate existing models and enable more accurate models to be developed in the future as they can take advantage of many more observations. In 2020 and 2021, for example, PG&E established an internal LFM sampling program to complement samples collected by state and federal agencies across Northern and Central California. This network consists of 30 locations where plant species, such as Chamise and Manzanita, are sampled to measure the amount of fuel moisture in these plants throughout the seasonal cycle. Site locations were selected and scouted by PG&E meteorologists as well as PG&E Safety and Infrastructure Protection Teams (SIPT) personnel. Samples are collected in the field and shipped to a laboratory for processing. The results of all measurements are uploaded and made publicly available via the National Fuel Moisture Database. These observations are critical to train and

validate high-resolution LFM models and satellite-derived LFM products and will be helpful for PG&E and others to train the next generation of LFM models.

4.2.1 Service Territory Fire-Threat Evaluation and Ignition Risk Trends

Present a map of the highest risk areas identified within the current HFTD tiers of the utility's service territory as a figure in the WMP. Discuss fire threat evaluation of the service territory to determine whether a modification to the HFTD is warranted (i.e., expansion beyond existing Tier 2 and Tier 3 areas). If the utility believes there are areas in its service territory that are not currently included in the HFTD but require prioritization for mitigation efforts, then the utility is required to provide a process outlining the formal steps necessary to have those areas considered for recognition in the CPUC-defined HFTD. Include a discussion of any fire threat assessment of its service territory performed by the electrical corporation, highlighting any changes since prior WMP submissions. In the event that the utility's assessment determines the fire threat rating for any part of its service territory is insufficient (i.e., the actual fire threat is greater than what is indicated by the CPUC's Fire Threat Map and High Fire Threat District designations), the utility is required to identify those areas for potential HFTD modification, based on the new information or environmental changes, showing the differences on a map in the WMP. To the extent this identification relies upon a meteorological or climatological study, a thorough explanation and copy of the study must be included as an Appendix to the WMP.

List, describe, and map geospatially (where geospatial mapping is applicable) any macro trends impacting ignition probability and estimated wildfire consequence within utility service territory, highlighting any changes since the 2021 WMP Update:

1. *Change in ignition probability and estimated wildfire consequence due to climate change*

2. *Change in ignition probability and estimated wildfire consequence due to relevant invasive species, such as bark beetles*

3. *Change in ignition probability and estimated wildfire consequence due to other drivers of change in fuel density and moisture*

4. *Population changes (including Access and Functional Needs population) that could be impacted by utility ignition*

5. *Population changes in HFTD that could be impacted by utility ignition*

6. *Population changes in Wildland Urban Interface (WUI) that could be impacted by utility ignition*

7. *Utility infrastructure location in HFTD vs non-HFTD*

8. *Utility infrastructure location in urban vs rural vs highly rural areas*

This section is divided into two subsections. Subsection (a) describes service territory fire-threat evaluation, and subsection (b) describes trends impacting ignition probability and estimated wildfire consequence within our service territory.

(a) Service Territory Fire-Threat Evaluation

To inform the scope of PSPS events, PG&E has performed, and continues to perform, a fire threat assessment of our service territory focused on identifying areas where an ignition during an offshore wind event could lead to a catastrophic wildfire.[35] The culmination of this assessment is referred to as PG&E's High Fire Risk Area (HFRA) map. The HFRA map serves as an initial filter in the PSPS scoping process, upon which additional event-specific spatial information is overlaid and analyzed to arrive at final PSPS scope. The HFRA map may be used for other purposes as well, such as informing workplans and risk assessment.

PG&E began development of our HFRA map in 2020, by using the Tier 2 and Tier 3 portions of the CPUC's HFTD map as a starting point and adding areas where we believe an ignition, during an offshore wind event, could lead to a catastrophic wildfire. At the end of 2020, PG&E's HFRA map included all areas in the Tier 2 and Tier 3 portions of the CPUC's HFTD map, as well as PG&E's additions. Those additions, the process used to identify them, and the resulting HFRA map were described in PG&E's 2021 WMP.[36]

In 2021, PG&E continued to develop our HFRA map. This was done by removing areas from the HFRA map where we concluded that an ignition during an offshore wind event either would not occur or otherwise would not lead to a catastrophic wildfire. The process used to identify areas for removal largely followed the process used to identify areas for addition, with two exceptions. First, a step was added for field validation, described in Step 3, below. Second, a step was added for wildfire exposure analysis, using wildfire simulation software, described in Step 4, below.

The steps of the process used in 2021 to identify areas for removal from the HFRA map are listed below.[37] In each step of the process, the candidate area was assessed to determine the potential that an ignition during an offshore wind event would lead to a catastrophic wildfire. If, at any step of the process, a candidate area was determined to have this potential, it was not considered any further for removal from PG&E's HFRA map. Only those areas that satisfied all five steps of the process were ultimately removed from the HFRA map. The five steps include:

1. Candidate areas were initially identified for potential removal from the HFRA map by subject matter experts familiar with the local area and fire history.

2. A core team, composed of PG&E subject matter experts in wildfire analysis, meteorology, electrical engineering, and PSPS operations, jointly assessed each of

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35 PG&E's HFRA focuses on offshore wind-event conditions because offshore wind events are essential features of the strong and episodic increases in catastrophic wildfire risk that PSPS is intended to mitigate.

36 2021 Revised WMP, pp. 85-89.

37 The HFRA modification process was implemented in three rounds in 2021, resulting in three HFRA map updates. The same steps were implemented in each round, but the order of the steps was changed between the first and second rounds to improve efficiency. The list presented here reflects the order used in the latter two rounds.

the candidate areas identified in Step 1, using geospatial software and datasets (e.g., aerial imagery, vegetation maps, topographic maps).

3. Each of the candidate areas remaining after Step 2 were assessed in the field by one or more of PG&E's Public Safety Specialists, each with extensive, local wildfire management experience.

4. Each of the candidate areas remaining after Step 3 were subjected to wildfire exposure analysis. Specifically, this analysis leveraged PG&E's 30-year, 2-km resolution climatology and Technosylva's wildfire simulation software to estimate fire behaviors and numbers of impacted structures resulting from simulated ignitions in each candidate area, under each candidate area's most extreme fire weather and dead fuel moisture scenarios of the last 20 years. Extreme scenarios included a mixture of worst-case days, as well as offshore wind-event days, PSPS days, days of catastrophic wildfire occurrence, and some typical hot and dry summer days.

5. Each of the candidate areas remaining after Step 4 were assessed by the UCLA B. John Garrick Institute for Risk Sciences, using geospatial software and datasets (e.g., aerial imagery, vegetation maps, topographic maps).[38]

Application of this process in 2021 resulted in the removal of 218 discrete areas from PG&E's HFRA map. At the end of 2021, PG&E's revised HFRA map represents the spatial net result of the CPUC's HFTD map, plus PG&E's 2020 additions, minus PG&E's 2021 removals. Table PG&E-4.2-3 below summarizes the results of HFRA modifications in 2020 and 2021, for transmission and distribution miles in HFRA areas in 2020 and 2021, and the number of customers that would be within PSPS scope. Figure PG&E-4.2-7 provides a map of HFTD Tier 2 and Tier 3 areas and HFRA areas in PG&E's service territory as of December 2021. In 2022, we plan to continue to evaluate our HFRA map to further improve alignment with our objective.

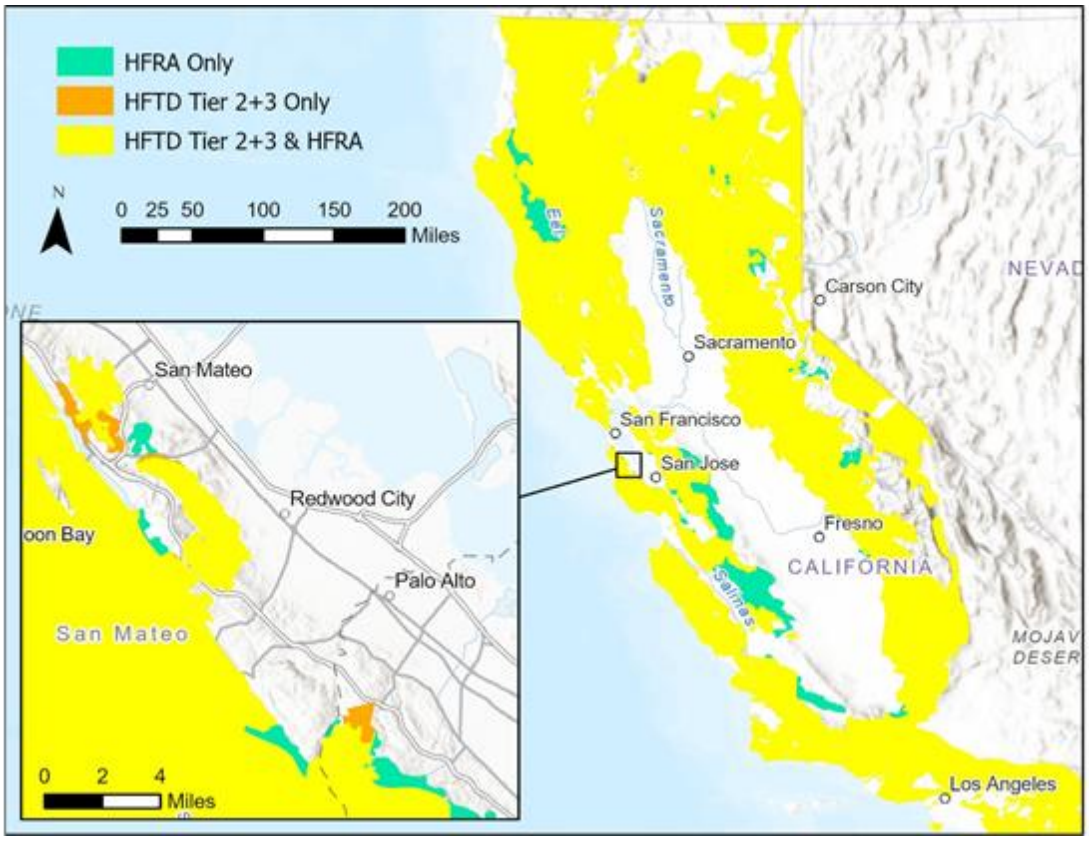
TABLE PG&E-4.2-3:
SUMMARY OF PG&E HFRA MODIFICATIONS IN 2021

	2020 Modifications	2021 Modifications
Area (square miles)	+3,280	-30
Overhead Transmission Circuit Miles	+230	-30
Overhead Distribution Circuit Miles	+610	-170
Customers in PSPS Scope	+3,000	-36,000

[38] Results of assessments by B. John Garrick Institute for Risk Sciences are summarized in reports. The three assessment reports pertaining to those areas considered for removal from HFRA in 2021, are included as attachments:

- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch01;
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch02; and
- 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.2.1_Atch03.

FIGURE PG&E-4.2-7:
CPUC HFTD MAP TIER 2 AND TIER 3, AND PG&E HFRA MAP, DECEMBER 2021



PG&E believes that many, but likely not all, of the past modifications to our HFRA map should also be applicable to the CPUC's HFTD map. This is based on the understanding that the CPUC's HFTD map and PG&E's HFRA map are designed to achieve related objectives. Tier 2 and Tier 3 of the CPUC's HFTD map are intended to identify areas where stricter fire-safety regulations are to be applied, which the CPUC did by identifying areas with elevated risk and extreme risk, respectively, (including likelihood and potential impacts on people and property) from wildfires associated with overhead utility power lines and overhead utility power-line facilities.[39] PG&E's HFRA map is intended to inform the geographic scope of PSPS events, which it attempts to do by identifying areas of PG&E's service territory where it believes an ignition, during an offshore wind event, could lead to a catastrophic wildfire, as well as informing in some cases work plans and risk assessments.

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39 CPUC D.17-01-009 (2017, p. 25) broadly defines Tier 2 and Tier 3 of the CPUC's HFTD map as "Areas with elevated wildfire risk" and "Areas with extreme wildfire risk", respectively. A set of more explicit definitions is given in the Independent Review Team Final Report on the Production of the California Public Utility Commission's Statewide Fire Map 2 (CPUC, 2017, p. 12), and reiterated in CPUC Decision 20-12-030 (2020, p. 2), and on the CPUC's Fire-Threat Maps and Fire-Safety Rulemaking webpage (https://www.cpuc.ca.gov/industries-and-topics/wildfires/fire-threat-maps-and-fire-safety-rulemaking).

All areas added to the HFRA map (i.e., areas currently within PG&E's HFRA map, but currently outside of Tier 2 and Tier 3 of the CPUC's HFTD map) should be candidates for inclusion in Tier 2 or Tier 3 of the CPUC's HFTD map based on the idea that stricter fire safety regulations should be applied in any area where an ignition could lead to a catastrophic wildfire. However, it is unclear how such additions should be allocated between Tier 2 and Tier 3, given existing Tier 2 and Tier 3 definitions. We also believe that some of the areas removed from the HFRA map (i.e., areas currently outside PG&E's HFRA map, but currently inside Tier 2 or Tier 3 of the CPUC's HFTD map) may warrant removal from Tier 2 or Tier 3 of CPUC's HFTD map. These areas were removed from the HFRA because they were determined to lack catastrophic wildfire risk, given an ignition, and under offshore wind event conditions. To determine their candidacy for removal from the CPUC's HFTD maps, these areas would need to be re-assessed with respect to wildfire risk generally, per Tier 2 and Tier 3 definitions (i.e., wildfire risk associated with all levels of wildfire consequence including but not limited to catastrophic wildfire, not conditional on an ignition, and not conditional on offshore-wind-event conditions).

For future modifications to the CPUC's HFTD map, PG&E envisions a CPUC-led process modeled on the one used to initially develop the CPUC's HFTD map, in which: (a) operational guidance and methodology were collaboratively developed; and (b) an Independent Review Team (IRT) conducted a technical review of the changes proposed by the Territory Leads, and made inquiries about, modified, and ultimately accepted or rejected the proposed modifications based on that technical review.

(b) Ignition Risk trends

Macro Trends Impacting Ignition Probability and/or Wildfire Consequence:

PG&E has identified the following macro-trends that may impact wildfire ignition probability and/or wildfire consequences:

TABLE PG&E-4.2-4:
MACRO TREND THAT MAY IMPACT WILDFIRE IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCES

Rank	Macro Trends	Comments
1	Change in ignition probability and estimated wildfire consequences due to climate change	Several key climate change trends are influencing variable periods of extreme wildfire risks in Northern California. These trends significantly increase wildfire ignition risks around utility networks. Warmer winters are causing increases in rainfall rather snow, resulting in a decrease to the snowpack. This reduces available water resources earlier in summer months, stressing vegetation and increasing available fuels. Compounding the shift from snow to rain are extended dry periods following summer months deeper into fall and early winter. Northeast winds are more common in fall and winter months in Northern California and if not accompanied by rainfall or other atmospheric moisture wildfire risks continue to increase despite the presence of lower temperatures. Ignitions that occur under these conditions can result in large conflagrating wildfires that can further promote risk associated with Northern California's abundant fuel and extreme terrain resulting in fires that develop their own devastating weather. *Reference*: OEHHA: https://oehha.ca.gov/epic/changes-climate/precipitation. "Extremely dry and extremely wet years have become more common in California. On average, the state receives 75 percent of its annual precipitation from November through March, with 50 percent occurring from December through February. As the winter months have become warmer in recent years, more precipitation has been falling as rain instead of snow over the watersheds that provide most of the state's water supplies." "The last decade also includes the driest consecutive four-year period, from 2012 to 2015." "Warming temperatures, declining snowpack, and earlier spring snowmelt runoff can create stresses on vegetation" *Reference:* National Geographic: https://www.nationalgeographic.com/science/2019/10/climate-change-california-power-outage/ "Increasing heat, changing rain and snow patterns, shifts in plant communities, and other climate-related changes have vastly increased the likelihood that fires will start more often and burn more intensely and widely than they have in the past." "The changes in climate have created the perfect conditions for fire. Lower precipitation and warmer air temperatures dry the forests and other vegetation. Add strong winds and decades of fire suppression into the mix and you have a dangerous recipe for wildfire." *Reference*: National Geographic: https://www.nationalgeographic.com/science/article/climate-change-increases-risk-fires-western-us "In recent years, the area burned by wildfires has increased in parallel with increasing air temperatures (OEHHA, 2018.)" Diablo events that carry warm and dry air to the coast, play a key role in amplifying "fire weather" conditions. The combination of Diablo events and the later onset of winter precipitation can create an environment of dry vegetation, which is primed for explosive wildfire conditions. *Reference*: CA State Gov https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf

TABLE PG&E 4.2-4:
MACRO TREND THAT MAY IMPACT WILDFIRE IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCES
(CONTINUED)

Rank	Macro Trends	Comments
2	Change in ignition probability and estimated wildfire consequence due to relevant invasive species, such as bark beetles	Invasive species create landscape level concerns that have significant potential to impact areas within and adjacent to utility rights of way (ROW). Effects can extend well beyond the ROW making effective mitigation challenging for utilities without more holistic engagement and support from surrounding landowners and stakeholders. Of concern to utilities are both invasive plant and insect species. Invasive insect species, such as bark beetles, can exacerbate forest health concerns and result in hazardous tree conditions that require repetitious monitoring and mitigation by utilities. Native insect species, under stressed environmental conditions – like drought, can impose the same impacts and challenges. Invasive plant species in California tend to thrive in disturbed environments, often displacing native species. There is evidence that these invasions can change and intensify fire regimes. Landscape disturbance can be presented following fires, as well as during ROW maintenance and enhancements. Regardless of disturbance origin utilities are continually compelled to perform additional monitoring and mitigation to identify and control detrimental impacts associated with invasive species. Bark beetle outbreaks can make wildfire outbreaks much worse. During the window of time after beetles have killed the tree and its needles turn from green to red, the wood is more susceptible to ignition. *Reference*: Earth Island https://www.earthisland.org/journal/index.php/articles/entry/are-bark-beetles-are-further-aggravating-wildfires-in-california/ The invasive cheatgrass has changed much of the West's fire cycle, especially across the sagebrush sea, this has been damaging to the habitat that supports more than 350 species of plant and animals. The most pervasive impact of cheatgrass domination has been its influence on the size, intensity, and natural cycles of wildfire. Cheatgrass dies just in time for a typical fire season to start and is an extremely flashy fuel. Today's fires are becoming hotter and more frequent in part because of the dominance of cheatgrass. *Reference*: Theodore Roosevelt Conservation Partnership https://www.trcp.org/2020/08/28/invasive-species-fueling-western-wildfires/

TABLE PG&E 4.2-4:
MACRO TREND THAT MAY IMPACT WILDFIRE IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCES
(CONTINUED)

Rank	Macro Trends	Comments
3	Changes in ignition probability and estimated wildfire consequence due to other drivers of change in fuel density and moisture	There have been notable changes to PG&E's service territory, in both fuel density and moisture over the last several decades. These changes significantly increase wildfire ignition risks around utility lines. Contributing factors to these changes cover a wide range of influences, including but not limited to; climate change, land use patterns, fire suppression and variable forest management practices. Fuel density is increasing while available moisture in critical wildfire risk periods is decreasing. This has been accompanied by increases in large tree mortality (partially due to bark beetles) and overall changes in forest structure. Bark beetles have always been present in periodic outbreaks, and normally cold winter weather keeps their population somewhat in check, preventing large tree die-offs. However, as winter temperatures rise, and in conjunction with the recent drought, their populations have burgeoned to create unprecedented tree die-offs. The lack of surviving seed trees is likely to cause failure of pine regeneration and result in forest conversion to shrubland. Extreme fire weather, particularly in the form of hot and dry winds, can have a strong influence on shrubland fire regimes, and contributes to conversion of shrublands to grasslands. *Reference*: CA State Gov https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf The combination of more fires and drier conditions may expand deserts and otherwise change parts of California's landscape. Livestock grazing may also accelerate the conversion of grassland to desert in response to a changing climate. The 2012-2016 drought led to the most severe moisture deficits in the last 1,200 years and a 1-in-500 year low in Sierra snowpack. Future increases in temperature, regardless of whether total precipitation goes up or down, will likely cause longer and deeper California droughts, posing major problems for water supplies, natural ecosystems, and agriculture. *Reference*: EPA https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-ca.pdf Forests are becoming denser with decreased presence of large trees and significant tree mortality over the last decade. Lands that are left unmanaged are subject to increases in accumulated dead and downed fuels that can be annually influenced by surrounding finer, flashier fuels following periods of rain or snowfall. *Reference:* PNAS: https://www.pnas.org/content/112/5/1458. *Reference:* California Energy Commission: https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-014_ADA.pdf
4	Population changes (including Access and	Population in California and PG&E's territory has seen consistent growth over time, though population of California decreased slightly in 2020 (due to a variety of factors related to the pandemic) (Cal Matters). Much of this population growth continues in lands previously undeveloped and bordering, or in, fire prone wildland areas. "San

TABLE PG&E 4.2-4:
MACRO TREND THAT MAY IMPACT WILDFIRE IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCES
(CONTINUED)

Rank	Macro Trends	Comments
	Functional Needs population) that could be impacted by utility ignition	Francisco is experiencing a unique and dramatic exodus, which is causing 50 percent or 100 percent increases in Bay Area in-migration for some counties in the Sierras" (LA Times). The lack of affordable housing near the coast, has also driven utility customers further south, north, and inland (CA Climate Change Assessment). *Reference:* CA Gov Climate Change Assessment https://barc.ca.gov/sites/default/files/20190116-sanfranciscobayarea.pdf *Reference*: Cal Matters https://calmatters.org/politics/2021/05/california-population-shrink-exodus/ *Reference*: LA Times https://www.latimes.com/california/story/2021-03-04/california-exodus-san-francisco-migration *Reference*: HBI http://www.homebuyinginstitute.com/news/california-forecast-cooling-trend-2022/ Current estimates suggest that at least 25 percent of California's residents already reside in areas subject to significant wildfire risk. With projection of upward population trends continuing, it is likely that populations in the WUI and/or the HFTD areas will relatedly increase. These trends may be compounded by the societal impacts of Covid-19. Housing trends in 2020 indicated a shift associated with stay-a-home orders and increased capability to telecommute. These emerging trends have indicated a desire to relocate from urban communities to more rural communities, many within the HFTD areas. The lack of availability and affordability of housing in lower wildfire risk urban areas within the PG&E territory are also factors that many residents evaluate and that all stakeholders, including policymakers, must consider as we all move forward. A significant, but variable and uncertain, portion of the population increases in higher wildfire risk areas will include customer with supplemental access or other functional needs. Utilities (and other stakeholders) will need to continue to engage in programs and education campaigns that inform and prepare all customers to mitigate these growing risks. *References:* LCAU: https://lcau.mit.edu/project/cataloguing- interface-wildfire-and-urban-development-California. PPIC: https://www.ppic.org/content/pubs/report/R_116HJ3R.pdf. CNBC: Warming climate, population sprawl threaten California's future with more destructive wildfires, https://www.cnbc.com/2019/11/09/why-californias-wildfires-are-going-to-get-worse.html.

TABLE PG&E 4.2-4:
MACRO TREND THAT MAY IMPACT WILDFIRE IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCES
(CONTINUED)

Rank	Macro Trends	Comments
5	Population changes in HFTD that could be impacted by utility ignition	See PG&E's response to Item #4. Given the overall area of the HFTD areas as a percentage of PG&E's service territory (over 50 percent), it is likely that population growth in the HFTD areas will not be an exception to anticipated trends. In fact, population growth in HFTD areas may exceed, at least in some areas, population growth in non-HFTD areas.
6	Population changes in WUI that could be impacted by utility ignition	See PG&E's response to Item #4. Given the overall area of the WUI as a percentage of PG&E's service territory, it is likely that population growth in WUI will not be an exception to anticipated trends. The HFTD map was informed by WUI data and tremendous overlap between the two categories exists within PG&E service territory.
7	Utility infrastructure location in HFTD vs non-HFTD	PG&E anticipates limited net-addition of utility assets in the near future. Therefore, the overall breakdown of assets between HFTD and non-HFTD areas is not expected to significantly evolve going forward. Nonetheless, the volume and location of utility infrastructure already in HFTD areas (~1/3rd of PG&E's overhead electric assets) presents a risk to be mitigated, which is the focus of this plan. When adding or replacing utility infrastructure, particularly in or near HFTD, siting decisions should complement other resiliency and hardening programs continually over the decades to come. Given the increased focus on upgrading, strengthening or replacing assets in HFTD, the location and characteristics of infrastructure in HFTD areas will see more significant changes as compared to Non-HFTD areas.
8	Utility infrastructure location in urban vs rural vs highly rural areas	See PG&E's response to Item #7. There is high correlation between the HFTD areas and rural/highly rural areas within PG&E's service territory. There is similar correlation between urban areas and non-HFTD areas. Therefore, the trends impacting urban vs. rural are largely similar to those impacting HFTD vs. non-HFTD.

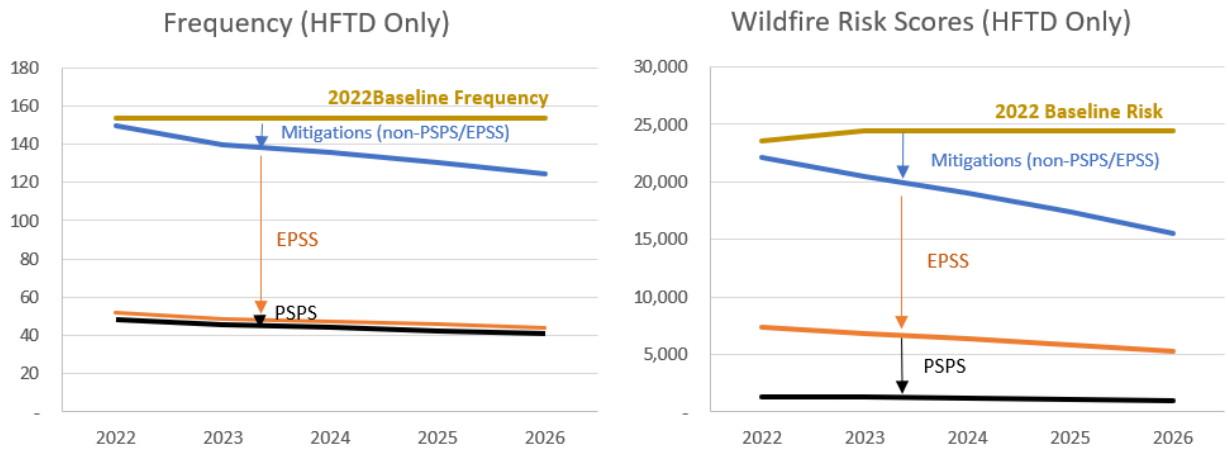
4.3 Change in Ignition Probability Drivers

Based on the implementation of the above wildfire mitigation initiatives, explain how the utility sees its ignition probability drivers evolving over the 3-year term of the WMP, highlighting any changes since the 2021 WMP Update. Focus on ignition probability and estimated wildfire consequence reduction by ignition probability driver, detailed risk driver, and include a description of how the utility expects to see incidents evolve over the same period, both in total number (of occurrence of a given incident type, whether resulting in an ignition or not) and in likelihood of causing an ignition by type. Outline methodology for determining ignition probability from events, including data used to determine likelihood of ignition probability, such as past ignition events, number of risk events, and description of events (including vegetation and equipment condition).

Based on our implementation of wildfire mitigation initiatives, PG&E has seen an overall decrease in the ignition probability, corresponding to changes in estimated wildfire frequency and risk scores.

In addition, PSPS and EPSS have had a significant impact on ignition probabilities, reflected in estimated wildfire frequency and risk scores. The impacts of PSPS and EPSS in HFTD are represented in Figure PG&E-4.3-1 below showing the impacts of ignition frequency and risk through the use of the 2022 Enterprise Risk Model.

FIGURE PG&E-4.3-1:
IMPACTS OF EPSS, PSPS AND MITIGATION ON IGNITION FREQUENCY AND IGNITION PROBABILITY (HFTD ONLY)



In the remainder of this section, we describe our :

(a) 2022 Enterprise Risk Model for Wildfire Risk;

(b) Methodology for Determining Ignition Probability From Events For WDRM;

(c) Equipment Probability of Ignition Model; and,

(d) Vegetation Probability of Ignition Model.

(a) 2022 Enterprise Risk Model for Wildfire Risk

In 2021, PG&E built the 2022 Enterprise Risk Model for Wildfire Risk, or 2022 ERM, to provide a consistent enterprise-wide risk assessment and modeling framework using PG&E's MAVF in alignment with the S-MAP Settlement Agreement.[40] This model is used to calculate pre-mitigated (or baseline) risk scores and post-mitigation risk scores, to compare them across different risks in PG&E's Corporate Risk Register and produce the RSE scores at a program level for the WMP and GRC (see Section 4.5.1(a) – 2022 Enterprise Risk Model for Wildfire Risk).

This section provides an overview of the 2022 ERM and, more specifically, ignition drivers considered in the model[41] used to evaluate wildfire risk. Exposure to the wildfire risk is modeled based on the approximately 99,000 total overhead circuit miles in PG&E's electric distribution and transmission systems. Of the total overhead circuit miles, approximately 25,500 distribution circuit miles are within the CPUC designated HFTD areas. The risk drivers used for this model are:

1) Vegetation Contact
2) Equipment/Facility Failure
3) Contact from Object
4) Wire-to-Wire Contact
5) Unknown
6) Other
7) Vandalism/Theft
8) Utility Work/Operation
9) Contamination
10) Seismic

The risk drivers for this risk event have been modified since PG&E filed our 2020 RAMP Report to align with the Cause categories outlined in the 2021 WMP Guidelines[42] for Table 7.1 and Table 7.2. The one exception is that in the 2021 WMP, Vegetation Contact is a sub-driver of the Contact from Object driver, whereas in the 2022 ERM,

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40 For a detailed description, see PG&E's Enterprise Risk Model Documentation and User Guide, available in 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.3_Atch01.pdf.

41 A more detailed discussion of the 2023 GRC Enterprise Risk Model was provided in PG&E's testimony in the 2023 GRC. See Exhibit (PG&E-4), Chapter 3.

42 Attachment 2.2: 2021 Wildfire Mitigation Plan (WMP) Guidelines Template (ca.gov)

Vegetation Contact is a stand-alone risk driver. This change in risk driver was made to reflect the vegetation contact driver's contribution to the risk.

Wildfire baseline risk includes approximately 483 risk events (ignitions)[43] systemwide and 153 (32 percent) risk events in HFTD areas for 2022. Risk events in HFTD areas accounted for 99 percent of the overall risk. The Equipment / facility failure risk driver accounts for 36 percent of ignitions systemwide and 21 percent of ignitions in HFTD areas.[44] Conductor and connector failures account for most of these equipment failure incidents. The Vegetation Contact risk driver accounts for 28 percent of ignitions systemwide and 18 percent of ignitions in HFTD areas.[45] The number of events and percentages for each driver are provided in Figures PG&E-4.2-1, PG&E-4.2-2, and PG&E-4.2-3 in Section 4.2 above.

PG&E updated our 2020 ERM to support the 2020 RAMP filing and our 2021 WMP. Since we our 2020 RAMP Report, we have made changes to our 2020 ERM as discussed below. Certain changes were made in response to feedback from SPD and parties, as noted below, while other changes were made by PG&E as we continue to update and refine our enterprise risk models. PG&E also made many changes to align to the 2021 Wildfire Distribution Risk Model v2 (2021 WDRM v2) by using the outputs in the 2022 ERM discussed in the 2021 WMP.

SPD and parties (intervenors) recommended that PG&E's risk models incorporate more granular tranching. For example, SPD stated that given the diverse environments and conditions covered by PG&E's electric distribution system it was unreasonable to assume a homogeneous risk profile as PG&E did in the 2020 RAMP Report.[46]

PG&E agreed that the tranches included in the 2020 ERM could be improved. In response to SPD and parties' feedback, PG&E revised the tranches in the 2022 ERM. PG&E expanded the number of tranches from 8 to 40 systemwide.[47] Transmission tranches were further refined by voltage class and HFTD areas, expanding from 2 to 12. HFTD distribution tranches were further refined, expanding from 3 to 25. The 25 distribution tranches represent the combination of 5 quintiles of the Likelihood of a Risk

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43 Based on the CPUC's reportable fire ignition definition, fire ignition is defined as an ignition resulting a fire that traveled more than one meter from the ignition point and burnt something other than PG&E facilities. (D.14-02-015, Appendix C, p. C-2, Section 1.A.4.) PG&E's current 2023 GRC Risk Model uses all reportable ignitions systemwide; previous versions of the model were limited to high fire risk areas (Fire Index Area's in the 2017 RAMP and HFTD areas in the 2020 GRC). PG&E's baseline forecast of 2022 ignitions is 483, which is based on historical ignitions with certain adjustments.

44 The Equipment Failure risk driver accounts for 21 percent of ignitions in HFTD areas, 20 percent of ignitions in HFTD Distribution, and 32 percent of ignitions in HFTD Transmission.

45 The Vegetation risk driver accounts for 48 percent of ignitions in HFTD areas, 52 percent for HFTD Distribution, and 5 percent of ignitions in HFTD Transmission.

46 SPD Staff Report, p. 5.

47 There are two substation tranches and one non-HFTD distribution tranche that have not changed since the 2020 RAMP Report.

Event and the CoRE. An important aspect of the refinement in HFTD distribution tranching is the alignment of the 2022 ERM to the 2021 WDRM v2.

The 2021 WDRM v2 provides a risk ranking for the prioritization of EVM and System Hardening work. The 2022 ERM assesses enterprise risks, including wildfire, using a common framework and develops RSEs using the MAVF scoring approach agreed to in the 2020 S-MAP Settlement Agreement. PG&E aligned the two models by using the outputs from the 2021 WDRM v2 in the 2022 ERM. For equipment/facility failure (conductor damage or failure) and vegetation contact risk drivers the 2021 WDRM v2 informs the 2022 ERM to the probability of ignition at the distribution circuit segment level within the HFTD areas. Additionally, Technosylva simulation results in the 2021 WDRM v2 inform the wildfire consequence at the distribution circuit segment level.

PG&E also made four key changes to our risk drivers since the 2020 RAMP Report:

1) In its evaluation of PG&E's 2020 RAMP Report, TURN, a party to the proceeding, stated that, "...[a] correct portrait of PG&E's wildfire risk requires that the considerable risk resulting from PG&E's operational failures be recognized and that the risk reduction benefits from fixing those problems be quantified."[48] SPD agreed that this was a valid comment and that operational failures should be modeled as a risk driver.[49] To capture this, the 2022 ERM includes ignitions associated with PG&E workforce-caused outages as a 'Utility work/Operation' driver. PG&E will continue to explore other ways to represent operational failures in the risk model.[50]

2) In the process of providing feedback to PG&E's 2020 RAMP Report, the Mussey Grade Road Alliance, a party to the proceeding, requested an analysis of ignitions by different drivers by local wind speed. From the analysis, it was concluded that ignitions resulting from both vegetation-related and equipment-related root causes are more likely to occur under higher wind speed conditions, and there is a strong correlation between high winds and RFW, during which destructive or catastrophic fires are more likely to occur.

   In the 2022 ERM, PG&E incorporated lessons learned from analyzing ignition data that indicated the likelihood of an ignition occurring during an RFW varies by ignition driver. Based on PG&E's 2015–2020 CPUC reportable ignitions report, the percentage of ignitions occurring when an RFW is in effect is the highest for vegetation contact, followed by equipment / facility failure, and then all other drivers. Also, since there is a higher likelihood for an ignition to develop into a large, destructive, or catastrophic fire when an RFW is in effect than when an RFW is not in effect, this results in a higher CoRE value for the vegetation-contact driver than the CoRE value for other drivers.

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48 TURN's Opening Comments on PG&E's RAMP Report and the SPD's November 25, 2020 Evaluation Report, A.20-06-012 (Jan. 15, 2021) (TURN Opening Comments), p. 7.

49 SPD Staff Report, p. 71.

50 For example, PG&E has introduced a new data entry field as part of our Corrective Action Program to identify and track ignitions that are submitted by PG&E workforce.

3) PG&E updated the 2022 ERM risk drivers and sub-drivers, used to inform our 2023 GRC, to align with those presented in the 2021 WMP so that the information is consistent between the two regulatory filings.

4) PG&E updated the risk drivers and sub-drivers for substation tranches. Even if there were no ignitions in the 2015-2020 dataset from specific drivers, substation outages that could cause an ignition were incorporated into the model to capture the potential substation failures that could lead to an ignition.

PG&E has also made three additional changes to the 2022 ERM since filing our 2023 GRC Application.

1) For certain risk driver/subdriver combinations, not covered by outputs from the 2021 WDRM v2, the 2022 ERM was updated to improve the allocation of system-wide ignition frequency among tranches.

2) In the 2022 ERM, the climate change cross-cutting factor (multiplier) is now applied to amplify the consequence of ignitions instead of the frequency of ignitions occurring during an RFW.

3) In the 2022 ERM, HFTD distribution tranches and associated risk scores were refreshed by incorporating the impact of mitigations implemented in 2021.

(b) Methodology for Determining Ignition Probability From Events For WDRM

In support of risk-based Electric Operations planning, PG&E has developed distribution[51] asset risk models designed to quantify wildfire risks from the distribution system at planning and situational awareness timescales, support risk-based decision making, and enable reporting of risk reduction activities to regulators and the public. To do this, PG&E characterizes wildfire risk as:

Risk = Ignition Probability x Wildfire Consequence.

Both the probability (also referred to as likelihood) and the consequence of an ignition are conditioned, to a degree, on the environmental factors (i.e., sustained wind speeds and gusts, temperature, vegetation, structures, and topography) experienced by distribution assets which utilizes the age of the asset, location of the asset, and other physical characteristics.

To answer the question of *where* ignition events are likely to occur, we have estimated fire season ignition probabilities using maximum entropy models (MaxEnt) pioneered in the modeling of ecological ranges of species. These models are trained on ignition (outage or initiating event) locations and gridded spatial (raster) environmental and asset attribute data. The data can draw from a specific time period, but the model itself is dedicated to spatial, not temporal, patterns. The MaxEnt Model provides relative scores or, probabilities for fire-season ignitions per “pixel” of input data.

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51 PG&E defines voltages below 60 kV as distribution and voltages 60 kV and above as transmission.

In order to more accurately assess and define risks, in 2020 PG&E:

1) Replaced the regression equipment ignition likelihood from prior models with the Equipment Probability of Ignition Model

2) Replaced the regression vegetation ignition likelihood from prior models with the Vegetation Probability of Ignition Model

By incorporating these models into the WDRM, PG&E was able to:

- Incorporate additional variables in the models, increasing accuracy (tree types, wind scores, ground cover);
- Model ignitions directly by utilizing the MaxEnt algorithm as compared to modeling proxies in prior models; and,
- Reduce overfitting by developing training and testing datasets for model development.

A wide range of input data sets were used in developing both the Vegetation Probability of Ignition and the Equipment Probability of Ignition Models. Table PG&E-4.3-1 summarizes the data developed to date for use in these models. A more detailed description of the Vegetation Probability of Ignition and the Equipment Probability of Ignition Models is provided after Table PG&E-4.3-1.

TABLE PG&E-4.3-1:
DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS

Data Set	Category	Source	Spatial resolution	Units	Descriptions
100-hour fuels	Meteorological data	gridMET	~4km	%	Unless otherwise noted, all gridMET data aggregated from 2014 to 2016. The dead fuel moisture data were obtained from gridMET, and the "100-hour-fuels" feature was included in the model. The exact gridMET variable use is known as fm-100, and is a standard fire modeling metric of fuel dryness for fuels about 1-3" in diameter - intermediate sized fuels.
1000-hour fuels	Meteorological data	gridMET	~4km	%	fm-1000, as defined above, but for 3-8" in diameter.
burn index	Meteorological data	gridMET	~4km		The US National Fire Danger Rating System (USNFDRS) Burning Index (BI)
energy release	Meteorological data	gridMET	~4km		USNFDRS Energy Release Component (ERC)
precipitation average	Meteorological data	gridMET	~4km	Mm	Daily precipitation average
specific humidity	Meteorological data	gridMET	~4km	kg/kg	Specific humidity
vapor pressure deficit avg	Meteorological data	gridMET	~4km	kPa	Measure how much water is in the air compared to how much it could hold at the given temperature. Vapor Pressure Deficit drives evapotranspiration and is the mechanism for fuels drying out during fire season.
temperature max average	Meteorological data	gridMET	~4km	K	Average of daily maximum temperature in Kelvin (recall that it is sensed via satellite)
wind avg	Meteorological data	RTMA	~2.5km	m/s	Hourly average wind speed at 10m, averaged from 2016 to 2018
wind max	Meteorological data	RTMA	~2.5km	m/s	Annual 99th percentile hourly wind speed at 10m assessed over 2016 to 2018

TABLE PG&E-4.3-1:
DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS
(CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
windy summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 15 mph
gusty summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 20 mph
tree height max	Tree data	Salo Sciences	100m		Tree height data were obtained from a third-party vendor, Salo, and the "tree-height-max" feature was developed by calculating the maximum tree height, in meters, for each 100m x 100m pixel area along the distribution grid, according to the processed satellite data provided by Salo. The satellite imagery was collected in November 2019.
tree height average	Tree data	Salo Sciences	100m		Same as above but taking the average tree height for each pixel.
Impervious	Surface condition	National Land Cover Database (NLCD)	100m	%	NLCD imperviousness products represent urban impervious surfaces as a percentage of developed surface over every 30-meter pixel in the United States, scaled to 100m.

TABLE PG&E-4.3-1:
DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS
(CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
Unburnable	Surface condition	LANDFIRE 2016 Surface Fuels Model	100m	%	The "un-burnable" feature is a land surface descriptor similar to imperviousness that includes surfaces that typically don't ignite when a spark occurs. The feature was derived from several land use types within the 2016 LANDFIRE surface fuel model (USGS, 2016) and is the percentage of the 100m x 100m pixel identified as un-burnable. The land use types considered "un-burnable" in the composite spatial layer include: urban, snow/ice, agriculture, water, and barren.
local topography	Surface condition	National Elevation Database (NED)	100m		The relative topography of the area was also used as a feature in the model. The topographic position index (TPI) was extracted from a USGS NED at 100-meter resolution. The TPI compares the cell elevation to the mean elevation for the local neighboring area (positive values are above the mean and negative values are below the mean) (The Nature Conservancy).
HFTD	HFTD	CPUC	100m		Categorical variable that is 1 for non-HFTD locations, 2 for Tier 2 and 3 for Tier 3.
Age	Asset data	Electric Distribution Geographic Information System (EDGIS) Conductors	100m		The estimated conductor age (the "estimated-age") was calculated as the number of years since the installation year, as listed in EDGIS. If the installation date was missing or invalid, then the estimated age in the STAR model dataset was used

TABLE PG&E-4.3-1:
DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS
(CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
Materials	Asset data	EDGIS Conductors	100m		The type of conductor material was split into one-hot encoded dummy variables, which identified conductor materials aluminum (Al), copper (Cu), and ACSR ("conductor-material-al," "conductor-material-cu," and "conductor-material-acsr," respectively) as binary model features.
Size	Asset data	EDGIS Conductors	100m		The conductor size dataset was split into one-hot encoded dummy variables, which identified conductor size #2, #4, and #6 ("conductor-size-2," "conductor-size-4," and "conductor-size-6," respectively) as binary model features. Lower numbers correspond with larger diameters.
Splice count	Asset data	EDGIS Conductors	100m		Splices were identified from the splices database table (Emili Scaief, 2020). In order to prevent splice locations from introducing bias to the model, only the Reliability Program splice records were used, which only included spans with more than three splices per phase/span.
Coastal indicator	Asset data	EDGIS Conductors	100m		Coastal areas were identified using a binary feature in the model. Coastal areas within PG&E service territory were mapped internally in PG&E and conductors are tagged with a coastal indicator field in EDGIS.

(c) Equipment Probability of Ignition Model

Ignition likelihood for equipment was determined based on a probability analysis predicting ignitions in 100m x 100m pixels. The Equipment Probability of Ignition Model was trained on conductor failure related ignitions limited to fire season events and CPUC reportable ignitions from 2015 to 2018 and tested using the 2019 ignitions. The modeling technique used was a maximum entropy (MaxEnt) algorithm. MaxEnt algorithm provides a way of estimating the relative occurrence rate given a fairly modest number of ignition locations. The principle of maximum entropy states that the

probability distribution which best represents the current state of knowledge is the one with the largest entropy, in the context of precisely stated prior data.

A range of variables were included in the initial modeling. These included meteorology data, PG&E asset data, and remote sensing data from government and private third parties. The most important variables for the Equipment Probability of Ignition Model are identified below in Table PG&E-4.3-2.

TABLE PG&E-4.3-2:
VARIABLES IN EQUIPMENT PROBABILITY OF IGNITION MODEL

Variable	Permutation Importance
Non-burnable area	30.8
Daily precipitation, mean	29.8
Conductor material: ACSR	9.7
Estimated conductor age	8.9
Max tree height	4.3
Reliability Program splice	4.3
Vapor pressure deficit, mean	4.0
Conductor size: 2	3.4
Conductor size: 4	1.6
100-hour fuels, mean	1.1
Max temperature, mean	1.0
Wind speed, mean	0.9
Local topography	0.2
Conductor size: 6	0.1
Conductor material: Al	~0
Conductor material: Cu	~0

Using these variables, a probability of ignition was assigned for each 100m x 100m grid. These probabilities were indexed and calibrated to the total expected ignition frequency.

Updates to this model are planned on an annual basis as additional equipment types are modeled. In 2021, Electric Corrective tag data and asset data was used in the Equipment Probability of Ignition Model and, additional equipment failure models for poles and transformers. These additional equipment models will combine with an update to the conductor failure model in the 2022 WDRM v3 to improve the predictive power of equipment caused ignition probabilities to further enhance the model to better inform mitigation programs.

(d) Vegetation Probability of Ignition Model

Ignition likelihood for vegetation was determined based on a probability analysis predicting ignitions in 100m x 100m pixels. As part of the 2021 WDRM v2, the Vegetation Probability of Ignition Model was trained on CPUC reportable ignitions during fire seasons from 2015 to 2018 and tested using the 2019 ignitions. This data set includes all vegetation related outages that resulted in an ignition. The modeling technique used was a MaxEnt algorithm. The MaxEnt algorithm provides a way of estimating the relative occurrence rate given a fairly modest number of ignition locations. The principle of MaxEnt states that the probability distribution which best

represents the current state of knowledge is the one with the largest entropy, in the context of precisely stated prior data.

Variables in the initial model included meteorology data, PG&E asset data, and remote sensing data from government and private third parties. The most important variables for the Vegetation Probability of Ignition Model are included below in Table PG&E-4.3-3.

TABLE PG&E-4.3-3:
VARIABLES IN VEGETATION PROBABILITY OF IGNITION MODEL

Variable	Permutation Importance
tree-height-max	26.1
100-hour-fuels-avg	24.1
vapor-pressure-deficit-avg	21.6
gusty-summer-day-pct	6
HFTD	4.2
precipitation-avg	3.1
Impervious	2.8
specific-humidity-avg	2.4
burn-index-avg	2.3
wind-max	1.9
temperature-avg	1.6
windy-summer-day-pct	1
local-topography	0.8
tree-height-avg	0.8
1000-hour-fuels-avg	0.6
energy-release-avg	0.4

Using these variables, a probability of ignition was assigned for each 100m x 100m grid. These probabilities were indexed and calibrated to the total expected ignition frequency.

4.4 Research Proposals and Findings

Report all utility-sponsored research proposals, findings from ongoing studies and findings from studies completed in 2020 and 2021 relevant to wildfire and PSPS mitigations.

4.4.1 Research Proposals

Report proposals for future utility-sponsored studies relevant to wildfire and PSPS mitigation. Organize proposals under the following structure:

1. *Purpose of research – Brief summary of context and goals of research*

2. *Relevant terms – Definitions of relevant terms (e.g., defining "enhanced vegetation management" for research on EVM)*

3. *Data elements – Details of data elements used for analysis, including scope and granularity of data in time and location (i.e., date range, reporting frequency and spatial granularity for each data element, see example table below).*

EXAMPLE TABLE REPORTING DATA ELEMENTS

Data Element	*Collection Period*	*Collection Frequency*	*Spatial Granularity*	*Temporal Granularity*	*Comments*
Ignitions from contact with vegetation in non-enhanced vegetation areas	*2014 – 2021+ (ongoing)*	*Per ignition*	*Lat/long per ignition*	*Date, hour of ignition (estimated)*	*–*
Ignitions from contact with vegetation in enhanced vegetation areas	*2019 – 2021+ (ongoing)*	*Per ignition*	*Lat/long per ignition*	*Date, hour of ignition (estimated)*	*–*

4. *Methodology – Methodology for analysis, including list of analyses to perform; section must include statistical models, equations, etc. behind analyses.*

5. *Timeline – Project timeline and reporting frequency to Office of Energy Infrastructure Safety.*

California Polytechnic State University, San Luis Obispo (Cal Poly) WUI Fire Information, Research, and Education (FIRE) Institute

1. Purpose of Research

The purpose of the Cal Poly FIRE Institute is to make significant contributions to solving the WUI fire problem through integrated and applied research and education that innovates, informs policy, disseminates information, and educates students and professionals.

In 2021, PG&E partnered with, and advised on the direction of research, and associated activities by, the FIRE Institute as it works toward the development of solutions for sustainable fire-resilient communities and safer and more effective fire-preparedness and response operations through applied research and incorporation of technology.

2. Relevant Terms

No terms used herein require additional definition.

3. Data Elements

There are no specific data elements related to this effort as the initial research proposals have not been concluded at this time.

4. Methodology

None currently, as this research partnership is in its beginning phase.

5. Timeline

Activities in 2021 included an open introductory seminar to engage stakeholders (e.g., private sector, utilities, government, regulatory bodies, academia), definition of areas of mutual research interest, discussion of initial research proposals, and planning for the in-person symposium in 2022 (postponed from 2021 due to COVID-19 restrictions).

As work progresses, we will continue to report on our advisory role to the FIRE Institute, PG&E-relevant research direction and initiatives, as well as PG&E WMP-relevant results from this research collaboration.

4.4.2 Research Findings

Report findings from ongoing and completed studies relevant to wildfire and PSPS mitigation. Organize findings reports under the following structure:

1. *Purpose of research – Brief summary of context and goals of research*

2. *Relevant terms – Definitions of relevant terms (e.g., defining "enhanced vegetation management" for research on EVM)*

3. *Data elements – Details of data elements used for analysis, including scope and granularity of data in time and location (i.e., date range, reporting frequency and spatial granularity for each data element, see example table above)*

4. *Methodology – Methodology for analysis, including list of analyses to perform; section must include statistical models, equations, etc. behind analyses*

5. *Timeline – Project timeline and reporting frequency to the Office of Energy Infrastructure Safety. Include any changes to timeline since last update*

6. *Results and discussion – Findings and discussion based on findings, highlighting new results and changes to conclusions since last update*

7. *Follow-up planned – Follow up research or action planned as a result of the research*

San Jose State University (SJSU) – Climatological Analysis

1. Purpose of Research

The purpose of the research is to better understand wildland fire behavior by studying fire-atmospheric interactions through partnership with the SJSU Fire Weather Research Lab. SJSU has established the largest academic Wildfire Interdisciplinary Research Center in the United States with five new tenure-track faculty members. SJSU will help PG&E analyze our 30-year 2 km × 2 km WRF model climatology to better understand the fire weather conditions associated with extreme wildfire and PSPS events. The analyses will be conducted by two tenure-track faculty, one post-doctoral scholar, and two graduate students.

2. Relevant Terms

No terms require additional definition.

3. Data Elements

TABLE PG&E-4.4-1:
DATA ELEMENTS
(SAN JOSE STATE UNIVERSITY – CLIMATOLOGICAL ANALYSIS)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
PG&E 30-year downscaled climatology	1990-2020 (modeled)	Modeled hourly weather data	2km × 2km grid	Hourly Data through the climatology	
PG&E Fire Occurrence Dataset	2003-2020	N/A	N/A	N/A	Dataset of fire ignitions in PG&E territory gathered from multiple sources.

4. Methodology

a) Conduct analyses using PG&E's new 30-year climatology of 2 kilometer, hourly, WRF model output.

- This data shall allow for robust analyses on critical fire weather conditions using a combination of high spatiotemporal resolution and long duration data to investigate the following combined with fire occurrence datasets:
  - Climatology and decadal trends in fire weather and Diablo Wind events, or other Foehn wind events (type, intensity, duration, etc.);
  - A Diablo Wind metric shall be created and used to understand the climatology of events;
  - This metric shall be used to rank all Diablo Wind Events across the 30-year history based on strength, geographic extent, and duration; and
  - Using PG&E's proprietary and public fire occurrence datasets to evaluate numerous fire weather indices to help determine which index is best correlated to daily fire growth.

b) Generation of grid point distributions, percentile data maps from the climatology data.

- Map visualizations to be generated: 90th, 95th, 99th and Maximum (minimum) maps of:
  - Wind Speed;
  - Wind Gust;
  - Temperature;

- Relative humidity (minimum);
- Dewpoint depression (minimum);
- Precipitation; and
- Diablo Fire Weather Index.

- Grid point specific distributions shall be used by PG&E to put the forecast in perspective with the historical data.

c) Covariation of fire weather mesoscale circulation patterns with the synoptic patterns and known modes of climate variability.

d) High-resolution trends in existing fire-weather indices and local fire season duration to help determine annual average start and end time of fire season.

e) SJSU will interact regularly with the PG&E Meteorological staff and will provide regular online meetings on research progress.

f) SJSU shall conduct the proposed analyses and publish the results in peer-reviewed journals.

5. Timeline

The research project is ongoing. Timeline for preliminary results is scheduled for 2022.

6. Results and discussion

There are no results at this time, as the research is ongoing.

7. Follow-up planned

Any follow-up would be planned after review of the research results.

Review of Dynamically Downscaled Climate Projections for the Pacific Gas and Electric Service Area

1. Purpose of Research

Climate model projections can help quantify future impacts from climate change. However, some modeling approaches are limited in their ability to resolve the small spatial and time scales over which climate impacts occur. To address this, high spatial and temporal resolution dynamically downscaled WRF simulations were developed for the PG&E service area using boundary conditions from three Global Climate Models. These dynamically downscaled simulations resolved projected changes through mid-century for a suite of climate variables relevant to operational planning and risk-based decision-making, including extreme windspeeds, 925 hectopascal (hPa) winds, the frequency of diablo wind events, soil moisture, and the frequency of precipitation days.

2. Relevant Terms

- Hectopascal – The international unit for measuring atmospheric or barometric pressure.
- Relative Concentration Pathway (RCP) – A greenhouse gas concentration pathway adopted by the Intergovernmental Panel on Climate Change to describe different climate futures.

3. Data Elements

TABLE PG&E-4.4-2:
DATA ELEMENTS
(REVIEW OF DYNAMICALLY DOWNSCALED CLIMATE PROJECTIONS FOR THE PACIFIC GAS AND ELECTRIC SERVICE AREA)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Extreme windspeeds	1995-2004, 2045-2054	N/A	12km	10 years	
925 hPa winds					
Frequency and location of Diablo wind events					
Soil moisture					
Precipitation Days					

4. Methodology

To develop high space and time resolution dynamically downscaled climate model simulations for a suite of climate variables relevant to PG&E's operational planning and risk-based decision-making, Argonne used 12-km, dynamically downscaled WRF simulations (WRF, Model V3.3.1) to develop projections for several climate variables of interest. Projections focus on the ten-year period surrounding mid-century (i.e., 2045-2054) relative to a ten-year historical baseline period (i.e., 1995–2004), and consider RCP 8.5, which assumes global greenhouse gas concentrations continue to rise largely unabated throughout the 21st century. The projected climate variables include (1) extreme surface wind speeds; (2) 925 hPa wind directions; (3) frequency of Diablo wind events; (4) 500 hPa heights; (5) root zone soil moisture; and (6) annual precipitation days.

5. Timeline

The research was completed in 2021.

6. Results and discussion

Results show large variabilities for future environmental and atmospheric variables, implying high uncertainty regarding the specifics of future wildfire-relevant

conditions. As such it is difficult to reach overarching conclusions concerning projected changes in Diablo wind events and wildfire risk. We therefore currently do not recommend the results of this research be quantitatively incorporated into risk modeling or other planning efforts.

7. Follow-up planned

No direct follow-up is planned at this time given the lack of conclusive agreement between projections generated by the study models. PG&E may revisit this topic in coming years once the next generation of Coupled Model Intercomparison Projections data becomes widely available.

Electrical Assets Probabilistic Risk Assessment Model

1. Purpose of Research

PG&E has partnered with the B. John Garrick Institute for the Risk Sciences at the University of California Los Angeles (UCLA) to leverage the rigorous modeling used in the nuclear industry to perform thorough and complex wildfire risk assessments and management planning. At the Diablo Canyon Nuclear Power Plant, PG&E has used a probabilistic risk assessment model for over 30 years. The model is constantly updated with current plant design and state-of-the-art analysis methodologies, where data from 30 years of industry and plant specific experience is used to model component reliability and unavailability. The model can perform quantitative assessment of risks from a multitude of complex factors, including internal plant failures, seismic events, fire, and flooding. Each model element has been independently reviewed by industry peer review teams and the results have been audited on numerous occasions by the Nuclear Regulatory Commission, and the model is capable of quantitatively risk-ranking over 3,000 individual system components including the transmission lines that supply Diablo Canyon with offsite power. Using the know-how with this model used at the Diablo Canyon Nuclear Power Plant, PG&E is working with risk experts at UCLA to develop a similar model for wildfire risks for our electrical assets within HFTD areas. This risk model is in an exploratory phase at this point and could potentially in the future have value to each of the initiatives directed at reducing potential ignitions, reducing ignition consequence, reducing the frequency of outages, reducing the duration of outages, and reducing the impact of outages.

2. Relevant Terms

No terms require additional definition.

3. Data Elements

The Probabilistic Risk Assessment model is a decision framework that utilizes the Data Elements of the models described in Section 4.5.1.

4. Methodology

The model performs a quantitative assessment of risks from a multitude of complex factors related to wildfire risks for our electrical assets within HFTD areas and is based

upon the know-how developed for modeling risk factors at the Diablo Canyon Nuclear Power Plant.

5. Timeline

The draft Probabilistic Risk Assessment reference planning model was completed in 2021, and the model was compared to other risk models that were used for decision making during the 2021 fire season. In 2022 the model will continue to be tested and calibrated. As this is exploratory research it is too early to determine a precise timeline as testing and calibration is ongoing.

Wildfire Mitigation Open Innovation Challenge

1. Purpose of Research

PG&E initiated an "Open Innovation Challenge" to identify novel technologies that could potentially reduce PG&E-caused wildfire risk. The search for innovations was global in reach and went beyond the electric utility industry technology sector. PG&E aimed to identify one or more promising innovative technologies for use in a pilot project.

2. Relevant Terms

No terms require additional definition.

3. Data Elements

No specific data elements for analysis are available.

4. Methodology

The open innovation challenge process started with a definition of problem statements, instead of pre-supposing potential solutions. These problem statements were created following a series of interviews conducted with internal and external subject matter experts on areas where innovations could potentially provide the greatest ignition risk reduction. The set of problem statements described the problem areas that PG&E would like solved or improved upon, without specifying any technology or techniques to solve the problems. As a result of this process, PG&E narrowed our focus for this challenge to the following four areas:

A. Advancement of the state-of-the-art for "monitor & mitigate" technologies for real-time detection of faults and prevention of arcing, sparking, and other ignition events along transmission and distribution infrastructure;

B. Alternatives to current undergrounding methods, including level-grounding;

C. Reducing labor required for vegetation management; and

D. Innovative heat-resistant materials.

Using these problem statements, PG&E solicited innovators, entrepreneurs, and startups to request that they apply if they have solutions for the defined problems.

The solicitation was made through two methods: a research community network-driven effort and an automated computer programmed Internet search method. For the research community network-driven method, PG&E reached out through known innovation networks, academic research partners, and other technology knowledge experts. For the automated computer method, a programmed Internet search parsed technical journals, professional sites, startups sites, patent databases, and other publications across industries and disciplines to identify authors, institutes, and companies with relevant ideas or expertise. After compiling the potentially relevant resources, PG&E created a ranked list of the top innovators in each challenge area for further solicitation including for referrals and submission of an application to this challenge. The resulting proposals were then vetted, and finalists selected.

5. Timeline

In December 2020, PG&E announced this open innovation challenge, published the problem statements described in the Methodology section above, and set a submission deadline in early 2021. The solicitation and innovator communication phase followed, concluding with the ranking and final selection phase for each of the challenge areas. For the remaining two finalists, the process has been ongoing throughout 2021.

6. Results and discussion

Below is a description of the seven finalists, the first two of which PG&E continues to pursue for pilots:

a. Smart Conductor

PG&E continues to pursue a pilot with this finalist for both distribution and transmission applications and continues to perform due diligence inside of PG&E as well as to benchmark with other North American electric utilities. The reasons for the continued interest include the potential for: (a) a distribution system hardening speed improvement by avoiding a rebuild as may be required with conventional re-conductoring practices; and (b) the ability to monitor the condition of the conductor for incipient fault or failure conditions end-to-end via an embedded fiber optic core.

b. Pole-mounted Multi-Sensor for Predictive and Real-Time Failure Reporting

PG&E continues to pursue a pilot with this finalist for its novel ability to provide both predictive failure analysis as well as real-time reporting of various of pole and pole-adjacent equipment (crossarms, guys, transformers, capacitor banks, conductors, etc.) failures that can lead to ignition.

c. Aerial and Fixed-Sensor Based Asset Predictive Maintenance, Vegetation Grow-in, and Dynamic Line Rating System

Upon further evaluation, this finalist was eliminated due to significant overlap of the proposed set of capabilities with other PG&E initiatives.

d. 3D Printing of Level-Grounding or Underground Assets

Upon further evaluation, this finalist was eliminated due to the immaturity and capability gaps of the proposed technology set as well as the acknowledgment that solving other problems that hinder improvement of undergrounding speed and cost would be of greater benefit. However, PG&E continues to communicate with this startup and is supportive of this startup's innovation as it may apply to undergrounding initiatives.

e. Protection Sensitivity Enhancer for Four-Wire Distribution

After the original analysis, the use case was refined to focus on enabling increased sensitivity of existing protection equipment on four wire distribution systems in HFTDs. Following a series of discussions with the company and third-party electrical engineering consultants, it was determined that the technology, and the operational integration of it, was not on a path to being able to allow meaningfully higher levels of circuit protection on four-wire distribution systems using the scheme consistently throughout the distribution system.

f. Ultrafast Breaker

The primary reason that PG&E ended the evaluation of this early-stage technology was that reducing breaker time will reduce fault current energy but will not change the relay time (which is more significant than breaker time) so the effectiveness at lowering the ignition risk potential was limited after further consideration of the operational context.

g. Satellite-Based Vegetation Analytics

This finalist is not being pursued further at this time as PG&E is evaluating the efficacy of satellite-based vegetation analytics through a different vendor and initiative.

7. Follow-up planned

For the two remaining finalists, an update will be provided in this section in the 2023 WMP.

Targeted Tree Species Study

1. Purpose of Research

The purpose of PG&E's Targeted Tree Species Study is to identify species that are more likely to fail near PG&E facilities, thereby creating potential wildfire ignitions. PG&E will use the information obtained through the study to evaluate the performance of the species risk rating component of our Tree Assessment Tool (TAT). The study involves an analysis of tree mortality rates related to precipitation. PG&E will also use the information obtained through the study to evaluate our scheduling for patrol cycles as part of our vegetation management responsibilities.

2. Relevant Terms

- Species Risk – What a particular tree species (in isolation of everything else) tells you about the likelihood of the tree failing or the likelihood of its failure relative to its frequency in the population.
- Tree Assessment Tool or TAT – Tool that evaluates an individual tree's likelihood of failing and supplies instruction of whether to abate or not abate the tree.
- Patrol Cycle – The span of time between inspections.

3. Data Elements

TABLE PG&E-4.4-3:
DATA ELEMENTS
(TARGETED TREE SPECIES STUDY)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Ignitions from contact with vegetation	2008-2020+ (ongoing)	Per ignition	Circuit and/or Regional level	Date	
Outages from contact with vegetation	2008-2020+ (ongoing)	Per outage	Circuit and/or Regional level	Date	
Trees assessed by TAT	March 2020+ (ongoing)	Per tree basis	Lat/Long per tree	Date	
Routine tree records	2013-2020+ (ongoing)	Per tree basis	Lat/Long per tree (where available)	Date	
Windspeed data	2006-2008	Average of daily maximum		Date	
Evapotranspiration Data provided by Vendor	January 2007 – June 2021			Date	

4. Methodology

A. The vendor will identify the appropriate external data sources to study in conjunction with internal data provided by PG&E to develop and execute a targeted tree species study to quantify failure risk by species and region.

B. The vendor will study tree mortality rates in conjunction with precipitation levels to evaluate patrol cycles within our service territory.

C. The vendor will develop a working knowledge of the TAT and the species risk rating component currently in use.

D. The vendor will evaluate the species risk component of the TAT currently in use for effectiveness, using available external data sources and data provided by PG&E.

E. The vendor will evaluate the weighting of the risk component of the TAT using data provided by PG&E.

F. The vendor will help set up a system for continuous monitoring of TAT for ongoing evaluation.

5. Timeline

The research is planned to be complete in Q2 2022. PG&E plans to report on the status of this research in the next annual update.

6. Results and discussion

The vendor was onboarded in April 2021 and initial data acquisition was completed June 2021. Dataset summary statistics were delivered by the vendor in September 2021, with reports, quantifiable and environmental analyses, peer reviews, and a final analysis and report expected to complete in Q1 2022.

7. Follow-up planned

Any follow-up would be planned after review of the research results.

Independent, External Review of 2021 Proposed Modifications to PG&E's HFRA Map by the B. John Garrick Institute for Risk Sciences at UCLA (GIRSRT)

1. Purpose of Research

The GIRSRT provided an independent, external review of 2021 proposed modifications to PG&E's HFRA Map. The HFRA map makes incremental changes to the HFTD map by adding regions where the risk of utility triggered catastrophic wildfire from an offshore wind event is high and removing regions where it is not.

2. Relevant Terms

- High Fire Risk Area – Mapping terminology that aligns with other California utilities' use of maps supplemental to the HFTD Map. While the HFTD is a foundational tool to identify areas of elevated or extreme wildfire risk for utilities, it was not developed at the electric asset level and is not operationally informed for PSPS program scoping and execution. HFRA refinements may also serve to inform future adjustments or recommendations to improve the HFTD map.

- Aspect – The direction the slope faces (north, east, south, west). The aspect determines the effect of solar heating, air temperature, and moisture. In the Northern Hemisphere, south facing slopes receive more solar heating which results in lower humidity, rapid moisture loss, and lighter fuels such as grasses. Seasonal directions of solar heating should be taken into consideration when analyzing a slope's aspect.

- Slope – A ratio of rise over run. Another way to think of slope is height over distance expressed as a percentage. Slopes can range from slight to steep but the influence on wildland fire is substantial. The steeper the slope the faster a fire moves uphill. Flames are closer to the fuel source, radiation heat increases the dehydration and preheats the vegetation, resulting in ignition sooner than on a slight slope or level ground.

- Land Use – Evaluation of modification and maintenance activities to the natural wildland landscape. Land use can change probability of fire ignition and fire behavior.

- Fuel Loading – Fuel loading is reported in tons of fuel available per acre. The higher the fuel loading, the more heat that will be produced during a fire.

- Fuel Position – Fuel position is based on relation to the ground. It can be defined by three types of fuels: subsurface fuels, surface fuels, and aerial fuels.

- Fuel Continuity – The horizontal and vertical spacing of fuels. These are often referred to as continuous fuels or patchy fuels. The rate and direction of the fire is predictable with continuous fuels. Patchy fuels are difficult to calculate because the radiant heat may not be able to ignite the source.

3. Data Elements

TABLE PG&E-4.4-4:
DATA ELEMENTS
FOR EXTERNAL REVIEW OF THE PROPOSED 2021 HFRA MAP

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Aerial imagery	Varied	Varied	Varied	Varied	Utilization of readily available and current satellite imagery from Google Earth and ESRI to inform land use, fuels, and terrain at variable scale to inform wildfire ignition risks and potential fire behavior.
Topographic map layers	Varied	Varied	Varied	N/A	Utilized to evaluate the slope of the terrain in and adjacent to areas of the HFRA to inform potential for fire spread.
Fire perimeter history	Annual Ongoing MTBS and GeoMAC	Ongoing	Varied	Varied	Utilization of fire perimeter data to evaluate fire frequency/regimes, fire spread patterns and effectiveness of historical suppression efforts.
Fire spread modeling	N/A	Varied	N/A	Varied	The use of computational fire spread modeling to inform or support recommendations based on qualitative local knowledge and other analysis.
Qualitative historical local knowledge	N/A	N/A	N/A	N/A	Experience-based inputs and recommendations from PG&E Public Safety Specialists with fire response and experience in specific regions of PG&E service territory.

TABLE PG&E 4.4-4:
DATA ELEMENTS
FOR EXTERNAL REVIEW OF THE PROPOSED 2021 HFRA MAP
(CONTINUED)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Field visits	N/A	N/A	N/A	N/A	As needed field verification for supplemental evaluation of actual current conditions.
Meteorology outputs	1989-2020 * modeled	N/A	2km x 2km grid	Hourly	Utilization of 30-year climatological re-analysis to inform anticipated exposures to electric assets and surrounding wildland fuels and terrain.
Historical outage datasets	2009-2017	On-going	N/A	N/A	Datasets of outages that occurred during offshore wind events were used to inform polygon creation and by highlighting areas that typically experience outages during offshore wind events.

4. Methodology

After internal draft development of proposed modifications to the HFRA Map, PG&E commissioned the GIRSRT to review the proposed modifications. During this review, the GIRSRT evaluated the criteria used to add or remove the areas to or from the HFTD Map. To supplement these criteria, the GIRSRT accessed additional data sets to enable complementary, objective assessments for land use, fuel load and slope. The GIRSRT also utilized fire history and perimeter data to check alignment of candidate regions with recent fires.

5. Timeline

GIRSRT's review of all 2021 proposed modifications to the HFRA map was completed by September 2021.

6. Results and Discussion

GIRSRT reviewed the proposed modifications to the HFRA Map, as well as the rationale used to make the case for each modification. GIRSRT agreed with PG&E's methodology and concurred with the majority of the proposed modifications. GIRSRT also recommended that some areas proposed for addition or removal be expanded or contracted based on their analysis.

7. Follow-up Planned

PG&E intends to continue utilizing GIRSRT for external review of additional proposed HFRA map modifications in 2022.

Lab Testing to Understand Ignition Behaviors Associated with Electric and Magnetic Field Induction

1. Purpose of Research

To understand potential ignition risks associated with deenergized power lines with induced voltages and currents, a thorough literature search was performed both internally and with the help of a third party, the Electric Power Research Institute, and no technical publications were found related to this scenario. To further explore this potential risk, lab testing was conducted to determine the fire ignition potential of induced voltages and currents at relatively low energy level associated with deenergized power lines in close proximity to other energized lines. Various scenarios were created in internal PG&E and external vendor labs to mimic the induction level currents and voltages and potential ignitions of a down conductor, with recognition of the varying factors in field conditions (i.e., ground resistivity).

2. Relevant Terms

No terms require additional definition.

3. Data Elements

TABLE PG&E-4.4-5:
DATA ELEMENTS
(LAB TESTING TO UNDERSTAND IGNITION BEHAVIORS ASSOCIATED WITH ELECTRIC AND MAGNETIC FIELD INDUCTION)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Lab Testing to understand Induction driven Ignition	2020	N/A	N/A	August-September 2020	Lab data collected via testing.

4. Methodology

Two types of current injection methodologies were used to perform the testing:

A. Current injection via a ground rod.

B. Current injection via a conductor resting on the surface of the ground.

Two types of fuel beds were used to represent flammable vegetation. The first type is a CAL FIRE specified fuel bed per page 23 of the California Power Line Fire Prevention Field Guide used to qualify electrical equipment devices for exemption from Public

Resource Code Section 4292. This fuel bed is an erosion control blanket consisting of 12 mm (1/2 inch) thick layer of agriculture straw material. Four layers of the blanket were laid over the 44″ × 44″ area of compacted topsoil. The required moisture of the fuel bed is less than 5 percent, and this was achieved by using an environmental chamber to dry the blanket for at least 48 hours prior to testing. The temperature of the environmental chamber was kept at approximately 100°F.

The second type of fuel bed consisted of sod purchased at the local hardware store and naturally dried outdoors for five days.

PG&E Internal Lab Test Circuit – For internal testing, energizing the ground rod/conductor using a high potential test unit with a max current output of 70mA, a current was injected through the fuel bed and soil to the ground plane, which created a ground potential rise and voltage gradient around the electrode.

External Lab's High Power Lab Test Circuit – For external testing, a high-power lab set was used, which was connected to BC Hydro's (British Columbia, Canada) largest substation via a 230kV transmission line. A stepdown transformer can provide voltages up to 44 kV. The lab capacitor bank had a selection of capacitors to adjust the current within the desired range of 0.1 – 5 A to match as closely as possible the large source impedance of the real system in an induced voltage scenario.

5. Timeline

The testing was conducted in August and September 2020.

6. Results and Discussion

Empirical data collected through a total of 150 tests provided us with better insight into ignition behaviors at low power levels, with different voltage and current combinations. However, the testing did not provide clear thresholds of ignition. The research found that the cases where the conductor was on the ground (representing a fallen conductor due to high wind or tree impact), the conditions of the ground and contact material were the most influential factors for ignition. We also witnessed reduced probability of ignition at lower voltage and current combinations, as well as increased ground impedance. Additionally, it was observed that current was less likely to be established and sustained in dry hay with lower voltages due to high impedance.

7. Follow-up Planned

Based on the findings from the testing, it was determined that grounding and sectionalizing the deenergized lines, where feasible, to reduce induced voltages and currents may be the best way to minimize ignition risk. PG&E is working on determining the feasibility and PSPS procedural impact of this requirement and establishing revised guidance.

4.5 Model and Metric Calculation Methodologies

4.5.1 Additional Models for Ignition Probability, Wildfire and PSPS Risk

Each utility is required to report details on the models and methodologies used to determine ignition probability, wildfire risk, and PSPS risk. This must include the following for each model – a list of all inputs, details of data elements used in the analysis, modeling assumptions and methodologies, input from Subject Matter Experts (SME), model verification and validation (e.g., equation(s), functions, algorithms or other validation studies), model uncertainty and accuracy, output (e.g., windspeed model) and applications of model in WMP (e.g., in selection of mitigations, decision-making).

The narrative for each model must be organized using the headings described below. A concise summary of the model(s) must be provided in the main body of the WMP in this section, with additional detail provided for each model in an appendix.

1. *Purpose of model – Brief summary of context and goals of model*

2. *Relevant terms – Definitions of relevant terms (e.g., defining "enhanced vegetation management" for a model on vegetation-related ignitions)*

3. *Data elements – Details of data elements used for analysis. Including at minimum the following:*

    a. *Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).*

    b. *Explain the frequency of data updates.*

    c. *Sources of data. Explain in detail measurement approaches.*

    d. *Explain in detail approaches used to verify data quality.*

    e. *Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).*

    f. *Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).*

4. *Modeling assumptions and limitations – Details of each modeling assumption, its technical basis, and the resulting limitations of the model*

5. *Modeling methodology – Details of the modeling methodology. Including at minimum the following:*

    a. *Model equations and functions*

    b. *Any additional input from Subject Matter Experts (SME) input*

    c. *Any statistical analysis or additional algorithms used to obtain input*

    d. *Details on the automation process for automated models*

6. *Model uncertainty – Details of the uncertainty associated with the model. This must include uncertainty related to the fundamental formulation of the model as well as due to uncertainty in model input parameters*

7. *Model verification and validation – Details of the efforts undertaken to verify and validate the model performance. Including at minimum the following:*

    a. *Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.*

    b. *Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.*

8. *Modeling frequency – Details on how often the model is run (for example, quarterly to support risk planning versus daily to support on-going risk assessments).*

9. *Timeline for model development – Model initiation and development progress over time. If updated in last WMP, provide update to changes since prior report*

10. *Application and results – Explain where the model has been applied, how it has informed decisions, and any metrics or information on model accuracy and effectiveness collected in the prior year.*

11. *Key improvements from working group – For each model, describe changes which have been implemented as a result of wildfire risk modeling working group discussions. Provide a high-level summary of recommendations from the wildfire risk modeling working group.*[52]

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52 For purposes of brevity, in the description of each model below, we will use the title for each of the eleven items requested by Energy Safety but will not include the full description of each item.

In this section, we are providing detailed information regarding our primary risk and operational models used for wildfire mitigation and situational awareness. We have tried to provide information for each of the 11 categories, and sub-categories, of information requested by Energy Safety. In some cases, we group the sub-categories into a response for a single category. We have tried to be as responsive as possible in providing the information requested by Energy Safety but are happy to provide additional information or detail regarding any of these models.

We are starting this section with Table PG&E-4.5.1-1 which lists the risk and operational models that will be discussed in this section. The models discussed in Section 4.5.1 can be thought of as "primary" models, meaning they may utilize information that was created from "component" models (also referred to as modules). The primary models are also included in Section 9.5, Table PG&E-9.5-1 which is our glossary of models. In addition, in Section 9.5, we are providing a list of component models or modules that provide information for our primary models. The component models are listed in Table PG&E-9.5-2.

Each primary risk and operational model has its own section within Section 4.5.1 and uses the headings (a) through (i). Because the component models feed into the primary models, they are not discussed in detail.

TABLE PG&E-4.5.1-1:
OVERVIEW OF PRIMARY PG&E RISK AND OPERATIONAL MODELS

4.5.1 Subsection	Model Name	Abbreviated Name	Brief Description	Use Case (Planning or Operational)
4.5.1(a)	2022 Enterprise Risk Model for Wildfire Risk	2022 ERM	Bow Tie-based wildfire risk model for distribution and transmission system	Planning
4.5.1(b)	2021 Wildfire Distribution Risk Model (Version 2)	2021 WDRM v2	Wildfire risk-based model for overhead (OH) Distribution system	Planning
4.5.1(b)	2022 Wildfire Distribution Risk Model (Version 3)	2022 WDRM v3	Wildfire risk-based model for OH Distribution system	Planning
4.5.1(c)	Wildfire Transmission Risk Model	WTRM	Wildfire risk-based model for OH Transmission system. This model is also known as the Transmission Composite Model (TCM)	Planning
4.5.1(d)	Wildfire Consequence Model	WFC Model	Wildland fire simulation model to estimate propagation and consequences of ignitions	Planning
4.5.1(e)	Enhanced Vegetation Management Tree Weighted Prioritization Model	EVM Tree Weighted Prioritization	Wildfire risk-based model incorporating tree density for OH Distribution circuit segments for the purpose of EVM scoping and prioritization	Planning
4.5.1(f)	Fire Potential Index Model	FPI Model	Provides estimates of the probability of large or catastrophic fire growth. Used to identify real-time and near-term forecasted risk due to various weather and fuel components.	Operational
4.5.1(g)	Ignition Probability Weather Model	IPW Model	Provides estimates of the probability of an ignition given an outage on an hourly basis.	Operational
4.5.1(h)	Transmission Operability Assessment Model	OA Model	Used to assess physical condition of Transmission facilities for operational and planning decisions	Operational/ Planning
4.5.1(i)	Public Safety Power Shutoff Consequence Model	PSPS Consequence Model	Projects the impacts and benefits of performing PSPS activities at the circuit or circuit segment level (formerly known as Circuit Protection Zones or CPZs)	Planning

4.5.1(a) 2022 Enterprise Risk Model for Wildfire Risk

The 2022 Enterprise Risk Model (2022 ERM) was developed for the Risk Assessment Mitigation Phase (RAMP) and General Rate Case (GRC) proceedings to evaluate enterprise risks that have potential safety consequences.[53] This model provides a consistent enterprise-wide risk assessment and modeling framework using PG&E's Multi Attribute Value Function (MAVF) in alignment with the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement (S-MAP Settlement).[54] This model is used to calculate pre-mitigated (or baseline) risk scores and post-mitigation risk scores, to compare them across different risks in PG&E's Corporate Risk Register, and produce the Risk Spend Efficiency (RSE) scores at a program level for the WMP and GRC. The 2022 ERM enables the calculation of a risk score at the system level and can determine changes to the risk score based on planned mitigations. Enterprise risk modelling capabilities are focused on a "whole risk view" covering all risk drivers and consequences for the entire system (including transmission and distribution) and an evaluation of mitigations at the program level.

1. Purpose of model

The purpose of the 2022 ERM is to assess enterprise risks (including wildfire) using a common framework (i.e., Risk Bow Tie and MAVF) and to compare baseline and post-mitigation risk using the MAVF scoring approach in the S-MAP Settlement and ultimately to develop RSEs at a portfolio/program level.

2. Relevant terms

- Attribute – An observable aspect of an event that involves risk or reflects a utility objective such as safety or reliability. Changes in the levels of attributes are used to determine the consequences of a Risk Event. The attributes in an MAVF should cover the reasons that a utility should consider risk mitigation activities. PG&E uses safety, reliability, and financial as Attributes.

- Bow Tie (or Risk Bow Tie) – A tool that visually represents the Risk Event in the center, a listing of drivers on the left side that potentially lead to the Risk Event occurring, and a listing of Consequences on the right side that show the potential outcomes if the Risk Event occurs.

- Consequence of Risk Event (CoRE) – The weighted sum of scaled values of the consequence levels of the individual Attributes using PG&E's full MAVF.

- Likelihood of Risk Event (LoRE) – The probability that a given Risk Event will occur with respect to a single element (unit of exposure) of a specified Tranche over a year in the planning period. PG&E computes LoRE based on the Frequency divided by total exposure units in a Tranche.

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53 For a detailed description, see PG&E's Enterprise Risk Model Documentation and User Guide, available in 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.3_Atch01.pdf.

54 The S-MAP Settlement was approved in D.18-12-014.

- Mitigation – a measure or activity proposed or in process that is designed to reduce the impact/consequences and/or the likelihood/probability of a risk event.[55]

- Multi-Attribute Value Function (MAVF) – Risk calculation methodology introduced during CPUC's S-MAP and RAMP proceedings.

- Natural Unit – The way the level of an attribute is measured or expressed. For example, the natural unit of a financial attribute may be dollars.

- Outcomes – The final resolution or end result.

- Range (of the Natural Unit) – Part of the specification of an Attribute. For an Attribute with a numerical natural unit, such as dollars, the smallest observable value of the Attribute is the low end of the range and the largest observable value is the high end of the range. Therefore, any Attribute level that results as a consequence of an event, or a risk mitigation action, or of doing nothing should be found within the range.

- Risk Driver – A factor that could influence the likelihood of occurrence of a Risk Event. A driver may include external events or characteristics inherent to the asset or system.

- Risk Event – An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition.

- Scaled Unit – The scaled unit is set to 0 for the most desirable level of natural unit in the range of natural units. The scaled unit is set to 100 for the least desirable level of natural unit in the range of natural units. For any level of attribute between the most desirable and the least desirable levels, the scale unit is between 0 and 100. The benefit achieved by changing the level of an Attribute in natural units is measured by the corresponding difference in scaled units.

- Sub-Driver – A further, more detailed categorization of a Risk Driver.

- Technosylva – Vendor of fire simulation software whose outcomes are based on available fuels, topography, and weather; and structure and population data. Technosylva simulation outputs are used as the source of spatially resolved fire severity data that is the primary input into the spatial wildfire consequence calculations.

- Tranche – A logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment.

3. Data elements

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55 D.18-12-014, p.17 (See 2018 S-MAP Revised Lexicon, pp. 16-19).

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

Table PG&E-4.5.1-2 provides the data elements for the 2022 ERM:

TABLE PG&E-4.5.1-2:
2022 ERM DATA ELEMENTS

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Source
CPUC Reportable Ignitions	2015-2020	Per Ignition	Lat/long, where known	Date and Time of estimated ignition start	PG&E Internal
Outage data	2015-2020	Per Outage	Lat/long, where known	Date and Time of outage start	PG&E Internal
Large fires in PG&E's service territory	2015-2020	Annually, when reports become available	Lat/long, where known	Date and Time of estimated ignition start	CALFIRE website
PSPS damages and hazards	2019-2020	Per each PSPS event	Lat/long, where known	Date	PG&E Internal
2021 Wildfire Distribution Risk Model	N/A	N/A	Pixel/Circuit segment	One year	PG&E Internal
PG&E Overhead Asset Line miles	N/A	N/A	Generally Lat/long	N/A	PG&E Internal
Mitigation data	N/A	As needed	N/A	N/A	PG&E Internal

b. Explain the frequency of data updates.

While datasets described above in Table PG&E-4.5.1-2 are updated on their own update cycles, for the ERM Model we have been updating the datasets for the past complete year at the time of each model update.

c. Sources of data. Explain in detail measurement approaches.

Data associated with CPUC-reportable ignitions, outage, and PSPS damages and hazards are measured in a variety of ways, including automated data collection, field inspections that may precede or follow the event, and desktop review of event records.

d. Explain in detail approaches used to verify data quality.

- CPUC-reportable ignitions are verified through a process undertaken by our Electric Incident Investigation (EII) team.

- Outage data is verified and quality checked by dedicated teams. Reviews are aligned to documented guidance documents. Input from SMEs—such as asset management, vegetation, incident investigations—is used to update the guidance document.

- Large fires in PG&E's service territory are based on data is gathered from external sources.

- PSPS damage and hazard data is collected for each event via the Inspect App and then reviewed for accuracy by the Intelligence & Investigation team within PG&E's Emergency Operations Center (EOC).

- The verification of data quality for the 2021 WDRM v2 is described below in Section 4.5.1(b).

- Mitigation data representing the exposure, effectiveness, and benefit length of a mitigation is verified through a quality control process undertaken by SMEs who review the data and perform validations of it.

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

The characteristics of the event data for the elements listed above are historical records of events with supporting data fields such as date/time, location, drivers, sub-drivers, asset type, etc.

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

Ignition data from 2015-2020 was modified by adding estimated avoided ignitions from system hardening, enhanced vegetation management, and PSPS during 2019 to 2020, to derive 2021 baseline risk score from historical data. PG&E also adds any known fires that are not included in the CPUC-reportable ignition dataset due to investigation status.

Data from the Conductor and Vegetation modules were used to inform the Likelihood of Risk Event (LoRE) for each circuit segment by HFTD Tiers 2 and 3 for conductor-involved ignitions and vegetation driver. (Please see Section 4.5.1(b) below for more information on these risk modules). Adjustments were made to account for: (1) the overlap between the Conductor module and Vegetation module so that there is no double counting of vegetation-driver conductor-involved ignitions; (2) 2015-2020 ignition counts because the Conductor module and Vegetation module were calibrated using 2015-2018 ignition data; and (3) mitigation impacts from System Hardening and Enhanced Vegetation Management programs implemented in 2019 and 2020. Non-vegetation conductor involved ignition frequency and vegetation driver frequency were then further allocated to applicable drivers and sub-drivers using outage data. Note that likelihood of ignitions that are not vegetation driver and not conductor-involved are unavailable from the 2021 WDRM v2. Thus, LoRE values for drivers and sub-drivers associated with those ignitions were added by LoRE calculated at the circuit

and tier level (i.e., circuit split by HFTD Tiers) using 2015-2020 ignition data for the applicable drivers and sub-drivers.

The Wildfire Consequence Model of the 2021 WDRM v2 was used to inform CoRE values of circuit segment by HFTD Tiers. Specifically, the Wildfire Consequence Model provided the probability of Large Fire given an ignition and probability of Destructive Fire given an ignition based on the Technosylva simulation of 8-hour fire spread, aggregated to each circuit segment by HFTD Tiers. These probabilities were further calibrated based on probabilities of Large and Destructive Fires given an ignition in PG&E's HFTD, which were calculated using PG&E's 2015-2020 CPUC-reportable ignitions and CALFIRE large fire dataset in PG&E territory during 2015-2020.

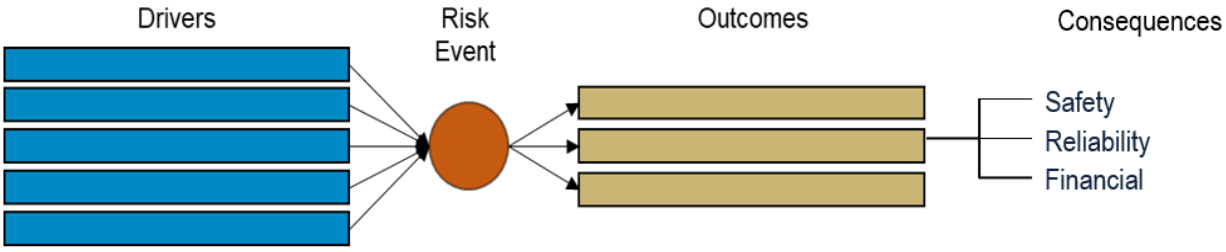
4. Modeling assumptions and limitations

The 2022 ERM follows the requirements set forth in the S-MAP Settlement, as described in more detail below in (5).

5. Modeling methodology

The 2022 ERM is built on a Bow Tie framework with the MAVF and Risk Score methodology required by S-MAP Settlement. The center of the Bow Tie represents a Risk Event, the left-hand side represents risk drivers, and the right-hand side represents risk outcomes. Outcomes are used to differentiate severity of consequences resulting from a risk event. This is illustrated in Figure PG&E-4.5.1-1.

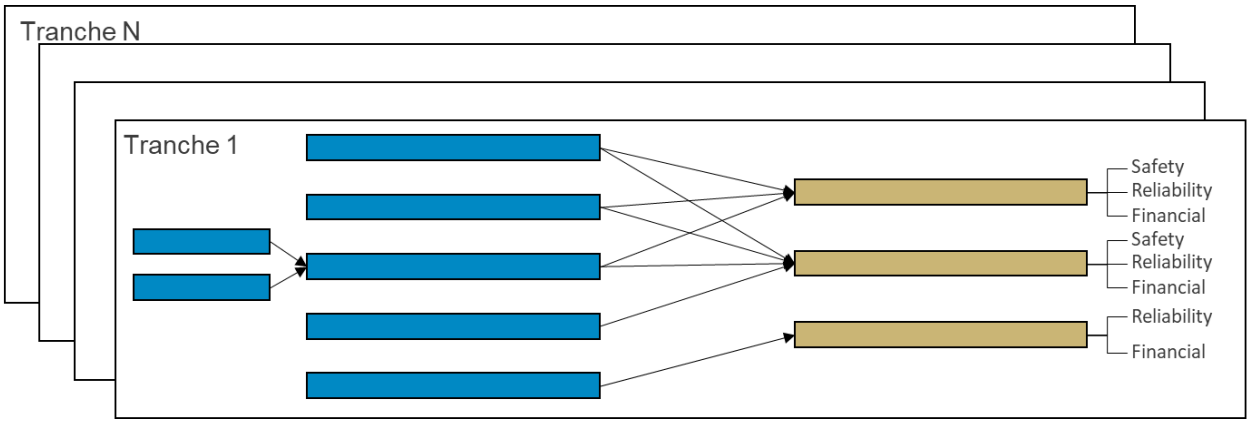
FIGURE PG&E-4.5.1-1:
CONCEPTUAL MODEL OF THE BOW TIE FRAMEWORK, WITH DRIVERS ON THE LEFT, THE RISK EVENT IN THE CENTER, OUTCOMES, AND CONSEQUENCES ON THE RIGHT



Note: The left-hand side of the Bow Tie is quantified using likelihood of a risk event for each driver; and the right-hand side of the Bow Tie is quantified using consequences of a risk event for each outcome.

The quantification is calculated at the Tranche level. A Tranche represents a logical disaggregation of a group of assets (physical or human) or systems into subgroups with similar risk profiles for the purpose of risk quantification. Thus, the final risk event Bow Tie is constructed from a series of tranche level Bow Ties that are ultimately combined and presented as a single Bow Tie. Figure PG&E-4.5.1-2 below shows the individual tranche level Bow Ties.

FIGURE PG&E-4.5.1-2:
ILLUSTRATION OF RELATIONSHIP BETWEEN DRIVERS (LEFT) AND OUTCOMES (RIGHT) WITH CONSEQUENCE ATTRIBUTES PER TRANCHE



Note: Even though Bow Tie graphics show an arrow from drivers (five blue boxes) to outcomes for visualization purposes, Bow Tie implemented in the Risk Model Input File and Enterprise Risk Model is more correctly represented by having arrows to come from sub-drivers (two blue boxes on the left) to outcomes directly without being aggregated into drivers.

Risk drivers, which can be further broken down into sub-drivers, are factors that contribute to the occurrence of a risk event. Sub-driver inputs represent the expected LoRE per unit of exposure. Sub-driver likelihood values (the probability of a risk outcome per unit of exposure per year from that sub-driver) are characterized at the Tranche × Sub-Driver × Outcome level.

The 2022 ERM Wildfire Risk Bow Tie has 65 tranches, 37 sub-drivers, and 10 outcomes, the number of likelihoods that are required by the Model as an input is 65 × 37 × 10 = 24,050.

The event frequency is the product of the exposure and expected annual likelihood of a risk event per unit exposure. The LoRE and event frequency are aggregated across sub-drivers, drivers, outcomes and/or tranches to show different levels of aggregated LoRE and event frequency.

Outcomes are characterized by statistical distributions of the potential levels of impact from a risk event across four different attributes, which are listed in Table PG&E-4.5.1-3 Consequences are sampled from their respective distributions for each set of tranche, outcome, and attribute and for each year of the analysis period.

TABLE PG&E-4.5.1-3:
CONSEQUENCE ATTRIBUTES AND THEIR NATURAL UNITS

Attribute	Natural Unit
Safety	Equivalent Fatality
Electric Reliability	Customer-Minutes Interrupted
Gas Reliability	Customers Affected
Financial	Dollars

a. Model equations and functions

Baseline Risk Score:

For each year *y* in the WMP period, the Baseline Risk Score can be expressed formulaically as:

$$R_{y,prbase} = \sum_{\tau \epsilon T} X_{y,\tau} \left(\sum_{o \epsilon O} \left(\underbrace{\sum_{d \epsilon D} \underbrace{\left(\sum_{\sigma \epsilon S_d} p_{y,\tau,d,\sigma}(d,\sigma) \times p_{y,\tau}(o|\sigma) \right)}_{p_{y,\tau,d}}}_{p_{y,\tau,o}} \right) \times C_{y,\tau}(\boldsymbol{c_a}|o) \right)$$

Where:

$T \equiv \{\tau$: Tranches per D.18-12-014. e.g. for Wildfire, there are 65 tranches$\}$
$D \equiv \{d$: $Known$ Risk Event drivers$\}$
$S_{d \epsilon D} \equiv \{\sigma$: Sub-drivers of Driver $d\}$
$O \equiv \{o$: Outcomes (e.g., Catastrophic, Destructive, etc.)$\}$
A $\equiv \{a$: Attributes - Safety, Electric Reliability, Gas Reliability, Financial$\}$
$X_{y,\tau}$: Exposure units (e.g. miles) in Tranche τ for year y
$p_{y,\tau,d,\sigma}(d,\sigma)$: $Year\ y$ probability of Risk Event due to driver d/sub-driver σ in Tranche τ
$p_{y,\tau,d}$: $Year\ y$ probability of Risk Event due to driver d in Tranche τ
$p_{y,\tau}(o|d)$: $Year\ y$ conditional probability in Tranche τ of Outcome o given driver d
$p_{y,\tau,o}$: $Year\ y$ probability of Outcome o in Tranche τ

Additionally, $C_{y,\tau}(\boldsymbol{c_a}|o)$above, the conditional Consequence of Risk Event (CoRE) for tranche τ, given Outcome *o*, is defined as

$$C_{y,\tau}(\boldsymbol{c_a}|o) \equiv 1000 \times \sum_{a \epsilon A} \omega_a \mathrm{E}_{y,a,\tau,o}[\mathrm{f}(\boldsymbol{c_a}/r_a)]$$

Where:

$\boldsymbol{c_a}$: A Random Variable for the levels for Attribute a, measured in natural units, pursuant to D.18-12-014
ω_a: Weight of Attribute a, pursuant to D.18-12-014
r_a: Range of Attribute a, pursant to D.18-12-014
$\mathrm{E}_{y,a,\tau}[.]$: Expected value under the probability distribution for Year y, Attribute a, Tranche τ,Outcome o
$f(.)$: PG&E Scaling Function, pursuant to D.18-12-014

Post-mitigation Risk Scores:

ERM also produces post-mitigation risk scores for each year in the horizon. The post-mitigation risk score is the level of risk assuming that a set of mitigation programs are implemented at specific levels with an assumed level of effectiveness in each tranche.

For each year in the horizon, the post-mitigation risk score is then calculated as follows:

$$R_{y,post} = \sum_{\tau \epsilon T} X_\tau \left(\sum_{o \epsilon O} \left(\sum_{d \epsilon D} \left(\sum_{\sigma \epsilon S_d} p'_{y,\tau,d,\sigma}(d,\sigma) \right) \times p_{y,\tau,o}(o|d) \right) \times C'_y(\boldsymbol{c_a}|o) \right)$$

Where:

$$p'_{y,\tau,d,\sigma}(d,\sigma) = p_{y,\tau,d,\sigma}(d,\sigma) \times \left[1 - \prod_{m \in M^L_\tau} \left(1 - \frac{X_{y,\tau,d,\sigma,m}}{X_{y,\tau}} \epsilon^L_{\tau,d,\sigma,m} \right) \right]$$

$$C'_y(\boldsymbol{c_a}|o) = 1000 \times \sum_{a \epsilon A} \omega_a \mathrm{E}_{y,a,o} \left[\mathrm{f}\left(\frac{\boldsymbol{c_a}}{r_a} \times \left[1 - \prod_{m \in M^C_o} \left(1 - \epsilon^C_{o,m} \right) \right] \right) \right]$$

And

$$M^L_\tau \equiv \{m\text{: Proposed mitigations that reduce probability/Likelihood for Tranche } \tau\}$$

$$M^C_o \equiv \{m\text{: Proposed mitigations that reduce Consequences of Outcome } o\}$$

$X_{y,\tau,d,\sigma,m}$: $Year\ y$ units (e.g. miles) in scope of mitigation *m*, for tranche τ, driver *d*, sub-driver σ
$\epsilon^L_{\tau,d,\sigma,m}$: Effectiveness (in %) of mitigation m that reduces likelihood/probability for tranche τ, driver *d*, sub-driver σ
$\epsilon^C_{o,m}$: Effectiveness (in %) of mitigation m that reduces consequences for tranche τ, outcome *o*

b. Any additional input from Subject Matter Experts (SME)

Consistent with the S-MAP Settlement, the 2022 ERM utilizes SMEs throughout the process. SMEs identify which data sets to use, provide the overall logic to use for calculating LoRE and CoRE, provide guidance on how to utilize tranches and scope risks, and review quantitative work to reduce potential errors in data and calculations. For example, SME inputs are used to determine the multipliers for CoRE and the probability of ignition developing into more severe fires for seismic scenarios. Also, SME input is used to in estimating the number of ignitions reduced from mitigations in 2019 and 2020 such as system hardening, EVM and PSPS, used to adjust historical ignition data to derive 2021 baseline frequency.

c. Any statistical analysis or additional algorithms used to obtain input

The 2022 ERM takes a probability distribution of a consequence in different attributes for each outcome severity (catastrophic, destructive, large and small) as an input. Calibration analysis using the fire dataset is done to find the reasonable probability distribution and its parameters.

d. Details on the automation process for automated models

Input preparation for the Bow Tie model is not automated but the 2022 ERM itself is automated using Python. Data is prepared manually, and inputs are prepared in combination of the Python code and manual calculation. Once input is prepared in the Risk Input File, which is standardized template for running 2022 ERM for any risk characterized using the Bow Tie framework, the Python code is executed to generate the output files that includes risk score and Bow Tie data.

6. Model uncertainty

There is uncertainty associated with the model formulation as well as model input parameters. Consistent with the S-MAP Settlement, the risk score formula is represented as the multiplication of the Frequency and CoRE. The Frequency is uncertain in nature but the S-MAP risk score formula uses the expected value of the frequency. The uncertainty in the frequency thus is not captured. In particular, the model estimates the baseline frequency for 2022 based on the historical event data from 2015-2020 adjusted for the estimated impact from major mitigations implemented in 2019 and 2020. There is variability and uncertainty around the external factors that impact risk event occurrence itself at different locations in PG&E's service territory and also around internal factors such as the impact of varying levels of mitigations in each year, and degradation of asset health.

The parameters for probability distribution used to represent the CoRE for each outcome severity are also uncertain. Probability distributions associated with financial consequence for a destructive fire and safety consequence for a catastrophic fire are calibrated using historical fires data in PG&E's service territory during 2015-2020 but the number of data points for such fires are limited, which leads to high uncertainty of distribution parameters.

Effectiveness percentages used to model mitigations are also subject to uncertainty, due to data variability, and/or use of SME judgement.

There is also uncertainty associated with the climate change multipliers which the 2022 ERM uses to adjust the probability distribution calibrated using historical fire consequence data to obtain the consequences of a risk event for future years. However, currently such uncertainty is not reflected and translated into the CoRE values.

7. Model verification and validation

a. Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.

The risk score calculation performed using Python was implemented in Microsoft Excel to verify the results are the same between Excel implementation and Python calculation. The Excel implementation of the risk score calculation was shared with parties in PG&E's 2020 RAMP Report[56] and 2023 GRC proceeding[57] along with ERM User Guide and Documentation.

In certain cases, the ERM uses closed-form formulas for calculating the CoRE values, which involves taking expected value of Scaled Units, when consequences in the natural unit is represented by a probability distribution. PG&E verified closed form formulas by performing the equivalent calculation using the Monte Carlo Simulations.

The MAVF calculation function of the 2022 ERM is verified through unit tests.

b. Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.

The 2022 ERM is used to calculate risk scores for baseline and post-mitigation scenarios. The model itself is not validated versus real-world observations.

8. Modeling frequency

Since 2019, the ERM has been updated annually to support WMP, RAMP and GRC submissions.

9. Timeline for model development

Since the 2021 WMP filing, the ERM has been updated to support the 2022 WMP and the 2023 GRC application.

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56 PG&E's 2020 Risk Assessment Mitigation Phase Report filed on June 30, 2020 in CPUC Application (A.) 20-06-012 (2020 RAMP Report).

57 PG&E's General Rate Case for rate years 2023-2026 filed at the CPUC in A.21-06-021 (2023 GRC).

10. Application and results

The 2022 ERM was used to compute the RSE values in the 2022 WMP and the 2023 GRC.[58] RSE is one, but not the only, factor that PG&E uses to assess projects and programs. In determining which projects to select, PG&E must consider factors such as risk reduction, cost, efficiencies, overall authorized GRC funding, the availability of PG&E and contractor resources, synergies with other work, and dependencies and requirements such as permitting and the different rules for working with California's counties and cities.

The model is also used to inform the trajectory of risk and components of the risk (such as contribution of each driver, sub-driver, outcome and tranche) to the risk.

11. Key improvements from working group

No specific recommendations have been provided from the Wildfire Risk Modeling Working Group to date for the ERM for Wildfire Risk.

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58 PG&E used the RSE Lite Tool, a model that uses outputs from the 2022 ERM to calculate RSEs. For a detailed description of the RSE Lite Tool, see PG&E's RSE Lite Tool Documentation and User Guide, available in 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.1_Atch01.pdf.

4.5.1(b) Wildfire Distribution Risk Model

This section addresses the Wildfire Distribution Risk Model or WDRM. Since the 2021 WMP, we have had two versions of this model. The 2021 Wildfire Distribution Risk Model (Version 2), also known as 2021 WDRM v2, was developed in 2020 and was used to inform work planning in 2021 and 2022. The 2021 WDRM v2 leveraged the Wildfire Risk Bow Tie and MAVF risk scoring methodology discussed in Section 4.5.1(a) above. The 2021 WDRM v2 is consistent with the application of wildfire risk being the product of the probability or likelihood of an ignition event multiplied by the consequence of the event. The 2021 WDRM v2 estimates wildfire risk values for circuit segments of the overhead distribution system in PG&E's HFTDs to provide insights into the locations with high wildfire risk by risk driver to inform the development of mitigation programs such as System Hardening and EVM. For a detailed description of the 2021 WDRM v2, please see our 2021 Revised WMP, starting on page 133, or see attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.1_Atch02.

The 2022 Wildfire Distribution Risk Model (Version 3), also known as 2022 WDRM v3, was developed by PG&E as a natural evolution of the 2021 WDRM v2. It is used to quantify the wildfire risk posed by PG&E's overhead distribution facilities (also known as assets or equipment), which includes conductors, transformers, support structures (or poles, which includes related equipment such as cross arms and guy wires). The 2022 WDRM v3 quantifies risk for additional risk drivers over the 2021 WDRM v2.

The 2022 WDRM v3 provides predictions of the where, why, and how much wildfire risk occurs during a typical wildfire season (defined as June 1st through November 30th). The model differentiates risk by location and/or individual assets, providing information on where the likelihood of ignitions and the consequences of ignitions are elevated (and by how much), so that PG&E can prioritize higher-risk areas for applying potential mitigation efforts. Through modeled relationships between risk and a wide array of environmental (i.e., wind, temperature, fuels) and asset characteristics, it also helps PG&E understand the factors contributing to risk. Finally, the 2022 WDRM v3 estimates whether specific mitigations (i.e., EVM, System Hardening, pole replacement, and transformer replacement) may be most effective for which asset types in which locations by estimating the wildfire risk reduction achieved by performing a given mitigation at a given location or on a given asset.

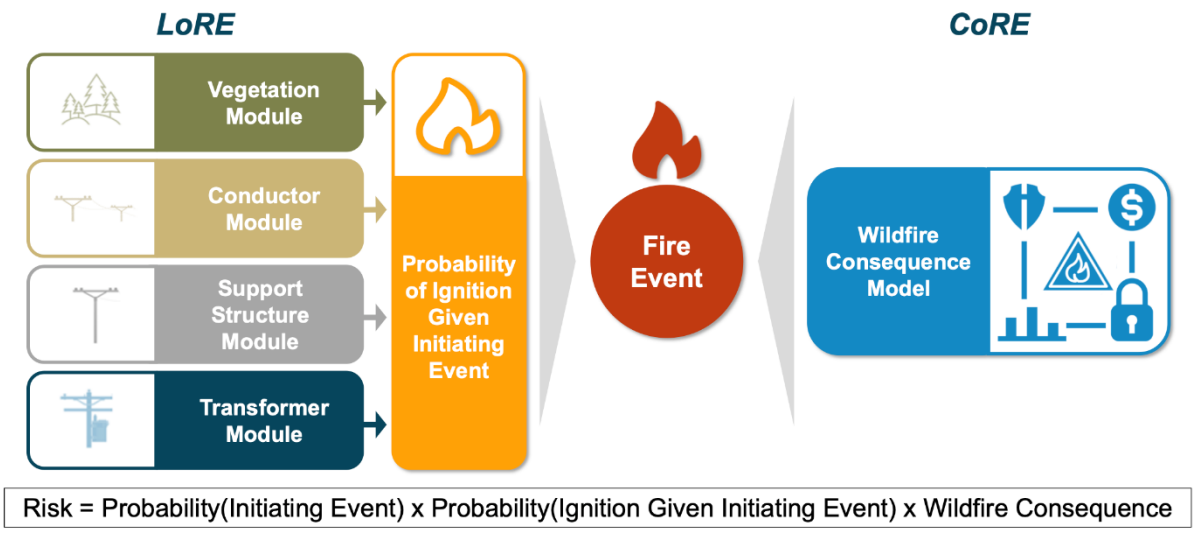
While there are temporal elements, like weather, within the 2022 WDRM v3, the predictions are defined as annual wildfire season-wide estimates of risk. The model does not determine when within the season (i.e., what month, day, or time) wildfires may occur in the future. The 2022 WDRM v3 is a "Planning" model whose outputs must be relevant over single to multi-year planning timeframes. To support planning work, the modeling time horizon is a single fire season. Other models, which are categorized as "Operational", such as PG&E's FPI and IPW Models, focus on informing day-to-day risk mitigation operations based on hourly weather forecasts, but only for a few days into the future.

The 2022 WDRM v3 introduces the composite model architecture. The output of the 2022 WDRM v3 is a spatial map with numerous layers – each characterizing risk from different causes and/or associated with different assets. These layers of risk, or modules, can be examined and compared individually, or they can be composited

together in various configurations to understand groups of risk, or total risk, from the overhead distribution system, at a particular location or for one or more asset types.

Figure PG&E-4.5.1-3 below summarizes the relationship of the 2022 WDRM v3 model to its risk modules.

FIGURE PG&E-4.5.1-3:
2022 WDRM V3 COMPOSITE MODEL ARCHITECTURE



Because the 2021 WDRM v2 was described in detail in our 2021 WMP, we will not repeat the same discussion here. In the remainder of this section, we address the 2022 WDRM v3.

Finally, it is important to note that in this 2022 WMP, the model that is used for the development of workplans for the distribution system is the 2021 WDRM v2 which is described above and in the 2021 WMP. As described in (9) below, the 2022 WDRM v3 is still being reviewed prior to approval. Since workplans for the 2022 WMP needed to be developed prior to the beginning of the year, the 2021 WDRM v2 was used to inform these workplans.

1. Purpose of model

The purpose of the 2022 WDRM v3 is to: 1) provide understanding of the potential wildfire risk associated with PG&E's electric distribution assets, 2) enable risk-informed decision making, and 3) give PG&E visibility into risk reductions from wildfire risk mitigation initiatives

The 2022 WDRM v3 is our primary wildfire risk model. Thus, an additional purpose of the model is to serve as the aggregation of various risk analysis, so the analysis is used consistently across all the various wildfire mitigation programs and projects on the electric distribution system.

2. Relevant terms[59]

- Area Under the Receiver Operating Characteristic (ROC AUC) – ROC AUC is a performance metric designed to test a model's ability to discriminate between cases that were correctly classified (true positive examples) versus non-cases (false positive examples) and is widely used to evaluate classification models.

- Consequence – The effect of the occurrence of a Risk Event. Consequences affect Attributes of an MAVF.

- Fire Behavior Index (FBI) – A scale of 1 to 5 that captures fire severity as a function of flame length (intensity of burn) and rate of spread. FBI of 3 or greater is expected to require aggressive suppression.

- Maximum Entropy (MaxEnt) – The name given to a family of algorithms that seek to differentiate between the characteristics of locations that have hosted grid events and those that have not.

- Mitigation – A measure or activity proposed or in process that is designed to reduce the impact/consequences and/or the likelihood/probability of a risk event.

3. Data elements

Because the 2022 WDRM v3 is a collection of multiple modules, each focused on a specific combination of cause and asset type, the response to each of the sections below may refer to the overall WDRM, or to elements within one or more of the modules.

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

The 2022 WDRM v3 utilizes a large array of data, gathered from such sources as Asset Management, Outage Reports, Inspection Records, PG&E and public Meteorology, Vegetation Management, etc.

Table PG&E-4.5.1-4 below provides information regarding the relevant data sets used in the 2022 WDRM v3.

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59 For purposes of brevity, PG&E will not repeat definitions of relevant terms that were defined for earlier models in this Section.

TABLE PG&E-4.5.1-4:
2022 WDRM V3 DATA SETS

Source	Provides	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Availability and URL
PG&E events - outages, ignition, PSPS, inspections, and other PG&E events	Event type, cause, equipment type, voltage, and other characteristics	2015-2021	Daily	Generally lat/long	Point-in-time events	PG&E internal
PG&E asset attributes	Asset types, locations, characteristics, for poles, conductors, transformers, etc.	2015-2021	NA	Generally lat/long	NA	PG&E internal
National Land Cover Database (NLCD) - produced by USGS	Land cover types, including vegetation and "impervious"	NA	NA	30m	NA	Public - https://developers.google.com/earth-engine/datasets/catalog/USGS_NLCD_RELEASES_2016_REL
GAP/LANDFIRE National Terrestrial Ecosystems data - produced by USGS	Detailed vegetation and land cover classification	2011	NA	30m	NA	Public - https://developers.google.com/earth-engine/datasets/catalog/USGS_GAP_CONUS_2011?hl=en
LANDFIRE surface fuels model - produced by USGS	"nonburnable" land cover	2016	NA	100m	NA	Public - https://www.nwcg.gov/publications/pms437/fuels/surface-fuel-model-descriptions
National Elevation Database (NED) - produced by USGS	Elevation, slope	NA	NA	100m	NA	Public - https://gee.stac.cloud/87CgnARxhwvgHXTnJH
High Fire Threat Districts - produced by CPUC	HFTD assignment	2018	NA	100m	NA	Public - https://www.cpuc.ca.gov/industries-and-topics/wildfires/fire-threat-maps-and-fire-safety-rulemaking
WorldPop	Population density	2010 and 2015	NA	100m	NA	Public - https://developers.google.com/earth-engine/datasets/catalog/WorldPop_GP_100m_pop
Salo Sciences	Satellite derived tree height, count, etc.	2019	NA	100m	NA	PG&E - licensed from Salo Sciences - https://salo.ai/
PG&E LiDAR Survey	LiDAR derived tree height, count, etc.	2019	NA	100m	NA	PG&E - Vegetation Management

TABLE PG&E-4.5.1-4:
2022 WDRM V3 DATA SETS
(CONTINUED)

Source	Provides	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Availability and URL
Fire Potential Index (FPI) - produced by PG&E Meteorology	Dead Fuel Moisture (DFM), wind speed and direction, temperature, precipitation, etc.	2020 and 2021	NA	2km	See documentation in Section 4.5.1(f)	PG&E - Meteorology - See documentation in Section 4.5.1(f)
gridMET - University of Idaho Gridded Surface Meteorological Database	Vapor Pressure Deficit, specific humidity, burn index, energy release component	2015-2019	NA	4km	Daily	Public - https://developers.google.com/earth-engine/datasets/catalog/IDAHO_EPSCOR_GRIDMET
Real-Time Mesoscale Analysis (RTMA) is a high-spatial and temporal resolution analysis for near-surface weather conditions, produced by NOAA/NWS	Wind gust data	2016-2018	NA	2.5km	Hourly	Public - https://developers.google.com/earth-engine/datasets/catalog/NOAA_NWS_RTMA
TreeMap	Prevailing tree species	2014	NA	30m	NA	Public - https://www.nature.com/articles/s41597-020-00782-x
California Wildlife Habitat Relationships (CWHR) –- California Department of Fish and Wildlife. California Interagency Wildlife Task Group. 2014. CWHR version 9.0	Habitat type / prevailing vegetation species or type	2014	NA	100m	NA	Public - https://wildlife.ca.gov/Data/CWHR
Gridded National Soil Survey Geographics Database (gNATSGO).	Local soil type/composition and characteristics	2019	NA	10m	NA	Public - https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcseprd1464625

b. Explain the frequency of data updates.

While the 2022 WDRM v3 will be formally updated once per year, the datasets described above in (3)(a) above each have different update cycles. For example, asset data is updated continuously, whereas a dataset like soils may be updated only once every decade. Leading up to the date when the final 2022 WDRM v3 is run, the data components used for the model are typically the most up-to-date elements available at that time.

c. Sources of data. Explain in detail measurement approaches.

Table PG&E-4.5.1-5 below identifies the measurement approach for data elements.

TABLE PG&E-4.5.1-5:
2022 WDRM V3 DATA SOURCES WITH MEASUREMENT APPROACH

ID	Source	Measurement
1	PG&E events - outages, ignition, PSPS, inspections, and other PG&E events	Events are measured in a variety of ways, including automated data collection, field inspections that may precede or follow the event, desktop review of event records, etc.
2	PG&E asset attributes	Asset attributes are measured in a variety of ways, including capture of attributes during asset installation or repair, transcription of paper to digital records, desktop review of records, LiDAR and other "bulk" survey methods, etc.
3	National Land Cover Database (NLCD) - produced by USGS	Measurement details can be found at the URL for this Source - see (3)(a) above
4	GAP/LANDFIRE National Terrestrial Ecosystems data - produced by USGS	Measurement details can be found at the URL for this Source - see (3)(a) above
5	LANDFIRE surface fuels model - produced by USGS	Measurement details can be found at the URL for this Source - see (3)(a) above
6	National Elevation Database (NED) - produced by USGS	Measurement details can be found at the URL for this Source - see (3)(a) above
7	High Fire Threat Districts - produced by CPUC	Measurement details can be found at the URL for this Source - see (3)(a) above
8	WorldPop	Measurement details can be found at the URL for this Source - see (3)(a) above
9	Salo Sciences	Measurement details can be found at the URL for this Source - see (3)(a) above
10	PG&E LiDAR Survey	A vendor to PG&E (SharperShape) collected LiDAR data via helicopters surveying assets and trees in primarily the HFTD portion of PG&E's service territory during 2019
11	Fire Potential Index (FPI) - produced by PG&E Meteorology	See documentation in Section 4.5.1(f)
12	gridMET - University of Idaho Gridded Surface Meteorological Dataset	Measurement details can be found at the URL for this Source - see (3)(a) above
13	Real-Time Mesoscale Analysis (RTMA) is a high-spatial and temporal resolution analysis for near-surface weather conditions, produced by NOAA/NWS	Measurement details can be found at the URL for this Source - see (3)(a) above
14	TreeMap	Measurement details can be found at the URL for this Source - see (3)(a) above
15	California Wildlife Habitat Relationships (CWHR) - California Department of Fish and Wildlife. California Interagency Wildlife Task Group. 2014. CWHR version 9.0	Measurement details can be found at the URL for this Source - see (3)(a) above
16	Gridded National Soil Survey Geographics Database (gNATSGO).	Measurement details can be found at the URL for this Source - see (3)(a) above

d. Explain in detail approaches used to verify data quality.

Table PG&E-4.5.1-6 below identifies the quality verification for data elements.

TABLE PG&E-4.5.1-6:
2022 WDRM V3 DATA QUALITY VERIFICATION

ID	Source	Data Quality Verification
1	PG&E events - outages, ignition, PSPS, inspections, and other PG&E events	PG&E's Risk and Data Analytics (RaDA) team performs extensive data cleansing and enhancement to improve the locations and characteristics of these events
2	PG&E asset attributes	RaDA team performs extensive data cleansing and enhancement to improve asset characteristics.
3	National Land Cover Database (NLCD) - produced by USGS	The data provider performs verification as this data is produced.
4	GAP/LANDFIRE National Terrestrial Ecosystems data - produced by USGS	The data provider performs verification as this data is produced.
5	LANDFIRE surface fuels model - produced by USGS	The data provider performs verification as this data is produced.
6	National Elevation Database (NED) - produced by USGS	The data provider performs verification as this data is produced.
7	High Fire Threat Districts - produced by CPUC	The data provider performs verification as this data is produced.
8	WorldPop	The data provider performs verification as this data is produced.
9	Salo Sciences	The data provider performs verification as this data is produced.
10	PG&E LiDAR Survey	The data provider performs verification as this data is produced.
11	Fire Potential Index (FPI) - produced by PG&E Meteorology	The data provider performs verification as this data is produced. See documentation in Section 4.5.1(f).
12	gridMET - University of Idaho Gridded Surface Meteorological Dataset	The data provider performs verification as this data is produced.
13	Real-Time Mesoscale Analysis (RTMA) is a high-spatial and temporal resolution analysis for near-surface weather conditions, produced by NOAA/NWS	The data provider performs verification as this data is produced.
14	TreeMap	The data provider performs verification as this data is produced.
15	California Wildlife Habitat Relationships (CWHR) - California Department of Fish and Wildlife. California Interagency Wildlife Task Group. 2014. CWHR version 9.0	The data provider performs verification as this data is produced.
16	Gridded National Soil Survey Geographics Database (gNATSGO).	The data provider performs verification as this data is produced.

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

Table PG&E-4.5.1-7 below identifies the characteristics of the data elements.:

TABLE PG&E-4.5.1-7:
2022 WDRM V3 DATA ELEMENTS AND CHARACTERISTICS

ID	Source	Field Definitions / Schema	Uncertainties	Acquisition Frequency
1	PG&E events - outages, ignition, PSPS, inspections, and other PG&E events	There are many fields in this dataset - the most relevant for WDRM include: location, time/date, event type (outage, ignition, etc.), cause, equipment involved	Much of this data is collected in the field by PG&E staff, which can lead to various uncertainties. Some of these events (especially ignitions) go through a desktop review process that can reduce uncertainty.	Preliminary data is typically available within minutes to days of the event occurring. Events that are reviewed and improved may take a few months to get updated.
2	PG&E asset attributes	There are many fields in this dataset - the most relevant for WDRM include: location, asset type, asset characteristics	Spatial uncertainties are present, but are being reduced by a long-term “conflation” project to update asset locations from LiDAR survey data. Asset attributes maybe be incorrect, and are sometimes absent.	Newly-installed assets are typically updated in PG&E's data systems within weeks to months. Various existing asset records may be updated by various data quality improvement projects at various times.
3	National Land Cover Database (NLCD) - produced by USGS	There are many fields in this dataset - those in use by WDRM include: impervious, rangeland components (e.g. shrubland, sagebrush, bare ground, etc.)	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
4	GAP/LANDFIRE National Terrestrial Ecosystems data - produced by USGS	Single field with 584 numerical values, indicating different landcover descriptions	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
5	LANDFIRE surface fuels model - produced by USGS	While this dataset may have many fields, only one is used in WDRM - the “unburnable” feature, which is a percentage of the 100m considered unburnable, because it is of land types not considered to have combustible fuel (agricultural land, snow and ice, water, and barren/rocky areas)	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.

TABLE PG&E 4.5.1 7:
2022 WDRM V3 DATA ELEMENTS AND CHARACTERISTICS
(CONTINUED)

ID	Source	Field Definitions / Schema	Uncertainties	Acquisition Frequency
6	National Elevation Database (NED) - produced by USGS	While this dataset may have many fields, only one is used in WDRM -elevation.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
7	High Fire Threat Districts - produced by CPUC	Single field with numerical values, indicating HFTD tier (1, 2, 3)	NA - this dataset is the canonical source of HFTD tier locations.	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
8	WorldPop	Single field with numerical value - estimated number of people residing in each grid cell	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
9	Salo Sciences	A few fields characterizing various tree attributes, such as height, coverage, etc.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM. Future PG&E licensing of refreshed data may result in updates to this source for future WDRM versions.
10	PG&E LiDAR Survey	While this dataset has many fields, processing performed by Salo Sciences to merge this data with their data results in just a few fields characterizing various tree attributes, such as height, coverage, strike trees, etc.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in v3 WDRM. Future PG&E LiDAR surveys may result in updates to this source for future WDRM versions.
11	Fire Potential Index (FPI) - produced by PG&E Meteorology	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)
12	gridMET - University of Idaho Gridded Surface Meteorological Dataset	While this dataset has many fields, only a few are used in WDRM: vapor pressure deficit, specific humidity, burn index, and energy release	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
13	Real-Time Mesoscale Analysis (RTMA) is a high-spatial and temporal resolution analysis for near-surface weather conditions, produced by NOAA/NWS	While this dataset has many fields, only one is used in WDRM: wind gust speed.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.

TABLE PG&E 4.5.1 7:
2022 WDRM V3 DATA ELEMENTS AND CHARACTERISTICS
(CONTINUED)

ID	Source	Field Definitions / Schema	Uncertainties	Acquisition Frequency
6	National Elevation Database (NED) - produced by USGS	While this dataset may have many fields, only one is used in WDRM -elevation.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in both v2 and v3 of the WDRM.
14	TreeMap	While this dataset has many fields, only one is used in WDRM: a numerical descriptor of tree species	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in v3 WDRM.
15	California Wildlife Habitat Relationships (CWHR) - California Department of Fish and Wildlife. California Interagency Wildlife Task Group. 2014. CWHR version 9.0	While this dataset has many fields, only one is used in WDRM: a numerical descriptor of habitat type / prevailing vegetation species or type	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in v3 WDRM.
16	Gridded National Soil Survey Geographics Database (gNATSGO).	A few fields characterizing various soil attributes, such as thickness, drainage, slope, water content, flood frequency, etc.	Uncertainty details can be found at the URL for this Source - see (3)(a) above	None - this dataset was acquired once and utilized in v3 WDRM.

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

Of the data listed in the tables above, most are utilized in 2022 WDRM v3 without modification. The few elements that are modified are described below:

- PG&E Events
  - PG&E events often have more than one location field, and the locations of a given event do not always align with one another. A heuristic is applied to pick the most likely accurate location available for each PG&E event.
  - Prior to re-energizing the circuit/circuit segment after a PSPS event, PG&E performs inspections of the assets located in the de-energized areas. These inspections produce reports of locations where outages and ignitions might have occurred had the lines remained energized. In the 2022 WDRM v3, virtual outage and ignition indicators (the attributes used to model outages and ignitions) are assigned to PSPS events to account for the risks they would pose if the power were on. These are calibrated with weights that reflect the expected number of outages and ignitions that would have occurred had the PSPS events not occurred (PSPS inspections uncover more defects than the outages/ignitions observed under similar energized conditions historically).

- PG&E Asset Attributes
  - The following missing values are imputed for support structure attributes so that the machine learning model predicting likelihood of failure can make predictions for each modeled pole:
    - Missing “pole age” data is imputed using a decision tree regressor machine learning model that predicts a pole’s installation year given a set of pole attributes as model covariates.
    - Poles that can’t be linked to an open tag or notification are assumed to have zero open tags.
    - Missing “height” values are imputed using the median height given the pole’s class.
    - Missing “pole original circumference” values are imputed using the median circumference given the pole’s class and height.
    - Missing values for the “number of years since the last pole test and treat inspection” are replaced with the age of the pole (i.e. it is assumed that these poles have not been inspected since installation).
    - Missing “is private property” values are assumed to be False, or zero.
    - Missing “pole material values” are labeled as “unknown.”
    - Missing “pole original treatment type” values are labeled as “unknown.”
- Gridded National Soil Survey Geographics Database (gNATSGO).
  - Missing values (NA) in the fields utilized by the Support Structure module are imputed by choosing the median values for each field.
- WorldPop
  - Population Density values that are missing (NA) are replaced with zero.
- Salo Sciences and PG&E LiDAR Survey
  - Missing values (NA) are replaced with zero.

4. Modeling assumptions and limitations

Assumptions:

- It is assumed that events from June-November, the typical timing of fire seasons, are representative of all events capable of producing wildfire risk. If the training data for the WDRM were to include events caused by winter storms, icing, and other causal processes not compatible with ignition and wildfire spread, the pattern of model predictions would be influenced by events that contribute little or no

wildfire risk. To avoid exposing the model to misleading data, the training events are restricted to June through November. This does not require the assumption that no wildfires are possible in other months, but only that any ignitions and wildfires that do occur would have the same relationship with the model covariates as the ones the model is already trained on.

- The 2022 WDRM v3 is an "observational model" that uses the pattern of past outages and ignitions to predict their future. The core assumption of such an approach is that the correlations and causal processes that have governed past outages and ignitions will continue to govern them in the future.

- Machine learning tools, like feature generation, model regularization, and the preferential use of out of sample performance metrics, are well suited to the prediction of ignition probability and risk, which is the primary output required of the 2022 WDRM v3.

- Where there is limited or no empirical record of pursuing the proposed mitigations for wildfire risk mitigations are defined as characterized by their applicability to reducing ignitions from one or more subset of ignitions with an expected efficacy determined by SMEs.

Limitations:

- Systematic collection of non-CPUC-reportable ignitions was not in place prior to 2018.

- The 2022 WDRM v3 draws upon four separate sources of location data and applies a heuristic to find the best estimates of event locations, but its estimates must be robust to locational uncertainty. Please note that for Support Structure module and Transformer module, only the events that can be traced to specific assets have been used.

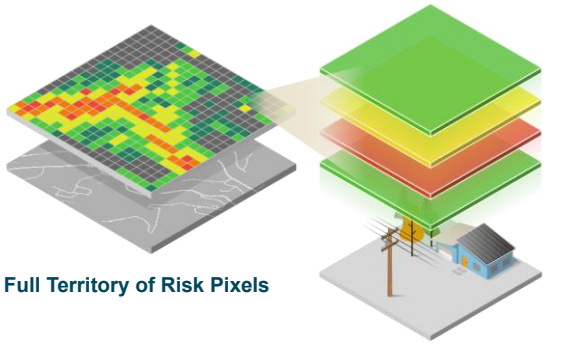
As described in the model development schedule in (9) below, the 2022 WDRM v3 does not make estimates for all risk drivers.

5. Modeling methodology

The 2022 WDRM v3 is a composite model, meaning the model includes numerous underlying risk modules, and the risk predictions of these modules may be composited together in various ways to serve various needs. Figure PG&E-4.5.1-4 below provides a graphic representation of composited modules.

FIGURE PG&E--4.5.1-4:
COMPOSITE MODEL ARCHITECTURE

The total risk (or probability) at a specific location (or specific asset) is the sum across each module in the composite.



Full Territory of Risk Pixels

Single Pixel with Four Modules to be Composited

	LoRE x CoRE = Risk		
	p(ignition)	Wildfire Consequence	Risk
Transformers	0.1%	17	0.017
Support Structures	0.5%		0.085
Primary Conductors	0.2%		0.034
Secondary Conductors	0.05%		0.0085
Composite (sum)	**0.85%**		**0.1445**

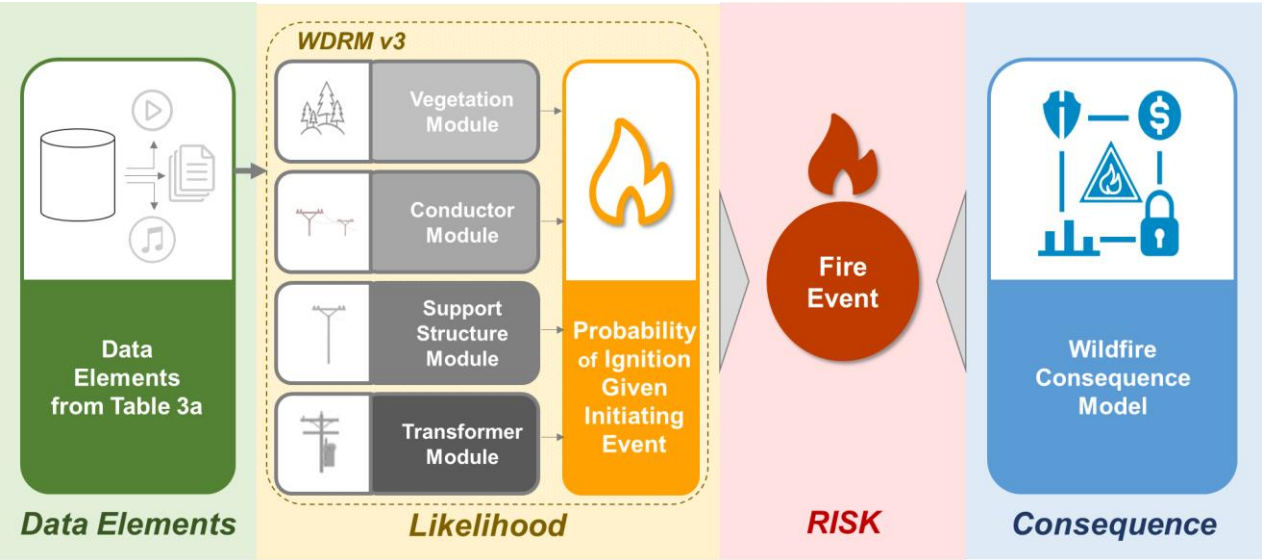
Compositing

The Composite model architecture allows identification of *specific* risk drivers, while also predicting *overall* risk

(Illustrative example only – 2022 WDRM v3 has slightly different modules and composites configuration)

Data elements (or datasets), such as environmental factors, meteorological factors, asset data, and other elements that could lead to an initiating event (outage), plus details of ignition events, and other failure and near-failure events, are inputs to the risk modules that are used by the 2022 WDRM v3.

FIGURE PG&E-4.5.1-5:
2022 WDRM V3 COMPOSITE MODEL ARCHITECTURE WITH DATA ELEMENTS



The output of the 2022 WDRM v3 are “pixel-based”, for evaluating risk scores within 100m x 100m grid cells across the PG&E service territory for the Vegetation and Conductor modules, and “asset-based” for the Support Structure and Transformer modules – risk scores are predicted per support structure and per transformer.

The 2022 WDRM v3 contains five risk modules that were developed for risk analysis. They are:

- Vegetation module, associated with vegetation in proximity to PG&E distribution assets;
- Conductor module, associated with six specific equipment types: primary and secondary conductor, primary and secondary interrupters, and primary and secondary other equipment (which includes all asset types other than conductors, interrupters, support structures, and transformers);
- Support Structure module, associated with support structures (e.g., poles, cross arms, guy wires);
- Transformer module, associated with overhead distribution transformers; and,
- Probability of Ignition Given Initiating Events module.

These five modules are aggregated to estimate the likelihood of a wildfire risk event (ignition) on the overhead distribution system for a grid location (pixel) or asset. This likelihood is then multiplied by Wildfire Consequence from the WFC Model to produce estimates of Wildfire Risk.

a. Model equations and functions

The key equation for the 2022 WDRM v3 is the risk equation defined as follows:

Wildfire Risk = Probability of Initiating Event x Probability of Ignition Given Initiation Event x Wildfire Consequence.

The following table lists the algorithm and method used for each risk module in the 2022 WDRM v3:

TABLE PG&E-4.5.1-8:
2022 WDRM V3 ALGORITHM/METHOD USED FOR RISK MODULES

Risk Analysis / Module	Algorithm/Method
Vegetation module	MaxEnt
Conductor module	MaxEnt
Support Structure module	Random Forest Classifier
Transformer module	Random Forest Classifier
Probability of Ignition (Given an Outage)	Logistic Regression
Wildfire Consequence Model	See Section 4.5.1(d)

Among the various algorithms in use in 2022 WDRM v3, the most prominent one is known as MaxEnt, which is short for “maximum entropy.” Below is a brief explanation of how MaxEnt is used along with assumptions and limitations.

For the spatially-explicit portions of the 2022 WDRM v3 (which are the probability (outage) portions of the Vegetation and Conductor modules), the objective is to identify which locale/site characteristics, patterns of weather and precipitation, and attributes of the grid assets, collectively termed the ‘model covariates’ are more correlated with outage locations than with random grid locations. For example, tall trees are more common among vegetation-caused outage locations than they are among typical distribution grid locations.

Metrics of dryness, HFTD tier assignments, conductor materials and size, and all the other data sources in these modules can all be checked for such patterns. The ratio of covariate value prevalence at outage locations to their prevalence across all grid locations is called the relative occurrence rate. MaxEnt provides a way of estimating the relative occurrence rate given a fairly modest number of outage locations. The way it does this is to fit a statistical distribution of covariate values for outage locations that is consistent with the values at known outage locations, but otherwise as similar as possible to the distribution of values found everywhere else along the distribution grid.

The similarity criteria described above is enforced using a metric called the relative information entropy between the outage locations and the Distribution grid locations, where the larger that metric is, the more similar the two distributions are. For this reason, the overall approach is referred to as a maximum entropy or MaxEnt estimation of the relative occurrence rate.

When multiplied by the fraction of all grid locations that experience fire-season outages annually, the relative occurrence rate is normalized into a distribution that provides the annual fire-season probability an outage will occur for all combinations of values of the covariates. This distribution can be used to or predict annual outage probabilities based on the covariate values found at each Distribution grid location.

b. Any additional input from Subject Matter Experts (SME) input

SMEs provided expertise on the types of inputs to be included for each risk module. Within the SME-identified inputs, and for some others recommended by data scientists, SMEs provided guidance as to the meaning of various codes, abbreviations, and terminology. SMEs shared knowledge with the data science team on various characteristics of the data that were helpful in preparing data sources for use in the modules.

After the initial running of the model, the SMEs were presented with draft model output. SMEs were asked to observe the output of the model, and comment on how the model predictions of wildfire risk aligned with their expertise. When SMEs provided feedback that WDRM predictions do not align with their expert opinions, WDRM team Analysts and Data Scientists examine the model predictions and related model input data—and findings are used to improve current and/or future versions of WDRM.

Estimates of mitigation effectiveness were provided by SMEs – these estimates were either used directly to calculate post-mitigation risk predictions (for Vegetation,

Conductor, and Transformer modules), or were used to inform empirical estimation of mitigation effectiveness (for Support Structure module).

c. Any statistical analysis or additional algorithms used to obtain input

Many of the data inputs used in the 2022 WDRM v3 are the output of precursor models. In some cases, the models are used to process and summarize remote-sensed data (e.g. land cover). In other cases, the models are used to process and summarize multiple and diverse data inputs into a singular output (e.g. population density).

An analysis of records of pole assets and support structure-related failures was performed to provide empirical estimates of the effectiveness, in terms of the reduction of probability (failure), and thus the reduction in wildfire risk, from pole replacement. These estimates were used to calculate post-mitigation risk values for the Support Structure module.

d. Details on the automation process for reproducibility of models

The 2022 WDRM v3 is highly automated using the Python computer language. When the model is run on an annual basis, it automatically grabs all datasets to be used, and locks them down. The model then continues with its automation to perform the step-by-step process of the modeling routines. When the model is finished running, it has a post-action state that can be audited to view each developed variable (such as covariates).

6. Model uncertainty

There is uncertainty in the location of events, especially outages and ignitions (due to different causes). The 2022 WDRM v3 has selected model methods (i.e. the maximum entropy model form) that are robust to location uncertainties, primarily because raster data is available at scales with values that are already assigned with appropriate resolutions and spatially correlated, but also because the expected error in locations is random in direction and thus a bias in the results is unlikely.

There is uncertainty in the numerical and categorical values of all 2022 WDRM v3 inputs, for reasons including:

- Uncertainty in the instrumentation that captured the data;
- Human fallibility in implementing and utilizing systems to record the data (i.e., cause options that are not available in the data collection interface, or incorrect options selected at time of data collection); and
- Lack of detail in the data structures used to capture the data (i.e., while it is ideal that only one outage should be associated with each ignition, there are sometimes multiple outages related to a single ignition event).

The goal of classification is to accurately separate events (ignitions, outages) from non-events by discovering or knowing the relationship between the event and the covariates. If the model is correctly specified and the variables accurately measured, then the remaining uncertainty is fundamental or irreducible uncertainty that cannot be

known. PG&E's strategy is to use a model structure that is flexible enough to take the shape of an unknown, true model. Both maximum entropy and the random forest classifier are very flexible. By taking an approach that includes covariates and using cross-validation to control for overfitting, the 2022 WDRM v3 structure seeks to minimize the fundamental uncertainty around the prediction of outage and ignition.

All models are subject to biases/variance errors that occur from incorrectly labeled events or inaccurately measured covariates. In WDRM, maximum entropy models the event data, and all spatial covariates are rasterized to 100m-scale resolutions. This down-resolution of the location data from latitude and longitude (lat-lon) to sub-kilometer scale grid location effectively eliminates problems introduced from small (< 100m) errors in measured location.

The potential for a non-event (normal operation) to be mislabeled as an event (ignition or outage) is very low. Similarly, events mislabeled as non-events are also unlikely, though more likely in the case of non-CPUC reportable ignitions prior to 2018. However, this type of error will likely not bias results because, by definition, none of these ignitions caused significant damage.

Likewise, covariates come from many sources and are expected to contain error but systematic bias in that error is rejected by PG&E based on qualitative assessment of each source.

In addition to the bias assessment, a sensitivity analysis for each covariate is conducted in the form of 'jackknife importance' or 'permutation importance' metrics. These values quantify the impact of leaving a variable entirely out of the module (jackknifing) or the effect of permuting (scrambling) the data for that variable. While there are significant non-linearities in the model structure, these metrics capture the relative importance of error in a covariate propagating through the model: the variables with the largest importance likely have the largest impact on overall uncertainty when they are mismeasured.

7. Model verification and validation

a. Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.

In early 2021, a detailed review of 2021 WDRM v2 was performed by Energy and Environmental Economics, Inc. (E3), an industry-leading source of expert guidance and technical analysis. That review produced numerous recommendations that influenced the development priorities for the 2022 WDRM v3.

In late 2021, E3 commenced another detailed review, this time of the 2022 WDRM v3. This review is considering all aspects of the 2022 WDRM v3 as well as the WFC Model, and some aspects of the larger risk and mitigation frameworks for which 2022 WDRM v3 is used. E3 is reviewing the technical approaches in use in WDRM, and the resulting model performance metrics. As of the state of the 2022 WMP submission, E3's review of 2022 WDRM v3 and WFC Model has not been completed. However, preliminary results are positive, and E3's assessment confirms that 2022 WDRM v3 is a substantial improvement over 2021 WDRM v2. E3's review process includes:

- Reviewing all relevant data, applications and documentation of results and approach as well as any internal efforts at validation and testing;

- Taking a critical look at the wildfire consequence data produced and how it is being incorporated into WDRM; and

- Building the 2022 WDRM v3 evaluation report in reference to and incremental to E3's review of 2021 WDRM v2.

The project is co-managed by E3's founding and managing partners who have prior experience working directly for PG&E with wildfire consequence data and the risks associated with climate change. They are assisted by a team of experts from E3 with backgrounds in the areas of risk modelling, grid planning, and short-term forecasting and machine learning.

b. Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.

The 2022 WDRM v3 estimates of outage probabilities were validated statistically by reviewing results for past outage events. Spatial (MaxEnt) model results (Vegetation and Conductor modules) were tested using a train-test split ratio of 80%-20% and asset (Random Forest) model results (Transformer Outage, and Support Structure modules) were tested using a train-test ratio of 75%-25%. In all cases, this means that 20-25% of event data was withheld from the model training step and instead used to test the accuracy of model predictions against data it had never observed. This produces "out of sample" performance metrics that are indicative of how well a model will predict rather than how well it explains the data it was trained on.

The primary performance metric utilized was the Area Under the Receiver Operating Characteristic (ROC AUC – typically referred to simply as AUC), which is widely used to evaluate classification models. AUC is a performance metric designed to test the model's ability to discriminate between cases that were correctly classified (positive examples) and versus non-cases (negative examples).

Generally, an AUC score of 1 is a perfect model, while scores near and above 0.70 are considered to have good performance. AUC scores above 0.8 are considered to have excellent performance. A model with no skill has an AUC of less than 0.5.

Outage probability modules yielded AUC scores mainly ranging from 0.7-0.8. At the low end, the Transformer module, at the time of this writing, has an AUC score of ~0.55. At the high end, three modules predicting vegetation caused outages have AUCs in the 0.85 – 0.87 range.

A similar approach (withholding 20% of the data at random for testing) was taken to assessing the performance of the "probability of ignition given outage" module, yielding an out-of-sample AUC score of 0.77.

When outage probabilities are converted to the ignition probabilities necessary for computing wildfire risk (by utilizing the aforementioned "probability of ignition given outage" model), AUC scores typically decrease slightly – most are in the 0.68 – 0.78

range, with the transformer module having the lowest AUC of 0.60, and the Vegetation Module having the highest AUC of 0.84.

When all module probability(ignition) predictions are composited together to produce a 2022 WDRM v3-wide prediction of probability(ignition), the AUC score is 0.73.

8. Modeling frequency

PG&E currently intends to update the WDRM on an annual basis. The 2022 WDRM v3 is a planning model, and therefore is used for longer term initiatives, such as System Hardening. These types of initiatives are typically budgeted at an annual rate, so the model's update frequency coincides with that.

9. Timeline for model development

Figure PG&E-4.5.1-6 below provides an overview of the 2022 WDRM v3 development schedule and Figure PG&E-4.5.1-7 provides a more detailed development schedule including model components.

FIGURE PG&E-4.5.1-6:
2022 WDRM V3 DEVELOPMENT SCHEDULE

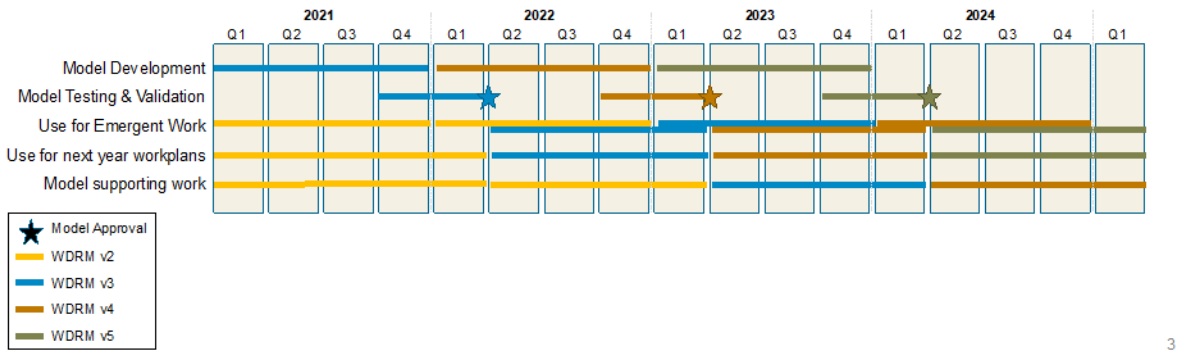
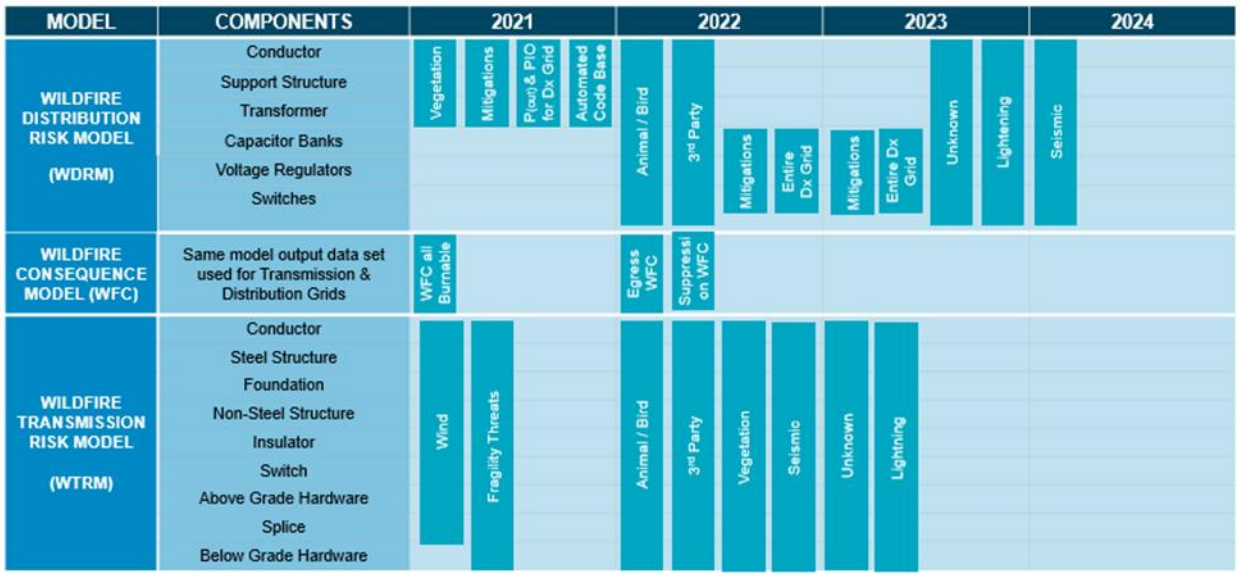


FIGURE PG&E-4.5.1-7:
WDRM RISK DRIVER DEVELOPMENT SCHEDULE



PG&E is currently reviewing the 2022 WDRM v3 for approval. The 2022 WDRM v3 review is scheduled to be completed and declared "final" by PG&E's Wildfire Governance Steering Committee in Q1 2022. The 2022 WDRM v3 will be used for the 2023 WMP. However, due to many notable improvements from 2021 WDRM v2 to the 2022 WDRM v3, PG&E has chosen to discuss the 2022 WDRM v3 in the 2022 WMP to describe these improvements. Importantly, the risk model used for the 2022 WMP workplan is the current 2021 WDRM v2.

The development of the 2022 WDRM v3 was the result of feedback from interested parties and through a review process by an independent third party (described in (7) above) which provided recommendations. Key improvements from the 2021 WDRM v2 to the 2022 WDRM v3 are more advanced machine learning techniques, incorporating newly available data, adding predictions of wildfire risk reduction when mitigating various sources of risk, and expansion of understanding of ignition sources and drivers.

10. Application and results

The 2022 WDRM v3 has not been applied in any capacity at this time. It will be applied to several initiatives after the internal process of review has been achieved and the model receives approval to replace 2021 WDRM v2. Once approved, the 2022 WDRM v3 will be used to develop 2023 workplans.

11. Key improvements from working group

The working group has not yet provided any recommendations that are directly related to the 2022 WDRM v3.

4.5.1(c) Wildfire Transmission Risk Model

The Wildfire Transmission Risk Model (WTRM) was developed by PG&E to quantify the wildfire risk related to PG&E's overhead transmission equipment. Like the 2022 WDRM v3, the goal of the WTRM is to assess risk based on the probability of an asset failure leading to an ignition occurring, and the consequence of a wildfire if it were to occur. The WTRM implements many of the same concepts as the 2022 WDRM v3, for example, by considering the situations in which wildfires could occur given the location and condition of assets. As will be discussed in more detail below, considerations for wind, vegetation, third-party damage, and contact from animals (including birds) are all considered to estimate the likelihood of an asset failure that could lead to an ignition. Like the 2022 WDRM v3, the consequence of a wildfire is estimated through the WFC Model.

The WTRM is a composite model. The probability of failure for a particular component is estimated based on a compositing of risk drivers (threats and hazards) that are specific to that component, herein referred to as a "module." Results for these modules are then combined with a consequence value to compute a risk value. These modules are supported through a combination of numerical analyses and quantitative modeling. The probability of ignition portion of this model has previously been referred to as the Transmission Composite Model (TCM).

1. Purpose of Model

The WTRM quantifies asset risk to enable prioritization of projects based on a common, interchangeable metric. It is analogous in purpose to the 2022 WDRM v3 except that the WTRM is for the Transmission system. To date, the output from the WTRM has been used to plan discretionary inspection work. Future plans include using results from the model to inform enhanced inspection and maintenance prioritization for the next year once the model has reached a stable state of maturity.

2. Relevant terms

- Failure Mode and Effects Analysis (FMEA) – A step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service.
- Fragility Curve – Represents the probability of failure for any value of a demand parameter.
- Hazard – Event that causes the ultimate failure of an asset (i.e., wind, ice, seismic, landslide, vandalism, vehicle impact, etc.).
- Threat – Degradation mechanism that weakens an asset and decreases the magnitude of a hazard needed to cause ultimate failure (i.e., corrosion, wear, contamination, erosion, etc.).

3. Data elements

Because the WTRM is a composite model of various analyses (or modules), the response to each of the sections below may refer to the overall model, or to elements within risk modules.

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

The datasets curated for and used by the WTRM are grouped as follows:

- Asset-specific data – This includes, but is not limited to, asset type, unique identifier, material type, and location (latitude and longitude). Examples of asset type include a steel lattice tower, ceramic insulator, or aluminum conductor steel reinforced (ACSR) conductor. The unique identifier is typically the equipment number, although other asset-specific identifiers are used. Material type includes steel, wood, concrete, ceramic, and polymer, depending on the type of asset being modeled. This asset registry data is updated daily and is available at the asset-specific location (latitude and longitude).

- Environmental data – This includes, but is not limited to, the corrosivity of the environment (atmospheric and soil, for example), site-specific hazards (such as wind speeds, seismic accelerations, and landslide potential), and proximity to water. This data is updated annually and is available at various resolutions from 3 km x 3 km to 2 km x 2 km and point-specific (latitude and longitude), depending on the dataset.

- Condition data – This includes inspection data, such as enhanced visual inspection data (for example, from ground, drone, climbing, and aerial inspections), material-specific inspection data (for example, the Osmose Pole Test and Treat inspection program), and capacity computations. This data is refreshed on a daily basis and is available at the asset-specific location (latitude and longitude). While the datasets are refreshed daily, the inspection data is collected on different cadences that can be monthly, annually, or longer.

- Maintenance/repair/modification data – This includes records of any repair, maintenance, or modification work that would influence the WTRM's forecast of the annual failure rate (or annual probability of failure) for the asset under evaluation. This data is refreshed on a daily basis and is available at the asset-specific location (latitude and longitude).

- Prior incident data – This includes the history of unplanned events, such as wind-driven outages and third-party damage. This data is typically refreshed annually and is available at either the asset-specific (latitude and longitude), 3 km x 3 km or 2 km by 2 km grid size, or at the circuit-level.

b. Explain the frequency of data updates.

Input data for the WTRM is refreshed on a daily basis, with the exception of datasets that have longer refresh cadences, for example, outage data. The model itself is refreshed on-demand and, at a minimum, on an annual basis.

c. Sources of data. Explain in detail measurement approaches.

The sources of data for the WTRM include:

- Asset-specific data – Systems of record include Electric Transmission Geographic Information System (ETGIS), Transmission Support Structure (TSS), the Asset Feature List (AFL) dataset, and third-party vendor sites. Attributes collected include age, location, structure type, and voltage class. The data curation process measures and tracks the number of structures missing a particular attribute and whether or not a conservative assumption had to be made to populate the value.

- Environmental data – Systems of record include Land Base Geographic Information System (LBGIS) and the United States Department of Agriculture. Attributes collected include corrosion (atmospheric and soil) potential, wear likelihood, and the expected frequency of site-specific hazards such as wind. Measurements on the curated data include the number of assets for which environmental attributes are unable to be located. Efforts are then made to resolve these issues so that a fully representative dataset is available for the model.

- Condition data – Systems of record include Sherlock (for enhanced visual inspection data), and third-party vendor sites (for example, for the Osmose Pole Test and Treat data). Attributes collected include the current condition and post-repair conditions. Measurements on this data include matching maintenance and repair data with condition scores so that assets that have been repaired or replaced have their condition score updated to reflect the latest site condition.

- Maintenance/repair/modification data – SAP is the system of record for this data. Attributes collected include notification records alerting the model to maintenance such as a repair or replacement to an asset. These notifications are used to update the WTRM's interpretation of the asset's condition.

- Prior incident data – Systems of record include the historical outages spreadsheet, climatological dataset, and SAP. Attributes collected include the incident location and its classification. Each prior incident is checked against available meteorological data to verify its classification prior to incorporation into the model.

d. Explain in detail approaches used to verify data quality.

Each risk module of the WTRM uses input data from a variety of sources. There are two types of data quality issues that are flagged by quality checks that run when source data is curated for the WTRM for (1) missing data and (2) inconsistent data. Where data is missing, conservative assumptions are applied, where possible, to supplement. For example, when age data is unavailable from the system of record, conservative age logic enables the model to infer a reasonably conservative age. Instances where conservative age logic is used, as well as where data is missing, are flagged

accordingly so that the team can work with the Asset Knowledge Management (AKM) team to resolve these flagged data quality issues. Regarding instances of inconsistent data, for example, where two different systems of record report a different value for the same asset, this is flagged and presented for correction through either a corrective action, remapping request, or in collaboration with the AKM team.

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

In general, the characteristics of the data elements for these risk modules include:

- Age – This is the age of the specific component group and is pulled from ETGIS and the AFL dataset. Conservative age logic is employed to ensure the published age value is as accurate as possible while also reasonably conservative where assumptions must be made. Data quality issues are flagged so that follow-ups can be done to improve the source data.

- Location – The location of the asset (its latitude and longitude) and position within a geospatial reference layer (for example, a POMMS grid ID for wind-specific data) are both useful to determine which environmental exposures apply to the asset. These environmental exposures include, but are not limited to, corrosion characteristics, site wind hazard, landslide susceptibility, and seismic parameters. Using spatial joins ensures that the correct location-specific data is applied to the asset.

- Load capacity – This is estimated from the Power Line Systems - Computer Aided Design and Draft (PLS-CADD)[60] modeling effort. Data quality verification starts with the source data, where a rigorous QA/QC process is maintained to ensure only validated data is pushed to a production system of records, and also includes checks at the system of record level to ensure the load capacity data is applied to the correct structure.

- Maintenance and repair history – Notification data are used to ensure that maintenance and repairs are reflected in the annual failure rate output from the Model.

- Outage or prior incidents – This dataset is curated by multiple SMEs who research each outage prior to its inclusion for the WTRM. Research includes records analysis from systems of record, meteorological analysis using historical climatological datasets, and interview with field personnel to ascertain the true cause and accurate location of an outage or other incident.

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60 According to https://www.powerlinesystems.com/plscadd – PLS-CADD is the most powerful overhead power line design program on the market. PLS-CADD runs under Microsoft Windows and features an easy to use graphical user interface. It integrates all aspects of line design into a single stand-alone program with a simple, logical, consistent interface.

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

Input data for the WTRM are modified through:

- Bayesian Updating – This is a statistical tool employed to adjust the median and uncertainty parameters for the fragility curve based on prior outage data.
- Inspection code modification – Condition scores (3, 4, or 5 values) are updated when it is confirmed that a component has been replaced.
- PLS-CADD data – This is used to influence the median parameter for the fragility curve.

4. Modeling assumptions and limitations

The WTRM builds on assumptions that have been employed by the Transmission Operability Assessment (OA) Model, discussed in Section 4.5.1(h). These include:

- The identification of 47 components from a FMEA analysis, a failure of any one of which could result a wildfire ignition. These 47 components were subsequently collected into 9 asset group types to which asset-specific datasets are assigned. While the scope of the WTRM exceeds that of the OA Model to incorporate other hazards, the asset group types remain a proxy for a collection of components that share similar (i) life cycles, (ii) sensitivities to threats and hazards, and (iii) Asset Management strategies.
- The prioritization of threat and hazard models for development and deployment to production systems. This prioritization is driven by SMEs who ranked the criticality of a failure resulting from a threat-hazard pairing to prioritize the order of work.
- Age data is required for each component in order for the WTRM to compute an annual failure rate. Where direct age data is unavailable, conservative age logic assumptions are employed to produce age values that result in reasonably conservative outputs from the model.

The WTRM considers 47 components, which were placed in a component grouping based on the following considerations:

- Similar asset lifecycle
- Sensitivity to similar threats and hazards
- Similar Asset Management strategy

The resulting nine component groups are:

- Group A Conductor – The conductor grouping includes conductor, jumpers, shield wires, optical ground wire (OPGW), armor rod, aviation marker balls, and smart grid

devices. All the components in the group are subject to the same threats and hazards, or a subset of the threats and hazards.

- Group B Insulator – The insulator grouping includes insulators, flying bells and grading rings. All the components in the group are subject to the same threats and hazards, or a subset of the threats and hazards component.

- Group C Non-steel structures (i.e., wood poles) – The non-steel structure grouping includes treated wood poles, wood crossarms and bird and animal guards. All the components in the group are subject to the same threats and hazards, or a subset of the threats and hazards.

- Group D Steel structures (including steel poles and lattice steel structures) – The steel structure grouping includes steel structures as the primary component. The other components in the group are leg members, non-leg members, crossarm members and bird and animal guards. There are also small populations of composite (fiberglass) poles, concrete poles, and hybrid poles. Hybrid poles are those poles that have a concrete pole base and tubular steel pole top. While all the components in the group are subject to the same threats and hazards, composite poles may also be subject to ultraviolet (UV) degradation. They also have the same or similar life cycle.

- Group E Foundations – The foundation grouping includes foundations, stub angles and anchor bolts. All the components in the group are subject to the same threats and hazards, or a subset of the threats and hazards, as the primary component.

- Group F Switches – The switch grouping includes switches as the primary component. Other components in the group are distribution equipment, switch insulator, potential transformer (PT), contact-live part, quick break attachment, interrupter, battery, and operating assembly.

- Group G Above grade hardware – The component grouping for above grade hardware consists of two sub-groupings.

  – Sub-group 1 consists of components where the life cycle closely aligns with that of the structure. These include the hanger plate and bolts.

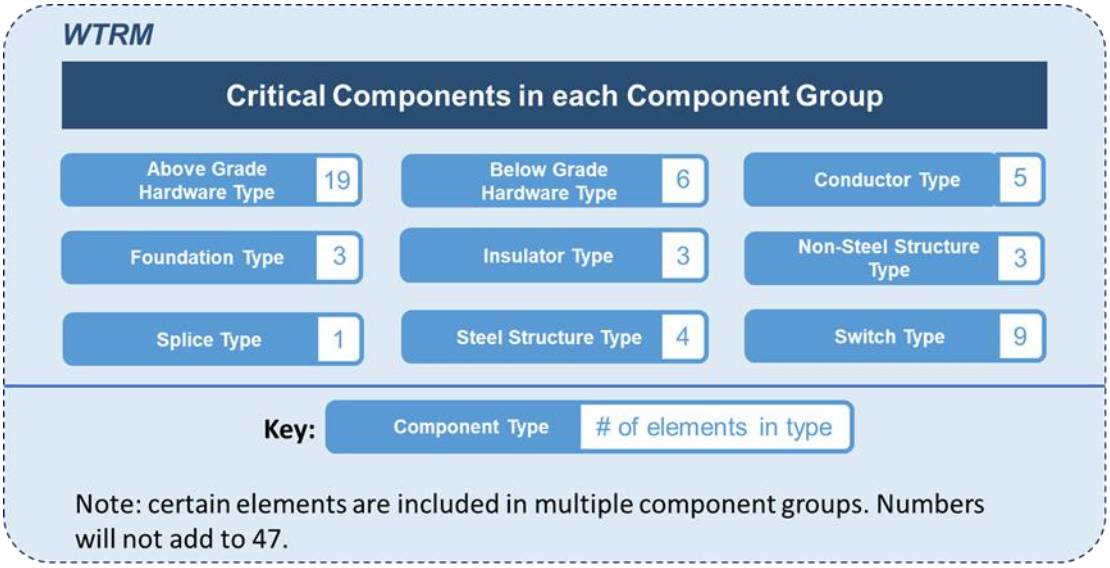
  – Sub-group 2 consists of components whose life cycle more closely aligns with that of conductor.

- Group H Below grade hardware – The below grade hardware grouping includes the anchor system, ground wire, and guy system.

- Group I Splice Type – The splice type component group captures threats and hazards that are specific to conductor splices. The prevalence of conductor splices are treated as uncertainty metrics for the WTRM. While invariably linked to conductors, their performance from an annual probability of failure perspective is computed separately and then combined with the conductor component group for the composite risk value.

The 47 components included in the WTRM, separated into the nine critical component groups described above, are reflected in Figure PG&E-4.5.1-8 below.

FIGURE PG&E-4.5.1-8:
WTRM COMPONENT GROUPS



The WTRM models all nine component groupings and considers only the hazard associated with wind, as well as the key threats associated with the group of components. As a starting point, the model assumes that all components have been designed to the minimum design wind loads and are equally susceptible to the threats affecting the component group. Therefore, the model results would be similar for all the components in a group.

As data is collected on individual components, the model framework will be used to select the most vulnerable component attributes for a given hazard. For example, if thicker hanger plates than required by minimum design wind loads have been installed on a structure, it may be determined that another component in the above grade hardware grouping has a higher probability of failure during high winds. In that case, the most vulnerable component attributes would be used to represent the component grouping probability of failure.

To ensure that the WTRM addresses the most conservative component attributes in a group, the model will consider multiple characteristics of components that make them more vulnerable to threats and hazards, such as age, damage identified by inspections, material properties most vulnerable to threats, and lower mechanical strength. As data is collected on individual components, the model framework can be used to identify one or more components of a grouping that exhibit different vulnerability to a particular hazard. In these cases, it may be desirable to form additional groupings of such components so that targeted asset management strategies can be developed accordingly.

Components of a given grouping will be modelled to ensure that the approach to hazard mitigation is conservative. For a few components with small populations and a limited deployment history, a probability of failure model will not be developed. In these cases, a deterministic approach will assign a conservative life cycle from the manufacturers' recommendations and industry best practices.

5. Modeling methodology

a. Model equations and functions

The WTRM is a first principles engineering model. Its model equations are rooted in established engineering and physics-based theories and does not explicitly employ machine learning algorithms because the underlying physics are amenable to mathematical modeling. However, various inputs to the model are derived from statistical approaches, such as the adjustments to the median and uncertainty terms of the fragility curve (through Bayesian Updating) and third-party damage forecasts (derived from a machine learning routine).

Formula used in the WTRM include:

- $R_f = C_f \cdot \sum P_f$
- R_f = Risk of asset failure
- Failure can be defined as ignition, or more broadly as outages
- Dx defining "failure" as ignition and subsequently evaluate risk of ignition
- P_f = Annual probability of failure
- Specific to asset categories and hazards but are additive
- Probability of failure by hazard can be influenced by degradation (fragility curve) of component driving by threat models
- C_f = Consequence of failure model, defined geospatially (i.e., Technosylva wildfire spread model)

b. Any additional input from Subject Matter Experts (SME) input

SMEs helped to:

- Prioritize the model development schedule by identifying which threats and hazards should be developed and deployed to production first.
- Interpret various datasets to make them usable as inputs for the WTRM.
- Provide feedback on the user interface design to ensure that outputs from the Model will support decision-making requirements.

On July 21, 2021, a cross-functional team of SMEs met at PG&E's Applied Technology Services (ATS) facility in San Ramon and on the phone to discuss grouping the 47 individual critical components into component groupings as described above in (4).

c. Any statistical analysis or additional algorithms used to obtain input

Bayesian Updating, mentioned previously, was used to adjust input parameters for the fragility computation based on historical outage data.

d. Details on the automation process for automated models

The WTRM is undergoing developments that will allow for automation. The model is being deployed to a Python code base. Input datasets are automatically prepared at the refresh cadences mentioned previously. These inputs are also backed up so that at any point in the future the WTRM can be run again.

6. Model uncertainty

Model uncertainty is measured and reported through dispersion terms applicable to key input parameters. The fragility curve, which represents the probability of failure for any value of a demand parameters, has the uncertainty (or dispersion) value as an input. The factors that influence this uncertainty term include the age of the asset or component, as well as environmental-specific factors referred to as "design life reduction factors."

7. Model verification and validation

a. Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.

The model code is verified with full-scale functionality testing where the inputs and outputs from the software are checked against the inputs and outputs of a separate instance of the model. Both outputs must match for the model code to be considered verified.

b. Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.

The WTRM will have its forecasts validated against on-the-ground inspection data. Variations between ground truth and model forecasts will then be studied to identify if the model's forecasting is consistent with observations. Since the WTRM is probabilistic, a statistically significant amount of field data must be collected and evaluated prior to any decision to tune the model to field observations.

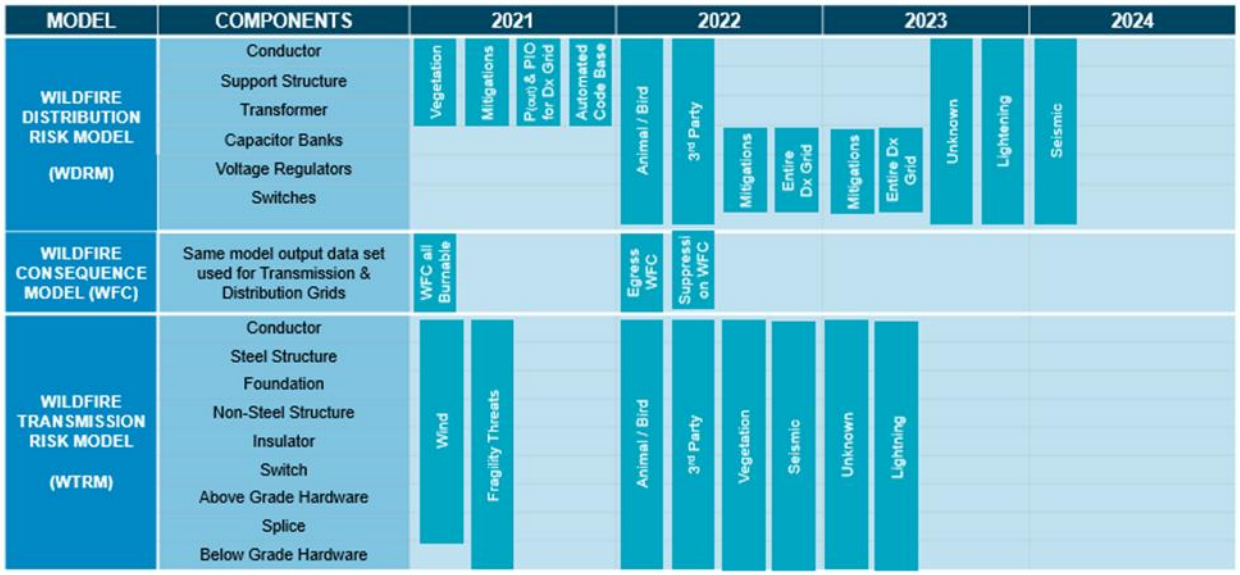
8. Modeling frequency

The WTRM will be run at least annually though it is also designed to run on-demand. The refresh cadence can be tuned to the requirements of Asset Strategy.

9. Timeline for model development

The timeline for development and release of the WTRM is provided in Figure PG&E-4.5.1-9 below. The multi-year schedule for the WTRM is shown along with the WDRM and WFC schedules in Figure PG&E-4.5.1-9.

FIGURE PG&E-4.5.1-9:
WTRM DEVELOPMENT SCHEDULE



10. Application and results

The WTRM has been used for discretionary inspections as referenced in the Section 7.3.4.10, Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations.

11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date for the WTRM.

4.5.1(d) Wildfire Consequence Model

1. Purpose of model

The Wildfire Consequence Model (WFC Model) is a historically calibrated estimate of the impact (i.e., consequence of an ignition) measured in MAVF units and estimated at relevant PG&E infrastructure locations. When an ignition occurs at a location, the WFC Model estimates the impacts. The model relies on historical fire damage, simulations of fire propagation from Technosylva, and the Fire Potential Index (FPI) Model. By combining the FPI and Technosylva fire spread simulations in the WFC Model, we leverage the strengths of both models such that a more complete and applicable estimate of consequences can be produced.[61]

2. Relevant Terms

- Cal Fire Redbook – Cal Fire's historical recordings of fire damage: acres burned, buildings destroyed, fatalities
- Consequence – The effect of the occurrence of a Risk Event.
- Fire Potential Index (FPI) Rating (R) Score – The FPI Rating (R) from R1 (lowest) to R5 (highest). Ref: 4.5.1(f).2f
- Flame Length (FL) – Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame measured in feet. Flame length is an observable, measurable indicator of fireline intensity.
- Multi-Attribute Value Function (MAVF) – Risk calculation methodology introduced during CPUC's S-MAP and RAMP proceedings.
- Rate of Spread (ROS) – ROS is a Technosylva simulation output measuring the speed with which the fire is moving away from the site of origin measured in chains (66 feet) per hour.
- Technosylva – Vendor of wildfire simulations based on inputs such as available fuels, topography, weather, structure, and population data. Technosylva simulation outputs are used as an input into the PG&E Wildfire Consequences Model.
- Technosylva Simulation – Computerized simulations of wildfire behavior given an ignition at a location on a particular date. Currently, PG&E uses Technosylva's 8-hour simulation product.
- Visible Infrared Imaging Radiometer Suite (VIIRS) – Earth observation satellite data from NOAA, in the visible and infrared bands

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61 The WFC Model provides estimates of consequence when Technosylva simulations are unavailable. The Technosylva simulation outputs are generated only for certain dates associated with high wildfire risk and limited to HFTD areas

3. Data elements

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

Table PG&E-4.5.1-9 below identifies the data elements in the WFC Model.

TABLE PG&E-4.5.1-9:
WFC MODEL DATA ELEMENTS

ID	Source	Provides	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Availability and URL
1	Wildfire simulation results	Acres burned, rate of spread, flame length, and other predicted fire impacts, for 8-hour wildfire simulations, performed under historically hazardous weather conditions, for points spaced 200m along PG&E's electrical asset network	2000-2020	NA	200m	NA	PG&E - licensed from Technosylva
2	Extended Fire Dataset with Agency Data	See documentation in Section 4.5.1(f).5	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)	PG&E - licensed from Sonoma Technologies
3	Fire Potential Index (FPI) - produced by PG&E Meteorology	Dead Fuel Moisture (DFM), wind speed and direction, temperature, precipitation, etc.	2004-2020	NA	2km	Hourly	PG&E - Meteorology - See documentation in Section 4.5.1(f)

b. Explain the frequency of data updates.

Please see Table PG&E-4.5.1-9 above.

c. Sources of data. Explain in detail measurement approaches.

Table PG&E-4.5.1-10 below provides the measurement approach for the WFC Model.

TABLE PG&E-4.5.1-10:
WFC MODEL DATA SOURCES WITH MEASUREMENT APPROACH

ID	Source	Measurement
1	Wildfire simulation results	NA - The outputs of the wildfire simulations are used as-is - there is no "measurement" per se
2	Extended Fire Dataset with Agency Data	See documentation in Section 4.5.1(f).5
3	Fire Potential Index (FPI) - produced by PG&E Meteorology	See documentation in Section 4.5.1(f)

d. Explain in detail approaches used to verify data quality.

All input data sources are checked for gross errors, and erroneous rows and columns are corrected or discarded before further utilization. Individual data sources are checked as described in Table PG&E-4.5.1-11 below:

TABLE PG&E-4.5.1-11:
WFC MODEL DATA QUALITY VERIFICATION

ID	Source	Data Quality Verification
1	Wildfire simulation results	Check for spatial completeness via mapping and visual inspection. The data provider performs verification as this data is produced.
2	Extended Fire Dataset with Agency Data	See documentation in Section 4.5.1(f)
3	Fire Potential Index (FPI) - produced by PG&E Meteorology	The data provider performs verification as this data is produced. See documentation in Section 4.5.1(f)

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

Table PG&E-4.5.1-12 below provides the data characteristics for the WFC Model.

TABLE PG&E-4.5.1-12:
WFC MODEL DATA CHARACTERISTICS

ID	Source	Field Definitions / Schema	Uncertainties	Acquisition Frequency
1	Wildfire simulation results	A few fields summarizing the behavior and impact of each simulated wildfire, including: acres burnt, rate of spread, flame length, structures impacted, etc.	Unknown	A prior version of this dataset was acquired for v2 WDRM. An updated version was acquired for v3 WDRM.
2	Extended Fire Dataset with Agency Data	See documentation in Section 4.5.1(f).5	See documentation in Section 4.5.1(f).5	See documentation in Section 4.5.1(f).5
3	Fire Potential Index (FPI) - produced by PG&E Meteorology	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)	See documentation in Section 4.5.1(f)

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

For long term risk assessment, PG&E utilized a projected fuel layer for the year 2030 that was provided by Technosylva. The intent is that the planning model is used to make longer-term decisions to reduce risk and we wanted to capture the potential future state of the fuels. Technosylva utilized their expertise in vegetative re-growth after fire disturbances (fire scars) to project the state of the fuels in 2030. This work leverages historical data on vegetation regrowth after fires based on satellite data and burn severity maps.

4. Modeling assumptions and limitations

The WFC Model is a partition that answers the question: What values of fire simulation variables FL and ROS, as well as FPI, allow PG&E to best capture historically destructive fires? The WFC Model includes two major assumptions.

First, the choice to identify the conditions leading to the most historically destructive fires is fundamental to PG&E's risk reduction goals. The historically destructive fires contribute disproportionally to the cost of all fires. The downside of this requirement is that the source data inherently limited; there are not very many highly destructive historical fires. This is both a model assumption and a data problem discussed below in (6). The more broadly PG&E tries to capture the destructiveness of fire conditions (the covariates), the more historical fires (data points) exist to estimate the consequences of an ignition. That is the consequences of ignition become the same regardless of fire conditions or mostly the same. The better PG&E captures the resolution in cost between different fire conditions the fewer data points to work with.

The second major assumption of the model is that the past relationship between historical fire destructiveness and the covariates FL, ROS, and FPI R score does not change over time.

5. Modeling methodology

a. Model equations and functions

In April 2021, Technosylva simulated 571 historically-dangerous weather conditions (from 2000 to 2020) across all burnable locations within PG&E's service territory, with simulated ignition points spaced in a 200 meter grid around all PG&E transmission and distribution assets.[62] The simulations assumed that the fuels present would be those as of 2030—which thus includes vegetation regrowth within historical wildfire burn scars.

For each ignition point, Technosylva provided the 8-hour fire simulation outputs (acres burned, buildings impacted, populations impacted, ROS and FL) for the 571 weather day simulations.

The PG&E Meteorology team produced an estimate for FPI on an hourly basis for 2km pixels, from 2004 to 2020. FPI Fire Danger Rating is assigned based on probability of large or catastrophic fire. We then applied the following steps to this data:

1. We calculate the consequence at each of the Technosylva 326,431 ignition points and create a 200m radius buffer around each ignition point for the consequence value.

2. For each ignition point we get FPI and Technosylva simulations daily data for summer months (May to November) from 2004-2020. Since, FPI is hourly data we aggregate hourly data using maximum value in that day.

3. Develop a methodology for Destructive Fire Classification:

    a) For each satellite detect fire temporally and spatially match Technosylva simulation results and FPI fire rating values and use these as a guidance to come up with the threshold values.

    b) From the above analysis boundaries are drawn at Flame Length (FL) >=5 and Rate of Spread (ROS) >=12, or FPI Fire Rating of R4 or above.

4. Calculate the Destructive Fire Probability for each of the Technosylva ignition points.

    a) Classify whether each day falls into destructive or non-destructive using both the Technosylva simulation attributes (ROS & FL) and FPI Fire Danger Rating Attribute.

---

62 This 200m grid around PG&E assets results in 326,431 ignition points.

1) Destructive Fire: (FPI Fire Danger Rating R4 or above) or Technosylva Criteria: Flame Length >= 5 ft & ROS >= 12 ch/hr

2) Non-Destructive Fire: not (Destructive Fire Condition)

3) Probability is the ratio of number of days it met the above condition over all the summer days in the time period (2014-2020)

5. Calculate the Expected MAVF CoRE values for destructive fire and non-destructive fire.

   a) For each of the satellite detect fires classify whether the fire meets necessary condition defined above for classifying as destructive fire.

   b) Using CalFire red books data, for each of the large fires we manually added buildings destroyed, and fatalities data. We assumed zero for the fires where we could not find the data.

   c) For each fire we calculated the MAVF CoRE values by converting the financial damage using acres and buildings destroyed. For Safety we used the actual fatalities data and ignored the reliability component.

      1) FINANCIAL_COST_PER_STRUCTURE = $1,000,000

      2) FINANCIAL_COST_PER_ACRE = $1,175

6. We took the mean value of fires in each class for the expected CoRE value aggregated by High Fire Risk Areas.

FIGURE PG&E-4.5.1-10:
WFC MODEL MAVF/CORE

:

	hfra_v4_1	destructive_class	mavf_core	lat
0	False	N	0.061373	2381
1	False	Y	0.182643	464
2	True	N	0.391632	3650
3	True	Y	240.180982	1109

7. Calculate the CoRE value for each ignition point by taking the weighted sum of the destructive fire probability and the CoRE value.

8. Create a 100m raster file using 200m Radius Buffer around each ignition point.

b. Any additional input from Subject Matter Experts (SME) input

The PG&E Public Safety Specialist (PSS) team performed a qualitative review of the WFC Model outputs. This review included exploration of consequence estimates in the Sierra Foothills, and in the vicinity of recent significant fires.

c. Any statistical analysis or additional algorithms used to obtain input

We classified historical satellite fire detects according to 2022 ERM fire size definitions and evaluated the model destructive fire criteria to determine the Accuracy and True and False Positive rate.

d. Details on the automation process for automated models

The WFC Model is partially automated. The output from Technosylva is automated as is the development of the FPI values. Future refinement of integration of these values will automate the production of the WFC Model values.

6. Model uncertainty

The historical fires are a record of real damage. Only a few dozen historical fires contribute significantly to the overall cost of fire. This is a source of uncertainty in the modeling process.

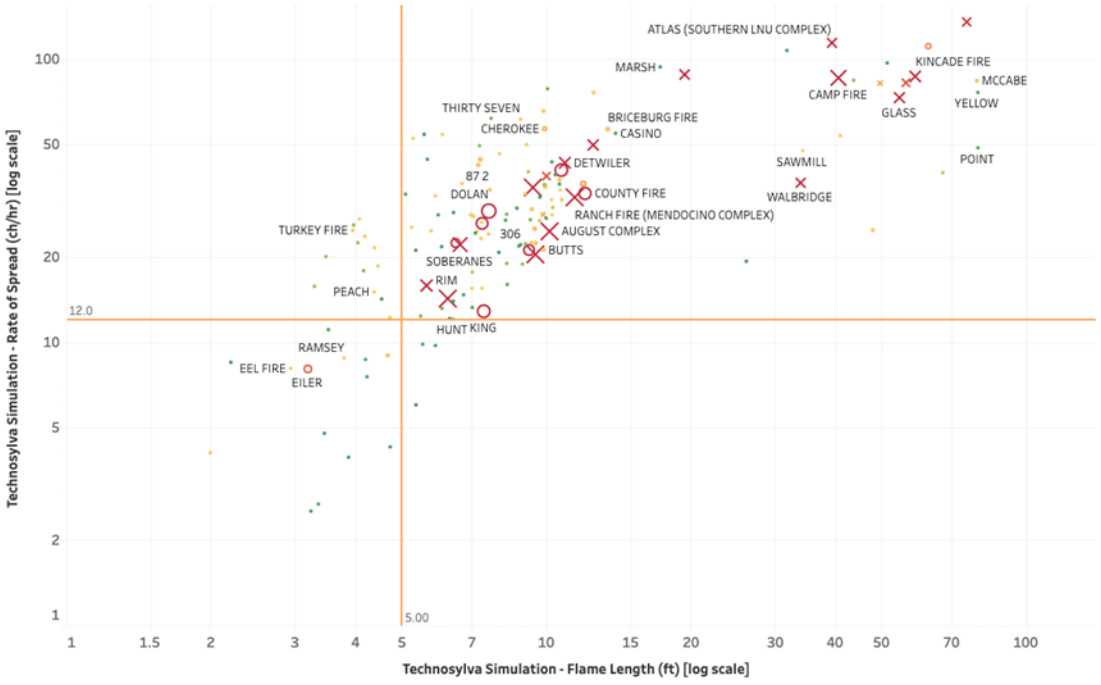
Additional assumptions and limitations of Technosylva inputs include:

- The wildfire simulations are 8-hours long. This only results in reasonably accurate.
- It is assumed that using outputs of wildfire simulations is sufficiently representative of real-world outcomes. The purpose of the WFC model is to accurately link the simulations to the historical outcomes but can be limited by the simulation accuracy and assumptions.
- The wildfire simulations exclude “unburnable” mostly urban or suburban locations—it is assumed that such locations are correctly characterized, and that these locations would not, in fact, support ignition and propagation of wildfires.

7. *Model verification and validation*

a. *Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.*

FIGURE PG&E-4.5.1-11:
VISUALIZATION OF DESTRUCTIVE FIRES USING TECHNOSYLVA DATA



Data from historical fires has been used to visualize and validate the conditions that have led to destructive fires—see Figure PG&E 4.5.1-11 above. The boundaries do separate the space of historical fires and capture the destructive/catastrophic fires (upper-right).

In addition, please see additional documentation of verification and validation in Section 4.5.1(b) regarding the validation process for 2022 WDRM v3, which includes review of the WFC model.

b. *Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.*

The model itself is a calibration of simulation inputs to the historical observations. By construction the model parameters, the threshold values of FPI R score, ROS, and FL, were chosen to: (1) partition the historical fires making sure to capture destructive fires entirely in one partition and (2) describe the partitions using the mean of historical MAVF consequence.

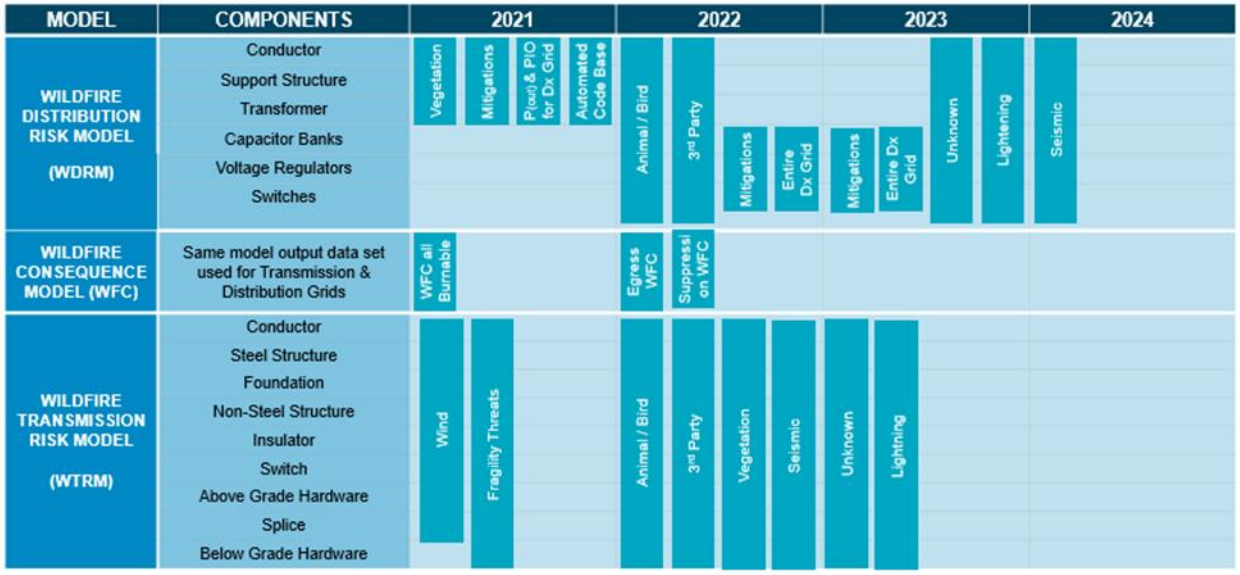
8. Modeling frequency

The WFC is updated annually.

9. Timeline for model development

The schedule for the WDRM, WTRM and WFC are outlined below in Figure PG&E-4.5.1-12. For the WFC, future improvements include accounting for egress and fire suppression.

FIGURE PG&E-4.5.1-12:
WFC MODEL DEVELOPMENT SCHEDULE



10. Application and results

See Section 4.5.1(b) above for discussion of how the Wildfire Consequence model's predictions are utilized in the 2022 WDRM v3.

11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date for the WFC Model.

4.5.1(e) Enhanced Vegetation Management Tree Weighted Prioritization

1. Purpose of model

The purpose of the EVM Tree Weighted Prioritization is to produce a risk-ranked list of circuit segments in HFTD areas for our EVM program. PG&E used the resulting list of circuit segments to develop our 2021 EVM Scope of Work, as well as our current 2022 EVM Scope of Work.

2. Relevant terms

- Circuit Protection Zone (CPZ) – A CPZ is a segment of a distribution circuit between two protection devices. CPZs are also sometimes referred to as circuit segments.
- EVM Scope of Work – The scope of work planned for PG&E's EVM program in a year.

3. Data elements

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

The EVM Tree Weighted Prioritization was developed by starting with the 2021 WDRM v2 and making three refinements to that model. The refinements and the data sets used are described in Table PG&E-4.5.1-13 below.

TABLE PG&E-4.5.1-13:
EVM TREE WEIGHTED PRIORITIZATION DATASETS

Data Set	Category	Source	Spatial Resolution	Units	Descriptions
Re-aggregation from 100m x 100m pixels to 1km x 0.7km grid areas (Unified Grid Maps)	Risk/ Consequence Data	(1) WDRM Risk pixel data (2) PGE Unified Grid spatial layer	100m		Uses a spatial join between the WDRM pixel location and the PGE Unified Grid layer to identify all the100m x 100m pixels in a 1km x 0.7km GRID area. The total area of the pixels contained in each grid, along with the total Risk Value of the pixel area within each grid is calculated.
Estimation of Tree Count per Grid area using 2019/2020 LiDAR Survey Data and VM Inspection results	Estimated Tree Count	(1) 2019/2020 LiDAR survey data analysis output produced on 2/4/2020. (2) EVM Inspection Data (3) Statistical analysis of LiDAR accuracy		Tree Count	LiDAR data includes a GRID area identifier. Data is summarized by GRID area, and an adjustment is made to the GRID area Tree Count based on a statistical analysis of the LiDAR Grid Tree Count accuracy.
Estimation of Remaining Tree Work on CPZ from EVM Execution Records	Estimated Remaining Tree Work Count	(1) LiDAR Estimated Tree Count per Grid Area (2) EVM completed Tree Work count (3) List of CPZs by Unified Grid Map area that shows the primary CPZ within the Grid area		Tree Count	LiDAR data from above is used to estimate the number of trees requiring work within a Grid Area. EVM data includes a GRID area identifier. This EVM data is matched with the LiDAR data to determine the estimated count of trees remaining to be worked within a Grid area. The estimated count of trees remaining to be worked within a Grid area is then summed among all the Grid Areas for a CPZ where the CPZ is listed as the Primary CPZ in the Grid area.

b. Explain the frequency of data updates.

PG&E has not updated the EVM Tree Weighted Prioritization since it was developed in 2021. The EVM Tree Weighted Prioritization has been used to inform the 2021 EVM Scope of Work, as well as the 2022 EVM Scope of Work. PG&E will evaluate the need to update the EVM Tree Weighted Prioritization after it completes a review and validation of the 2022 WDRM v3.

c. Sources of data. Explain in detail measurement approaches.

Sources of data for the EVM Tree Weighted Prioritization datasets can be found in Table PG&E-4.5.1-13 above.

d. Explain in detail approaches used to verify data quality.

For data included in the WDRM models, which was the basis for the EVM Tree Weighted Prioritization, please see the description of data verification efforts above in Section 4.5.1(b). The additional data used in the EVM Tree Weighted Prioritization was either a result of reaggregation of data or was data available for PG&E's VM program.

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

Sources of data for the EVM Tree Weighted Prioritization datasets can be found in Table PG&E-4.5.1-13 above.

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

As noted above, our VM Asset Management Team made three refinements to the 2021 WDRM v2 vegetation output when we were developing the EVM Tree Weighted Prioritization.

First, the team re-aggregated the risk from 100 m x 100 m pixels used in the 2021 WDRM v2 to approximately 1 kilometer (km) x 0.7 km grid areas. We refer to these re-aggregated areas as Unified Grid Maps. The rationale for re-aggregating is to align the output of 100 m x 100 m pixel risk scores from the 2021 WDRM v2 located on the circuit segments into how work is assigned and executed by our VM tree crews. The re-aggregated grid areas are assigned to a single circuit segment.

Second, the team estimated the number of trees per grid area using LiDAR survey data and VM inspection results along approximately 25,000 miles of distribution circuits in the HFTD. The LiDAR data was obtained in mid-2019 to early 2020 and helped identify trees that could potentially require EVM work. Inspectors subsequently visited approximately 5,000 miles of circuit segments to validate the data that was collected by LiDAR. They added data points where the LiDAR analysis did not identify a tree that would require work. The data that the inspectors collected along the approximately 5,000 miles of circuit was used as part of a regression analysis to predict the amount of work that exists along the remaining approximately 20,000 miles of circuits. This provided the predicted tree work in a grid area and associated circuit segment.

The third modification weighted each grid area and associated circuit segment by the remaining tree work. The results of the predicted tree work in each grid map and associated circuit segment was combined with the number of trees that have already been completed in the grid area and associated circuit segment to estimate the Remaining Tree Work on that circuit segment. The number of remaining trees were then used to weigh the circuit segment risk.

4. Modeling assumptions and limitations

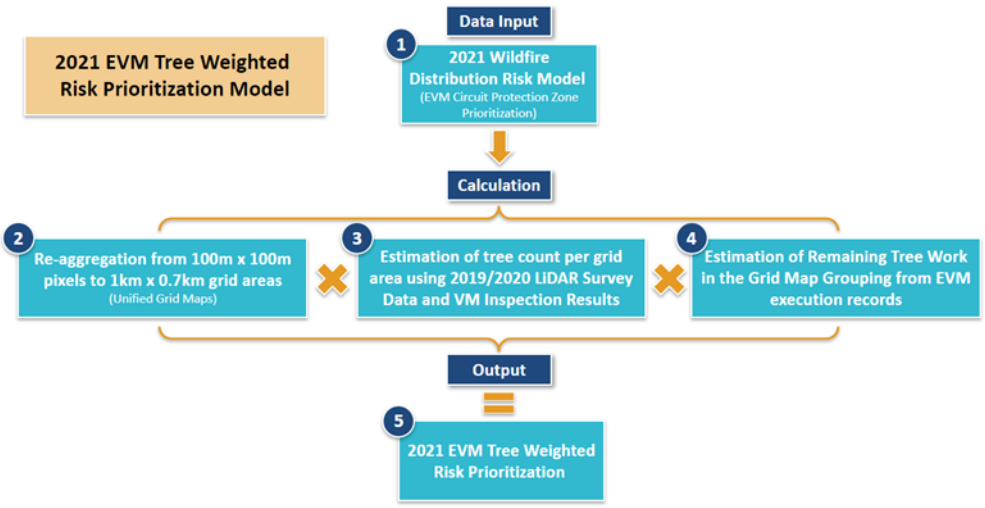
The EVM Tree Weighted Prioritization is built on the assumption that past events predict future outcomes, as well as assumptions underlying the 2021 WDRM v2. For assumptions regarding the WDRM models, see Section 4.5.1(b) above.

5. Modeling methodology

a. Model equations and functions

2021 EVM Tree Weighted Risk Prioritization is calculated as shown in Figure PG&E-4.5.1-13 below.

FIGURE PG&E-4.5.1-13:
CALCULATION OF EVM TREE WEIGHTED PRIORITIZATION



b. Any additional input from Subject Matter Experts (SME) input

Input from the VM team used in the development of the EVM Tree Weighted Prioritization is described above in (3)(f).

c. Any statistical analysis or additional algorithms used to obtain input

See (3) above for a description of the elements of the EVM Tree Weighted Prioritization.

d. Details on the automation process for automated models

See (3) above for a description of the elements of the EVM Tree Weighted Prioritization.

6. Model uncertainty

In addition to any uncertainties associated with the 2021 WDRM v2, additional uncertainties for the EVM Tree Weighted Prioritization include the accuracy of data elements such as the estimations of tree count and remaining tree work count.

7. Model verification and validation

a. Documentation describing the verification basis of the model, demonstrating that the software is correctly solving the equations described in the technical approach.

PG&E has previously provided to Energy Safety and the CPUC documentation describing the verification of the 2021 WDRM v2, including an external review by E3. We do not have any additional documentation regarding verification of the EVM Tree Weighted Prioritization.

b. Documentation describing the validation basis of the model, demonstrating the extent to which model predictions agree with real-world observations.

The dataset used to train the EVM Tree Weighted Prioritization achieved an AUC score of 0.73. The 2019 dataset was used as an out-of-sample test dataset to evaluate the model fit and achieved a score of 0.64 but a randomly withheld test sample from several years achieved a score of 0.72. The minimal reduction in AUC score between the training and testing datasets gives confidence that the model is not overfitting to the training dataset but also raises the possibility that the spatial pattern and other characteristics of 2019 vegetation-caused ignitions deviated slightly from 2015-2018.

8. Modeling frequency

The EVM Tree Weighted Prioritization was performed once to establish a list of risk ranked CPZs or circuit segments. This list was then used to inform the 2021 EVM Scope of Work and the 2022 EWM Scope of Work.

9. Timeline for model development

We do not currently have a timeline for any further development or updates to the EVM Tree Weighted Prioritization. Development will be dependent in part on the review and approval of the 2022 WDRM v3.

10. Application and results

The 2021 EVM Tree Weighted Prioritization method was applied to planning the 2021 and 2022 EVM Scope of Work.

11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date for the EVM Tree Weighted Prioritization.

4.5.1(f) Fire Potential Index (FPI) Model

1. Purpose of model

To better understand and predict the potential for large and catastrophic fires to occur across our service territory, we developed the FPI Model in 2015 and have improved the model several times since.

The FPI Model combines fire weather parameters (wind speed, temperature, and vapor pressure deficit), dead and live fuel moisture data, topography, and fuel model data to predict the probability of large and/or catastrophic fires. The FPI Model was trained on an enhanced fire occurrence dataset that combines agency fire information with sub-daily growth from satellite fire detections.

The FPI Model is used as a daily and hourly tool to drive operational decisions to reduce the risk of utility-caused fires. On a day-by-day basis, the FPI Model informs crews and operators what precautions must be taken to reduce the risk of fire ignitions as directed by utility standards. The FPI Model also informs the potential need and execution for PSPS events.

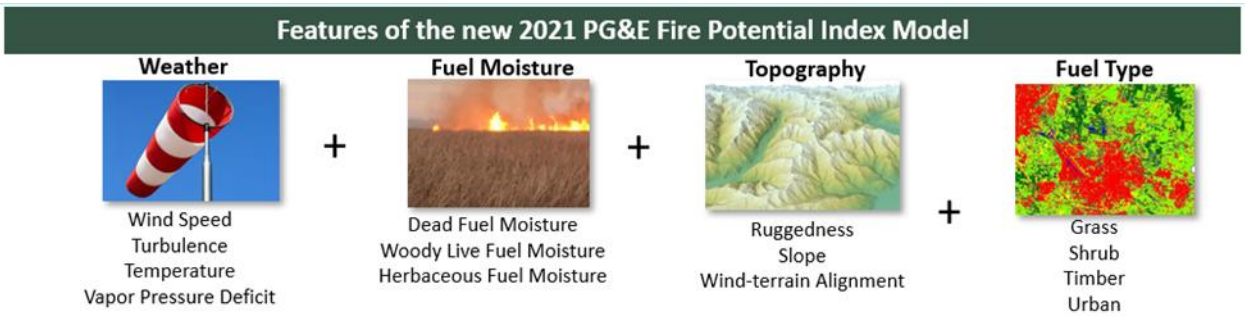
2. Relevant terms

- Dead Fuel Moisture (DFM) – Moisture content of dead vegetation, which responds current and antecedent environmental conditions and is critical in determining fire potential.
- Fire Index Area (FIA) – A geographical area over which fire danger determinations are produced.
- Live Fuel Moisture (LFM) – Moisture content within living vegetation. Living vegetation contains more moisture than dead vegetation because it is biologically active.
- PG&E Operational Mesoscale Modelling System (POMMS) – A configuration of the Weather Research and Forecasting (WRF) model. A numerical weather prediction model.

3. Data elements

The list of model features used in the machine learning FPI Model are discussed in this section. These feature build upon the traditional “fire behavior triangle” that incorporate the effects of fuel, weather and topography on fire behavior. The FPI Model features can be grouped into four main categories: (1) Weather; (2) Fuel Moisture; (3) Topography; and (4) Fuel Type. The balanced random forest classifier in the FPI Model offers advantages over the previously used logistic regression, as the model learns how features may interact and captures non-linearities between the features and catastrophic fire spread.

FIGURE PG&E-4.5.1-14:
FPI MODEL DATA ELEMENTS



The weather data is sourced from the 2 x 2 km POMMS weather forecast model and 31-year climatology. The company, DTN, is the vendor of this numeric weather prediction information. The dead fuel moisture at multiple time lag classes and live fuel moisture is derived from coupling the weather and climatology to fuel moisture models developed by Atmospheric Data Solutions (ADS). New measures of live fuel moisture were added as features to the FPI Model and are sourced from Technosylva. These take advantage of remote sensing to estimate the amount of available moisture in woody and herbaceous plant species.

Topography characteristics of terrain ruggedness, slope, and wind-terrain alignment were also evaluated and added as features for the FPI Model. These features are derived from USGS 30m Digital Elevation Models. Terrain ruggedness, which provides a measure of the terrain change in slope and aspect within each 2 x 2 km model grid cell, also proved useful as fire suppression can be impacted by how rugged (or not) the terrain is. The slope is also considered and shows to have a positive effect on fire size where there is existence of steep slopes.

A dynamic wind-terrain alignment factor is computed each hour to provide an assessment of the wind-terrain alignment in each 2 x 2 km grid cell. During Diablo wind events, scientific literature has shown that winds can accelerate down the lee of the terrain feature when the wind flow is perpendicular to terrain. During model testing, a similar pattern emerged, which shows that winds perpendicular to terrain (upslope or downslope winds) have a positive relationship to fire size compared to terrain-aligned (cross slope) winds.

A continuous fuel model type is considered in each 2 x 2 km model grid cell. This information is sourced from Technosylva. The fuel model map baseline is the latest iteration from LANDFIRE but is then enhanced to account for recent burn scars and vegetation regrowth after fires that are not considered in LANDFIRE. The fuel model map resolution is 30 x 30 m. The fuel models are aggregated into six parent fuel type groups of Urban, Grass, Grass-Shrub, Shrub, Timber-litter or Timber-understory. PG&E worked closely with Technosylva fire scientists to consolidate the 40+ fuel model types into these six parent categories. Each fuel type group is a separate feature of FPI and is represented as the fraction of the 2 x 2 km model grid cell that is that fuel type. Each model feature used in the FPI Model is presented in Table PG&E-4.5.1-14 below.

The FPI is a machine learning classification model and outputs the fire growth probability (p) across three fire classes shortly (typically within 12 hours) after an ignition occurs. More detail is found in the FPI methodology section. Thus, for each 2 x 2 km model grid cell every hour, the FPI provides outputs for each class as defined below.

FPI Classification Definitions[63] based on first satellite fire detection area:

- <70 acres – FPI P(Small)
- 70-500 acres – FPI P(Large)
- >500 acres – FPI P(Catastrophic)

[63] These definitions only apply to the FPI classification for fire size as they are based on the fire size shortly after ignition and not final fire size.

TABLE PG&E-4.5.1-14:
FIRE POTENTIAL INDEX MODEL FEATURES

Feature Group	Feature	Altitude	Description	Source	Update Cadence	Spatial Granularity	Temporal Granularity
Weather	Temperature	Surface	Temperature at the surface in Fahrenheit	POMMS	4x per day	2 km	Hourly
Weather	Vapor Pressure Deficit	Surface	Measure of lack of water vapor relative to saturation in millibars	POMMS	4x per day	2 km	Hourly
Weather	Wind Speed (sustained)	Surface	Wind speed at the surface in mph	POMMS	4x per day	2 km	Hourly
Weather	Wind Speed (sustained)	300 m	Wind speed at 300m above surface in mph	POMMS	4x per day	2 km	Hourly
Weather	Friction Velocity (u_*)	Surface	Wind shear stress in velocity terms.	POMMS	4x per day	2 km	Hourly
Weather	Turbulent Kinetic Energy	50 m	Kinetic energy per unit mass observed in eddies characteristic of turbulent flow in Joules/kg	POMMS	4x per day	2 km	Hourly
Fuel Moisture	Dead Fuel Moisture - 1000hr	Surface	1000-hour fuel moisture content	POMMS & ADS	4x per day	2 km	Hourly
Fuel Moisture	Dead Fuel Moisture - 100hr	Surface	100-hour fuel moisture content	POMMS & ADS	4x per day	2 km	Hourly
Fuel Moisture	Dead Fuel Moisture - 10hr	Surface	10-hour fuel moisture content	POMMS & ADS	4x per day	2 km	Hourly
Fuel Moisture	Live Fuel Moisture - Chamise New	Surface	Live fuel moisture content of Chamise (new growth) species	POMMS & ADS	Daily	2 km	Daily
Fuel Moisture	Live Fuel Moisture - Herbaceous	Surface	Live fuel moisture content of herbaceous species	Technosylva	Daily	2 km	Daily

TABLE PG&E-4.5.1-14:
FIRE POTENTIAL INDEX MODEL FEATURES
(CONTINUED)

Feature Group	Feature	Altitude	Description	Source	Update Cadence	Spatial Granularity	Temporal Granularity
Fuel Moisture	Live Fuel Moisture - Woody	Surface	Live fuel moisture content of woody species	Technosylva	Daily	2 km	Daily
Topography	Terrain Ruggedness Mean	Surface	Terrain ruggedness average in POMMS grid cell.	USGS 30m DEM (Digital Elevation Model)	USGS 30m DEM	30 m -> 2km	Static after being updated
Topography	Slope Degree Mean	Surface	Slope of terrain averaged over POMMS grid cell.	USGS 30m DEM	USGS release cadence	30 m -> 2km	Static after being updated
Topography	Wind-Terrain Alignment	Surface	Alignment between wind direction and dominant aspect	POMMS & USGS 30m DEM	4x per day	30 m -> 2km	Hourly
Fuel Type	Urban	Surface	Fraction of fuel category in POMMS grid cell attributed to urban	Technosylva	At least once per year	30 m -> 2km	Static after being updated
Fuel Type	Grass-Shrub	Surface	Fraction of fuel category in POMMS grid cell attributed to grass-shrub	Technosylva	At least once per year	30 m -> 2km	Static after being updated
Fuel Type	Shrub	Surface	Fraction of fuel category in POMMS grid cell attributed to shrubs	Technosylva	At least once per year	30 m -> 2km	Static after being updated
Fuel Type	Timber Litter	Surface	Fraction of fuel category in POMMS grid cell attributed to timber litter	Technosylva	At least once per year	30 m -> 2km	Static after being updated

TABLE PG&E-4.5.1-14:
FIRE POTENTIAL INDEX MODEL FEATURES
(CONTINUED)

Feature Group	Feature	Altitude	Description	Source	Update Cadence	Spatial Granularity	Temporal Granularity
Fuel Type	Grass	Surface	Fraction of fuel category in POMMS grid cell attributed to grasslands	Technosylva	At least once per year	30 m -> 2km	Static after being updated
Fuel Type	Timber Understory	Surface	Fraction of fuel category in POMMS grid cell attributed to timber understory	Technosylva	At least once per year	30 m -> 2km	Static after being updated

4. Modeling assumptions and limitations

The FPI Model requires the requisite input forecast data as described above to produce a forecast each hour. This high-resolution forecast data is currently available with about a 4-5 day ahead forecast horizon. The FPI Model is driven largely from the weather forecasts and will have similar limitations as general weather forecasting.

5. Modeling methodology

The FPI Model was first created in 2015 and has been significantly enhanced in subsequent model versions. For example, the FPI Model was enhanced in 2019 by coupling the weather and fuels data around the ignition of each fire in the USFS's Fire Program Analysis – Fire-Occurrence Database (FPA-FOD). The 2019 version of the FPI Model was trained with a USFS fire occurrence dataset that provided information on each fire, the ignition location and the final fire size. This provided valuable information to train the 2019 FPI Model, but we sought to test if model performance could be improved by utilizing daily to sub-daily fire growth data. For PSPS, we are primarily concerned with those fires that ignite and have a rapid rate of spread shortly after ignition. These fires pose a higher risk to nearby communities than slow spreading fires since populated areas have less time to evacuate.

The end goal was to create an FPI Model that could predict, based on forecasted weather and fuels conditions, the probability of a large or catastrophic fire given an ignition. This FPI Model represents the next evolution that takes advantage of additional model features, an enhanced fire occurrence dataset based on satellite fire detections, and further evolves the machine-learning model approach.

To help build an improved fire occurrence dataset, we partnered with Sonoma Technology, Inc. (STi) to combine historical satellite fire detections with agency fire occurrence datasets to derive sub-daily fire growth statistics. These detections come from high-resolution instruments aboard polar orbiting satellites that can detect fires from their infrared radiance during each pass. The sample rate of these satellites is at least 2 times per day. By leveraging a GIS platform, STi was able to compile satellite data for each pass to determine the amount of fire growth between each pass. The satellite data was combined with agency records from CAL FIRE's Fire and Resource Assessment Program (FRAP), ICS-209 reports, GeoMAC, USFS FIRESTAT, and USFS FPA FOD data sets to provide growth metrics for large, named fires and small, unnamed fires. This new fire occurrence dataset allowed us to train the FPI on fires that show rapid growth shortly after ignition.

The FPI Model leveraged new data sources in the 2 x 2 km weather and fuels climatology as well as the STI enhanced fire occurrence dataset. The goal of this project was to build a more accurate FPI Model that can be used in forecast mode to inform daily and PSPS operations to reduce the risk of utility-caused catastrophic fires.

Data scientists, meteorologists, and fire scientists tested dozens of new model features and various model configurations. Among the model-types tested were logistic regression and multiple machine-learning model types. Model results were tested using a train-test split ratio of 70%-30%. This involved training the model with 70% of the input data and testing predictions against the remaining 30%.

The FPI Model is a Multi-Classification Balanced Random Forest Machine Learning model which was selected based on model fit and performance. Random Forest models like other decision tree frameworks, models non-linearities and interactions of the features.

The FPI Model predicts how fast a fire will grow shortly after an ignition, should one occur. Fires that were observed to grow >500 acres based on the first satellite fire detection ultimately grow on average, to a final fire size of ~20,000 acres. Some of the fires observed to grow the fastest based on the first satellite detection are the Zogg, Tubbs, Atlas, Camp, and Kincade fires, which were all observed to grow >9,000 acres in the first day after ignition.

6. Model uncertainty

Please see (7) below which provides model verification statistics.

7. Model verification and validation

The FPI Model was validated statistically and climatologically by reviewing results for past fires. Model results were tested using a train-test split ratio of 70%-30%. This involved training the models with 70% of the input data and testing predictions with the remaining 30%. The performance metric utilized was the Area Under the Receiver Operating Characteristic (ROC AUC or AUC), which is widely used to evaluate classification models. AUC is a performance metric designed to test the model's ability to discriminate between cases that were correctly classified (positive examples) and versus non-cases (negative examples).[64] The FPI Model's ability to classify fires that grow >500 acres, yielded an AUC score of 0.88. For comparison, the previous FPI Model (2019 - 2020) yielded an AUC score of 0.71.

The FPI Model was also evaluated against past catastrophic fires using historical weather data matched in both time and space for each fire. With the class separation at 70 and 500 acres, the FPI performs well, differentiating between the natural categories of fires: catastrophic fires with a high rate of spread—typical of wind-driven events, large fires with low to moderate rate of spread, and small fires.

Scatter plots are presented below to show FPI Model output compared to the final fire size (top) and fire size shortly after ignition as measured by the first satellite detection (bottom). The fire size at the first satellite fire detection of a fire from the Visible Infrared Imaging Radiometer Suite (VIIRS), typically within first 12 hours or less of the start of the fire, is shown in these figures to illustrate those fires with high rate of spread shortly after ignition. This data includes all fires in the PG&E service territory regardless of cause.

Two sets of scatter plots are also provided. The first, Figure PG&E-4.5.1-15, shows the FPI Model output of probability large or catastrophic for each fire, where P(Large or

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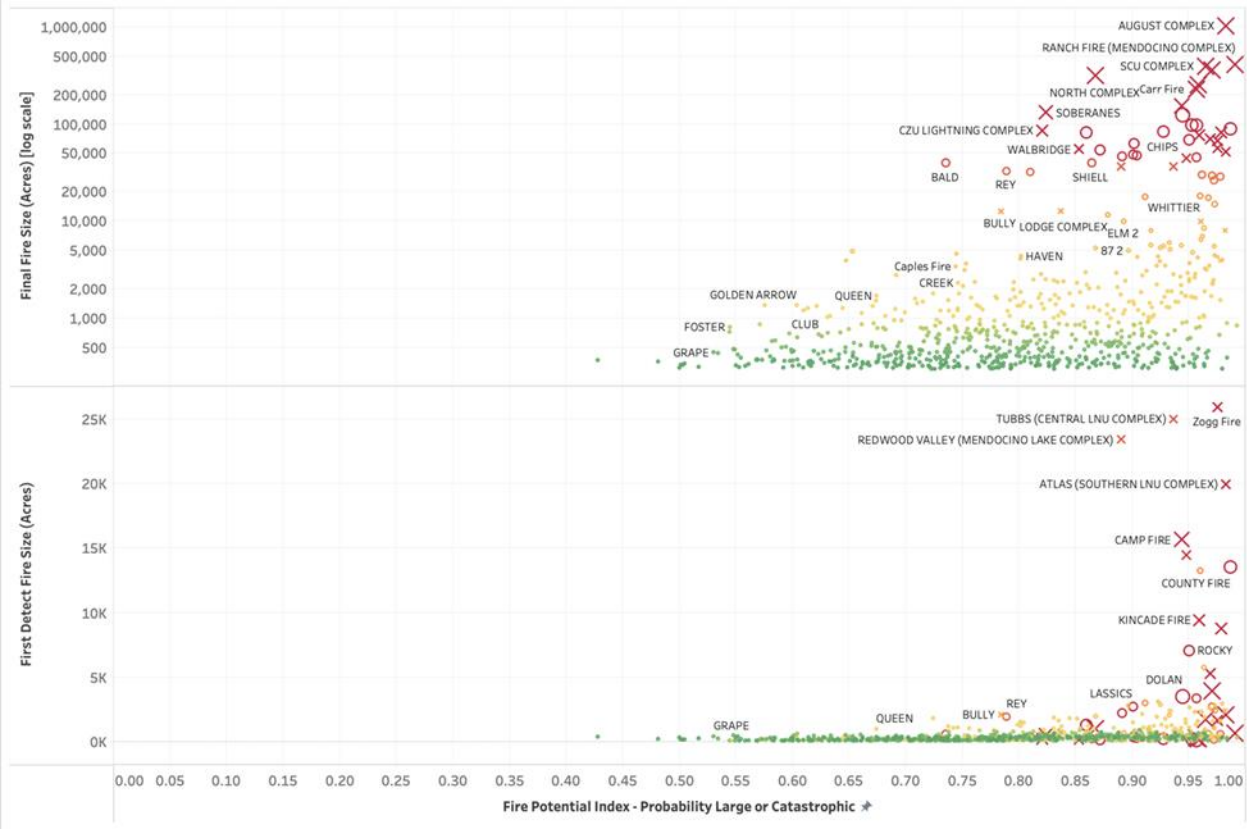
64 Generally, an AUC score of 1 is a perfect model, scores above 0.8 are considered to have excellent performance, while scores near and above 0.70 are considered to have good performance. A model with no skill has an AUC score of less than 0.5.

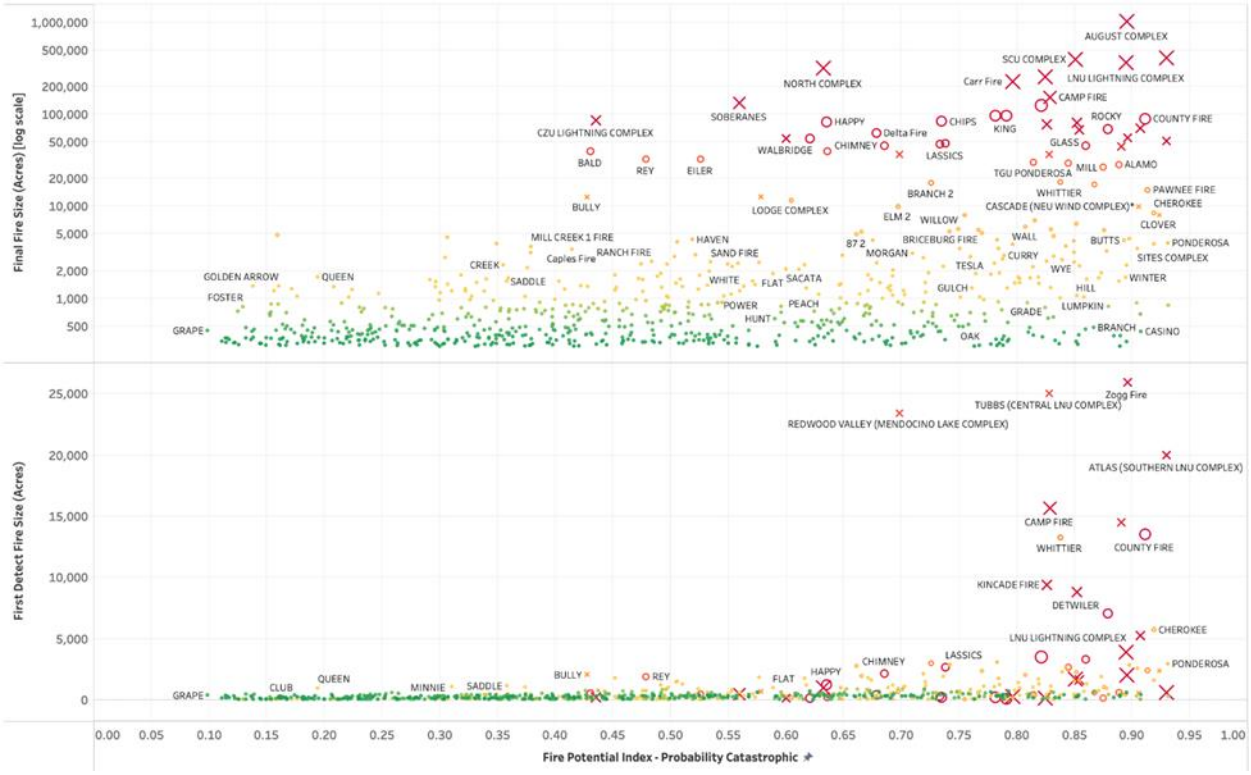
Catastrophic) = P(Large) + P(Catastrophic). Note that many destructive and catastrophic fires of the past (including the Zogg, Tubbs, Camp, Atlas, and Kincade) have values near the top of the range (maximum value of 1). The second set of scatter plots, Figure PG&E-4.5.1-16, shows the FPI probability catastrophic class for each fire, P(Catastrophic). This scatter plot is provided to illustrate how the FPI classification model multi-classification approach is able differentiate between those fires with rapid rate of spread shortly after ignition through P(Catastrophic), and large fires with low to moderate rates of spread through P(Large or Catastrophic). Note that many destructive and catastrophic fires of the past including the Zogg, Tubbs, Camp, Atlas, and Kincade, have FPI P(Catastrophic) values >0.8.

FIGURE PG&E-4.5.1-15:
FPI P(LARGE OR CATASTROPHIC) FOR FIRES VS THE FINAL FIRE SIZE (TOP) AND THE FIRE SIZE AT FIRST SATELLITE FIRE DETECTION ONLY (BOTTOM)



Note: For fires of any cause >300 acres from 2012-2020, compared to the size of the fire based on the final fire size (top) [log scale for clarity] and the fire size at the first satellite fire detection (bottom). Colored by final fire size, and shape of X given to those fires that resulted in a fatality or destroyed more than 50 structures, and shape O otherwise.

FIGURE PG&E-4.5.1-16:
FPI P(CATASTROPHIC) ONLY FOR FIRES VS THE FINAL FIRE SIZE (TOP) AND THE FIRE SIZE AT FIRST SATELLITE FIRE DETECT ONLY (BOTTOM)



Note: For fires of any cause >300 acres from 2012-2020, compared to the size of the fire based on the final fire size (top) [log scale for clarity] and the fire size at the first satellite fire detection (bottom). Colored by final fire size, and shape of X given to those fires that resulted in a fatality or destroyed more than 50 structures, and shape O otherwise.

8. Modeling frequency

The FPI Model is refreshed when new weather and fuel moisture outputs are available. These outputs are updated four times per day.

9. Timeline for model development

The FPI Model has been updated, on average, every 2 years after it was first developed in 2015. The latest model version was operationalized in 2021.

10. Application and results

The FPI Model outputs the probability from 0 – 1 (or 0 to 100%) that a fire will be one of the three fire classes of small, large, or catastrophic (see classification definitions above). The FPI Model is run hourly on the same model domain as the POMMS weather and Ignition Probability Weather Model (IPW Model).

For PSPS applications, the FPI P(Catastrophic) is used as input into the PSPS decision-making framework together with IPW Model at a 2 x 2 km resolution. For daily operational decisions and applications, the FPI P(Large) plus FPI P(Catastrophic) is categorized into ratings and spatially aggregated by geographic areas called “Fire Index Areas (FIAs)” to represent the highest level of fire potential in that area per day – see Figure PG&E-4.5.1-17 and Figure PG&E-4.5.1-18 for examples of the FPI output.

The FPI P(Large) plus FPI P(Catastrophic) is translated onto a fire danger rating scale from R1 (low) to R5 (extreme) based on breakpoints. These breakpoints were established by reviewing climatological percentiles as well as FPI output for historic fires in the PG&E territory from 2008 – 2020. This methodology is identical to how federal agencies translate numeric outputs of the National Fire Danger Rating System to a fire adjective rating (e.g., “low” or “extreme”). These daily ratings are used by field crews and operators to mitigate the potential for utility-caused wildfires. These mitigation actions are discussed in Utility Standard TD-1464S, Preventing and Mitigating Fires While Performing PG&E Work. The FPI rating of “R5-Plus” is issued when a PSPS event is likely. This is utilized to not only illustrate that PSPS is possible in these areas, but to differentiate between R5 driven by the high FPI and R5 coupled with increased probability for utility outages and ignitions during strong wind events.

FIGURE PG&E-4.5.1-17:
EXAMPLE OUTPUT FROM THE PG&E UTILITY FPI WEB APPLICATION

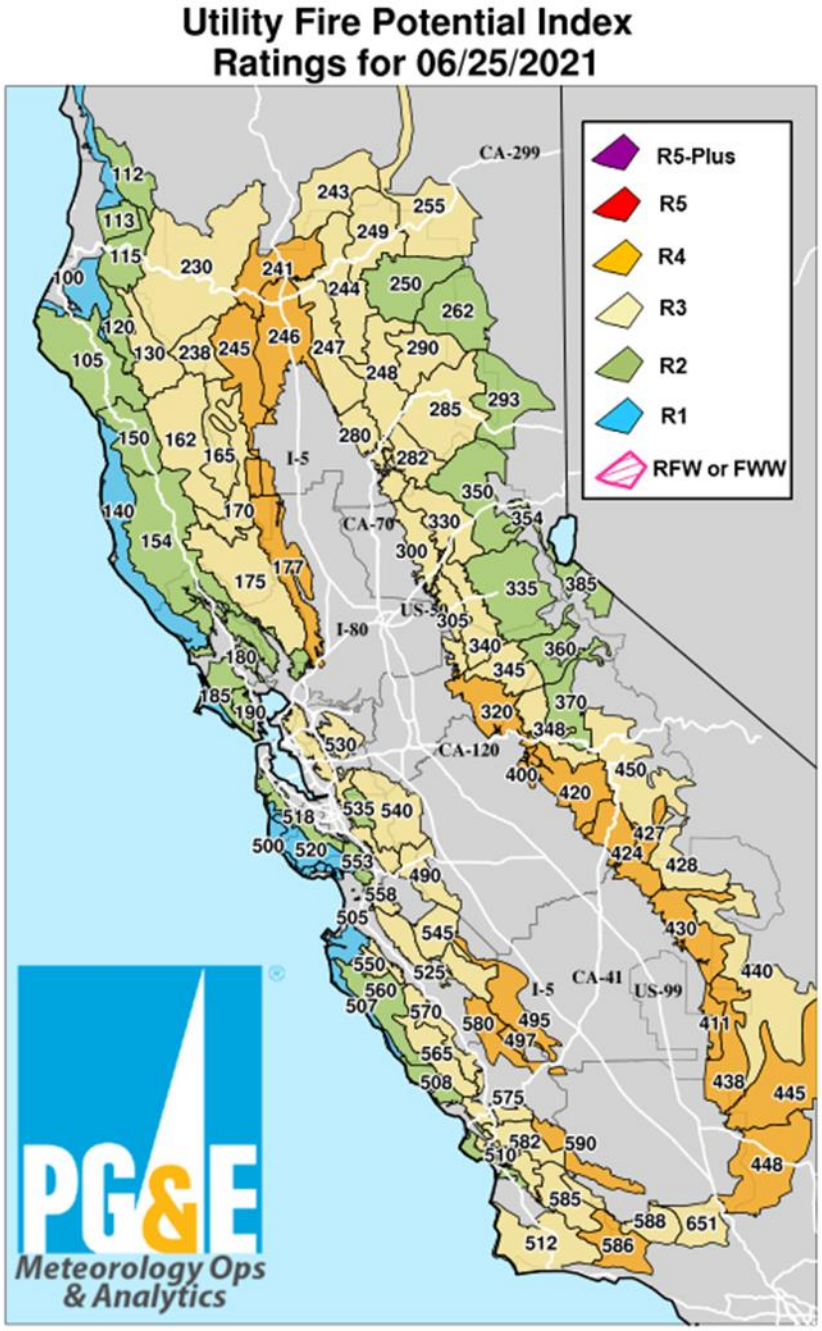
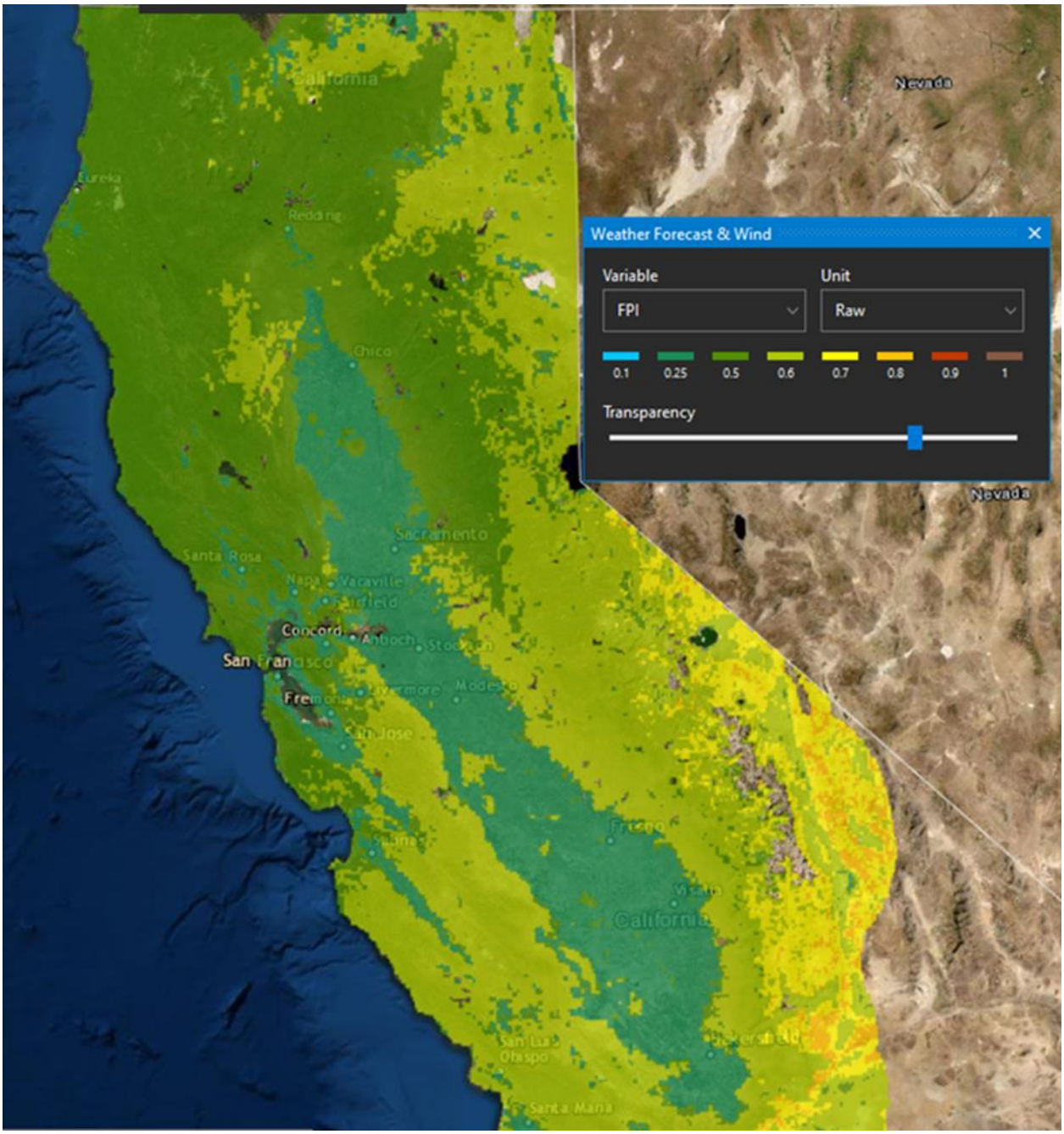


FIGURE PG&E-4.5.1-18:
EXAMPLE OUTPUT FROM THE PG&E UTILITY FPI WEB APPLICATION



11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date for the FPI Model.

4.5.1(g) Ignition Probability Weather Model

1. Purpose of model

The Ignition Probability Weather (IPW) Model is used in unison with the FPI Model to assess the need for a PSPS event. A PSPS event may be initiated when there is a high probability of utility caused ignitions (IPW) combined with a high probability of catastrophic fires (FPI) in both space and time.

2. Relevant terms

- 2021 Outage Probability Weather (OPW) Model – A machine learning model that outputs the probability of outage by cause (e.g., vegetation) as a function of weather.

- PG&E Operational Mesoscale Modelling System (POMMS) – A configuration of the Weather Research and Forecasting model. A numerical weather prediction model.

3. Data elements

The weather variables used to train the IPW Model include wind speed at 10m and 50m, turbulent kinetic energy at 50m, friction velocity, vapor pressure deficit at 2m, temperature at 2m, and precipitation. The aerial LiDAR tree overstrike for each tree is summed per 2 x 2 km grid cells to provide the IPW Model with a measure of tree density and risk in each grid cell. The “node” is a key categorical variable that allows the model to learn outage trends specific to each location that is not otherwise explained (e.g., due to asset condition, vegetation stress, materials, soils, cars, balloons, animals, and other exogenous factors). The IPW Model features are described below in Table PG&E-4.5.1-15.

TABLE PG&E-4.5.1-15:
IPW MODEL FEATURES

Predictor	Altitude	Description	Source	Update Cadence	Spatial Granularity	Temporal Granularity
Temperature	Surface	Temperature at the surface in Fahrenheit	POMMS	4x per day	2 km	Hourly
Wind Speed (sustained)	Surface	Wind speed at the surface in mph	POMMS	4x per day	2 km	Hourly
Wind Speed (sustained)	50 m	Wind speed at 50m above surface	POMMS	4x per day	2 km	Hourly
Vapor Pressure Deficit	Surface	Measure of lack of water vapor relative to saturation in millibars	POMMS	4x per day	2 km	Hourly
Turbulent Kinetic Energy	50 m	Kinetic energy per unit mass observed in eddies characteristic of turbulent flow in Joules/kg	POMMS	4x per day	2 km	Hourly
Friction Velocity (u_*)	Surface	Wind shear stress in velocity terms.	POMMS	4x per day	2 km	Hourly
Precipitation	Surface	Precipitation in mm per hour	POMMS	4x per day	2 km	Hourly
Tree Overstrike	Surface	The length in ft of tree overstrike. Overstrike is calculated by measuring the tree's point of contact on a conductor to the top of the tree if it were to fall directly towards the conductor.	Vegetation Management Aerial LiDAR	Updated when new Aerial LiDAR data is available	Point tree data, aggregated to 2 km	Static until next Aerial LiDAR update

4. Modeling assumptions and limitations

The IPW Model requires the requisite input forecast data as described above to produce a forecast each hour. This high-resolution forecast data is currently available with about a 4-5 day ahead forecast horizon. The IPW Model is driven largely from weather forecasts and will have similar limitations as general weather forecasting.

5. Modeling methodology

The IPW Model represents the next generation of distribution outage and ignition probability models building on the 2020 OPW Model previously discussed in the 2021 WMP, Section 4.2.A. The core IPW Model is a new multi-classification outage model, that now can forecast outage probability by specific outage causes. The probability of outage output for each class is transformed to an ignition probability (IPW) using outage to ignition rates for each cause class.

The IPW Model is trained on windspeeds and other weather features from our 31-year down-scaled climatology at 2 x 2km resolution and approximately 500,000 sustained and momentary outages occurring on the distribution grid from 2008 to end of 2020. Asset damage and hazards found during PSPS events were also included in the training set. Outages were excluded from the training dataset if they were underground or occurred on non-weather driven major event days, such as fires and earthquakes. The operational application of the IPW Model is forecast four times per day producing 3-hourly outage and ignition probabilities. The model has a forecast horizon of 129 hours ahead at the same 2 x 2 km resolution as POMMS, a configuration of Weather Research and Forecasting model. The enhancements to the IPW Model, which is a Machine Learning non-linear model, multi class, exponential time weight ensemble, represent significant enhancements over the 2020 OPW Model. The end goal was to better model ignition probabilities to inform when PSPS is needed.

The IPW Model is a multi-classification Cat Boost Machine Learning model. It is a state-of-the-art model based on decision trees with advanced categorical feature support.

The IPW Model outputs the probability of five outage classes and a no-outage class for each 2 x 2 km grid cell based on weather variables, tree overstrike per 2 x 2 km grid cell from aerial LiDAR, and a local “node” categorical variable. The five outage classes are: Animal/Third-Party contact such as cars and balloons; Equipment - Electrical which includes transformers and fuses; Equipment - Structural which includes assets such as poles, cross-arms, connectors, conductors, etc.; Vegetation outages; Unknown; and with the final prediction being No-Outage. The cause classes are presented below.

$$cause\ classes$$
$$= \{\text{Animal/3rdParty}, \text{Equipment Electrical}, \text{Equipment Structural}, \text{Unknown}, \text{Vegetation}\}$$
$$class \in cause\ classes$$

The probability of an outage by class by cell per hour can be represented by:

$$P(Outage_{class,cell,hour})$$
$$= f(wind\ speed_{cell,hour},\ turbulent\ kinetic\ energy_{\ cell,hour}, vapor\ pressure\ deficit_{\ cell,hour},$$
$$temperature_{\ cell,hour}, lidar\ tree\ overstrike_{\ cell}, node).$$

The outage probabilities for each outage class are multiplied by the probability of ignition given outage to determine the utility ignition probability. The IPW Model is represented by:

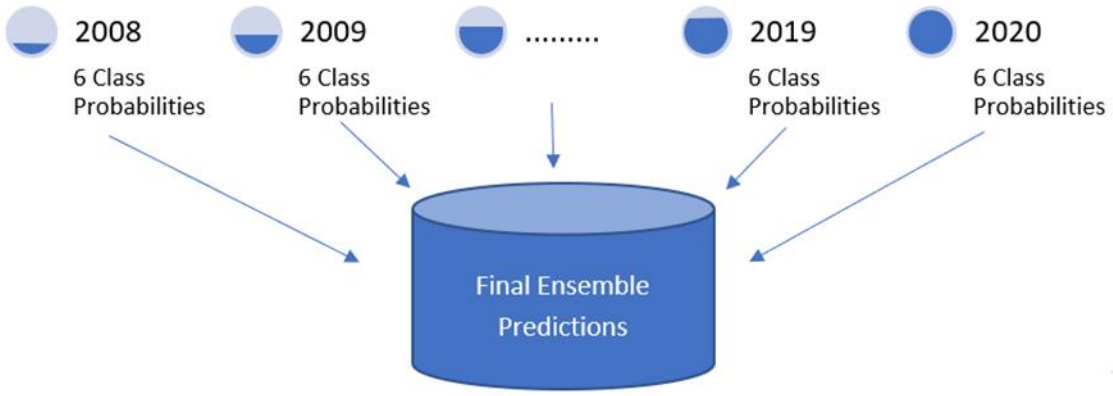
$$IPW = P(utility\ ignition_{cell,hour})$$

$$= \sum_{class}^{cause\ clases} P(Outage_{class,cell,hour}) * P(Ignition_{class}|Outage_{class})$$

The probability of ignition given outage is based on the mean arrival rate of CPUC reportable ignitions to outages observed from 2015-2020 between May-November excluding weather days that included rain, winter storm, low snow, and lightning, for each of those cause classes. This filter provides the summer to fall outage to ignition ratios to apply to the IPW Model input to the PSPS model. Vegetation cause outage class, for example, has the highest propensity to cause an ignition.

To address positive and negative trends in grid performance and reliability year-over-year, we apply a time-weighted approach to weight current years more heavily in the final model output. The IPW Model is comprised of 13 models trained on each year separately from 2008-2020, and then the class probabilities are combined using a weighted mean with the weight of each model contribution as an exponential weight function (weight $=e^{bt}$ where b is the exponential growth weight we are applying over time in years t from 2008). An optimal b was selected as 0.1 out of a grid search of values based off an evaluation of 2020 prediction using an ensemble model trained with 2008-2019 data. This exponential weighted mean allows changes in local areas to be learned (both negative – increased tree mortality, asset degradation, etc.; and positive – conductor and pole replacement, vegetation management, etc.). A schematic and example formula for P(vegetation outage) is presented below in Figure PG&E-4.5.1-19.

FIGURE PG&E-4.5.1-19:
OUTAGE PROBABILITY WEATHER MODEL ENSEMBLE CONSTRUCTION



6. Model uncertainty

Please see (7) below which provides model verification statistics.

7. Model verification and validation

The 2021 IPW Model was validated statistically and climatologically by testing outage predictions per outage class. The year 2020 and outages from 2020 were withheld from the model training dataset and used to evaluate performance. The performance metric applied was the standard Area Under the Receiver Operating Characteristic (AUC ROC). A strength of the model is predicting the probability in the vegetation cause class, which were also found to have the highest outage to ignition propensity. The AUC ROC score for vegetation-caused outages is 0.81 for example. In post-PSPS event patrols, the majority of damages and hazards found to date have been caused by vegetation. The AUC ROC is reported for each other cause class: Equipment-Structural is 0.69, 3rd-Party-Animal is 0.68, Equipment-Electrical is 0.67, Unknown Cause is 0.64, Negative Class is 0.67, and finally the Macro Average of AUC ROC for all classes is 0.70. Third Party, Animal and Equipment-Electrical and Unknown cause classes are harder to predict cause classes which is reflected in the AUC ROC values.

After model performance was verified on the year 2020, data from 2020 were incorporated into the IPW Model for operations in 2021. The final IPW Model candidate with 2020 included was calculated in hind-cast mode hourly through the 2 x 2 km climatology from 2008-2020. This IPW Model climatology enables evaluation of key historical event days by Operational Meteorologists. Major weather events since 2017 where significant outages and fire ignitions occurred due to weather were evaluated using an interactive event dashboard that allows rapid exploration of model outputs during key days (e.g., 10/8/2017 and 11/8/2018). The dashboard also includes all the PSPS damages and hazards with ability to filter to see individual events by hour. Operational Meteorologists used the dashboard to evaluate model performance against key historical storm events, evaluating timing of weather onset compared to modeled outage probability increases, and relative magnitude of outage probabilities.

8. Modeling frequency

The IPW Model is refreshed when new weather outputs are available. These outputs are updated four times per day.

9. Timeline for model development

PG&E first deployed the OPW Model in 2019, which was used to forecast the probability of an outage based on wind speed. In 2020, the OPW Model was enhanced from the ground up. The 2020 OPW Model was more granular and had the ability to run on the new 2 x 2 km weather model grid. The model was trained on both sustained and momentary outages, as well as damages and hazards found in 2018 and 2019 PSPS events. During the 2021 model development, we wanted to bridge the gap between outages and ignitions and leveraged our CPUC reportable ignitions to achieve this goal. The 2021 IPW Model version represents the next generation of distribution outage and ignition models building on the 2020 OPW Model.

10. Application and results

For PSPS applications, the IPW Model is used as input into the PSPS decision-making framework together with FPI Model at a 2 x 2 km resolution.

11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date on the IPW Model.

4.5.1(h) Transmission Operability Assessment Model

1. Purpose of model

The Transmission Operability Assessment Model or OA Model provides probability of failure of transmission line assets (at a structure level) in windy conditions. The OA Model is primarily used to scope Electric Transmission PSPS events but also provided input for 2022 enhanced inspection and maintenance planning. During PSPS events, the OA Model is combined with the FPI Model and the WFC Model to inform transmission line de-energization decisions.

PG&E discussed the OA Model in detail in our 2021 WMP, Section 4.5.1(f).

2. Relevant terms

- Bayesian updating – A methodology by which the wind-based asset strength and uncertainty estimation provided by the OA Model is continuously improved as additional outage data is received (typically on a yearly cadence). In this manner, the OA Model works to maintain relevancy by incorporating new data in the form of newly-reported failures and survivals of transmission assets subjected to windy conditions.

- Fragility curve – Represents the probability of failure for any value of a demand parameter.

- Input data – Any dataset that is fed into the OA model and used as a means of calculating the OA probability of failure (Pf). The input datasets to the OA model are detailed in Section 3. Data elements

- Probability of failure (Pf) – A calculated likelihood that an electric transmission asset (structure or related component) will fail at a given windspeed from 1 to 120 MPH.

- Transmission asset – Any component of the electric transmission system such as, the primary structure (tower or pole); crossarms; hangers; insulators; conductor wire; foundation; guy wires; and support structures.

3. Data Elements

Table PG&E-4.5.1-16 provides details on the data the OA Model takes as inputs to the probability calculations.

TABLE PG&E-4.5.1-16:
OA MODEL DATA ELEMENTS

Input Data	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Description
PLS-CADD	2019 - present	Bi-monthly	N/A	Bi-monthly	Advanced analysis of assets
Corrosion	2020 - present	Yearly	N/A	Daily	Air and soil* corrosivity factors
Inspection results	2019 - present	Daily	N/A	Daily	Current condition of assets
Outage	2007 - present	Yearly	N/A	Daily	Historical outages and causes
Structure details	1899 - present	Daily	N/A	Daily	Age, material, GIS
Pole test and treat	2006 - present	Yearly	N/A	Daily	Wood pole analysis
Repairs	2019 - present	Daily	N/A	Daily	Repair details
Asset feature list data	2021 - present	Once	N/A	Daily	Enhanced asset records
Bayesian updating	2019 - present	Yearly	N/A	Daily	Historical data
Wind gust percentile	2019 - present	Yearly	N/A	Daily	Wind gusts data
Wind speed analysis	2019 - present	Yearly	N/A	Daily	Analyzed wind data
Structure material	2019 - present	Yearly	N/A	Daily	Analyzed structure data

4. Modeling assumptions and limitations

The OA Model employs the same modeling framework as the WTRM that is outlined in Section 4.5.1(c) above. The key difference is that the OA Model is an operational model which produces the probability of failure for conditions at a given time and the WTRM is a planning model that provides an annual probability.

The OA Model relies on varying types of input data and on real-world-representative equations to calculate accurate and usable fragility curves. The input data to the OA Model has expanded each year since program inception (2019). This allows the model to calculate physical world threats to the electric transmission infrastructure, such as corrosion, but the model is limited by the data available.

5. Modeling methodology

The OA Model computes an asset-based fragility (probability of failure due to wind gust speed) by quantitatively assessing the condition (or health) of transmission structures and components and accounting for known degradation mechanisms. Probability is calculated based on an asset fragility curve that is a function of windspeed. Asset failure curves are adjusted from “brand new” based on various factors such as inspection condition, age, environment, and previous performance.

6. Model uncertainty

The uncertainty, or dispersion, aspect of the asset-based fragilities is handled by various uncertainty terms that include age and environmental factors, such as atmospheric corrosion, below grade corrosion, wear, fatigue, outage density (the

prevalence of historical outages), splice density (the prevalence of conductor splices), and Bayesian Updating. Uncertainty can be pictured as a change in the shape of the fragility curve—higher uncertainty can be pictured as a "flattening" of the fragility curve and, therefore, an increase in the range of wind gust speeds over which probability of failure values are nontrivial.

7. Model verification and validation

For transmission, the OA Model methodology is derived from the performance-based engineering framework supported by the Pacific Earthquake Engineering Research (PEER) program, which is a consortium of research and industry experts who have extensively published peer-reviewed technical papers related to this topic. PG&E SMEs reviewed the OA Model methodology in numerous meetings and workshops, where the nature, purpose, and preliminary outcomes of the model were discussed. An independent, external review was also performed by experts in probabilistic engineering analysis with the B. John Garrick Institute for Risk Sciences at UCLA.

Best practices from data science and software development were employed to integrate the OA Model methodology into Python and Power BI. These best practices included code peer review, automated scripts that compare the model outputs from two independent systems, and automated unit tests of the code for repeatable validation.

Updates and enhancements to the OA Model go through the same review and validation processes, with the additional step of PG&E's transmission consultant preparing a delta study that identifies the impact of these updates or enhancements on the model outputs. OA Model documentation, including the technical basis of the methodology, is maintained by the Transmission OA team.

8. Modeling frequency

The OA Model updates daily for use in PSPS events.

9. Timeline for model development

The OA Model was initiated in 2019 and is continuously updated/enhanced each year in preparation for fire season. Planned 2022 enhancements to the OA model include updated conservative age assumption logic, updated Bayesian updating, enhanced below-grade corrosion modeling, and the incorporation of flashover probabilities. Additional use of PLS-CADD modeling data will also be incorporated, which is also discussed in Section 7.3.4.8.

10. Application and results

The OA Model is primarily used for transmission line de-energization guidance for PSPS events but aspects of the model were also used in the transmission 2022 enhanced inspection and maintenance planning.

11. Key improvements from working group

No recommendations have been provided from the Wildfire Risk Modeling Working Group to date on the OA Model.

4.5.1(i) PSPS Consequence Model

1. Purpose of model

The purpose of the PSPS Consequence Model is to represent the spatial/circuit variation in PSPS consequence and to prioritize PSPS mitigation efforts in high-risk locations based on frequency, customer, and duration of PSPS impact. This more granular model will help assess the impacts of PSPS de-energizations in support of making PSPS mitigation planning decisions based on lookback analysis.

PSPS is used as a measure of last resort, is called as a proactive and protective measure to prevent potential ignitions which could cause catastrophic wildfires. As a result of a PSPS event, circuits or circuit segments are de-energized, meaning that customers will be without power until critical fire weather conditions subside. The PSPS Consequence Model quantifies these consequences and aggregates to the circuit level, differentiating between the consequence driven by distribution system scoped impact or transmission system scoped impact.

In Q4 2021, PG&E refreshed the model to take into account the 2021 lookback, as well as develop more granular modelling results at the circuit segment level to support PG&E Remedy 21-05, described in Section 4.6.

2. Relevant terms

- Customer Minutes Interrupted (CMI) – The number of minutes a customer is without service during a PSPS event.

3. Data elements – Details of data elements used for analysis. Including at minimum the following:

In Table PG&E-4.5.1-17 below, we provide the data elements of the PSPS Consequence Model:

TABLE PG&E-4.5.1-17:
PSPS CONSEQUENCE MODEL DATA ELEMENTS

Data Element	Description
Enterprise Risk Model – PSPS Overall System	Calculates the overall PSPS Consequence Score using the Enterprise Risk Model. This uses the same PSPS historical lookback data but uses a Monte Carlo simulation based on probability distributions as described in Section 4.2. This leads to slightly different MAVF scores at the overall system level. As such, the ERM calibrates this PSPS Consequence Model to consistent MAVF score at a more granular level.
2020 PSPS Historical Lookback	Dataset that provides a 10-year historical lookback of possible PSPS events determined based off 2020 PSPS protocols. These protocols represent the guidelines from meteorology on the criteria to initiate PSPS, as well as the representation of the system configuration (e.g., sectionalization devices) at that point in time Information includes circuits, total customers impacted, and duration for specific events for transmission and distribution circuits. This primary data is used to estimate distribution and transmission consequence at the circuit level.
2021 PSPS Historical Lookback	Dataset that provides a 11-year historical lookback of possible PSPS events determined based off 2021 PSPS protocols. These protocols represent the guidelines from meteorology on the criteria to initiate PSPS, as well as the representation of the system configuration (e.g., sectionalization devices) at that point in time Information includes circuits, total customers impacted, and duration for specific events for transmission and distribution circuits. This primary data is used to estimate(?) consequence at a circuit isolation zone level.
Customer Classification and Weighting	Weighting assessment by customer classifications to adjust consequence and prioritization for critical customers based on the SME feedback Data set includes customer classifications from customer care & billing (CC&B), aggregated at the circuit level.

a. Scope and granularity (or, resolution) of data in time and location (i.e., date range, spatial granularity for each data element, see example table above).

The results of the PSPS Consequence Model is as granular as at the Service Point Identification, or customer meter level, and can be aggregated all the way up to a circuit isolation zone, circuit segment, circuit, or PG&E system level. The input data set is evaluated back through 2010-2021 and represents best available view of consequence looking forward into 2022 onwards.

b. Explain the frequency of data updates.

Frequency of data updates is based on when new lookbacks are created, typically after a significant change in PSPS protocols. In 2021, PG&E updated our PSPS protocols and lookback, which is referred to as 2021 historical lookback, and PG&E updated this model to capture the data refresh, in support of activities for PG&E Remedy 21-05 discussed in Section 4.6.

c. Sources of data. Explain in detail measurement approaches.

See Table PG&E-4.5.1-17.

d. Explain in detail approaches used to verify data quality.

Most of the data quality verification occurs during the lookback dataset development. As part of this model specifically, data quality is verified by taking a top-down vs a bottom-up approach. PG&E employs the top-down approach by calculating the risk scoring using the ERM to estimate the overall PSPS consequence score in the form of MAVF units. From a bottom-up approach, PG&E calculates the MAVF score of each individual lookback event and aggregating the results across the lookbacks to represent a bottom up MAVF score. This is to verify that the high level estimates of PSPS consequence is similar to the results by aggregating the consequence scores of each circuit isolation zone.

e. Characteristics of the data (field definitions / schema, uncertainties, acquisition frequency).

See Table PG&E-4.5.1-17.

f. Describe any processes used to modify the data (such as adjusting vegetative fuel models for wildfire spread based on prior history and vegetation growth).

Not applicable

4. Modeling assumptions and limitations

A variety of assumptions are used in the PSPS Consequence Model to facilitate calculations. A list of assumptions used in calculating consequence scores is provided below in Table PG&E-4.5.1-18, where these assumptions directly impact the results of the model:

TABLE PG&E-4.5.1-18:
PSPS CONSEQUENCE MODEL CONSIDERATIONS

Risk Type	PSPS Risk Modeling Considerations
Safety	Consequence score calculated based on estimated Equivalent Fatalities (EF) due to a PSPS event. EF calculated based on a ratio of Equivalent Fatalities (EF) per million Customer Minutes Interrupted (MCMI), as estimated from previous PG&E PSPS and other large external outage events.[(a)] Customer Minutes Interrupted (CMI) calculated using circuit estimates for number of customers impacted and expected duration of de-energization for a PSPS event.
Reliability	Consequence score calculated using CMI circuit estimates for number of customers impacted and expected duration of de-energization.
Financial	Consequence score calculated based on two financial cost estimates of a PSPS event: (1) distribution of a lump sum cost of execution across all relevant circuits; and (2) an estimated proxy cost per customer per PSPS event.

(a) Previous PG&E PSPS events include 2019-2020 events, and other large external outage events include 2003 Northeast Blackout in New York City, 2011 Southwest Blackout in San Diego, 2012 Derecho Windstorms, 2012 Superstorm Sandy, and 2017 Hurricane Irma.

Limitations for the PSPS Consequence Model result from the fact that the model is based off of historical lookback of what our PSPS protocols would be.

5. Modeling methodology

The PSPS Consequence Model involves estimating: (1) potential PSPS consequence at the system level, 2) PSPS circuit level and transmission level consequence, and (3) Customer Adjusted Consequence Scores and any other necessary data used in the calculations.

1. The PG&E Enterprise Risk Model utilizes the MAVF framework, as defined through the S-MAP. The tool's calculations for risk use an industry-wide standard MAVF, with a non-linear scaling of consequences reflecting PG&Es focus on low-frequency/high-consequence risk events without neglecting high-probability/low-consequence risk events. The MAVF is a unitless number that captures the safety, reliability, and financial impact of identified potential risk events. Once the consequence values (safety, reliability, financial) are estimated, they are converted into MAVF risk scores as defined through our RAMP and 2023 GRC[65] filings.

65 Full details of the MAVF methodology are provided through the RAMP Report, pp. 3-3 to 3-15 and 2023 GRC workpapers in response to Energy Division GRC-2023-PhI_DR_ED_001_Q01Supp01.

2. Described below are the primary modeling equations used to estimate the consequence values:

PSPS Potential Electric Reliability Consequence:

$$Customer\ Minutes\ Interrupted = [Duration\ of\ Outage] * [Number\ of\ Customers\ Impacted]$$

PSPS Potential Safety Consequence:

$$EF_{PSPS} = \frac{(Customer\ Minutes\ Interrupted) * \left(\frac{Equivalent\ Fatalities}{MCMI}\ ratio\right) * \left(\frac{Number\ of\ Customer\ Meters}{Population\ Impacted}\ ratio\right)}{1{,}000{,}000}$$

PSPS Potential Financial Consequence:

$$WF\ Financial\ Cost\ (Projected) = \frac{Cost\ of\ Execution}{Number\ of\ Circuits\ in\ PSPS\ Event} + ((Number\ of\ Customers) * (Projected\ Cost/Customer))$$

The process to estimate consequence scores for distribution and transmission events at the circuit level results in the ability to rank and prioritize circuits. Both distribution and transmission customer durations are calculated separately to recognize the distinct levels of consequence and mitigation strategies. Since distribution and transmission events pose different consequence onto the system, it is necessary to delineate between the number of customers and duration between these event types.

Described below are the primary modeling equations used to estimate distribution and transmission outage durations, consequence percentages, and consequence scores:

Outage Duration:

$$Dx\ Only\ Outage\ Duration = Distribution\ Customers * Event\ Duration$$

$$Tx\ Only\ Outage\ Duration = \ Transmission\ Customers * Event\ Duration$$

If customer is impacted by Tx and Dx, the consequence would not be double counted but the consequence would be allocated between Tx and Dx.

$$Dx\ Component\ Outage\ Duration = \ 0.5 * Distribution\ Customers * \ Event\ Duration$$

$$Tx\ Component\ Outage\ Duration = \ [(0.5 * Distribution\ Customers) + (Transmission\ Customers - Distribution\ Customers)] * Event\ Duration$$

Consequence %:

$$Distibution\ Consequence\ \% = \frac{Distribution\ Customer\ Duration}{Total\ Customer\ Duration} * 100\%$$

$$Transmission\ Consequence\ \% = \frac{Transmission\ Customer\ Duration}{Total\ Customer\ Duration} * 100\%$$

Consequence Score:

$$Total\ Circuit\ Consequence\ Score = \frac{(Circuit\ Customer\ duration\ )}{(Total\ Customer\ Duration)} * (PSPS\ Consequence\ Score)$$

$$Dx\ Consequence\ Score$$

$$= Distribution\ Contribution\ \%\ per\ circuit\ * Total\ Consequence\ Score\ per\ circuit$$

$$Tx\ Consequence\ Score$$

$$= Transmission\ Contribution\ \%\ per\ circuit\ * Total\ Consequence\ Score\ per\ circuit$$

The PSPS Consequence Model uses customer classification and weighting information to calculate an adjusted MAVF consequence score at the circuit level needed to re-prioritize circuits based on the customer types that reside on a specific circuit. Described below are the primary modeling equations used to estimate adjusted consequence scores, and distribution and transmission circuit consequence scores:

Attribute Adjustments:

Safety: $(Total\ Customers\ per\ Event + Critical\ Customer\ Weighted\ Count) * Average\ Customer\ Duration$

Reliability/ Financial: $(Total\ Customers\ per\ Event) * Average\ Customer\ Duration$

Consequence Score:

$$Critical\ Customer\ Adjusted\ Consequence\ Score$$

$$= (Safety * 6\% + Reliability * 92\% + Financial * 2\%)$$

$$Customer\ Adjusted\ Circuit\ Factor = \frac{Customer\ Adjusted\ Consequence\ Score\ @\ Circuit}{\sum Customer\ Adjusted\ Consequence\ Score}$$

$$Adjusted\ Customer\ Circuit\ Score$$

$$= Customer\ Adjusted\ Circuit\ Factor\ X\ ERM\ PSPS\ Consequence\ Score\ (2195)$$

$$Dx\ Circuit\ Risk\ Score$$

$$= Adjusted\ Customer\ Consequence\ Score\ X\ Distribution\ Consequence\ \%$$

$$Tx\ Circuit\ Risk\ Score$$

$$= Adjusted\ Customer\ Consequence\ Score\ X\ Transmission\ Consequence\ \%$$

6. Model uncertainty

Model uncertainty is based purely on the impacts from the PSPS lookback. Any uncertainty relates back to uncertainty with the PSPS lookback.

7. Model verification and validation

As our meteorology team develops PSPS protocols and doing a lookback analysis, as part of their validation and verification, they are looking at historical events to decide if it makes sense based on these conditions.

8. Modeling frequency

The PSPS Consequence Model is updated annually when new PSPS lookback information is available.

9. Timeline for model development

Similar to what was provided in Section 4.6, PG&E Remedy 21-05:

In developing the PSPS Consequence Model, we were able to achieve the following milestones as shared in the Progress Report:

- October 2021: Finalization of 2021 Circuit Segment List
- November 2021: Finalization of 2021 PSPS protocol historical lookback
- December 2021: Overlay the 2021 Circuit Segments with the 2021 historical lookback
- January 2022: Finalization of PSPS risk scores at the circuit segment level.

As of January 2022, PG&E is in the process of sharing the results with stakeholders and management to help validate the results of the PSPS Consequence Model. Once validated and approved, PG&E plans to use this model to support the development of 2023+ workplans, especially for the undergrounding initiative, which would consider both risk reduction from wildfire and PSPS. PG&E anticipates updating the PSPS Consequence Model annually, subject to the timing and availability of either new PSPS lookback data and/or refreshed circuit segment designations. Additionally, PG&E continues to share developments during joint IOU working groups, and any actionable feedback for adjustments would drive further modelling developments.

10. Application and results

PG&E is using this model into our quantification of risk reduction and RSE in support of Table 12 in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch01. Overall, PG&E is in the process of utilizing this model into planning for PSPS reduction programs, like informing locations for our undergrounding initiative.

11. Key improvements from working group – For each model, describe changes which have been implemented as a result of wildfire risk modeling working group discussions. Provide a high-level summary of recommendations from the wildfire risk modeling working group.

No recommendations have been provided by the Risk Modeling Working Group that impact the PSPS Consequence Model.

4.5.2 Calculation of Key Metrics

Report details on the calculation of the metrics below. For each metric, a standard definition is provided with statute cited where relevant. The utility must follow the definition provided and detail the procedure they used to calculate the metric values aligned with these definitions. The utility must cite all data sources used in calculating the metrics below. In addition, the utility must include GIS layers showing Red Flag Warning (RFW) frequency and High Wind Warning (HWW) frequency (use data from the previous five years, 2016-2021), as well as GIS layers for distribution of Access Functional Need (AFN) customers, and urban/rural/highly rural customers, and disadvantaged communities[66] *in its service territory.*

1. *Red Flag Warning overhead circuit mile days – Detail the steps to calculate the annual number of red flag warning (RFW) overhead (OH) circuit mile days. Calculate as the number of circuit miles that are under an RFW multiplied by the number of days those miles are under said RFW. Refer to the National Weather Service (NWS) Red Flag Warnings. For historical NWS RFW data, refer to the Iowa State University archive of NWS watch / warnings.*[67] *Detail the steps used to determine if an overhead circuit mile is under a RFW, providing an example of how the RFW OH circuit mile days are calculated for a RFW that occurred within the utility service territory over the last five years.*

RFWs are issued by the NWS in defined fire zones (https://www.weather.gov/gis/FireZones). These zones are different from the typical NWS public forecast zones. Because fire zones are used by the NWS for issuing RFWs, overhead circuit miles were calculated by the PG&E GIS team for each of the NWS fire zone polygons that intersect and are within the PG&E service territory. Then, RFW days for each year and/or quarter were calculated for each fire zone. A RFW day is defined as the number of days that a RFW was valid from issue date to expiration date. For example, if a RFW lasted for 12 hours before expiring, then it will be equal to 0.5 RFW days. Finally, the RFW overhead circuit mile days were calculated by multiplying the RFW days and the overhead miles for each NWS fire zone. All RFW overhead circuit mile days were summed up across the NWS fire zones to give the total RFW overhead circuit mile days. RFW archived data shapefiles were downloaded from the Iowa State University's public archived NWS Watch/Warning website (https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml). GIS layers showing RFW frequency can be found in the attached file, 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2_Atch01.

2. *High Wind Warning overhead circuit mile days – Detail the steps used to calculate the annual number of High Wind Warning (HWW) overhead circuit mile days. Calculate as the number of OH circuit miles that are under an HWW multiplied by the number of days those miles are under said HWW. Refer to High Wind Warnings as issued by the National Weather Service (NWS). For historical NWS*

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66 Energy Safety recommends using CalEnviroScreen and Senate Bill 535 to identify disadvantaged communities.

67 https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml.

data, refer to the Iowa State University archive of NWS watch / warnings.[68] *Detail the steps used to determine if an OH circuit mile is under a HWW, providing an example of how the OH HWW circuit mile days are calculated for a HWW that occurred within the utility service territory over the last five years.*

HWWs are issued by the NWS in defined public forecast zones (https://www.weather.gov/gis/PublicZones), which are different from the NWS fire zones. The PG&E GIS team calculated the overhead circuit miles for all NWS public forecast zones that are within and intersect the PG&E territory. Then, HWW days were calculated for all the same NWS public forecast zones. A High Wind Warning Day is defined as the number of days that a High Wind Warning was valid from issue date to expiration date within an NWS public zone. For example, if a HWW was valid for six hours within a public zone, then the number of HWW days for that zone is equal to 0.25 days. Finally, the HWW overhead circuit mile days were calculated by multiplying the RFW days and overhead miles for each NWS public zone. All HWW overhead circuit mile days were summed up across the NWS public zones to give the total HWW overhead circuit mile days. HWW archived data shapefiles were downloaded from the Iowa State University's public archived NWS Watch/Warning website (https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml). GIS layers showing HWW frequency can be found in the attached file, 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2_Atch01.

3. *Access and Functional Needs population – Detail the steps to calculate the annual number of customers that are considered part of the Access and Functional Needs (AFN) population. Defined in Government Code § 8593.3 and D.19-05-042 as individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking,*[69] *older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.*

PG&E follows the four-step process to calculate the annual number of customers that are considered part of the AFN population.

Step 1 – Collect data from the following categories that apply to the CPUC's AFN definition for which data is available in PG&E databases:

1) Customers enrolled in the Medical Baseline program;

   - Data source – Medical baseline enrollment data.

2) Customers enrolled in California Alternative Rates for Energy (CARE) program or Family Electric Rate Assistance (FERA) program;

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68 *Id.*

69 Guidance on calculating number of households with limited or no English proficiency can be found in D.20-04-003.

- Data source: CARE or FERA enrollment data.

3) Customers that self-identify to receive an in person visit before disconnection for non-payment (e.g., vulnerable);

   - Data source – Self-identification to receive in person visit before disconnection for non-payment enrollment data.

4) Customers that self-identify as having a person with a disability in the household (e.g., “disabled”);

   - Data source – Self-identification as having a person with a disability in the household enrollment data.

5) Customers who self-select to receive utility communications in nonstandard format (e.g., in braille or large print);

   - Data source – Self-selection to receive utility communications in nonstandard data enrollment data.

6) Customers who indicate a non-English language preference;

   - Data source – Non-English language preference enrollment data.

7) Customers that self-identify as having a person in the household that uses durable medical equipment;

   - Data source – Self-identification as having a person in the household that uses durable medical equipment;

8) Customers that self-identify as having a person in the household that uses Assistive Technology;

   - Data source – Self-identification as having a person in the household that uses Assistive Technology;

9) Customers that self-identify as having a person in the household that has a Hearing Disability (e.g., Deaf or Hard of Hearing);

   - Data source – Self-identification as having a person in the household that has a Hearing Disability (e.g., Deaf or Hard of Hearing);

10) Customers that self-identify as having a person in the household that has a Vision Disability (e.g., Low Vision);

    - Data source – Self-identification as having a person in the household that has a Vision Disability (e.g., Low Vision)

11) Customers that self-identify as having a person in the household that is Blind; and

    - Data source – Self-identification as having a person in the household that is Blind

12) Customers that self-identify as having a person in the household that is 65+ years old.

    - Data source – Self-identification as having a person in the household that is 65+ years old

Step 2 – Calculate the number of customers in each of the categories above and add them together.

Step 3 – Calculate the number of customers appearing in more than one of the above six categories.

Step 4 – Subtract the result of Step 3 from the result of Step 2 to arrive at the total annual number of customers that are considered part of the AFN populations.

Please refer to 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2Atch02 for a GIS layer showing the distribution of AFN customers, and a GIS layer showing the distribution of disadvantaged communities. The term 'Customer' in this dataset refers to a single electric (or gas) meter, or premise location, and inclusion in the AFN file means at least one person associated with that account is designated as meeting one or more AFN definitions. The disadvantaged communities layer was built using the publicly available SB535 Dataset.

Data Source – CC&B Characteristics from RQT Table in Teradata IDA Extracted: 1/28/2022

4. *Wildland-Urban Interface – Detail the steps to calculate the annual number of circuit miles and customers in Wildlife wildland-urban interface (WUI) territory. WUI is defined as the area where houses exist at more than 1 housing unit per 40 acres and (1) wildland vegetation covers more than 50% of the land area (intermix WUI) or (2) wildland vegetation covers less than 50% of the land area, but a large area (over 1,235 acres) covered with more than 75% wildland vegetation is within 1.5 mi (interface WUI) (Radeloff et al, 2005).*[70]

The annual number of circuit miles in the WUI is calculated by PG&E geospatial overlay/intersect of OH distribution and transmission circuits within WUI polygons and calculation of total circuit lengths in miles within the WUI. The sources of data used in the calculation of this information include University of Wisconsin Madison WUI GIS data layer[71] and PG&E's GIS data layer. The annual number of customers in the WUI is calculated by PG&E geospatial overlay of transformer locations as a proxy for the customer locations and summing up the number of service points associated with each transformer to obtain total customer count within the WUI. The sources of data used in the calculation of this information include University of Wisconsin-Madison WUI GIS

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[70] Paper can be found here: https://www.fs.fed.us/pnw/pubs/journals/pnw_2005_radeloff001.pdf with the latest WUI map (form 2010) found here - http://silvis.forest.wisc.edu/data/wui-change/.

[71] SILVIS Lab have not yet released a new WUI (their methodology is based on Census data) so PG&E is still using the same version of WUI that was used previously.

data layer provided by the University of Wisconsin-Madison SILVIS Lab, available here: http://silvis.forest.wisc.edu/data/wui-change/, which shows the WUI areas within California as of 2010, and the PG&E GIS data layer.

5. *Urban, rural and highly rural – Detail the steps for calculating the number of customers and circuit miles in utility territory that are in highly rural, rural, and urban regions for each year. Use the following definitions for classifying an area highly rural/rural/urban (also referenced in glossary):*

- Highly rural – In accordance with 38 CFR 17.701, "highly rural" shall be defined as those areas with a population of less than 7 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.

- Rural – In accordance with GO 165, "rural" shall be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.

- Urban – In accordance with GO 165, "urban" shall be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.

Population density numbers are calculated using the American Community Survey (ACS) 1-year estimates on population density by census tract for each corresponding year (2016 ACS 1-year estimate for 2016 metrics, 2017 ACS 1-year estimate for 2017 metrics, etc.). For years with no ACS 1--year estimate available, we use the 1--year estimate immediately before the missing year.

PG&E calculates the number of customers in utility service area that are in highly rural, rural and urban regions each year by using population density by census tract, based on population totals in the ACS – 2019.[72] The population per square mile will be calculated for each census tract to define tracts as urban, rural, or highly rural, in accordance with the population density definitions. The number of customers that fall within these regions will be calculated by providing a geospatial overlay of transformer locations as a proxy for the customer locations and summing up the number of service points associated with each transformer to obtain total customer count with the urban/rural/highly rural census tracts and then calculating the total number of meters within each urban, rural, or highly rural region type.

The sources of data used in the calculation of this information include Topologically Integrated Geographic Encoding and Referencing (TIGER)/Line with Selected Demographic and Economic Data – 2018, ACS – 2019, PG&E GIS data layers.

[72] 2020 census still not officially released so PG&E is still using the 2019 estimated.

Please refer to Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.2Atch02 for a GIS layer showing the distribution of urban/rural/highly rural customers.

4.6 Progress Reporting on Key Areas of Improvement

Report progress on all key areas of improvement identified in Section 1.3 of the utility's 2021 Action Statement. Provide a summary table of the actions taken to address these key areas and report on progress made over the year. Summarize the progress in a table using a high-level bullet point list of key actions, strategies, schedule, timeline for completion, quantifiable performance-metrics, measurable targets, etc. The table must also include a cross-referenced link to a more detailed narrative and substantiation of progress in an appendix. The summary table must follow the format illustrated in Table 4.6-1.

ILLUSTRATIVE TABLE 4.6-1:
PROGRESS ON KEY AREAS OF IMPROVEMENT AND REMEDIES, 2021

Utility-#	Issue Title	Summary of Progress
e.g., Southern California Edison Company (SCE) 21-01	e.g., Risk Spend Efficiency (RSE) estimates not provided for all Public Safety Power Shutoff (PSPS)-related mitigation initiatives	Brief Narrative • Highlight 1 • Highlight 2 • Highlight 3 • Highlight # Refer to Appendix Section XXX for further detail

In the Final Action Statement issued by the Office of Energy Infrastructure Safety (Energy Safety or OEIS) on September 22, 2021, Energy Safety identified 29 remedies (Remedies) that we were required to address in a Progress Report submitted on November 1, 2021 (Progress Report). In addition, the Final Action Statement included Additional Issues and Remedies (Additional Issues) that were to be addressed in the 2022 Wildfire Mitigation Plan (WMP).

In this section of the WMP, as directed by Energy Safety, we are including tables that provide summaries of updates on the Remedies and Additional Issues:

- Table PG&E-4.6-1 below provides a summary update on the Remedies.
- Table PG&E-4.6-2 below provides a summary update on the Additional Issues.

We are providing more detailed information on the Remedies and Additional Issues, as necessary, in Attachments
2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 and
2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

Finally, please note that Tables PG&E-4.6-1 and PG&E-4.6-2, and the associated attachment, describe activities that we currently intend to undertake in 2022. However, these activities are not Initiative Targets and will not be included in our quarterly reporting or in the Annual Report on Compliance.

TABLE PG&E-4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-01	*Unclear inclusion of future climate data into planning*	*PG&E must explain how it incorporates components of its climate resilience team's report into its own risk assessment.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding how climate projections were used in the development of our HFRA maps. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-02	*Lack of consistency in approach to wildfire risk modeling across utilities.*	*The utilities must collaborate through a working group facilitated by Energy Safety to develop a more consistent statewide approach to wildfire risk modeling. After Energy Safety completes its evaluation of all the utilities' 2021 Wildfire Mitigation Plan (WMP) Updates, it will provide additional detail on the specifics of this working group.* *A working group to address wildfire risk modeling will allow for –* *1) Collaboration among the utilities;* *2) Stakeholder and academic expert input; and* *3) Increased transparency.*	Key Activities Completed to Address Issue – The initial activities of the risk modeling working group, through October 29, 2021, were described in the Progress Report. Since that time, the risk modeling working group has continued to meet to address risk modeling issues. Key Activities Planned to Address Issue – Continue participation in the Energy Safety risk modeling working group in 2022. Target Completion Date – Ongoing progress. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-03	*Inadequate speed of improvements made to risk modeling.*	*1) Demonstrate that it is applying automation as quickly as possible, explaining any constraints on progress; and* *2) Supply its workplan to enhance its modeling efforts.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding risk modeling automation. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-04	*PG&E does not adequately justify the wind speed inputs it uses in its Probability of Ignition models.*	*1) Demonstrate that it appropriately accounts for wind speed in its Probability of Ignition models' input data sets. This shall be handled both within the Working Group set up in PG&E-21-02, as well as an individualized report; and* *2) Address discrepancies between its input data sets and those of peer utilities.*	Key Activities Completed to Address Issue – The 2022 WDRM v3 risk model incorporated wind data with the data characterizing each failure. Key Activities Planned to Address Issue – Participation in the Energy Safety risk modeling working group to align the utilities and stakeholders on the use of wind speed data in predictive models. Target Completion Date – Ongoing progress. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-05	*Lack of PSPS consequence model at a circuit segment level.*	*1) A detailed update on the functionality of its PSPS consequence model at a circuit segment level, and* *2) Quantitative targets for any remaining work or future developments.*	Key Activities Completed to Address Issue – This remedy will be completed with the information that PG&E previously provided in the Progress Report and is providing in the 2022 WMP. Key Activities Planned to Address Issue – Activities concerning the PSPS Consequence Model are described in Section 4.5.1 and Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Target Completion Date – Completed on February 25, 2022 with the 2022 WMP submission. Targets/Goals if Applicable – The goals for PG&E's PSPS Consequence Model are described in Section 4.5.1(i). Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-06	*Insufficient transparency for modifications to Wildfire Risk Models and circuit segment prioritization.*	*1) Provide an update on progress made on each of the third-party's recommendations;* *2) Provide any and all updates to the explanation and timeline for how and when it intends to address the recommendations;* *3) Provide an Excel spreadsheet detailing what changes have been made to its 2021 risk models since the submission of its 2021 WMP Update; and* *4) Provide a description of any changes it has made to its circuit segment the prioritization as a result of changes to its risk model since the submission of its 2021 WMP Update.*	Key Activities Completed to Address Issue – This remedy will be completed with the information that PG&E previously provided in the Progress Report and is providing in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Key Activities Planned to Address Issue – A description of PG&E's response to the third-party recommendations is included in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Activities concerning the WDRM are described in Section 4.5.1. Target Completion Date – Completed on February 25, 2022 with the 2022 WMP submission. Targets/Goals if Applicable – PG&E's risk modeling improvements in response to the third-party evaluation are described in Section 4.5.1(b). Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-07	*PG&E's DFA and EFD technology pilot outcome is lacking justification for the scope of installment.*	*1) Provide details and performance metrics on the outcome of the 2020 Distribution Fault Anticipation (DFA) and Early Fault Detection (EFD) technology pilot program; and* *2) Explain how the determination was made to increase deployments of DFA/EFD technology across High Fire Threat District (HFTD) areas.*	Key Activities Completed to Address Issue – This remedy was addressed in the Progress Report with a description explaining the deployment of DFA and EFD technology. Key Activities Planned to Address Issue – in 2022, PG&E currently plans to Install EFD technology on two circuits and DFA technology in approximately 40 circuits, and to complete strategic assessment for ongoing deployment by December 31, 2022. Target Completion Date – 12/31/2022 Target/Goals if Applicable – Installation of EFD and DFA technology. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-08	*Weather station program target not met.*	*1) Provide details on why PG&E did not meet the targeted 400 weather station installs in 2020; and*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding missed weather station targets. Key Activities Planned to Address Issue – Not applicable.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		2) Explain why weather station installation totals in the original 2021 WMP Update differ from the revised 2021 WMP Update.	Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-09	*Limited evidence to support the effectiveness of covered conductor.*	*The utilities must coordinate to develop a consistent approach to evaluating the LT risk reduction and cost-effectiveness of covered conductor deployment, including –* *1) The effectiveness of covered conductor in the field in comparison to alternative initiatives; and* *2) How covered conductor installation compares to other initiatives in its potential to reduce PSPS risk.*	Key Activities Completed to Address Issue – The activities through November 1, 2021 of the utilities' covered conductor working group were described in the Progress Report. Since that time the utilities have made progress collectively and individually on each of the following sub-workstreams, summarized in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 of this WMP: • Benchmarking • Testing / Studies • Estimated Effectiveness • Additional Recorded Effectiveness • Alternative comparison • Potential to Reduce PSPS risk • Cost Key Activities Planned to Address Issue – The covered conductor working group is continuing to meet to develop a methodology and approach for determining the risk reduction and cost-effectiveness of covered conductor. Target Completion Date – Meetings of the working group are ongoing and no specific date has been set yet for a final report from the working group. Targets/Goals if Applicable – Develop as much as possible a consistent approach among the utilities to evaluate the long-term risk reduction and cost-effectiveness of covered conductor. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01, 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-09_Atch01, and 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-09_Atch02

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-10	*Insufficient pace of expulsion fuse replacement plan.*	*1) Demonstrate that it is replacing expulsion fuses with fuses that reduce wildfire risk at a speed that adequately addresses risk;* *2) Explain any current limits or constraints on the scope of PG&E's expulsion fuse replacement program; and* *3) Increase the pace of its expulsion fuse replacement program, provided reasonable constraints do not limit such expansion.*	Key Activities Completed to Address Issue – This remedy will be completed with the information that PG&E previously provided in the Progress Report and is providing in the 2022 WMP regarding expulsion fuse replacements. Key Activities Planned to Address Issue – Activities regarding the pace of expulsion fuse replacement are described in Section 7.3.3.7. Target Completion Date – Completed on February 25, 2022 with the 2022 WMP submission. Targets/Goals if Applicable – The expulsion fuse replacement targets are described in Section 7.3.3.7. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-11	*Insufficient detail regarding installation of expulsion fuses in HFTD areas.*	*1) Explain the circumstances under which it installed non-exempt expulsion fuses in HFTD areas; and* *2) Clarify if any of the new expulsion fuses it is installing in the HFTD in 2021 and beyond are nonexempt fuses.*	Key Activities Completed to Address Issue – There were 69 installations of non-exempt fuses in HFTD in 2021 due to situations that relate to emergency conditions and protection coordination. Key Activities Planned to Address Issue – A non-exempt fuse would only be installed in the situations as outlined in the Progress Report. In these locations, PG&E adheres to California Public Resources Code Section 4292 to clear vegetation on all non-exempt poles. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not Applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-12	*Failure to adequately track copper conductor replacements and insufficient detail regarding targeting replacements*	*1) Develop a workplan to target and track Copper (CU) reconductoring projects; and* *2) Demonstrate that it is targeting its CU reconductoring projects to its highest risk circuits, including justification for any projects outside of the HFTD.*	Key Activities Completed to Address Issue – This remedy will be completed with the information that PG&E previously provided in the Progress Report and is providing in the 2022 WMP regarding CU reconductoring. Key Activities Planned to Address Issue – PG&E described our Non-HFTD Replacement Program and System Hardening Program in the Progress Report, including the ongoing activities associated with these programs. Target Completion Date – Completed on February 25, 2022 with the 2022 WMP submission.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
	to highest risk areas.		Targets/Goals if Applicable – Not Applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-13	*Failure to demonstrate that system hardening plan targets highest risk circuit segments.*	*PG&E must fully demonstrate that its system hardening mitigation efforts efficiently target reducing wildfire risk and PSPS events, including a description of how PG&E determines the order in which circuit segments are scheduled for mitigation.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding system hardening mitigation efforts. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-14	*Inadequate transparency of system hardening plan.*	*1) Provide its short-term system hardening plans, including the following details for each planned project (via comprehensive list and Geographic Information System (GIS) files) –* *a) Location;* *b) Initiative type (covered conductor, undergrounding, line removal, etc.);* *c) Status of the project (scoping, design permitting, etc.);* *d) Relevant CPZs (Circuit Protection Zones);* *e) Planned length; and* *f) Risk-type identified for prioritization of the project (top 20 percent of risk buydown curve, fire rebuild, PSPS mitigation, public safety specialist identified, or non-risk related).* *2) Provide its LT system hardening plan regarding –*	Key Activities Completed to Address Issue – See updated 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-14_Atch01 for activities since the Progress Report submission. Key Activities Planned to Address Issue – See Section 7.3.3.17.1, Questions 4 and 5 responses for system hardening; Section 7.3.3.16, Questions 4 and 5 responses for undergrounding. Target Completion Date – Ongoing Targets/Goals if Applicable – See Section 7.3.3.17.1, Questions 4 and 5 responses for system hardening; Section 7.3.3.16, Questions 4 and 5 responses for undergrounding. Attachments – See Attachments 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 and 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Remedy 21-14_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		a) Estimated rate of system hardening per year; and *b) If/how PG&E plans to increase its resources to allow for an accelerated pace of system hardening.* *3) Explain how, if at all, PG&E's recently announced undergrounding plan –* *a) Changes its decision-making framework for initiative selection for individual circuit segments; and* *b) May cause delays deferrals, and/or cancellation of research and/or deployment of advanced technology mitigations.* *4) Provide an update on its completed system hardening efforts through November 1, 2021.* *5) Additionally, if PG&E is moving forward with its stated intention to underground 10,000 miles of power lines, PG&E must provide detail in its 2022 WMP Update on the decision to underground and plans for such undergrounding.*	
PG&E-21-15	*Insufficient detail regarding covered conductor maintenance.*	*1) Provide its procedures for determining when covered conductor maintenance is required, including any thresholds and aspects analyzed during inspections; and* *2) Explain why PG&E's cost projections decrease from 2021 to 2022 despite line mile projections remain the same.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding our maintenance of covered conductor. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-16	*Insufficient evidence of effective covered conductor maintenance program.*	*PG&E must provide all supporting material to demonstrate that its maintenance programs effectively maintain its covered conductor, including the following information –* *1) Pace and quantity of scheduled maintenance; and* *2) Pace and quantity of inspections.* *If PG&E finds that its existing maintenance programs do not provide effective maintenance for covered conductor, PG&E must –* *1) Enhance its current operations to provide such maintenance;* *2) Detail the enhancements to its existing programs; and* *3) Provide all supporting material for the enhancements to its existing program, including the information listed above.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding our maintenance of covered conductor. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-17	*Insufficient evidence of Quality Assurance/ Quality Control (QC) for work performed by contractors.*	*1) Demonstrate that it is tracking the quality of work of contractors performing asset management and inspection work.* *2) Describe how it is addressing underperforming asset management and inspection contractors; and* *3) Describe how it is expanding QC of work performed by asset management and inspection vendors, including additional QCs for those with a history of flawed work.*	Key Activities Completed to Address Issue – Since the Progress Report, no material changes have occurred, and plan implementation continues. The QC team established and successfully implemented its Desktop QC Review program. This program currently applies to Overhead Distribution and Transmission Ground inspection methods. Discrepancies identified during the Desktop review are compiled by the QC Analytics team and dashboards are created and shared weekly with the System Inspection Execution leadership team to track and monitor the quality of contract vendors and their inspectors. Key Activities Planned to Address Issue – Since the Progress Report, no material changes have occurred, and the plan continues to be implemented as described in more detail in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Target Completion Date – Ongoing.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
			Targets/Goals if Applicable – Not applicable Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-18	*Minimally planned maturity of Vegetation Management (VM) Program*	*1) Reach a maturity of at least 1 for capabilities 24 "Vegetation grow-in mitigation" and 25 "Vegetation fall-in mitigation" by the end of 2023;* *2) Clearly define goals and targets to reach each level of maturity for capabilities 21-26;* *3) Include a timeline for completion of the goals and targets from (1); and* *4) Provide a LT vision for each VM initiative in Subsection 5 "Future improvements to the initiative" (or similar) including any relevant timelines.*	Key Activities Completed to Address Issue – Maturity scores for each capability have been updated in the 2022 WMP Survey. In addition, please see Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 for a description and updates (where applicable) to goals and targets for each capability. Key Activities Planned to Address Issue – Please see updates below and refer to the 2022 Utility Survey update. Target Completion Date – Please see updates In Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 and refer to the 2022 Utility Survey update. Targets/Goals if Applicable – Please see updates in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 and refer to the 2022 Utility Survey update. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-19	*Delays in achieving mutually agreeable environmental mitigation.*	*PG&E must show progress on achieving environmental and community impact mitigation agreements with agencies, local governments, and tribal governments. PG&E must consider the development of Operations and Maintenance Plans and Memorandums of Understandings with relevant federal, state, and local land managing agencies to facilitate agreed-upon review times of permits and/or VM activities. PG&E must document the outcomes of these efforts and any lessons learned.*	Key Activities Completed to Address Issue – PG&E has added two additional programmatic permits for Undergrounding Habitat Conservation Plan (HCP) and Tribal Lands as In Progress programmatic permits. Please see updates Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Key Activities Planned to Address Issue – PG&E continues to make progress on establishing programmatic permits and agreements. Target Completion Date – Ongoing progress. Targets/Goals if Applicable – Not Applicable Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
PG&E-21-20	*Non-inclusion of fire damage attributes in hazard tree assessments.*	*PG&E must –* *1) Clarify what tool or standard PG&E and its contractors use in post-wildfire response circumstances for hazard tree assessments;* *2) If such a tool or standard does not already include post-fire specific factors (e.g., crown, bole, and root scorch, char, duff consumption). PG&E must include these factors in such tool or standard;* *3) If such a tool or standard does not exist, PG&E shall develop one to use in post-wildfire response circumstances;* *4) Provide the training to its staff and contractors in post-fire tree assessments;* *5) Use such a tool during PG&E's Phase 2 "Non-Imminent Hazard Trees" post-wildfire response; and* *6) PG&E should use such a tool during Phase 1 "Imminent Threat Inspection" as feasible.*	Key Activities Completed to Address Issue – Key activities include the release of the final version of the VM Wildfire Inspection Guidelines. Key Activities Planned to Address Issue – Please see Section 7.3.5.21 of the 2022 WMP for activities. Target Completion Date – Ongoing. Targets/Goals if Applicable – Please see Section 7.3.5.21. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-21	*Unknown environmental impact of fire retardant used on a planned basis.*	*1) Its review of fire-retardant that includes the following – product toxicological and environmental analysis; efficacy analysis; environmental planning and permitting assessment; and the scope of use;* *2) A report on the objectives and execution of its Preventative Fire Retardant Program (PFRP) in 2021 and its PFRP plan for 2022;* *3) Quarterly reports regarding the deployment of fire-retardant to the Compliance Division of Office of Energy*	Key Activities Completed to Address Issue – PG&E completed our initial bench scale testing of fire retardants and trial of preventative applications in the field. The objective of the 2021 Preventative Fire Retardant Program was two-fold: 1. Attempt to apply retardant to high risk circuits to mitigate ignition risk during the peak of the wildfire season. 2. To establish and test the end-to-end process for preventative fire retardant applications at scale and determine the viability of continued preventative fire retardant applications at scale in 2022. At the conclusion of the 2021 pilot, PG&E determined that additional environmental testing of retardants in outdoor conditions is necessary

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		Infrastructure Safety (OEIS) per California Public Utilities Commission (CPUC)-approved Compliance Operational Protocols. These reports must include where and when the retardant was used, how much retardant was used, and the specific fire-retardant that was used; and *4) An RSE value its PFRP.*	during the 2022 wildfire season in order to determine whether it is appropriate to conduct preventative fire retardant applications at scale in subsequent years. In addition, PG&E has identified the Enhanced Powerline Safety Settings Program as being more effective than preventative fire retardant applications in reducing ignition potential during the wildfire season and as such will be looking to rely on that program for mitigation ignition risk in the HFTDs. Key Activities Planned to Address Issue – In 2022, additional environmental testing will be conducted to build on the 2021 Bench Scale testing. The testing is described in more detail in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Target Completion Date(s) – • Efficacy/Durability Testing – June 30, 2022 • Ecological and Human Health Risk Assessments – December 31, 2022 • Dissipation Studies – December 31, 2022 Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-22	*Incomplete identification of vegetation species and record keeping.*	*1) Use scientific names in its reporting (as opposed to common names). This change will be reflected in the upcoming updates to Energy Safety GIS Reporting Standard;* *2) Add genus and species designation input capabilities into its systems which track vegetation (e.g., vegetation inventory system and vegetation-caused outage reports);* *3) Identify the genus and species of a tree that has caused an outage or ignition in the Quarterly Data Reports (QDR) (in these cases, an unknown "sp." designation is not acceptable);*	Key Activities Completed to Address Issue – Translation of data in quarterly spatial data delivery will be made in the Q4 data delivery. System enhancements and communication will be developed as part of scheduled enhancements in 2022. Key Activities Planned to Address Issue – Ongoing. Please see below for further details. System enhancements and communication will be developed as part of scheduled enhancements in 2022. Target Completion Date – Ongoing. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		4) If the tree's species designation is unknown (i.e., if the inspector knows the tree as "Quercus" but is unsure whether the tree is, for example, Quercus kelloggii, Quercus lobata, or Quercus agrifolia), it must be recorded as such. Instead of simply "Quercus," use "Quercus sp." If referencing multiple species within a genus use "spp." (e.g., Quercus spp.); *5) Teach tree species identification skills in its VM personnel training programs, both in initial and continuing education; and* *6) Encourage all VM personnel identify trees to species in all VM activities and reporting, where possible.*	
PG&E-21-23	*Inadequate joint plan to study the effectiveness of enhanced clearances*	*PG&E, SCE, and San Diego Gas & Electric Company will participate in a multi-year vegetation clearance study. Energy Safety will confirm the details of this study in due course. The objectives of this study are to –* *1) Establish uniform data collection standards;* *2) Create a cross-utility database of tree-caused risk events (i.e., outages and ignitions caused by vegetation contact);* *3) Incorporate biotic and abiotic factors into the determination of outage and ignition risk caused by vegetation contact; and* *4) Assess the effectiveness of enhanced clearances.* *In preparation for this study and the eventual analysis, PG&E must collect the relevant data; the required data are currently defined*	Key Activities Completed to Address Issue – The activities through November 1, 2021 of the utilities' enhanced clearance working group were described in the Progress Report. Since that time, the most recent meetings have focused on each IOU demonstrating our current analysis around the effectiveness of enhanced clearances. Initial analysis focus on outage/interruption events as these are precursors to ignition events. Ignition data does not have a sufficient population sample size to evaluate at this time. These initial analyses are, summarized in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01 of this WMP. Key Activities Planned to Address Issue – Key activities and plans for this joint working group are described in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01. Target Completion Date – Ongoing. Targets/Goals if Applicable – Not applicable Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		by Energy Safety GIS (GIS Data Reporting Standard for California Electrical Corporations – V2). Table 2 in Section 5.5 of this Action Statement outlines the feature classes which Energy Safety believes will be most relevant to the study. Energy Safety will also be updating the GIS Reporting Standards in 2021, which may include additional data attributes for vegetation-related risk events.	
PG&E-21-24	*Need for quantified VM compliance targets.*	*PG&E must define quantitative targets for all VM initiatives. If quantitative targets are not applicable to an initiative, PG&E must fully justify this, define goals within that initiative, and include a timeline in which it expects to achieve those goals.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding VM targets. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-25	*Lack of specificity regarding how increased grid hardening will change system operations, change PSPS thresholds, and reduce PSPS events.*	*For each mitigation alternative, including pilot program initiatives, PG&E must provide quantitative analysis on –* *1) Changes in system operations;* *2) Changes in PSPS thresholds; and* *3) Estimated changes in the frequency, duration, and number of customers impacted by PSPS events.*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding mitigation alternatives. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-26	*Inadequate discussion on impact of RSEs in initiative selection.*	*PG&E must provide an overview of its decision-making framework to include a clear explanation of how RSE estimates impact decision making for initiative selection. The overview must show the rankings of the relative decision-making factors (e.g., planning and execution lead times,*	Key Activities Completed to Address Issue – This remedy was completed with the information that PG&E provided in the Progress Report regarding RSE impacts. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on November 1, 2021.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		resource constraints, etc.) and pinpoint where quantifiable risk reductions and RSE estimates are considered in the initiative selection process. Energy Safety recommends a cascading, dynamic "if-then" style flowchart to effectively demonstrate this prioritization process and satisfy this requirement.	Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
PG&E-21-27	*Lack of methodology to verify RSE estimates.*	*PG&E must provide a detailed RSE verification plan with attainable benchmarks and timeline.*	Key Activities Completed to Address Issue – PG&E has continued to refine our RSE analysis and is actively participating in the joint utility working group facilitated by Energy Safety. Key Activities Planned to Address Issue – Participation in utility working group and feedback from third-party technical advising group. Target Completion Date – Ongoing. Targets/Goals if Applicable – Feedback from third-party technical advising group retained to assist with RSEs and joint utility working group in 2022. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.
PG&E-21-28	*RSE values vary across utilities.*	*The utilities must collaborate through a working group facilitated by Energy Safety to develop a more standardized approach to the inputs and assumptions used for RSE calculations. After Energy Safety completes its evaluation of the 2021 WMP Updates, it will provide additional detail on the specifics of this working group.* *This working group will focus on addressing the inconsistencies between the utilities' inputs and assumptions, used for their RSE calculations, which will allow for –* *1 Collaboration among utilities;* *2) Stakeholder and academic expert input; and*	Key Activities Completed to Address Issue – The RSE working group facilitated by Energy Safety was initiated after the Progress Report. The utilities have prepared a joint update regarding the working group. Key Activities Planned to Address Issue – The RSE working group will continue to review and evaluate the RSE methodologies used by the utilities to address inconsistencies where appropriate and provide for further alignment among the utilities. Target Completion Date – Ongoing progress. Targets/Goals if Applicable – Address inconsistencies between utility RSE inputs, assumptions, and calculations, where applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch01.

TABLE PG&E 4.6-1:
PROGRESS ON TWENTY-NINE REMEDIES
(CONTINUED)

Utility-#	Issue title	Remedy	Summary of Progress
		3) Increased transparency.	
PG&E-21-29	*PSPS targets and projections set to expire*	*As soon as practicable, and no later than September 30, 2021, PG&E must submit a Change Order Report –* *1) Describing in full and complete detail its updated PSPS protocols.* *2) Showing how its updated PSPS protocols affect PSPS projections (Table 11).* *3) Showing how its updated PSPS protocols affect all quantitative and qualitative target for reducing the scale, scope, and frequency of PSPS.* *4) Meeting all requirements for a Change Order Report set out in Section 7 of this Action Statement.*	Key Activities Completed to Address Issue – This remedy was completed with the submission of the Change Order on September 30, 2021. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Completed on September 30, 2021. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.

TABLE PG&E-4.6-2:
PROGRESS ON ADDITIONAL ISSUES

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
4.1.A	*Provide section and page numbers*	*Provide section and page number(s) in [Table 2-1]*	Key Activities Completed to Address Issue – PG&E is providing section and page numbers in Table 2-1 of our 2022 WMP. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – February 25, 2022. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
4.1.B	*Table of prioritized list of wildfire risks and drivers*	*Provide a table with a prioritized list of wildfire risks and drivers and the rationale for prioritization.*	Key Activities Completed to Address Issue – Please refer to Table PG&E-4.2-2 in Section 4.2 to find a prioritized list of wildfire risks and drivers. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02
4.2.A	*Use Energy Safety Classification Scheme for financials*	*PG&E must report all wildfire mitigation-related activity spend in its 2022 and subsequent WMP updates, using the Energy Safety classification scheme required in the upcoming 2022 WMP Update Guidelines. PG&E must provide accurate spend information for its 2022 WMP Update upon initial submission. Any follow-up corrections must be fully explained and justified, with all calculations and underlying data reported to Energy Safety.*	Key Activities Completed to Address Issue – PG&E has reviewed the Energy Safety classification scheme and will be utilizing the templates for the 2022 WMP and subsequent WMP submissions. Key Activities Planned to Address Issue – Please note that PG&E has created sub-initiatives to appropriately describe PG&E's full list of mitigations that are addressing wildfire risk. Target Completion Date – February 25, 2022. Targets/Goals if Applicable – Not Applicable. Attachments – Not applicable.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
4.4.A	*Methodology for long-term planning*	*PG&E must develop a robust methodology for planning out 10 years (or longer) within its WMP to reduce long-term risk and buy down the costs of mitigation efforts.*	Key Activities Completed to Address Issue – As a part of our long-term planning effort, we have: (1) Identified undergrounding as the key solution to reduce long-term wildfire risk and stood up undergrounding Project Management Office Key Activities Planned to Address Issue – (1) Build a tool to centralize the necessary information, automate the current manual processes and enable advanced analysis for the identification of undergrounding locations (2) Coordinate other identified program work on the circuits that are currently in scope for undergrounding, including assessing and addressing current and future needs on a given circuit or segment (3) Develop Short and Long Term plans to achieve objectives while balancing various decision criteria Target Completion Date – December 31, 2022 Targets/Goals if Applicable – See "Key Activities Planned to Address Issue." Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.1.A	*Remedy (#1) – Separate HFRA costs from non-HFTD in Table 12* *Remedy (#2) – Provide process outlining inclusion of additional areas in CPUC-defined HFTD*	*Remedy (#1) – PG&E must separate HFRA from its non-HFTD costs, presented in the format of WMP Table 12.* *Remedy (#2) – If PG&E believes there are areas in its service territory that are not currently included in the HFTD but should be prioritized for mitigation efforts, PG&E shall provide a process outlining the formal steps necessary to have those areas considered for recognition in the CPUC-defined HFTD.*	*Remedy (#1) –* Key Activities Completed to Address Issue – PG&E will include the HFRA data in our financial information in Table 12 to show the breakout of what is HFRA vs HFTD vs Non HFTD. Key Activities Planned to Address Issue – Not applicable. Target Completion Date – February 25, 2022. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable. *Remedy (#2) –* Key Activities Completed to Address Issue – This issue is addressed in Section 4.2.1. Key Activities Planned to Address Issue – See Section 4.2.1. Target Completion Date – February 25, 2022. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.1.B	*Remedy (#1) –* *Explanation of automation for risk modeling relative to peers* *Remedy (#2) – Workplan for enhancing automation of risk modeling*	*Remedy (#1) – PG&E must explain why it does not have the same level of automation for risk modeling as its peers, including an explanation of any constraints on progress; and.* *Remedy (#2) – PG&E must supply a workplan and schedule for enhancing its automation capabilities in its risk modeling.*	*Remedy (#1) –* Key Activities Completed to Address Issue – We were able to accomplish the automation of model and data through use of the Palantir Foundry platform. Key Activities Planned to Address Issue – The issue has been addressed through the use of the Palantir Foundry platform. Target Completion Date – Completed Targets/Goals if Applicable – N/A Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. *Remedy (#2) –* Key Activities Completed to Address Issue – The workplan was developed in 2021 and executed as described in Remedy (#1). Key Activities Planned to Address Issue – The issue has been addressed through the use of the Palantir Foundry platform. Target Completion Date – Completed Targets/Goals if Applicable – N/A Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.1.C	*Methodology to measure egress*	*PG&E must provide an update on its development of a methodology to accurately measure and account for egress or explain how it accounts for egress in determining which circuits segments to prioritize for mitigation.*	Key Activities Completed to Address Issue – PG&E developed a pilot egress model. Key Activities Planned to Address Issue – We continue to calibrate the egress model to different communities in the PG&E service territory and to evaluate how to integrate the egress model into our other wildfire risk models. Target Completion Date – December 21, 2022 Targets/Goals if Applicable – Integrate egress model into other wildfire risk models. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.2.A	*Benefit of Fault indicator post-events*	*PG&E must* *1) Develop a proactive plan to evaluate the benefit of installing fault indicators post-events; or* *2) Demonstrate that fault detection is sufficiently covered, including reducing time to restoration of service, by other existing initiatives.*	Key Activities Completed to Address Issue – PG&E does not leverage fault indicators for wildfire mitigation. They are installed in a reactive fashion to help reduce future outage restoration time. Key Activities Planned to Address Issue – See Section 7.3.2.2.5. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.3.A	*Remedy (#1) – Conductors in corrosion zones/HFTD* *Remedy (#2) – Aluminum conductor*	*Remedy (#1) – PG&E must explain why it is not prioritizing conductors located in overlapping corrosion zones and HFTDs* *Remedy (#2) – PG&E must specifically explain whether any higher priority is given to aluminum conductor within corrosion zones outside of HFTDs.*	*Remedy (#1) –* Key Activities Completed to Address Issue – The System Hardening Program (Maintenance Activity Type (MAT) 08W) is the system hardening program within HFTD and is informed by the 2021 Wildfire Distribution Risk Model (WDRM) v2 that takes many consequences and probability factors into account. The program prioritizes work in HFTD

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			areas. Conductor material (Aluminum (AL) and Aluminum Conductor Steel-Reinforced (ACSR)) are used as covariates in the probability of ignition model. Although corrosion is not specifically mentioned, the probability uses a coastal covariate. In cases where AL or ACSR as well as coastal indicators align with other factors in the model, they are prioritized in the model and used to inform the 08W program. In general, the criticality of the System Hardening Program is a higher priority than the Non-HFTD Replacement Program (MAT 08J) given the potential wildfire impact and consequences. Key Activities Planned to Address Issue – Not applicable Target Completion Date – Not applicable Targets/Goals if Applicable – Not applicable Attachments – Not applicable *Remedy (#2) –* Key Activities Completed to Address Issue – The Non-HFTD Replacement Program (MAT 08J) is the deteriorated conductor replacement program in non-HFTD areas. The focus of this program is replacement of conductor with elevated wires down rates, specifically small gauge Copper and ACSR material conductors as well as other factors such as past wires down, corrosion, splice count, and overstressed conductor due to available fault current as well as safety consequences. There is not a simple priority given to ACSR in corrosion zone as other factors are considered for both the probability and consequence of failure. Key Activities Planned to Address Issue – Not applicable Target Completion Date – Not applicable Targets/Goals if Applicable – Not applicable

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			Attachments – Not applicable
5.3.B	*Capacitors and SCADA-enabled controllers*	*PG&E must* *1) Provide an update on the status, scope, and timeline for its unneeded capacitor program analysis,* *2) Provide an estimated number of capacitor removals based on its analysis, if available,* *3) Provide an update on the status, scope, and timeline for adding SCADA-enabled controllers to capacitors,* *4) Provide an update on the status, scope, and timeline for removing or using switches on fixed bank capacitors, and* *5) Explain how adding SCADA-enabled controllers to capacitors and removing or using switches on fixed bank capacitors will reduce ignition risk.*	Key Activities Completed to Address Issue – PG&E conducts annual inspections of capacitor banks and repairs or removes equipment as needed. Key Activities Planned to Address Issue – PG&E's inspection of capacitor banks, removal of obsolete equipment, and approach to SCADA enabled devices is addressed in more detail in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.4.A	*Equipment failure analysis, findings, and corrective actions*	*PG&E must* *1) Provide any findings and associated corrective actions as a result of its failure analysis program development,* *2) Provide an update on any findings relating to equipment failure rates in comparison to other utilities, including explanations on modifications made to PG&E's asset inspections and maintenance programs as a result of such findings, and* *3) Explain why projected ignition rates based on equipment failure or damage remains flat for some equipment types.*	Key Activities Completed to Address Issue – PG&E has been investigating equipment failures and ignitions. Key Activities Planned to Address Issue – We continue to investigate ignitions related to equipment failure and benchmark with other utilities. Target Completion Date – Not applicable. Targets/Goals if Applicable – PG&E is undertaking a multi-year effort to investigate higher risk ignition areas associated with equipment components. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.4.B	*Corrective Notifications*	*PG&E must* *1) Provide statistics (such as asset type, asset age, potential ignition risk, etc.) on the types of corrective notifications created as part of its distribution and transmission inspections, including 2020 and 2021 notifications, and track such statistics moving forward,* *2) Provide details on the types of corrective notifications that the enhanced inspections generate that previous inspection practices would have overlooked,* *3) Explain how PG&E has adjusted its inspection and maintenance practices as a result of the additional corrective notifications,* *4) Discuss how PG&E assesses trends in issues identified by corrective notifications, any trends it has recognized, and the associated actions it has taken in relation to these trends, and* *5) Discuss PG&E's predictions for future corrective notification trends, including whether PG&E expects a decrease in corrective notifications in the future.*	Key Activities Completed to Address Issue – PG&E is continuing to conduct enhanced inspections of our facilities and is using the findings from these inspections to prioritize repair work and also observe trends from the data collected. Key Activities Planned to Address Issue – Key activities are described in detail in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. Target Completion Date – Ongoing. Targets/Goals if Applicable – Not applicable. This is an ongoing program and targets/goals are established as the results from inspections become available. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.4.C	*Pilot use of drones or aerial inspections*	*PG&E must either –* *1) Pilot use of drones or other aerial inspections as part of its inspections of its distribution assets and include a cost-benefit analysis in its evaluation of the success of the pilot program, or* *2) Explain why its current detailed inspections of its distribution assets are adequate without the enhancement of aerial inspections, including a cost-benefit comparison of PG&E's existing program of using aerial inspections to enhance distribution patrols to detailed inspections, including findings per mile.*	Key Activities Completed to Address Issue – A helicopter pilot was conducted in Q4 2020 of pre-selected Tier 3 structures where inspections were limited to images of the top two-thirds of the structure. A drone pilot was launched in Q4 2021 based on a PSPS event. Key Activities Planned to Address Issue – An expanded Distribution aerial pilot will take place in 2022 to define the initial Distribution Aerial Inspections program to launch in 2023. The scope of the expanded pilot will include a cost/benefit analysis, an implementation plan, and address findings from previous pilots. Target Completion Date – 2022 to define initial Distribution Aerial Inspections Program. Targets/Goals if Applicable – Develop Distribution Aerial Inspections program to launch in 2023. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.4.D	*Asset information discrepancy between Maturity Model and WMP narrative*	*PG&E must –* *a) Explain the discrepancy of asset information updates between its Maturity Model assessment and the text within the WMP, and* *b) Develop a plan to increase the frequency in which condition assessments are updated in its equipment inventory database before the start of 2023 or explain why it is not possible for PG&E to do so.*	Key Activities Completed to Address Issue – In Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02, we explain why there was not a discrepancy between the 2021 WMP Survey and statements in the 2021 WMP. Key Activities Planned to Address Issue – No additional activities are required for this issue. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.5.A	*Remedy (#1) – Expanded substation clearances* *Remedy (#2) – Increase substation clearances justification*	*Remedy (#1) – Additional fuel risks identified on PG&E Substation parcels that exist outside of recommended defensible space zones and/or may impede emergency access to energized equipment. Scope of additional hardening includes removal and management of flash fuels, brush, felling of hazard trees and removal of flammable debris to the parcel boundary.* *Remedy (#2) – On larger PG&E owned Substation parcels, the recommended Defensible Space zones may fall short of the property boundary. In a continued effort to reduce risk of rapid spread and improve access without impediment, fuel reduction beyond the recommended Defensible Space boundaries is warranted.*	*Remedies (#1) and (#2) –* Key Activities Completed to Address Issue – We executed fuel reduction or fuel break operations scope review on PG&E Substation parcels through 2021 inspection aside from routine maintenance activities and outside of recommended Defensible Space zones. Assessment and prescription of work meets or exceeds criteria of the "Reduced Fuel Zone" as defined by the Defensible Space recommendation. Key Activities Planned to Address Issue – 2022 planned inspections include an assessment of the whole Substation parcel for fuel risks in addition to the recommended Defensible Space zones. Prescribed work outside of the recommended Defensible Space zones but on PG&E Substation property will be planned and conducted separately from routine Defensible Space maintenance activities and meets or exceeds "Reduced Fuel Zone" criteria. Target Completion Date – December 31, 2022. Targets/Goals if Applicable – Planned inspections to include an assessment of the whole Substation parcel for fuel risks in addition to the recommended Defensible Space zones and to perform work to address identified risks. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.5.B	*Remedy (#1) – Carry-over trees reduction* *Remedy (#2) – Carry-over trees data table*	*Remedy (#1) – Detail PG&E's efforts to reduce the number of "carry-over" trees so repeat visits due to barriers (e.g., permitting, access) are limited and trees are trimmed in a more timely and efficient manner.* *Remedy (#2) – Provide a table that indicates the number of "carry-over" trees by region and Priority Level Finding.*	Key Activities Completed to Address Issue – In 2021, PG&E implemented contracts with performance-based payment criteria within its Routine Distribution program and has increased available tree crew resources for both routine and EVM programs by over 3,009 personnel (121 percent) since the start of the year. In addition to efforts aimed at reducing the overall volume of 'carryover' tree work at year end, PG&E maintains initiatives that target the completion of higher risk tree work, including – • Priority tree work continues to be tracked against procedural timelines i.e., next day for Priority 1 and 20 business days for Priority 2. In addition, PG&E has recently tightened operational focus around the completion of constrained Priority 2 units; and • Mid-Cycle, Tree Mortality tree work within or outside HFTD areas, respectively, is now tracked against 180 and 365-day timelines, subject to constraints. Key Activities Planned to Address Issue – See description in Key Activities Completed above. Target Completion Date – PG&E does not have a target *per se* for this issue, but instead is increasing resources and the targeting of work to address priority tree work. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.5.C	*Quality Verification (QV) audit goal for 2021 and beyond*	*PG&E must consider increasing its QV audit goal for 2021 and beyond.*	Key Activities Completed to Address Issue – PG&E believes that this issue may be based on a misunderstanding as to the Work Verification and QV programs. This is issue addressed in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. Key Activities Planned to Address Issue – PG&E continues to set audit targets for its QV program based on available resources. Target Completion Date – QV audits are ongoing. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.5.D	*Remedy (#1) – Decision tree or flowchart on communication forms* *Remedy (#2) – ProjectWise capabilities*	*Remedy (#1) – Provide a flow chart or decision tree on communication forms for customers and partner agencies for routine VM, EVM, and emergency work.* *Remedy (#2) – Explain the capabilities of ProjectWise, and whether it will be used to communicate with customers, governments, and agencies.*	*Remedy (#1) –* Key Activities Completed to Address Issue – PG&E has begun our effort to standardize and enhance customer and agency outreach. This enhanced customer outreach process uses standardized T-minus timing to contact customers and agencies during up to five key touchpoints surrounding VM work – prior to inspections, during pre-inspections, prior to tree work, during tree work, and post tree work. PG&E plans to implement the full flow of this new process to EVM and Routine programs by Q2 of 2022. PG&E will have also kicked off a new workflow to better coordinate with landowners and internal/external stakeholders on escalations and refusals. The full workflow of this process will go into effect Q2 of 2022. Key Activities Planned to Address Issue – *See* description in Key Activities Completed above. Target Completion Date – Q2 2022

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			Targets/Goals if Applicable – Development of workflows as described above. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. *Remedy (#2)* – Key Activities Completed to Address Issue – Project-Wise is a cloud-based program that allows us to share and track documents with external parties. It records the time/date stamp of all document activity, including if and when a recipient has opened a sent document. PG&E will continue to utilize Project-Wise to track external communications with our opted in counties and other government agencies. The Regional Water Quality Control Board has opted-in to receive the VM work plan look-ahead report on a monthly basis. In addition, 20 counties in our service territory have opted-in to receive both the VM work plan look-ahead and the system hardening look-ahead report. PG&E utilizes Project-Wise to send and track these reports. Key Activities Planned to Address Issue – *See* description in Key Activities Completed above. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments –Not applicable.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.5.E	*Fuel reduction near potential ignition sources*	*In Section 7.3.5.5, PG&E must discuss its plan and execution of fuel management activities that reduce the availability of fuel in proximity to potential sources of ignition, including both reduction or adjustment of live fuel (in terms of species or otherwise) and of dead fuel, including "slash" from VM activities that produce vegetation material such as branch trimmings and felled trees.*	Key Activities Completed to Address Issue – Please see Section 7.3.5.5. Key Activities Planned to Address Issue – Please see Section 7.3.5.5. Target Completion Date – Please see Section 7.3.5.5. Targets/Goals if Applicable – Not applicable. Attachments – Not applicable.
5.5.F	*VM refresher curriculum implementation*	*PG&E must report on the progress of developing and implementing its new refresher curriculum in Section 7.3.5.14 (or equivalent). This includes detailing the "issues across various scopes of work identified in the previous year"163 and the "changes to [its] VM programs or changes to safety or work.*	Key Activities Completed to Address Issue – The refresher curriculum is still in the process of being developed. Key Activities Planned to Address Issue – Additional details regarding curriculum development and project scope are provided in Section 7.3.5.14. Target Completion Date – Q2 2022 Targets/Goals if Applicable – Development of refresher curriculum. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.5.G	*Remedy (#1) – Tracking of Structured Learning Path (SLP) pass rate metrics* *Remedy (#2) – Proctored exam for SLP*	*Remedy (#1) – PG&E must begin tracking passing metrics including, but not limited to, the number of attempts taken to pass the SLP knowledge checks in order to track statistical anomalies that may indicate a problem.* *Remedy (#2) – PG&E should consider implementing its proctored exam with limited pass attempts at the conclusion of the SLP as soon as possible.*	*Remedy (#1) –* Key Activities Completed to Address Issue – PG&E will be implementing knowledge assessments. With the planned implementation of knowledge assessments for specific courses such as VEGM-0110, VEGM-0410, VEGM-0411, and VEGM-0450, it will place an enforcement of 3 attempts to pass the required PG&E training courses before the employee or contractor will have a 30-day waiting period before being allowed to retake the training course. Key Activities Planned to Address Issue – Implementation of knowledge assessment

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			Target Completion Date – The knowledge assessments will begin execution in 2022. Targets/Goals if Applicable – Not applicable Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. *Remedy (#2)* – Key Activities Completed to Address Issue – Currently, PG&E has a proctored exam for VEGM-0450 (EVM Field Assessment). Key Activities Planned to Address Issue – In addition to VEGM-0450, VEGM-0110 (Skill Assessment for PI Basics) is slated to be proctored once COVID-19 restrictions are lifted. PG&E will continue to evaluate the need for additional proctored exams throughout 2022. Target Completion Date – Q4 2022 Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.5.H	*VM personnel professional growth*	*PG&E must describe how it is promoting and ensuring the continued professional growth of its VM personnel.*	Key Activities Completed to Address Issue – PG&E has completed and implemented a 5-week tree worker training program at seven California Community colleges that will be focused on developing and supporting individuals who are looking to make a transition to the utility tree worker industry. PG&E has also completed the digitization of tree training courses. Key Activities Planned to Address Issue – PG&E continues to explore community college partnerships to focus on developing and supporting individuals who are looking to make a transition to the utility tree worker industry. Target Completion Date – Q4 2022 Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.6.A	*Fixed-wing fleet increase*	*PG&E must* *1) Explain how it is evaluating the need to increase its fixed-wing fleet, including providing a cost-benefit analysis comparing increasing its fixed-wing fleet to contracting aircraft operators for inspection work,* *2) Provide details on the intended increase for PG&E's fixed-wing fleet, including how PG&E has determined or will determine the additional number of fixed-wing crafts to purchase, and* *3) Discuss how it anticipates an increase in its fixed-wing fleet would impact helicopter inspections.*	Key Activities Completed to Address Issue – PG&E evaluated the usage of the company-owned fixed-wing fleet and determined that the existing complement of two is sufficient for WMP related activities at the current time. Key Activities Planned to Address Issue – There are no current plans to increase the company owned fixed wing aircraft fleet for WMP related activities. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.7.A	*Spatial QDR data corrections*	*PG&E must submit correct locations, complete age data, and primary keys.*	Key Activities Completed to Address Issue – PG&E has continuously improved our data quantity and quality on a quarterly basis since the implementation of the GIS Data Standard in Q3 2020. Key Activities Planned to Address Issue – PG&E's ongoing activities to improve data quantity and quality are described in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachments – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.8.A	*Equivocating language*	*PG&E must eliminate the usage of equivocating language in order to provide measurable, quantifiable, and verifiable benchmarks.*	Key Activities Completed to Address Issue – PG&E will continue to review our WMP submissions to eliminate equivocating language where applicable and to establish measurable, quantifiable, and verifiable benchmarks. Key Activities Planned to Address Issue – See description in Key Activities Completed above. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachment – Not applicable

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
5.8.B	*Use of RSE in capital allocation*	*PG&E must –* *1) Explain why it does not currently consider RSE estimates for capital resource allocation, and* *2) Provide a detailed pathway to begin the consideration of RSE estimates for capital resource allocation in its 2022 WMP Update.*	Key Activities Completed to Address Issue – PG&E is currently using RSEs for capital resource allocation decisions. Key Activities Planned to Address Issue – PG&E will continue to use RSEs as appropriate in capital resource decisions. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable. Attachment – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.9.A	*Methodology to track customer feedback and identify priorities*	*PG&E needs to develop a transparent methodology to track customer feedback, identify priorities and incorporate those into future plans.*	Key Activities Completed to Address Issue – PG&E evaluates outreach effectiveness around wildfire safety, PSPS preparedness, and PSPS performance through both qualitative and quantitative research. Qualitative research involves representative surveys of a specific population (customers, Community-Based Organizations, etc.) that may measure statistically significant progress over time. Non-survey quantitative measures include web-traffic, click-through rates of advertisements and conversion rates/actions taken by customers as a result (e.g., attendance of a webinar, updates made to contact information, or adoption of various customer programs). Key Activities Planned to Address Issue – PG&E plans to continue to evaluate outreach effectiveness around wildfire safety, PSPS preparedness, and PSPS performance through both qualitative and quantitative research similar to the research conducted in 2021. In 2022, we will continue to apply best practices and leverage lessons learned from our 2021 customer outreach experience. Going forward, we support a collaborative, data driven process to define the most effective and appropriate outreach and in language translation requirements. Target Completion Date – Ongoing.

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			Targets/Goals if Applicable – Complete the Post-Season General Population survey. Attachment – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.9.B	*Lessons learned and corrective actions through After Action Review (AAR)*	*PG&E must describe what lessons it learned through its AAR process and how the corrective action improvements were implemented following this process.*	Key Activities Completed to Address Issue – The four corrective action improvements discovered as a result of the 2020 AAR process allowed PG&E to submit the issues into the Corrective Action Program (CAP) process. The CAP process allows the submitted issues to be evaluated, assessed for risk, and resulting corrective and preventive actions, are tracked to resolution. 75 percent of the CAPs are complete as of August 2021. Key Activities Planned to Address Issue – The final CAP is in progress to be completed by March 31, 2022. Target Completion Date – March 31, 2022 Targets/Goals if Applicable – Not applicable. Attachment – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
5.9.C	*Emergency Planning and Preparedness maturity and spend decrease*	*PG&E must describe how it plans to accomplish its projected maturity in Emergency Planning and Preparedness initiatives when spend has decreased.*	Key Activities Completed to Address Issue – Emergency Planning and Preparedness initiatives spend has not decreased. See Table 12 of the QDR for Q3 2021 that shows an increase in actual and projected expenses between 2020 and 2022. Key Activities Planned to Address Issue – N/A Target Completion Date – N/A Targets/Goals if Applicable – N/A

TABLE PG&E 4.6-2:
PROGRESS ON ADDITIONAL ISSUES
(CONTINUED)

Utility-#	Issue Title (Summary)	Remedy	Summary of Progress
			Attachment – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.
6.A	*Refine PSPS projection methodology*	*PG&E must refine its PSPS projection methodology. Projections must be comparable to recorded data from past events. To the extent practicable, projections should factor the actual duration experienced from past PSPS events.*	Key Activities Completed to Address Issue – PG&E has refined our PSPS projection methodology. The updated projection methodology uses a 4-year average of simulated historical events. Key Activities Planned to Address Issue – No additional activities are planned because we have completed refining the PSPS methodology. Target Completion Date – Not applicable. Targets/Goals if Applicable – Not applicable Attachment – See Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.6_Atch02.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 5

INPUTS TO THE PLAN AND DIRECTIONAL VISION FOR WMP

5. Inputs to the Plan and Directional Vision for Wildfire Risk Exposure

5.1 Goal of the Wildfire Mitigation Plan

The goal of the Wildfire Mitigation Plans (WMP) are shared across Energy Safety and all utilities: Documented reductions in the number of ignitions caused by utility actions or equipment and minimization of the societal consequences (with specific consideration to the impact on Access and Functional Needs populations and marginalized communities) of both wildfires and the mitigations employed to reduce them, including Public Safety Power Shutoff (PSPS).

The following sub-sections report utility-specific objectives and program targets towards the WMP goal. No utility response is required for Section 5.1.

5.2 The Objectives of the Plan

Objectives are unique to the utility and reflect the 1, 3, and 10-Year projections of progress towards WMP goals. Objectives are determined by the portfolio of mitigation strategies proposed in the WMP. The objectives of the plan must, at a minimum, be consistent with the requirements of California Public Utilities Code (Pub. Util. Code) §8386(a).

Each electrical corporation shall construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment.

Describe utility WMP objectives, categorized by each of the following timeframes, highlighting changes since the prior WMP:

1. *Before the Next Annual WMP Update (by February 2023);*

2. *Within the Next 3 years (2021-2023); and*

3. *Within the Next 10 years – Long-Term Planning Beyond the 3--year Cycle.*

Our stand is that catastrophic wildfires will stop. Our over-arching objective for the 2022 WMP is to reduce the risk and consequences of wildfires associated with utility electrical equipment, thereby avoiding catastrophic wildfires across central and northern California. To achieve our 2022 WMP objective, we structured our WMP around three strategic goals as shown in Figure PG&E-5.2-1 below:

FIGURE PG&E-5.2-1:
2022 WMP GOALS

We intend to reduce wildfire potential by reducing ignitions through various programs including, but not limited to, vegetation management (VM) work, inspections and repairs of electric facilities, system hardening, and system automation.

During high-risk weather periods, Public Safety Power Shutoffs (PSPS) may be used in a targeted manner to reduce ignition risk. In the 2021 wildfire season, we also implemented Enhanced Powerline Safety Settings (EPSS), which dramatically reduced ignitions by adjusting the sensitivity of our equipment to automatically turn off power faster if the system detects a problem. PSPS and EPSS have significant safety and wildfire risk benefits and we are working to reduce the PSPS and EPSS customer impacts through the implementation of updated, data-driven PSPS protocols as well as optimizing EPSS settings to reduce outage potential and having resources available to reduce the time and impact of outages. In addition, to mitigate against PSPS impacts, we are continuing to install sectionalization devices as well as performing system hardening work and operating temporary distribution microgrids. PG&E is also targeting circuit segments that are frequently impacted by PSPS events for undergrounding. We are also continuing to expand outreach for customers that are likely to be impacted by PSPS and EPSS related outages.

Finally, we intend to improve our situational awareness by refining our models, such as weather models, continuing to install weather cameras and high definition cameras that provide data that we can both use and share with first responders and local governments, and deploying technology such as Distribution Fault Anticipation and Early Fault Detection technology.

Below, PG&E more specifically addresses how our 2022 WMP objective to stop catastrophic wildfires will be advanced and realized in the time-frames identified by Energy Safety.

(a) Before the Next Annual Update (February 2023)

Tables 5.3-1(a) and 5.3-1(b) in Section 5.3 below identify our 2022 Initiative Targets aimed at reducing the risk and consequences of wildfires associated with utility electrical equipment. These Initiative Targets address our portfolio of mitigation strategies prior to the filing of our 2023 WMP. In addition, in Section 7.3 of the 2022 WMP, we describe our efforts associated with each of the initiatives specified by Energy Safety including ongoing programs such as routine vegetation management, inspections, and operating practices that minimize the risk of wildfire ignition. While these initiatives do not have specific targets, we are undertaking a wide array of activities all of which contribute to the reduction of wildfire potential, reducing the impacts of EPSS and PSPS, and improving situational awareness.

(b) Within the Next Three Years and Within the Next 10 years – Long-Term Planning Beyond the 3-year Cycle.

Over the next 10 years, we are focused on permanent wildfire risk reduction solutions. We do this in light of the ever changing climate and wildfire risks. Over the next 10 years, our efforts will significantly reduce the risk of catastrophic wildfires and the reliability impacts to communities from PSPS and EPSS, while spreading the costs of risk mitigations over longer periods to moderate bill impacts. Our program to underground 10,000 circuit miles of distribution lines is the cornerstone of our long-term strategy which will mitigate the majority of known wildfire risk today and future risks that may materialize. Undergrounding will also allow for the spreading of costs over a longer period of time and will allow us to significantly reduce ongoing programs and the associated costs, such as vegetation management, in areas that have been undergrounded removing the need to inspect, trim and cut trees.

Within three years, while we continue to deploy the hardening investments that will permanently reduce ignitions, we are focusing our efforts on reducing ignitions and ensuring that for any ignitions which do occur, the spread and consequence to life and property is minimized. This requires a portfolio of solutions, drawing on the current portfolio, but evolving with technology.

As always, we will be adaptive and responsive to the changing conditions—but the best solution is a long term one, which is robust to multiple future conditions.

Our current objectives for the next three and ten years are provided in Table PG&E-5.2-1 below. These objectives will continue to evolve as our data, analysis, and risk lens further inform our approach to significantly reducing wildfire risk.

TABLE PG&E-5.2-1:
PG&E'S 3- AND 10-YEAR OBJECTIVES FOR REDUCING THE RISK OF CATASTROPHIC WILDFIRES

3-Year Objectives	10-Year Objectives
• MAKE SUBSTANTIAL progress towards our goal of undergrounding 10,000 miles of distribution lines by completing approximately 1,375 of underground distribution miles • PERFORM system hardening in areas where undergrounding is not the best alternative and CONTINUE to IMPLEMENT other system hardening solutions, such as remote grid • CONTINUE to EXPAND ignition risk models to include additional risk drivers and APPLY the best available weather information when conducting infrastructure work and developing design and construction standards • CONTINUE to PARTNER with leading early detection technology vendors with the goal of achieving accurate and timely early threat detections • DEVELOP an egress model for use in future risk models as part of the wildfire consequence portion of the risk equation formulation • MAINTAIN the pace of replacing expulsion fuses with the potential to INCREASE to more rapidly decrease ignition risks on circuits while factoring in potential EPSS impacts • TRANSITION to a more risk-based prioritization utilizing the Wildfire Transmission Risk Model in conjunction with the Wildfire Consequence Model to INFORM inspection frequency for HFTD lines, above a baseline inspection cadence • UPGRADE communication systems to enable remote communications to SCADA devices and DEPLOY multi-year communication infrastructure improvements • PURSUE a continued evolution of effectiveness of vegetation management program (including routine inspections, tree mortality inspections and EVM)	• CONTINUE to make substantial progress towards our goal of undergrounding 10,000 miles of distribution lines • FACILITATE the development of remote grids, distributed generation, and other customer solutions that can allow for the removal of overhead electrical facilities in high fire risk areas • CONTINUE system hardening in areas where undergrounding is not the best alternative • IMPLEMENT programs to install proven early detection technology for ignition and wildfire threats • CONTINUE programs to REPLACE equipment at greater risk of causing ignitions (e.g., expulsion fuses) as needed until such equipment has either been fully replaced or remediated • USE state-of-the-art machine learning and risk modeling to INFORM all wildfire mitigation efforts and programs • OPTIMIZE all inspections programs and approaches to support varying risk profiles of assets and pursue execution efficiencies • DEVELOP predictive modeling capability for vegetation management that would include data analytics and creating a risk informed process for procedures and checklists, and re-focus vegetation management as a result of undergrounding and system hardening efforts. • IMPLEMENT a dynamic interface for accessibility to operating data and asset performance • CONTINUE to UPGRADE communication infrastructure and systems to ALLOW for real-time communication regarding potential wildfire ignition threats

TABLE PG&E-5.2-1:
PG&E'S 3- AND 10-YEAR OBJECTIVES FOR REDUCING THE RISK OF CATASTROPHIC WILDFIRES
(CONTINUED)

3-Year Objectives	10-Year Objectives
• IMPROVE the centralized inventory of vegetation clearances and IDENTIFY individual high risk-trees across the grid • MATURE and OPTIMIZE PSPS and EPSS to IMPROVE customer reliability • CONTINUE to adjust grid elements during high threat weather conditions by increasing sensitivity of risk reduction elements and monitoring near misses • LEVERAGE the enterprise data platform to DEVELOP a centralized data base of relevant wildfire data and situational intelligence and analytic tools that SUPPORT long-term and real time operational risk management • EVALUATE risk spend efficiency on synergy initiatives by improving and expanding modeling and data capabilities • INCORPORATE circuit based and asset-based risk methodologies into prioritization methodology to ALLOW for more efficient use of financial and human resources and IDENTIFY more opportunities for mitigating multiple risks • IMPROVE and REFINE RSE calculations with better data for effectiveness and scope calculations, coupled with better input from the SMEs as the use of data for RSE calculations	• REDUCE the need for PSPS and EPSS as a result of undergrounding, system hardening, other mitigation programs, and improved weather modeling

5.3 Plan Program Targets

Program targets are quantifiable measurements of activity identified in WMPs and subsequent updates used to show progress towards reaching the objectives.

List and describe all program targets the electrical corporation uses to track utility WMP implementation and utility performance over the last five years. For all program targets, list the 2019-2021 performance, a numeric target value that is the projected target for end of year 2022 and 2023,[73] *units on the metrics reported, the assumptions that underlie the use of those metrics, update frequency, and how the performance reported could be validated by third parties outside each utility, such as analysts or academic researchers. Identified metrics must be of enough detail and scope to effectively inform the performance (i.e., reduction in ignition probability or wildfire consequence) of each targeted preventive strategy and program.*

Pub. Util. Code Section 8386.3(c)(5) requires a utility to notify Energy Safety "after it completes a substantial portion of the VM requirements in its wildfire mitigation plan." To ensure compliance with this statue, the utility is required to populate Table 5.3-1 with VM program targets that the utility can determine when it has completed a "substantial portion" and that Energy Safety can subsequently audit. Energy Safety has provided some required, standardized VM targets below. It is expected that the utilities provide additional VM targets beyond those required. The identification of other VM targets and units for those targets (e.g., for inspections, customer outreach, EVM, etc.) are at the discretion of the utility.

Additionally, in Table 5.3-1, utilities must populate the column "Target%/ Top-Risk%" for each 2022 performance target related to initiatives in the following categories: Grid design and system hardening; Asset management and inspections; and Vegetation management and inspections. This column allows utilities to identify the percentage of the target that will occur in the highest risk areas. For example, if a utility targets conducting 85 percent of its vegetation management program in the top 20 percent of its risk-areas, it should input "85/20" in this column. In the "Notes" column, utilities must provide definitions and sources for each of the "Top-Risk%" values provided. In the given example above, an acceptable response would be: "The top 20% of risk areas used for this target relate to the circuit segment risk rankings from [Utility Company's] Wildfire Risk Model outputs, as described in [hyperlink to Section XX] of the 2022 WMP Update."

Below, we provide our 2022 WMP quantitative initiative targets in Table PG&E-5.3-1(A) and our qualitative initiative targets in Table PG&E-5.3-1(B) (jointly Initiative Targets). Rather than establishing a target or targets for every initiative, we are streamlining the 2022 WMP to focus on Initiative Targets that we believe will have the most significant impact on wildfire risk reduction. Before providing the Tables, some background information is important.

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73 Based on revisions to the 2022 WMP Guidelines and the template for Table 5.3-1 provided in the final 2022 WMP Guidelines, PG&E understands that only 2022 data needs to be included and that the reference to 2023 was inadvertently left from earlier versions of the 2022 WMP Guidelines. Thus, PG&E is providing information for 2022, but not for 2023.

- Ongoing and Routine Programs – The Initiative Targets do not include ongoing and routine programs that are not specifically wildfire-related, such as vegetation and equipment inspections required for compliance with CPUC General Orders (GO) or other regulatory requirements. Many of these routine and ongoing compliance programs were being implemented before the WMP process was initiated and are continuing consistent with regulatory requirements.

- Reporting – PG&E will use the Initiative Targets in Tables PG&E-5.3-1(A) and (B) below for quarterly reporting in 2022 including the Quarterly Initiative Update (QIU), Quarterly Notification, and the Annual Report on Compliance. It is also important to note that throughout the 2022 WMP, we discuss current plans for wildfire-related activities and work in 2022. The timing and scope of these activities and work may change during 2022. We will not be reporting on these plans or activities in our quarterly reporting, or in the Annual Report on Compliance, because they are not Initiative Targets but are providing descriptions of these plans and activities in our 2022 WMP to provide a complete picture of our mitigation activities.

- 2021 Targets – We are not including in Tables PG&E-5.3-1(A) and (B) all of the initiatives with quantitative and qualitative targets from the 2021 WMP. However, these targets and the progress on these targets was fully described in our Q4 2021 QIU that was submitted on February 1, 2022. In addition, these initiative targets will be addressed in our Annual Report on Compliance for the 2021 WMP, which will be submitted on March 30, 2022.

- Initiative Numbering – Each quantitative and qualitative Initiative Target has a unique number (e.g., A.01, A.02, etc.). These numbers are indicated in the tables below and will be used for reporting purposes. The letters represent different Energy Safety initiative categories (e.g., A = Risk Assessment and Mapping, B = Situational Awareness and Forecasting, etc.).

- Table PG&E-5.3-1(A) Information Summary – In Table PG&E-5.3-1(A), we are providing the Initiative Target name, applicable WMP Initiative Section and the Initiative Target ID number in the Program Target column. In the 2022 Target column, we provide a more detailed description of the quantitative Initiative Target. We are also providing the Target%/Top-Risk%, whether it can be audited by a third-party, and any additional notes in the columns specified by Energy Safety for Table 5.3-1. However, these columns are not a part of the actual Initiative Target. Instead, the actual Initiative Target is in the Program Target column. The explanation of how we developed the Target% / Top-Risk% for Table 5.3-1(a) is provided after the table.

- Table PG&E-5.3-1(B) Information Summary – In Table PG&E-5.3-1(B), we are providing the Initiative Target name, applicable WMP Initiative Section and the Initiative Target ID number in the Program Target column. In the 2022 Target column, we provide a more detailed description of the qualitative Initiative Target. We are also providing whether it can be audited by a third-party. However, this column is not a part of the actual Initiative Target. Instead, the actual Initiative Target is in the Target column.

- External Factors – Some of the targets refer to External Factors. External Factors represent circumstances which may impact targets including, but are not limited to, physical conditions, landholder refusals, environmental delays, customer refusals or non-contacts, permitting delays/restrictions or operational holds, weather conditions, removed or destroyed assets, and active wildfire.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Weather Stations -Installations and Optimizations (B.02) Section 7.3.2.1.3	400	426	400	378	300	308	Install or Optimize 100 weather stations. A unit is deemed "installed" when it is in service and verified as operating when initially installed. A unit is deemed "optimized" when a weather station is moved from an existing location to a new location for the purposes of improving our understanding of the weather conditions in the area. Target Date: 12/31/2022	N/A	# of Weather Stations	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A
High-Definition Cameras - Installations (B.03) Section 7.3.2.1.4	71	124	200	216	135	153	Install 98 new cameras that are facing HFTD Tier 2 or Tier 3 viewsheds. In the case a site is destroyed, and a camera can be replaced / relocated nearby with a different visual coverage than the original, this will count as a new installation. Target Date: 12/31/2022	N/A	# of HD Cameras	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A
Distribution Fault Anticipation (DFA) - Installations (B.04) Section 7.3.2.2.3	N/A	6	N/A	1	N/A	16	Install 40 Distribution Fault Anticipation (DFA) sensors on circuits feeding into HFTD areas or HFRA. One sensor per circuit at initiating substation. Target Date: 12/31/2022	N/A	# of DFA Sensors	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Early Fault Detection (EFD) - Installations (B.05) Section 7.3.2.2.3	N/A	1.5	N/A	0	N/A	0	Install Early Fault Detection (EFD) sensors on 2 circuits feeding into HFTD areas or HFRA. Target Date: 12/31/2022	N/A	# of circuits	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A
Line Sensor - Installations (B.06) Section 7.3.2.2.5	N/A	14	~20	46	N/A	67	Install Line Sensor devices on 40 circuits feeding into HFTD areas or HFRA to cover mainline and major tap lines in areas meeting minimum load requirements and within cellular coverage areas to provide visibility. Target Date: 12/31/2022	N/A	# of circuits	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019 Target	2019 Perf.	2020 Target	2020 Perf.	2021 Target	2021 Perf.	2022 Target	2022 Target% / Top-Risk%	Units	Audited by Third Party ? (Y/N)	Notes
Expulsion Fuse - Removal (C.01) Section 7.3.3.7	625	708	~625	643	1200	1429	Remove 3,000 non-exempt fuses/ cutouts identified on distribution poles in HFTD areas or HFRA. Target Date: 12/31/2022	15% / Top Risk	# of fuses	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WFC Model Additional Notes: Engineering coordination studies are required for the replacement of some fuses. To maintain multi-year plan of full expulsion fuse removal, fuses not requiring an engineering study are prioritized while the coordination studies are being performed. 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Distribution Sectionalizing Devices - Install and SCADA commission (C.02) Section 7.3.3.8.1	N/A	241	592	604	250	269	Install and SCADA commission 100 new PSPS SCADA enabled Distribution Sectionalizing devices. Target Date: 9/1/2022	100% / Top Risk	# of distribution sectionalizing devices	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: PSPS 10 Year Lookback Additional Notes: Newly installed devices may not be located in the HFTD or HFRA but are on circuits that traverse HFTD areas or HFRA 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Transmission Line Sectionalizing - Install and SCADA commission (C.03) Section 7.3.3.8.2	N/A	0 (For PSPS Mitigation)	23	54	29	41	Install and SCADA commission 15 transmission line switches on lines that traverse the HFTD areas. The switches themselves may not be located in the HFTD areas but can be used to support customer impact reduction. Target Date: 9/1/2022	60% / Top Risk	# of switches	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: PSPS 10 Year Lookback Additional Notes: The Top Risk % is based on a multi-year workplan and in year deployment may vary 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Distribution Line Motorized Switch Operator (MSO) - Replacements (C.04) Section 7.3.3.8.3	N/A	N/A	N/A	2	48	50	Replace at least 50 of the 104 remaining Motorized Switch Operators that are located within or are energizing line sections that feed into HFTD areas or HFRA. Target Date: 12/31/2022	100% / Top Risk	# of MSOs	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: Newly installed devices may not be located in the HFTD or HFRA but are on circuits that traverse HFTD areas or HFRA 2019-2022 Performance/ Target Notes: The 2021 Target was updated from undefined/pilot to 48 via the Change Order submitted on 11/1/2021.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
SCADA Recloser Equipment - Installations (C.05) Section 7.3.3.9.1	N/A	N/A	N/A	20	81	81	Install 17 substation SCADA enabled reclosers on circuits serving line sections that feed into HFTD areas or HFRA, barring any exceptions due to connectivity issues necessary to SCADA-enable the recloser. Footnote: There may be connectivity issues for some SCADA reclosers that will require manual setting updates, but there is still benefit in installing the recloser to get the sectionalization on the circuit. Target Date: 12/31/2022	100% / Top Risk	# of reclosers	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: Newly installed devices may not be located in the HFTD or HFRA but are on circuits that traverse HFTD areas or HFRA. 2019-2022 Performance/ Target Notes: This initiative, related to system automation, was used to capture the replacement of all Legacy 4C controllers through the end of 2021. In the 2022 WMP, this initiative reflects a different system automation workstream, putting automated reclosers near older distribution substations.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party ? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Fuse Savers (Single Phase Reclosers) - Installations (C.06) Section 7.3.3.9.2	N/A	N/A	N/A	N/A	70	71	Install 80 single phase recloser sets in HFTD areas or HFRA. Target Date: 12/31/2022	100% / Top Risk	# of fuse saver sets	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: Newly installed devices may not be located in the HFTD or HFRA but are on circuits that traverse HFTD areas or HFRA. 2019-2022 Performance/ Target Notes: PG&E piloted these devices in 2018-2019 to determine if they work as designed. In 2020, the devices were used as part of the Distribution Line Sectionalizing program (Section 7.3.3.8.1).

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Temporary Distribution Microgrids (C.07) Section 7.3.3.11.1	N/A	1 [+3 temporary configurations]	Mitigate the customer impacts of PSPS through permanent and temporary front-of the-meter microgrid solutions	3 (2 additional) [+3 temporary configurations]	8 (5 additional)	8 (5 additional) [+1 temporary configurations]	Make operationally-ready at least four additional Distribution Microgrid Pre-installed Interconnection Hubs (PIHs). This target will include 1 PIH that completed construction in December 2021 and will be made ready to operate in 2022. Target Date: 12/31/2022	100% / Top Risk	# of PIHs	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: PSPS 10 Year Lookback Additional Notes: N/A 2019-2022 Performance/ Target Notes: Primary unit of measure reflects cumulative PIHs available and ready to operate for PSPS events.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party ? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
											2019: 1 permanent complete plus 3 temporary configurations 2020: There was no specific unit target for this program in 2020, instead, 2020 Target was embedded as part of the broader commitment to "Mitigate the customer impacts of PSPS through permanent and temporary front-of-the-meter microgrid solutions". Two additional PIHs were completed in 2020, plus three temporary configurations were available for PSPS mitigation.
Rincon Transformer Fuse - Replacement (C.08) Section 7.3.3.11.2	N/A	N/A	N/A	N/A	N/A	N/A	Replace the fuse with a circuit switcher on the Rincon Transformer Bank 1. Target Date: 6/1/2022	N/A	# of fuses	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Emergency Back-up Generation – Equip PG&E Service Centers & Materials Distribution Centers (C.09) Section 7.3.3.11.3	N/A	0	N/A	5	23	32	Equip 15 PG&E Service Centers or Materials Distribution Centers sites with emergency back-up generation to allow the sites to operate with the same amount of functionality as they would if they were being fed from their normal utility power source. Target Date: 12/31/2022	N/A	# of sites	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: Preliminary work began on the program in 2020 and successfully completed 5 sites.
10K Undergrounding (C.10) Section 7.3.3.16	N/A	N/A	N/A	N/A	N/A	73	Complete at least 175 circuit miles of undergrounding work. The 175 circuit mile target includes undergrounding taking place as part of both System Hardening (Section 7.3.3.17.1), Butte County Rebuild efforts (Section 7.3.3.17.6) including a small volume of previously hardened overhead lines that are being placed underground, and any other undergrounding work performed in HFTD or fire rebuild areas. Target Date: 12/31/2022	80% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WDRM Additional Notes: The Top Risk is based on a multi-year workplan and in year deployment may vary. 2019-2022 Performance/ Target Notes: These miles will count for the 10,000-mile undergrounding goal.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
System Hardening - Distribution (C.11) Section 7.3.3.17.1	150	171	220	342	180	210	Complete at least 470 circuit miles of system hardening work which includes overhead system hardening, undergrounding and removal of overhead lines in HFTD or buffer zone areas with the exception of any mileage being undergrounded and tracked separately as part of our Butte County Rebuild efforts (Section 7.3.3.17.6). Target Date: 12/31/2022	80% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WDRM Additional Notes: The Top Risk is based on a multi-year workplan and in year deployment may vary. 2019-2022 Performance/ Target Notes: The 2020 and 2021 performance figures do not include any undergrounding that took place as part of the Butte Rebuild.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
System Hardening - Transmission (C.12) Section 7.3.3.17.2	N/A	40	N/A	103	92	104	Remove or replace 32 circuit miles of transmission conductor on lines traversing the HFTD areas or HFRA. Target Date: 12/31/2022	100% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: Transmission system hardening requires long lead time projects, requiring emphasis on operational feasibility 2019-2022 Performance/ Target Notes: N/A
Surge Arrestor - Removals (C.13) Section 7.3.3.17.3	N/A	4,602	8,850	10,263	15,000	15,465	Remove all the remaining non-exempt surge arrestors in HFTD areas (based on the known population of 4,590 surge arrestors as of January 1, 2022) through replacement with exempt equipment. Target Date: 12/31/2022	100% / Top Risk	# of surge arrestors	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Remote Grid - Operate New SPS Units (C.14) Section 7.3.3.17.5	N/A	N/A	Deploy 4-8 initial sites to validate use cases, design standards, deployment processes and commercial arrangements and deliver recommendations for scale-up	0	1	1	Operate 2 new Remote Grid Standalone Power System (SPS) units Target Date: 12/31/2022	100% / Top Risk	# of Remote Grids	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: PSPS 10 Year Lookback Additional Notes: N/A 2019-2022 Performance/ Target Notes: This was a new Technology initiative that started in 2020. In 2020, the primary objectives of learning through the deployment of actual projects were completed. In 2020, the 5 Remote Grid sites were delayed by challenging permitting constraints associated with sensitive species.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Butte County Rebuild - Undergrounding (C.15) Section 7.3.3.17.6	N/A	N/A – part of the System Hardening metrics (7.3.3.17.1)	Trench Miles: 20**	Trench Miles: 29.3** Circuit Miles: 36.6	Trench Miles: 23	Trench Miles: 23.6 Circuit Miles: 31.5	Complete 55 circuit miles of undergrounding work as part of the Butte County Rebuild program. Target Date: 12/31/2022	100% / Top Risk	# of primary circuit miles	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WDRM Additional Notes: The Butte rebuild is identified as a high risk area due to the fact that the wildfire risk has already occurred in that area. 2019-2022 Performance/ Target Notes: During the first year 2019 performance figures were incorporated in the System Hardening Program described in Section 7.3.3.17.1. Previously reported historical data for 2020 - 2021 was provided in trench miles but the 2022 WMP now measures in circuit miles, consistent with system hardening in Section 7.3.3.17.1.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
											The 2021 performance, as measured in circuit miles, does not include a small volume (approximately 1.4 circuit miles) of previously hardened overhead lines that were placed underground in 2021. **The 2020 WMP target of 20 miles reflected only the portions of the Butte Rebuild in HFTD areas, PG&E completed 22.2 miles in HFTD areas, plus 7.1 rebuild miles in non-HFTD areas to total 29.3 trench miles completed in 2020. The 2021 WMP target of 23 trench miles included both HFTD and non-HFTD rebuild areas.
Detailed Inspections - Distribution (D.01) Section 7.3.4.1	685,000	694,250	100% of HFTD Tier 3, and 33% of HFTD Tier 2 assets.	98% of Tier 3 (198,172) and 33% of Tier 2 (151,520)	Tier 3 and Zone 1 – annually; and Tier 2 and High Fire Risk Areas (HFRA) within the non-High Fire	Tier 3 and Zone 1 – annually; and Tier 2 and High Fire Risk Areas (HFRA) within the non-High Fire Threat District	Complete detailed inspections on a minimum of 396,000 distribution poles, which were identified in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any poles discovered after January 1, 2022 with a field installation date on	100% / Top Risk	# of poles	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019 Target	2019 Perf.	2020 Target	2020 Perf.	2021 Target	2021 Perf.	2022 Target	2022 Target% / Top-Risk%	Units	Audited by Third Party? (Y/N)	Notes
					Threat District (HFTD) – every three years (477,309)	(HFTD) – every three years (480,749)	or before 2020 will be inspected within 90 days of when added to the asset registry. Any poles discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target. Target Date: 7/31/2022				2019-2022 Performance/ Target Notes: For WSIP in 2019, we counted the number of inspections. In 2020 and beyond, we began measuring units by the number of poles inspected. On November 1, 2021, PG&E submitted a Change Order to update the target number of distribution poles for this commitment to 477,309, however, as part of the ongoing record validation the target has since been increased to 480,749.
Detailed Inspection Transmission – Ground (D.02) Section 7.3.4.2	40,623 - Complete a WSIP enhanced inspection of all 50,000 structures by May 1, 2019. (Approx. 9,377 inspections were completed in	49,715	Transmission – aerial and visual for ~22,000 structures	100% of Tier 3 (11,313) and 33% of Tier 2 (14,970)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (26,810)	26,826	Complete detailed ground inspections on a minimum of 39,000 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets discovered after January 1, 2022 with a	20% / Top Risk	# of structures	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: OA Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: For WSIP in 2019, we counted the number of inspections. In 2020 and beyond, we began measuring units by the

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
	December 2018)						field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target. Target Date: 7/31/2022				number of structures inspected. On November 1, 2021, PG&E submitted a Change Order to update the target number of transmission structures requiring enhanced detailed inspections and some form of aerial assessment to 26,810, however, as part of the ongoing record validation the target has since been increased to 26,826. In 2022, we have separated the Detailed Inspections of transmission structures target into the three inspection methods: climbing, aerial, and ground.
Detailed Inspection Transmission – Climbing (D.03) Section 7.3.4.2	40,623 - Complete a WSIP enhanced inspection of all 50,000 structures by May 1, 2019. (Approx. 9,377 inspections were complete	49,715	Transmission – aerial and visual for ~22,000 structures	100% of Tier 3 (338) and 33% of Tier 2 (779)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (26,810)	1,385	Complete detailed climbing inspections on a minimum of 1,800 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the	100% / Top Risk	# of structures	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes:

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
	d in December 2018)						asset registry. Any assets discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target. Target Date: 7/31/2022				For WSIP in 2019, we counted the number of inspections. In 2020 and beyond, we began measuring units by the number of structures inspected. On November 1, 2021, PG&E submitted a Change Order to update the target number of transmission structures requiring enhanced detailed inspections and some form of aerial assessment to 26,810, however, as part of the ongoing record validation the target has since been increased to 26,826. In 2022, we have separated the Detailed Inspections of transmission structures target into the three inspection methods: climbing, aerial, and ground.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019 Target	2019 Perf.	2020 Target	2020 Perf.	2021 Target	2021 Perf.	2022 Target	2022 Target% / Top-Risk%	Units	Audited by Third Party? (Y/N)	Notes
Detailed Inspection Transmission – Aerial (D.04) Section 7.3.4.2	40,623 - Complete a WSIP enhanced inspection of all 50,000 structures by May 1, 2019. (Approx. 9,377 inspections were completed in December 2018)	49,715	Transmission – aerial and visual for ~22,000 structures	100% of Tier 3 (11,036) and 33% of Tier 2 (14,376)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (26,810)	26,826	Complete detailed aerial inspections on a minimum of 39,000 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target. Target Date: 7/31/2022	20% / Top Risk	# of structures	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: OA Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: For WSIP in 2019, we counted the number of inspections. In 2020 and beyond, we began measuring units by the number of structures inspected.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
											On November 1, 2021, PG&E submitted a Change Order to update the target number of transmission structures requiring enhanced detailed inspections and some form of aerial assessment to 26,810, however, as part of the ongoing record validation the target has since been increased to 26,826. In 2022, we have separated the Detailed Inspections of transmission structures target into the three inspection methods: climbing, aerial, and ground.
Infrared Inspections - Distribution (D.05) Section 7.3.4.4	N/A	N/A	N/A	5,450	N/A	10,093	Complete infrared inspections on a minimum of 9,000 distribution circuit miles in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets identified after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets identified after January 1, 2022 with a	100% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: This initiative did not have WMP targets for 2019-2021

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
							field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target. Target Date: 12/31/2022				
Supplemental Inspections - Substation Distribution (D.06) Section 7.3.4.15	177	177	69	69	71	71	Complete supplemental inspections on 86 distribution substations in HFTD areas or HFRA, barring External Factors. Target Date: 7/31/2022	30% / Top Risk	# of Distribution Substations	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WFC Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A
Supplemental Inspections - Substation Transmission (D.07) Section 7.3.4.15	51	51	124	124	33	33	Complete supplemental inspections on 43 transmission substations within HFTD areas or HFRA, barring External Factors. Target Date: 7/31/2022	30% / Top Risk	# of Transmission Substations	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: WFC Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Supplemental Inspections - Hydroelectric Substations and Powerhouses (D.08) Section 7.3.4.16	60	61	38	38	38	38	Complete supplemental inspections on 52 Hydroelectric Generation Substations and Powerhouses within HFTD areas or HFRA, barring External Factors. Co-located Hydroelectric substations and Transmission & Distribution substations are counted separately as two distinct units. Target Date: 7/31/2022	30% / Top Risk	# of Hydroelectric Substations and Powerhouses	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized * Associated Risk Score: WFC Model Additional Notes: The Top Risk % is based on a multi-year workplan and in year deployment may vary 2019-2022 Performance/ Target Notes: N/A
Enhanced Vegetation Management (E.01) Section 7.3.5.2	2,450	2,498	1,800	1,878	1,800	1,983	Complete EVM work on 1,800 risk ranked distribution circuit miles, barring External Factors. Target Date: 12/31/2022	80% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: EVM Tree Weighted Risk Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party ? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Pole Clearing Program (E.02) Section 7.3.5.2	N/A	3,932	N/A	7,253	N/A	9,869	Complete work on at least 9,000 poles identified as needing work during pre-inspection in PG&E's Vegetation Management Database as of October 1, 2021, in HFTD areas or HFRA, not required by PRC 4292 and barring External Factors. Any assets discovered after October 1, 2021 will be inspected and cleared within 45 days of when added to the Vegetation Management Database. Target Date: 4/30/2022	100% / Top Risk	# of distribution poles	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: This initiative did not have WMP targets for 2019-2021

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
LiDAR Ground Inspections - Distribution (E.03) Section 7.3.5.7	N/A	12,165.7	N/A	79.6	N/A	N/A	Complete at least 2,000 circuit miles of Mobile LiDAR capture on HFTD road-access electric distribution lines, barring External Factors. If at any point PG&E determines this technology does not effectively support efforts to reduce wildfire risk when compared to other viable approaches or technology, PG&E will pause or discontinue Ground Based LiDAR efforts. Target Date: 12/31/2022	100% / Top Risk	# of circuit miles	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: This initiative did not have WMP targets for 2019-2021. In 2019, we scanned the entire accessible HFTD to define a baseline. In 2020, we piloted the integration of VM operations and data extraction. In 2021 - 2022, we integrated mobile LiDAR into the routine VM program. The 2021 performance miles are not yet available. We need additional data processing from outside vendor to get the total miles scanned for 2021. We hope to have this data by Q2 2022.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
LiDAR Routine Inspections - Transmission (E.04) Section 7.3.5.8	N/A	LiDAR 19,913	N/A	LiDAR Routine 18,220 LiDAR Mid-Cycle 5,662	N/A	LiDAR Routine 17,757.8 miles(a) LiDAR Midcycle (Rapid Reporting) 6,290 miles(b) LiDAR Midcycle (Routine) 1,333.4 miles(c)	Complete LiDAR inspection of a minimum of 18,000 circuit miles of transmission lines, barring External Factors. Target Date: 6/30/2022.	N/A	# of circuit miles	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: (a) In 2021, mileage was based on ETGIS, however LiDAR survey miles differ by 122. (b) In 2021, Midcycle completed miles includes circuits assessed for Unlisted Critical Detections (UCDs) where none were found and circuits where one or more UCDs were delivered. (c) In 2021, Midcycle routine mileage refers to routine deliverables processed via the LiDAR data collected in June 2021.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Defensible Space Inspections - Distribution Substation (E.06) Section 7.3.5.17.1	N/A	N/A	N/A	163	N/A	170	Complete defensible space inspections in alignment with the guidelines set forth in PRC 4291 at 132 distribution substations within HFTD areas or HFRA, barring External Factors. Target Date: 12/31/2022	100% / Top Risk	# of Distribution Substations	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A
Defensible Space Inspections - Transmission Substation (E.07) Section 7.3.5.17.2	N/A	N/A	N/A	45	N/A	79	Complete defensible space inspections in alignment with the guidelines set forth in PRC 4291 at 55 transmission substations within HFTD areas or HFRA, barring External Factors. Target Date: 12/31/2022	100% / Top Risk	# of Transmission Substations	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Defensible Space Inspections - Hydroelectric Substations and Powerhouses (E.08) Section 7.3.5.17.3	N/A	N/A	N/A	N/A	N/A	63	Complete defensible space inspections at 61 Hydroelectric Generation Substations and Powerhouses within HFTD areas or HFRA, barring External Factors. Co-located hydroelectric substations and Transmission & Distribution substations are counted separately as two distinct units. Target Date: 12/31/2022	100% / Top Risk	# of Hydroelectric Substations and Powerhouses	Y	Target % / Top Risk % Notes: Approach: HFTD/HFRA Informed Prioritized* Associated Risk Score: N/A Additional Notes: N/A 2019-2022 Performance/ Target Notes: N/A
Utility Defensible Space - Distribution (E.09) Section 7.3.5.20	N/A	N/A	N/A	N/A	N/A	5,551	Complete utility defensible space work on a minimum of 7,000 poles in the HFTD, barring External Factors. Target Date: 12/31/2022	80% / Top Risk	# of distribution poles	Y	Target % / Top Risk % Notes: Approach: Risk Informed Prioritized* Associated Risk Score: EVM Tree Weighted Risk Model Additional Notes: N/A 2019-2022 Performance/ Target Notes: The UDS program was paused in 2020 to evaluate program effectiveness and scope which resulted in modifications to the program. As a result, PG&E is unable to provide documentation for its UDS program in 2019-2020.

TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
EPSS - Install Settings on Distribution Line devices (F.02) Section 7.3.6.8	N/A	N/A	N/A	N/A	N/A	This new program achieved its initial scope and goal for the 2021 wildfire season. Through Q4, the 170 target circuit devices had EPSS settings, ultimately disabled in concert with the onset of significant rain and reduced fire risk.	Load the engineered settings on protection line devices (line reclosers and fuse savers) on the identified 988 circuits (based on WRGSC approval as of 1/26/2022) on the following schedule, barring External Factors: (1) line devices on 80% of identified circuits by 5/1/22 and, (2) line devices on the remaining 20% by 8/1/22. Target Date: 8/1/2022	N/A	# of line reclosers and fuse savers	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: This initiative did not have WMP targets for 2019-2021. This new program started in July 2021 to mitigate ignition risks for the 2021 wildfire season.
EPSS - Reliability Improvements (F.04) Section 7.3.6.8	N/A	N/A	N/A	N/A	N/A	N/A	Initiate reliability mitigations on 50 EPSS capable circuits in the HFTD areas, HFRA and non-HFTD buffer zones based on highest projected Customer Experiencing Sustained Outage (CESO). Target Date: 8/1/2022	N/A	# of circuits	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: This initiative did not have WMP targets for 2019-2021. This new program started in July 2021 to mitigate ignition risks for the 2021 wildfire season.

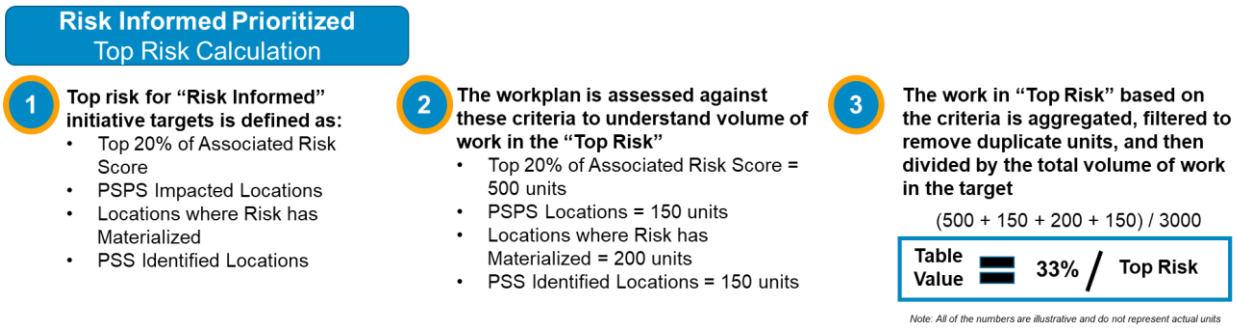
TABLE PG&E-5.3-1(A):
LIST AND DESCRIPTION OF QUANTITATIVE PROGRAM TARGETS, LAST FIVE YEARS
(CONTINUED)

Program Target	2019		2020		2021		2022		Units	Audited by Third Party? (Y/N)	Notes
	Target	Perf.	Target	Perf.	Target	Perf.	Target	Target% / Top-Risk%			
Community Engagement - Meetings (J.01) Section 7.3.10.1	N/A	Hosted 23 community open houses and three customer-specific webinars with approximately 3,200 attendees.	N/A	Hosted 15 regional and three systemwide virtual open houses and one safety town hall with over 5,000 attendees to provide a localized update on wildfire safety work happening in respective communities and answer customer questions.	N/A	Hosted 3 systemwide virtual open houses and 10 safety town halls to provide a localized update on wildfire safety work happening in respective communities and answer customer questions.	Host 22 customer and community focused virtual meetings (i.e., Safety Town Halls, CWSP Webinars) to further stakeholder and community awareness of PG&E's wildfire mitigation efforts. Target Date: 12/31/2022	N/A	# of meetings	Y	Target % / Top Risk % Notes: N/A 2019-2022 Performance/ Target Notes: N/A

*The “Target % / Top-Risk %” were calculated for quantitative targets in the Grid design and system hardening, Asset management and inspections, and Vegetation management and inspections section using two approaches depending on how the units of work contained within the Initiative Target were prioritized. The calculations and descriptions of the two approaches are as follows:

- For Initiative Targets that utilized additional risk factors besides HFTD/HFRA to inform prioritization of the work, values are calculated as follows:

FIGURE PG&E-5.3-1:
RISK-INFORMED PRIORITIZED APPROACH



  – Top risk is defined as:

    - Top 20% of Associated Risk Score – Top 20 percent of units based on a descending list of risk scores at the circuit level or equipment level.

    - PSPS Impacted Locations – Circuits that have historically been impacted by PSPS events either in fact or the 10--year lookback analysis, and apply to initiatives intended to reduce the frequency, scope, or duration of PSPS events.

    - Locations where Risk has Materialized – Locations where historic wildfires have occurred, and wildfire risk has materialized.

    - PSS Identified Locations – Locations selected by PG&E’s public safety specialist were risk or consequence of a risk event are deemed high.

- For Initiative Targets that primarily utilize HFTD or HFRA locations to inform prioritization of the work, values are calculated as follows:

FIGURE PG&E-5.3-2:
HFTD/HFRA INFORMED PRIORITIZED APPROACH

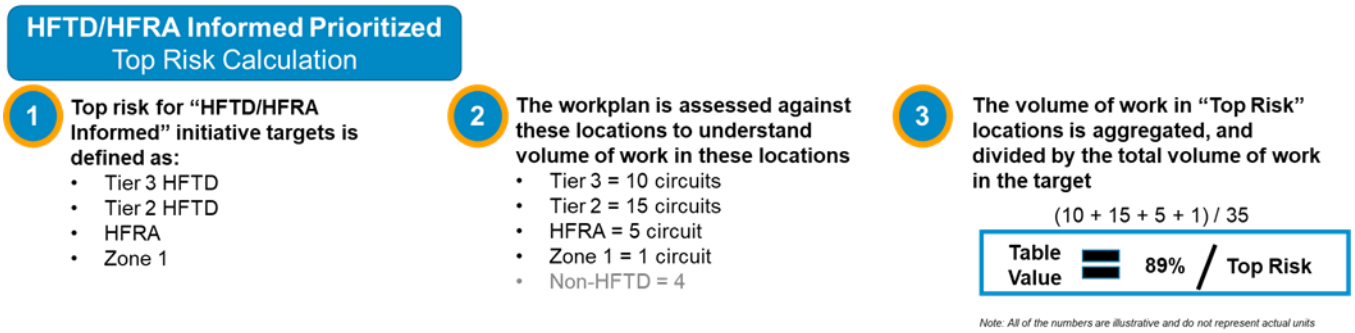


TABLE PG&E-5.3-1(B):
LIST AND DESCRIPTION OF QUALITATIVE PROGRAM TARGETS, LAST FIVE YEARS

Program Target	2022 Target	Audited by Third Party ? (Y/N)	Due Date
Distribution Modeling Enhancements - Equipment Failure and Contact From Object (A.01) Section 7.3.1.3	Develop additional Distribution Equipment Failure (EFF) and Distribution Contract From Object (CFO) sub-models. Conduct assessment to determine whether newly developed sub-models should be included in the WDRM model.	Y	12/31/2022
Transmission Modeling Enhancements - Threat and Hazard Risk Drivers (A.02) Section 7.3.1.3	Develop Threat and Hazard (Risk drivers) sub-models that cover: Threats (e.g., Atmospheric corrosion, Underground corrosion, Fatigue, Mechanical Wear, Decay, Contamination, Vibration), and Hazards (primarily Wind). Conduct assessment to determine whether newly developed sub-models are to be included in the WTRM model.	Y	12/31/2022
PSPS Consequence Model (A.03) Section 7.3.1.4	Conduct an assessment of the PSPS Consequence model to inform if it is fit for use to inform PSPS mitigation plans to minimize customer impact.	Y	6/1/2022
Wildfire Consequence Model Enhancements - Ingress/Egress (A.04) Section 7.3.1.5	Develop an approach on how to incorporate ingress/egress into the Wildfire Consequence Model.	Y	12/31/2022
Wildfire Consequence Model Enhancements - Resistance to Control (A.05) Section 7.3.1.5	Evaluate an approach to incorporate "Resistance to Control" (i.e., TDI) into the Wildfire Consequence Model. Resistance to Control is the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior.	Y	12/31/2022
FPI and IPW Modeling - Revision Evaluation (B.01) Section 7.3.2.1.1	Evaluate running the FPI and IPW Models with the ensemble mean output of the POMMS-EPS.	Y	9/1/2022
Asset Inspections - Quality Assurance (D.09) Section 7.3.4.14	Perform Transmission and Distribution system inspection quality audits prioritizing HFTD/HFRA areas. Statistically valid methodology parameters, such as a confidence level of 95%, will be utilized.	Y	12/31/2022
Vegetation Management - Quality Assurance (E.05) Section 7.3.5.13	Perform vegetation management program quality audits prioritizing HFTD/HFRA areas. Statistically valid methodology parameters, such as a confidence level of 95%, will be utilized.	Y	12/31/2022
EPSS - Settings Design and Test (F.01) Section 7.3.6.8	Conduct laboratory testing to refine the circuit device design parameters for 2022 EPSS implementation.	Y	4/1/2022
EPSS - Develop Enablement Standards and Procedures (F.03) Section 7.3.6.8	Develop the procedure to govern the enablement of EPSS settings in 2022.	Y	5/1/2022
Data Governance - Identify and Centralize High Priority Data (G.01) Section 7.3.7.1	1. Document and implement a process to identify data gaps in Foundry for critical risk drivers 2. Identify and incorporate new high-priority datasets into Foundry in support of analytic products 3. Identify and incorporate 20 new, foundational ontology objects into Foundry	Y	12/31/2022
Risk Spend Efficiency - Develop and Share Governance Process (H.01) Section 7.3.8.3	Develop and share RSE Governance Process with Energy Safety.	Y	9/30/2022

5.4 Planning for Workforce and Other Limited Resources

Report on worker qualifications and training practices regarding wildfire and PSPS mitigation for workers in the following target roles:

1. *Vegetation inspections;*
2. *Vegetation management projects;*
3. *Asset inspections;*
4. *Grid hardening; and*
5. *Risk event inspection.*

For each of the target roles listed above:

1. *List all worker titles relevant to target role (target roles listed above);*
2. *For each worker title, list and explain minimum qualifications with an emphasis on qualifications relevant to wildfire and PSPS mitigation. Note if the job requirements include the following:*
    a. *Going beyond a basic knowledge of GO 95 requirements to perform relevant types of inspections or activities in the target role;*
    b. *Being a "Qualified Electrical Worker" (QEW) and define what certifications, qualifications, experience, etc. is required to be a QEW for the target role for the utility; and*
    c. *Include special certification requirements such as being an International Society of Arboriculture Certified Arborist with specialty certification as a Utility Specialist.*
3. *Report percentage of Full Time Employees (FTE) in target role with specific job title;*
4. *Provide a summarized report detailing the overall percentage of FTEs with qualifications listed in (2) for each of the target roles; and*
5. *Report plans to improve qualifications of workers relevant to wildfire and PSPS mitigation. The utility must explain how they are developing more robust outreach and onboarding training programs for new electric workers to identify hazards that could ignite wildfires.*

For consistency and clarity in responding to the five items of information identified for the target roles, we have created summary tables to address Items 1 through 4 for each of the target roles. These items are referenced at the top of each table. Note that the Item 3 percentages include all listed active roles in 2021 and Item 4 percentages are based only on the roles with "High Interest" qualifications from Question 2 such as QEWs. Both Items 3 and 4 percentage totals sum to 100 percent representing the distribution of those resources across the different worker titles. Item 5 (plans to improve qualifications) is included in the narrative following each table.

5.4.1 Target Role – Vegetation Inspections

TABLE PG&E-5.4-1:
TARGET ROLE – VEGETATION INSPECTIONS

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications[(a)]	Qualifications Relevant to Wildfire and PSPS Mitigation	FTE % by Target Role	FTE % by High interest Qualification
Vegetation Control (VC) Technician (Crew and Pre-Inspector (PI))	N/A	VC position that carries out physical pole clearing work and pre-inspection	15%	N/A
Vegetation Management (VM) Consulting Utility Forester	N/A	VM Patroller (AKA Pre-Inspector or PI) under Routine, Defined scope or CEMA etc.	78%	N/A
VM Estimating Arborist (EA)	N/A	VM position that does EA work as a primary function	2%	N/A
VM Senior Consulting Utility Forester	N/A	VM position that supervises a group of PIs	4%	N/A
Total			100%	

(a) The Minimum Qualification only listed the qualifications outlined in part 2 (a, b, and c), the other qualifications for these positions are listed in the "Qualification Summary" section below.

Minimum Qualifications:

The Vegetation Management Inspection (VMI) roles do not require any of the three minimum qualifications (QEW,[74] special certifications, advanced knowledge of GO 95). Some VM inspectors are certified arborists, but it is not a requirement for these roles.

PG&E uses the completion of training to ensure minimum qualifications are met before contractors can gain access to databases that are required to perform work in the field. Only after successfully completing specific training related to certain positions will the user be allowed access to the PG&E databases. Training requirements specific to the employee or contractor role are summarized below.

Qualification Summary:

- All VC Technicians (Tree Crew and PI) are expected to complete the PI Basics Structured Learning Path (SLP) which consists of courses VEGM-0101 through VEGM-0110 described in Table PG&E-5.4-2 below.

[74] Cal/OSHA Title 8 regulations/Dept. of Industrial Relations defines an QEW as a "qualified person who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved."

- VC workers must complete SLP VEGM-0302.
- Right of Way (ROW) PIs, Consulting Utility Foresters and Senior Consulting Utility Foresters must complete the SLP VEGM-0101.
- Anyone working for EVM must also complete SLP VEGM-0410 before receiving access. This course provides an overview of EVM procedures and the scope of work.

TABLE PG&E-5.4-2:
SLP CLASS SUMMARY OF QUALIFICATIONS

Course Number	Course Name	Description
VEGM-0101WBT	Introduction to Pre-Inspection Basics	Electrical equipment basics, the VM patrol process, tree work, and customer relations.
VEGM-0102WBT	Mapping Patrol Line Segments	How to identify patrol line segments on the index map.
VEGM-0103WBT	Pre-Inspection Tools and Practices	Tools and procedures PIs must follow during VM work activities.
VEGM-0104WBT	Tree Assessment Tool (TAT)	How to use the TAT.
VEGM-0105WBT	Tree Strike Potential	Strike potential decision process and data entry into the mobile device.
VEGM-0106WBT	Major Woody Stem Exemption	Major woody stem exemption decision process.
VEGM-0107WBT	Tree Growth Potential	Tree growth potential decision process and data entry into the mobile device.
VEGM-0108WBT	Abnormal Field Conditions Reporting	Identify abnormal field conditions during VM work activities.
VEGM-0109WBT	Assess Treatment of Resprouting Stumps	How to identify and treat resprouting stumps.
VEGM-0110WBT	Skills Assessment for PIs	Final skill assessment that will test key subjects from past VM training.

_____

Note "WBT" indicates a web based training class.

Plans to Improve Worker Qualifications:

We are supporting the further development of certifications within the VM industry in alignment with utility VM laws and regulations (including in specific states). To bolster recruitment and the pipeline of qualified personnel, we have partnered with the International Brotherhood of Electrical Workers (IBEW) and educational institutions, such as the California Community College system, to establish a training program designed to provide the skills and knowledge necessary to perform tree crew work safely and competently. Through these training courses and programs, we will be able to develop an internal pool of VMIs for hire.

In addition, in August 2021, PG&E began implementation of knowledge assessments on specific PI courses. With the implementation of the knowledge assessments on VEGM-0110, VEGM-0410, VEGM-0411, and VEGM-0450, it will place an enforcement of 3 attempts to pass the required PG&E training courses before the PI employee or contractor will be placed in a cooling off period before being allowed to retake the training course. For additional information, please see Section 7.3.5.14.

5.4.2 Target Role – Vegetation Management Projects

TABLE PG&E-5.4-3:
TARGET ROLE – VEGETATION MANAGEMENT PROJECTS

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
VM Project Coordinator	N/A	VM position that oversees a project not- a PI	67%	N/A
VC Project Coordinator	N/A	VC Project Coordinator	2%	N/A
VM Project Manager	N/A	VM position that oversees and is responsible for an entire project	29%	N/A
ROW Project Manager	N/A	ROW position that oversees several enhancement projects	2%	N/A
Total			100%	

Minimum Qualifications:

Similar to VMI roles discussed above, VM project roles do not require any of the three minimum qualifications (QEW, special certifications, advance knowledge of GO 95).

PG&E uses the completion of training to ensure minimum qualifications are met before contractors can gain access to databases that are required to perform work in the field. Employees and contractors in VM project roles are required to complete the SLP training identified in Table 5.4-3 above. The SLP requires the completion of a comprehensive training program that includes web-based -training, scenario-based -skills assessments, on the job training (OJT), and mentoring relationships with experienced PIs.

Plans to Improve Worker Qualifications:

Please refer to Section 5.4.1 above for details on how VM is working to improve worker qualifications for both VMI and VM projects work.

5.4.3 Target Role – Asset Inspections

Asset Inspections are assigned to either contract or internal qualified personnel who have received the training to be classified as Qualified Company Representatives (QCR) Inspectors for PG&E. Therefore, two tables have been included below providing: (1) a list of all worker titles relevant to a target role; (2) the minimum qualifications for each of those titles; (3) the percentage of full-time employees in a target role; and (4) the percentage of full-time employees with these minimum qualifications.
Table PG&E-5.4-4, provides a list of all internal asset inspection roles.
Table PG&E-5.4-5, provides a list of all external asset inspection roles. The tables describe minimum qualifications and further explanation of training to be a QCR to perform inspection work is below.

TABLE PG&E-5.4-4:
TARGET ROLE – ASSET INSPECTIONS INTERNAL ROLES

(1)	(2a.b.c)	(1)	(3)	(4)
PG&E Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Compliance Inspector	QEW	Journeyman Linemen (IBEW), QEW (distribution only)	62%	62%
Compliance Inspector – Underground	QEW	Journeyman Linemen (IBEW), QEW (distribution only)	2%	2%
Transmission Troubleman	QEW	Journeyman Linemen (IBEW) QEW (transmission OH only)	10%	10%
Transmission Towerman	QP	Journeyman Towerman (IBEW) Qualified Persons (QP) (structural climbing assessments only), QP but are not journeyman linemen classification	13%	13%
Inspection Review Specialist, Senior	QEW	QEW, five years utility related experience	5%	5%
Inspection Review Specialist, Expert	QEW	QEW, 7 years utility related experience	8%	8%
Total			100%	100%

TABLE PG&E-5.4-5:
TARGET ROLE – ASSET INSPECTIONS EXTERNAL ROLES

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
CONT – Aerial Inspection Review (AIR) Inspector	QCR	2 years' experience transmission troubleman, transmission engineer or transmission asset inspector	15%	15%
CONT – AIR SME	QCR	4 years' experience transmission troubleman, transmission engineer or transmission asset inspector	3%	3%
CONT - Inspection Review Specialist	QCR	QEW five years utility related experience	1%	1%
CONT – Inspection Review Specialist, Senior	QCR	QEW 7 years utility related experience	3%	3%
CONT – Compliance General Foreman	QEW	Journeyman Linemen (IBEW), QEW	0%	0%
CONT – Compliance Foreman	QEW	Journeyman Linemen (IBEW), QEW	0%	0%
CONT – Compliance Inspector	QEW	Journeyman Linemen (IBEW), QEW	77%	77%
Hiring Hall Compliance Inspector	QEW	Journeyman Linemen (IBEW), QEW	1%	1%
Total			100%	100%

The Qualification Process for Linemen:

Both internal and external candidates can apply to join PG&E as an (internal) apprentice lineman. Selection requires successfully completing a comprehensive assessment process. Promotion to journeyman requires completion of a multi-year apprentice training and assessment program.

The process to qualify as a PG&E Journeyman includes the following steps:

(1) Online application.

(2) A Certification Review confirming the candidate has completed a valid apprenticeship and maintains Journeyman qualifications.

(3) Successfully passing the Journeyman Lineman Knowledge Assessment, a proctored web-based assessment.

(4) Completing the Journeyman Lineman Assessment Program which includes a full day's physical assessment conducted on site at PG&E.

(5) Interviews with PG&E Supervisors and/or Superintendents; and

(6) Completing a successful background investigation, including Department of Transportation drug test.

To conduct overhead inspections, Journeyman Linemen must become QCR Inspectors by completing the same requirements as listed above, as well as the PG&E orientation and coursework for Inspectors as outlined in System Inspections Safety and Compliance Training Table PG&E-5.4-6 below. Regular status journeymen employees who bid into the System Inspections department, or are externally hired into the department, must complete pre-employment testing, a multi-day orientation to inspection work, and participate in knowledge checks within the training material. They must also complete OJT support once they join System Inspections.

PG&E separates out the minimum requirements for personnel performing inspections based on the type (electrical, structural) and voltage (transmission, distribution) of the assets being evaluated. The minimum position qualification for detailed transmission or distribution overhead electrical inspections is that of a Journeyman Lineman, who are QEWs. California Occupational Safety and Health Administration (Cal/OSHA) Title 8 regulations and the Department of Industrial Relations defines a QEW as a "qualified person who by reason of a minimum of two years of training and experience with high voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved." In some instances, work can be performed or supported by various non QEW roles, but the work is always performed under the direction of a QEW.

The Qualification Process for Towermen:

The minimum qualification required for structural climbing assessments of transmission overhead tower structures is to be a Journeymen Towermen, this classification is trained in the construction and assessment of structural integrity. Apprentice Towermen may support climbing assessments but must be under the direction of a Journeyman. Journeymen Towermen are considered QP (Qualified Person) and can be trained to be QCR Inspectors (see Qualification Process for System Inspections below) but these are not QEW classifications. Therefore, the assessments completed by Towermen focus on the structural soundness of the towers and foundations, aligned with their training and experience.

The Qualification Process for AIR+ Inspections Evaluation of aerial imagery:

The qualification process is completed by AIR+ Inspection Review Specialists or contractor AIR+ inspectors who hold either engineering credentials or QEW status. The Statement of Work (SOW) for inspection contractors states that only Journeymen Linemen and Foremen are qualified to perform detailed inspections, and QEWs or engineers are permitted to assess aerial imagery for the purpose of asset inspections.

Upon hire, or upon execution of a contract SOW to complete electric asset inspections (detailed overhead inspections), the journeyman (or engineering) credentials of the worker are confirmed. Contracted personnel must also complete ISNetworld (ISN) (third party online portal) registration and intake training prior to arrival and onboarding into the inspection program. Upon acceptance of worker eligibility and ISN credentials, personnel who will complete electric asset inspections are provided a multi-day orientation on the expectations, guidelines, and tools relevant for the work. Inspection

personnel, whether contracted or employees, must complete this training before being released to on-the-job orientation and oversight. PG&E employees in inspection roles are also provided annual refresher training to update them on any changes to guidelines, tools, and processes.

The Qualification Process for System Inspections:

System Inspections requires inspectors who act as QCR Inspectors to complete training beyond the minimum qualifications listed in Tables 5.4-4 and 5.4-5. This additional training is both instructor-led and web-based.

- Orientation to inspection work: For PG&E QEWs, this is multi day new employee training focused upon System Inspections requirements.
  - For QEWs that will be assigned Distribution Inspection work, this is a two-day course explaining PG&E's Electric Distribution Procedure Manual (EDPM), related Job Aids, and Technology training.
  - For QEWs and QCRs assigned to Transmission Inspection work, this is a three-day course explaining PG&E's Electric Transmission Procedure Manual (ETPM) and related Job Aids. Technology training is introduced at a later time.
- For Contracted QEWs for Distribution and Transmission work, this is a three-day course explaining PG&E field processes, either the EDPM or ETPM manuals, related Job Aids, and technology training. Refresher training for System Inspections' internal, regular status QCR Inspectors is provided annually. It may be shorter and supplemented by web-based training.
- Contracted QEWs who have successfully completed a valid apprenticeship program to become journeymen, must complete a series of safety trainings courses on ISN platform and attend PG&E's 3-day (8 hours a day) orientation and training for all personnel who conduct detailed inspections (i.e., QCR Inspectors). The orientation and training include the following:
  - Contractor Pre-Arrival Training:
    - ISN safety training completed per Utility Standard ENV-1003S and TD-1952P-01. Course completion is validated by both the Vendor and PG&E prior to the contractor conducting field inspections.
    - ISN safety training may be validated in the field by scanning ISN contractor badge.
  - PG&E provided Training:
    - Electric Distribution and Electric Transmission: 3-day training (8 hours a day), and OJT up to 2 days.
    - Substation – 2-day classroom and 1-day OJT (8 hours a day).

TABLE PG&E-5.4-6:
SYSTEM INSPECTIONS SAFETY AND COMPLIANCE TRAINING

	Training Delivery	Training	Duration
Distribution	ISN	Corporate Contractor Safety Orientation, SAFE0101	40 min
		SAFE 1503WBT, Fire Danger Precautions	60 min
		SAFE 4513WBT, Electric Operations Safety Foundations for Contractors	150 min
	Administered by Vendor	Not Applicable	-
	PG&E My Learning	CORP 9044WBT: Records & Info Management	45 min
		ISEC 9020WBT: Security & Privacy Awareness	45 min
Transmission	ISN	Corporate Contractor Safety Orientation, SAFE0101	40 min
		SAFE 1503WBT, Fire Danger Precautions	60 min
		SAFE 4514WBT, T Line Contractor Safety Orientation	150 min
	Administered by Vendor	Not Applicable	-
	PG&E My Learning	CORP 9044WBT: Records & Info Management	45 min
		ISEC 9020WBT: Security & Privacy Awareness	45 min
Substation	ISN	Corporate Contractor Safety Orientation, SAFE0101	40 min
		SAFE 1503WBT, Fire Danger Precautions	60 min
	Administered by Vendor	Substation Safety Field Orientation (SSFO) 2020 2021	-
	PG&E My Learning	PSOS 2500WBT: MAD/ARC for Substations (35 minutes)	35 min
		SAFE 1505WBT: Arc Flash Hazard Control Basics (30 minutes)	30 min
		CORP 9044WBT: Records & Info Management	45 min
		ISEC 9020WBT: Security & Privacy Awareness	45 min

Because PG&E's Journeymen Towermen perform structural construction, maintenance, and assessment on a regular basis as part of their normal work duties, the QCR training is a refresher training. Towerman training has emphasis on new or updated PG&E processes, standards, and procedures, including technology that is used while performing field inspections on Tower assets. Training duration is approximately 4 1/2 hours and is currently provided remotely due to COVID-19 social distancing protocols.

Plans to Improve Worker Qualifications:

No material improvements have been identified at this time. Enhancements to training will be implemented based on changes to processes and procedures or in response to any lessons learned or identified gaps. New or modified training, as needed, will be developed and delivered to personnel to drive a safe and competent workforce.

5.4.4 Target Role – Grid Hardening

Grid hardening projects are generally assigned to either contract or internal crews for the duration of the project construction. Therefore, two tables have been provided below reflecting the resource composition for contracted grid hardening jobs as compared to internally-resourced projects.

TABLE PG&E-5.4-7:
CONTRACTED GRID HARDENING PROJECTS

(1)	(2a.b.c)	(2 a,b,c)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Lineman	QEW	Contractor company is responsible for the qualifications of their employees. Multiple PG&E departments perform safety observations of contractors and perform quality audits of completed work. Contractors should have ISN badges that are confirmed by EH&S org during site visits.	67%	75%
Apprentice Lineman			0%	
Foreman	QEW		22%	25%
Groundman			0%	
General Forman			11%	
Total			100%	100%

TABLE PG&E-5.4-8:
INTERNALLY-RESOURCED GRID HARDENING PROJECTS

(1)	(2a.b.c)	(2 a,b,c)	(3)	(4)
PG&E Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Lineman	QEW	Required Training - relevant to Wildfire and PSPS – see below for the list of minimum qualifications and list of specific trainings	22%	59%
Apprentice Lineman			32%	
Foreman	QEW		15%	41%
Utility Worker			15%	
Miscellaneous Equipment Operator			15%	
Total			100%	100%

Minimum Qualifications:

In order to perform grid hardening work, at least one worker on site must be a QEW. In some instances, work can be performed by various non-QEWs roles, but the work is always performed under the direction of a QEW. For internal PG&E positions, the

"Groundman" role could include Utility worker, Ground Worker, T&D Assistant or Electric Line Assistant.

Related Qualifications:

PG&E has a PSPS training program for QEW workers focused on inspecting, patrolling and reporting findings related to wildfire mitigation. Grid Hardening utilize the same pool of QEW workers from the training program. The PSPS qualification training summary includes:

- PSOS 0414 Transmission Inspections-Overhead – The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the overhead portion of the ETPM Manual. Upon completion of this course, personnel are able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Overhead, Infrared (IR), and Corrective Maintenance.

- PSOS 0415 Transmission Inspections-Underground – The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the underground sections of the ETPM Manual. Upon completion of this course, personnel are able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Underground, IR, and maintenance.

- PSOS 0416 Transmission Inspections-Towerman – The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the tower sections of the ETPM Manual. Upon completion of this course, personnel are able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Tower and Maintenance.

- SAFE 0256 Aerial Patrol – This course prepares patrolmen and pilots to work together as a team so they can avoid hazards while patrolling in the utility environment. Course participants will learn how to: (1) Prepare for the patrol prior to taking flight; (2) Establish roles and responsibilities within the crew; (3) Apply crew resource management behaviors; (4) Implement safe patrol techniques; (5) Identify and call out hazards; (6) Respond in emergency situations; and (7) Identify lessons learned during the post flight debrief.

Plans to Improve Worker Qualifications:

No material improvements have been identified at this time. Enhancements to training will be implemented based on changes to processes and procedures or in response to any lessons learned or identified gaps. New or modified training, as needed, will be developed and delivered to personnel to drive a safe and competent workforce.

5.4.5 Target Role – Risk Event Inspections

TABLE PG&E-5.4-9:
TARGET ROLE – RISK EVENT INSPECTIONS

(1)	(2a.b.c)	(2)	(3)	(4)
PG&E Titles	High Interest Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Troublemen (T-Men)	QEW	While these roles do not have certifications directly related to Wildfire and PSPS mitigation, these roles and their work is important to the ongoing, safe operation of PG&E equipment throughout our Service Area, including to mitigate wildfire risks.	86%	98%
Cablemen	QEW		1%	2%
Distribution Line Technicians (DLT)			13%	0
Total			100%	100%

Minimum Qualifications:

In order to perform this work, a worker needs to be a QEW. In some instances, work can be performed by various non-QEWs roles, but the work is always performed under the direction of a QEW.

Plans to Improve Worker Qualifications:

No material improvements have been identified at this time. Enhancements to training will be implemented based on changes to processes and procedures or in response to any lessons learned or identified gaps. New or modified training, as needed, will be developed and delivered to personnel to drive a safe and competent workforce.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 6

PERFORMANCE METRICS AND UNDERLYING DATA

6. Performance Metrics and Underlying Data

Instructions: Section to be populated from Quarterly Reports. Tables to be populated are listed below for reference.

NOTE: Report updates to projected metrics that are now actuals (e.g., projected 2020 spend will be replaced with actual unless otherwise noted). If an actual is substantially different from the projected (>10 percent difference), highlight the corresponding metric in light green.

Consistent with the 2022 Wildfire Mitigation Plan (WMP) Guidelines, Pacific Gas and Electric Company (PG&E) has compared projected 2021 data that was provided in the 2021 WMP to the 2021 actual results provided as part of the 2022 WMP in the tables within Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.a_Atch01. PG&E has highlighted cells in light green in which the actual results differ by more than 10 percent from the previously reported, projected 2021 numbers.

6.1 Recent Performance on Progress Metrics, Last Seven Years

Instructions for Table 1 of Attachment 3:

In the attached spreadsheet document, report performance on the following metrics within the utility's service territory over the past seven years as needed to correct previously-reported data. Where the utility does not collect its own data on a given metric, each utility is required to work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in the "Comments" column.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 1.

6.2 Recent Performance on Outcome Metrics, Annual, Last Seven Years

Instructions for Table 2 of Attachment 3:

In the attached spreadsheet document, report performance on the following metrics within the utility's service territory over the past seven years as needed to correct previously reported data. Risk events and utility-related ignitions are normalized by wind warning status (Red Flag Warning (RFW) and High Wind Warning (HWW). Where the utility does not collect its own data on a given metric, the utility is required to work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in "Comments" column.

Provide a list of all types of findings and number of findings per type, in total and in number of findings per circuit mile.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 2.

6.3 Description of Additional Metrics

Instructions for Table 3 of Attachment 3:

In addition to the metrics specified above, list and describe all other metrics the utility uses to evaluate wildfire mitigation performance, the utility's performance on those metrics over the last seven years, the units reported, the assumptions that underlie the use of those metrics, and how the performance reported could be validated by third parties outside the utility, such as analysts or academic researchers. Identified metrics must be of enough detail and scope to effectively inform the performance (i.e., reduction in ignition probability or wildfire consequence) of each preventive strategy and program.

PG&E does not have new or additional metrics to include to evaluate wildfire mitigation that are not already captured in other sections of the 2022 WMP. However, PG&E may analyze and look to reuse these metrics in ways no documented in the WMP as we continue to mature our data sets and modeling.

6.4 Detailed Information Supporting Outcome Metrics

Enclose detailed information as requested for the metrics below.

Instructions for Table 4 of Attachment 3:

In the attached spreadsheet document, report numbers of fatalities attributed to any utility wildfire mitigation initiatives, as listed in the utility's previous or current WMP filings or otherwise, according to the type of activity in column one, and by the victim's relationship to the utility (i.e., full-time employee, contractor, of member of the general public), for each of the last five years as needed to correct previously-reported data. For fatalities caused by initiatives beyond these categories, add rows to specify accordingly. The relationship to the utility statuses of full-time employee, contractor, and member of public are mutually exclusive, such that no individual can be counted in more than one category, nor can any individual fatality be attributed to more than one initiative.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 4.

Instructions for Table 5 of Attachment 3:

In the attached spreadsheet document, report numbers of Occupational Safety and Health Administration (OSHA)-reportable injuries attributed to any utility wildfire mitigation initiatives, as listed in the utility's previous or current WMP filings or otherwise, according to the type of activity in column one, and by the victim's relationship to the utility (i.e., full-time employee, contractor, of member of the general

public), for each of the last seven years as needed to correct previously reported data. For members of the public, all injuries that meet OSHA-reportable standards of severity (i.e., injury or illness resulting in loss of consciousness or requiring medical treatment beyond first aid) must be included, even if those incidents are not reported to OSHA due to the identity of the victims.

For OSHA--reportable injuries caused by initiatives beyond these categories, add rows to specify accordingly. The victim identities listed are mutually exclusive, such that no individual victim can be counted as more than one identity, nor can any individual OSHA -reportable injury be attributed to more than one activity.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 5.

6.5 Mapping Recent, Modelled, and Baseline Conditions

The utility must provide underlying data for recent conditions (over the last five years) of the utility's service territory in a downloadable shapefile Geographic Information System (GIS) format, following the spatial reporting schema. All data is reported quarterly, this is a placeholder for quarterly spatial data.

The underlying data for recent conditions of the utility service territory is enclosed with the GIS Data Standard quarterly submission. Please see the Q4 2021 GIS Data Standard submission Cover Letter for additional discussion on the GIS data provided.

6.6 Recent Weather Patterns, Last Seven Years

Instructions for Table 6 of Attachment 3:

In the attached spreadsheet document, report weather measurements based upon the duration and scope of National Weather Service RFW, HWW and upon proprietary Fire Potential Index (or other similar fire risk potential measure if used) for each year. Calculate and report 5-year historical average as needed to correct previously-reported data.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 6.

6.7 Recent and Projected Drivers of Ignition Probability

Instructions for Table 7.1 and Table 7.2 of Attachment 3:

(Table 7.1) In the attached spreadsheet document, report recent drivers of outages according to whether or not risk events of that type are tracked, the number of incidents per year (e.g., all instances of animal contact regardless of whether they caused an outage, an ignition, or neither), the rate at which those incidents (e.g., object contact, equipment failure, etc.) cause an ignition in the column, and the number of ignitions that

those incidents caused by category, for each of last seven years as needed to correct previously -reported data. Calculate and include 5-year historical averages. This requirement applies to all utilities, not only those required to submit annual ignition data. Any utility that does not have complete 2021 ignition data compiled by the WMP deadline is required to indicate in the 2021 columns that said information is incomplete.

(Table 7.2) Similar to Table 7.1, but for ignition probability by line type and High Fire Threat District (HFTD) status, according to if ignitions are tracked.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Tables 7.1 and 7.2.

6.8 Baseline State of Equipment and Wildfire and PSPS Event Risk Reduction Plans

6.8.1 Current Baseline State of Service Territory and Utility Equipment

Instructions for Table 8 of Attachment 3:

In the attached spreadsheet document, provide summary data for the current baseline state of HFTD and non-HFTD service territory in terms of circuit miles; overhead transmission lines, overhead distribution lines, substations, weather stations, and critical facilities located within the territory; and customers by type, located in urban versus rural versus highly rural areas and including the subset within the Wildland-Urban Interface (WUI) as needed to correct previously-reported data.

The totals of the cells for each category of information (e.g., "circuit miles (including WUI and non-WUI)" would be equal to the overall service territory total (e.g., total circuit miles). For example, the total of number of customers in urban, rural, and highly rural areas of HFTD plus those in urban, rural, and highly rural areas of non-HFTD would equal the total number of customers of the entire service territory. Table 8: State of service territory and utility equipment – reference only, fill out attached spreadsheet to correct prior reports

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 8.

6.8.2 Additions, Removal, and Upgrade of Utility Equipment By End of 3-Year Plan Term

Instructions for Table 9 of Attachment 3:

In the attached spreadsheet document, input summary information of plans and actuals for additions or removals of utility equipment as needed to correct previously reported data. Report net additions using positive numbers and net removals and undergrounding using negative numbers for circuit miles and numbers of substations. Report changes planned or actualized for that year – for example, if 10 net overhead

circuit miles are added in 2020, then report "10" for 2020. If 20 net overhead circuit miles are planned for addition by 2022, with 15 being added by 2021 and 5 more added by 2022, then report "15" for 2022 and "5" for 2021. Do not report cumulative change across years. In this case, do not report "20" for 2022, but instead the number planned to be added for just that year, which is "5".

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 9.

Instructions for Table 10 of Attachment 3:

Referring to the program targets discussed above, report plans and actuals for hardening upgrades in detail in the attached spreadsheet document. Report in terms of number of circuit miles or stations to be upgraded for each year, assuming complete implementation of wildfire mitigation activities, for HFTD and non-HFTD service territory for circuit miles of overhead transmission lines, circuit miles of overhead distribution lines, circuit miles of overhead transmission lines located in Wildland-Urban Interface (WUI), circuit miles of overhead distribution lines in WUI, number of substations, number of substations in WUI, number of weather stations and number of weather stations in WUI as needed to correct previously-reported data.

If updating previously -reported data, separately include a list of the hardening initiatives included in the calculations for the table.

The comments and notes for this table are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 10.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 7

MITIGATION INITIATIVES

7. Mitigation Initiatives

7.1 Wildfire Mitigation Strategy

Describe organization-wide wildfire mitigation strategy and goals for each of the following time periods, highlighting changes since the prior Wildfire Mitigation Plan (WMP):

1. *By June 1 of current year*

2. *By September 1 of current year*

3 *Before the next Annual WMP Update*

4. *Within the next three years*

5. *Within the next 10 years*

Our wildfire mitigation strategy focuses on three overarching goals for preventing catastrophic wildfires associated with electrical equipment: (1) reducing wildfire potential; (2) improving situational awareness; and (3) reducing the impact to our customers and communities due to Public Safety Power Shutoff (PSPS) events and outages on circuits with Enhanced Powerline Safety Settings (EPSS) enabled..
To support this effort, we are working with regulators, communities, other utilities, and industry experts to gain a better understanding of the wildfire problem and ways to address and limit wildfire risk. Below, we describe our wildfire mitigation strategy and goals within the next year, within the next three years, and within the next 10 years.

Within the Next Year:

Our wildfire mitigation strategy and goals through June 1, September 1 and the next WMP update focus on the Initiative Targets identified in Section 5.3 and specifically in Tables PG&E-5.3-1(A) and PG&E-5.3-1(B). For brevity, we will not repeat the Initiative Targets here.

Within Three Years:

Our wildfire mitigation strategy and goals for the next three years are described in Section 5.2 and specifically in Table PG&E-5.2-1 and for brevity are not repeated here.

Within 10 Years:

Our wildfire mitigation strategy and goals for the next ten years are described in Section 5.2 and specifically in Table PG&E-5.2-1 and for brevity are not repeated here.

7.1.A. PG&E's Approach to Managing Wildfire Risk

A. Discuss the utility's approach to determining how to manage wildfire risk (in terms of ignition probability and estimated wildfire consequence) as distinct from managing risks to safety and/or reliability. Describe how this determination is made both for: (1) the types of activities needed; and (2) the extent of those activities needed to mitigate these two different groups of risks. Describe to what degree the activities needed to manage wildfire risk may be incremental to those needed to address safety and/or reliability risks.

In this section, Pacific Gas and Electric Company (PG&E) addresses how wildfire risks are evaluated and managed differently than other safety (non-wildfire) and reliability risks. To address risk, PG&E uses the Safety Model Assessment Proceeding (S-MAP) principles to implement the methodologies adopted in the S-MAP Settlement which was approved by the California Public Utilities Commission (CPUC or Commission) in Decision (D.) 18-12-014. Our risk management program enables PG&E to: (1) identify those risks that could lead to catastrophic safety consequences; (2) implement the actions that have the highest and most cost-effective potential to reduce risk; and (3) transparently monitor and report results.

Through the S-MAP process PG&E developed the Corporate Risk Register, presenting each risk event with definitions, risk Bow Tie analyses, and data. For each risk on the Corporate Risk Register, PG&E assessed the likelihood of a risk event (LoRE), and the consequence of a risk event (CoRE) attributed to Safety, Reliability, and Financial. The consequences of a risk event's different attributes are combined through the Multi-Attribute Value Function (MAVF) framework and used to calculate a Multi-Attribute Risk Score (MARS) by multiplying frequency of a risk event. This, in total, allows PG&E to assess the level of risk between wildfire and other risks.

Table PG&E-7.1.A-1 below presents how wildfire risk compares to other risks, such as third-party safety incidents and failure of electric distribution overhead assets. Given the significant difference in risk scores between wildfire and other risks, mitigation programs that effectively mitigate ignition or wildfire consequence show higher risk reduction than non-wildfire mitigation programs.

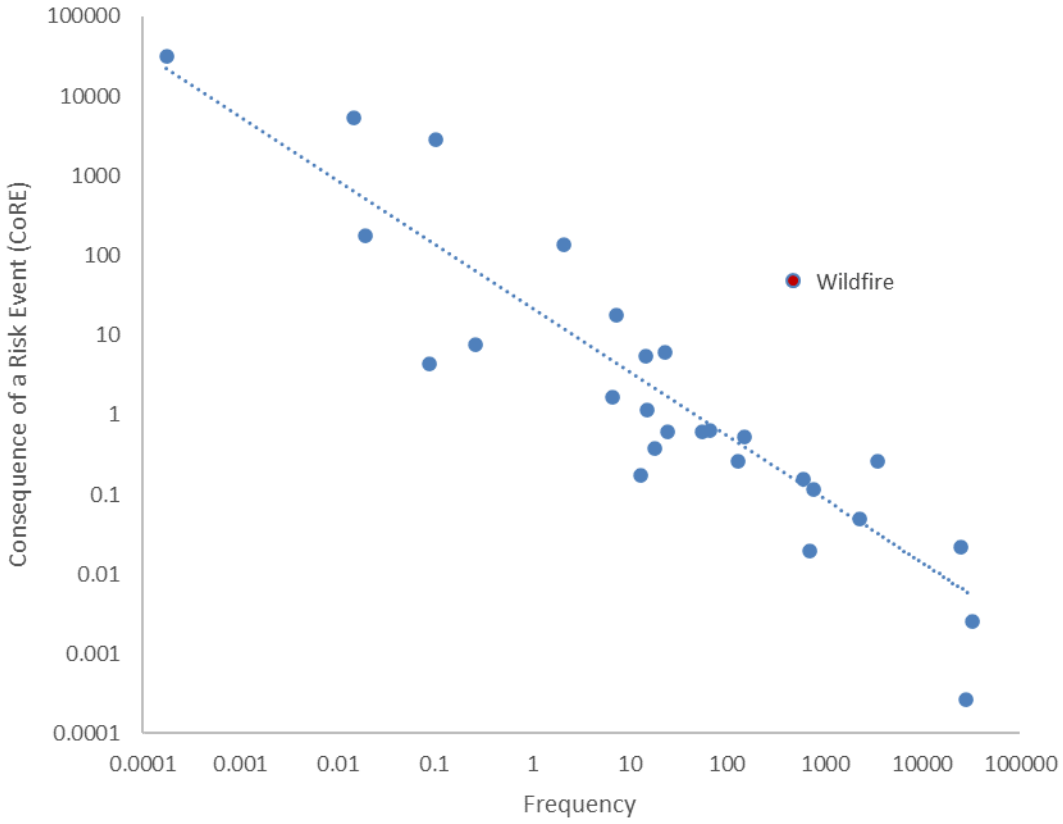
TABLE PG&E-7.1.A-1:
2023 BASELINE RISK RANKING

Risk – Sorted by Total Risk Score	Safety Risk Score	Reliability Risk Score	Financial Risk Score	Total Risk Score
Wildfire	7,810	387	14,947	23,143
Third Party Safety Incident	863	60	–	923
Failure of Electric Distribution Overhead Assets	15	480	44	539
Nuclear Extended Shutdown	–	–	290	290
Loss of Containment on Gas Transmission Pipeline	247	8	29	284
Cyber Security Incident	–	–	142	142
Real Estate and Facilities Failure	108	–	20	128
Failure of Electric Distribution Underground Assets	8	100	8	116
Employee Safety Incident	90	–	4	94
Information Technology (IT) Asset Failure	–	–	89	89
Loss of Containment on Gas Distribution Main or Service	60	3	20	84
Large Uncontrolled Water Release (Dam Failure)	43	–	37	80
Aviation Incident	80	0	0	80
Contractor Safety Incident	79	–	–	79
Failure of Electric Distribution Substation Assets	3	23	16	42
Data Loss Event	–	–	34	34
Hazardous Material Release	–	–	34	34
Failure of Electric Distribution Network Assets	17	0	0	17
Extended Unplanned Shutdown of Critical Power Generation Asset	–	–	15	15
Motor Vehicle Incident	13	–	1	14
Large Overpressure Event Downstream of Measurement and Control (M&C) Facility	11	0	0	11
Loss of Containment on Customer Connected Equipment	7	0	0	8
Insufficient Capacity to Meet Customer Demand	2	5	0	7
Core Damaging Event	1	–	5	6
Loss of Containment at a Storage Well or Reservoir	2	0	1	4
Loss of Containment at a Compressed Natural Gas (CNG) Station	2	0	0	2
Loss of Containment at Compression and Processing (C&P) or M&C Facility	0	2	0	2
Loss of Containment on Liquified Natural Gas (LNG)/CNG Portable Equipment	0	0	0	0

The largest distinction between wildfire risk and other risks in the Corporate Risk Register is a high average consequence associated with a risk event while a risk event occurs frequently. Figure PG&E-7.1.A-1 below shows how the frequency and consequence of a wildfire risk event compares to other risk events. Therefore, PG&E's determination of the activities needed to mitigate wildfire risk and prioritization of those

activities are driven significantly by the consequence of an ignition, which is informed by the Wildfire Distribution Risk Model (WDRM) and is dependent on the location.

FIGURE PG&E-7.1.A-1:
BASELINE FREQUENCY VS. CONSEQUENCE OF A RISK EVENT



A Bow Tie analysis also helps to compare top drivers of each risk to identify mitigations to address each of the top risk drivers. PG&E's risk assessment process to identify the top drivers of wildfire risk and PG&E's approach for addressing each of those drivers are detailed in Section 4.2.

After performing a risk analysis on the wildfire risk, PG&E focuses on understanding each mitigation programs' benefit in managing and mitigating that risk, either by reducing the likelihood of a risk event or by reducing the consequence of an event. This is detailed in Table 12 in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01 for the initiatives assessed.

Approximately 99 percent of PG&E's wildfire risk is located in the High Fire Threat District (HFTD) Tier 3 and Tier 2 areas, even though only 32 percent of risk events occur inside the HFTD. The largest drivers of wildfire risk are vegetation contact and conductor failure. In 2021, we used the 2021 WDRM v2 to help delineate wildfire risk within HFTD areas at a distribution circuit segment level.

Many programs that mitigate wildfire risks address reliability risks as well. PG&E separates the ignition events into wildfire risk and non-ignition asset failures into asset failure risks. For example, PG&E's major wildfire mitigation activities such as system hardening, Enhanced Vegetation Management (EVM), and non-exempt surge arrester programs also mitigate the risk of distribution overhead asset failures, which are all associated with reliability risks. However, the effectiveness of reducing wildfire risk of overhead system hardening and EVM is estimated to be less than 70 percent. Given catastrophic consequences associated with the residual wildfire risk, PG&E's approach for mitigating wildfire risk is to supplement those programs with PSPS and EPSS programs which help mitigate the risk of catastrophic wildfire. Additionally, we are increasing the amount of undergrounding (which has effectiveness greater than 95 percent) in Tier 3 and Tier 2 areas to reduce the need for PSPS and EPSS and improve system reliability.

7.1.B. Risk Modeling Outcomes in Decision-Making and Mitigations

B. Discuss how risk modeling outcomes are used to inform decision-making processes and used to prioritize mitigation activities. Provide detailed descriptions including clear evaluation criteria[75] and visual aids (such as flow charts or decision trees). Provide an appendix (including use of relevant visual aids) with specific examples demonstrating how risk modeling outcomes are used in prioritizing circuit segments and selecting mitigation measures.

At an enterprise level, our 2022 Enterprise Risk Model (2022 ERM) provides PG&E with a "top-down" macro view of the enterprise risks (i.e., wildfire, earthquake, cyber/physical attacks, etc.) that could impact PG&E and could result in significant safety, reliability, and/or financial impacts. The 2022 ERM predicts a relative magnitude assessment in terms of MAVF score to develop program level mitigation plans and apply them at the tranche level. The 2022 ERM allows us to consider and evaluate all risks, including wildfire risks. The 2022 ERM is described in detail in Section 4.5.1(a).

Other models, such as the WDRM, allow PG&E to view wildfire risk specifically at a much more granular, "bottom up" view at the circuit segment level. The 2021 WDRM v2 and 2022 WDRM v3 modeling outputs are or will be used to inform decision-making processes and to prioritize distribution mitigation activities at a locational level, as depicted in Figure PG&E-7.1.B-1 below.[76]

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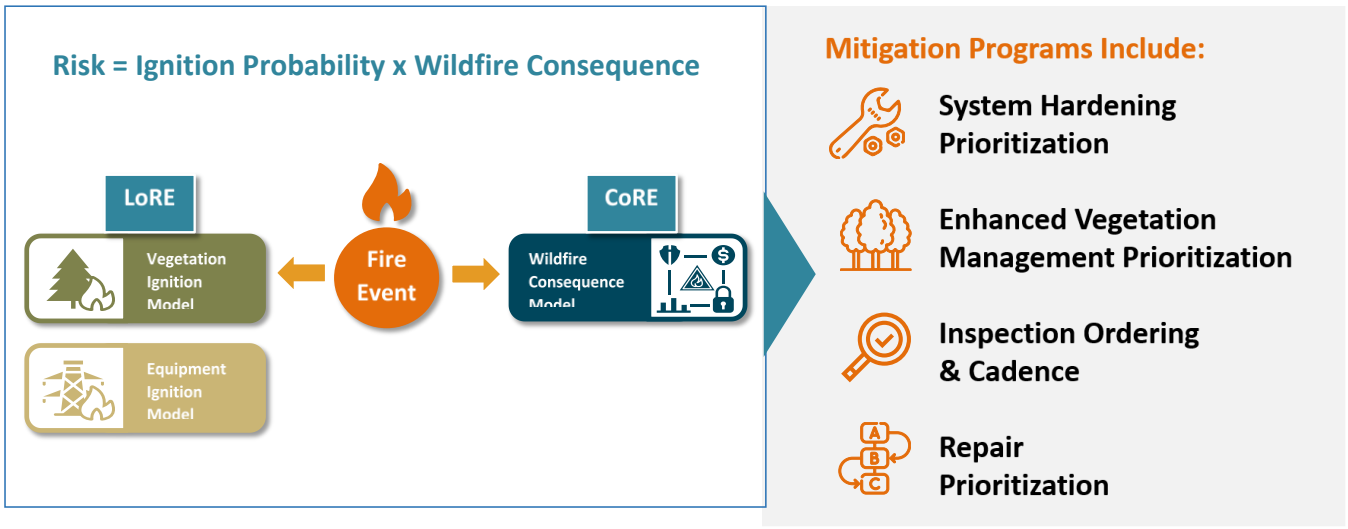
75 "Evaluation criteria" should include all points of considerations including any thresholds and weights that may affect the outcome of their decision, as well as a descriptor of how it is evaluated (i.e., given a risk score, using SME expertise to determine that score, using a formula).

76 The 2021 WDRM v2 and 2022 WDRM v3 are described in Section 4.5.1.

FIGURE PG&E-7.1.B-1:
RISK MODELING FRAMEWORK FOR INFORMING WILDFIRE MITIGATION ACTIVITIES

Our 2021 wildfire risk modeling framework is used to assess the Probability of Ignition or Likelihood of Risk Event (LoRE) and the Consequence of Risk Event (CoRE)* and helps us target our Enhanced Vegetation Management work, among other efforts.

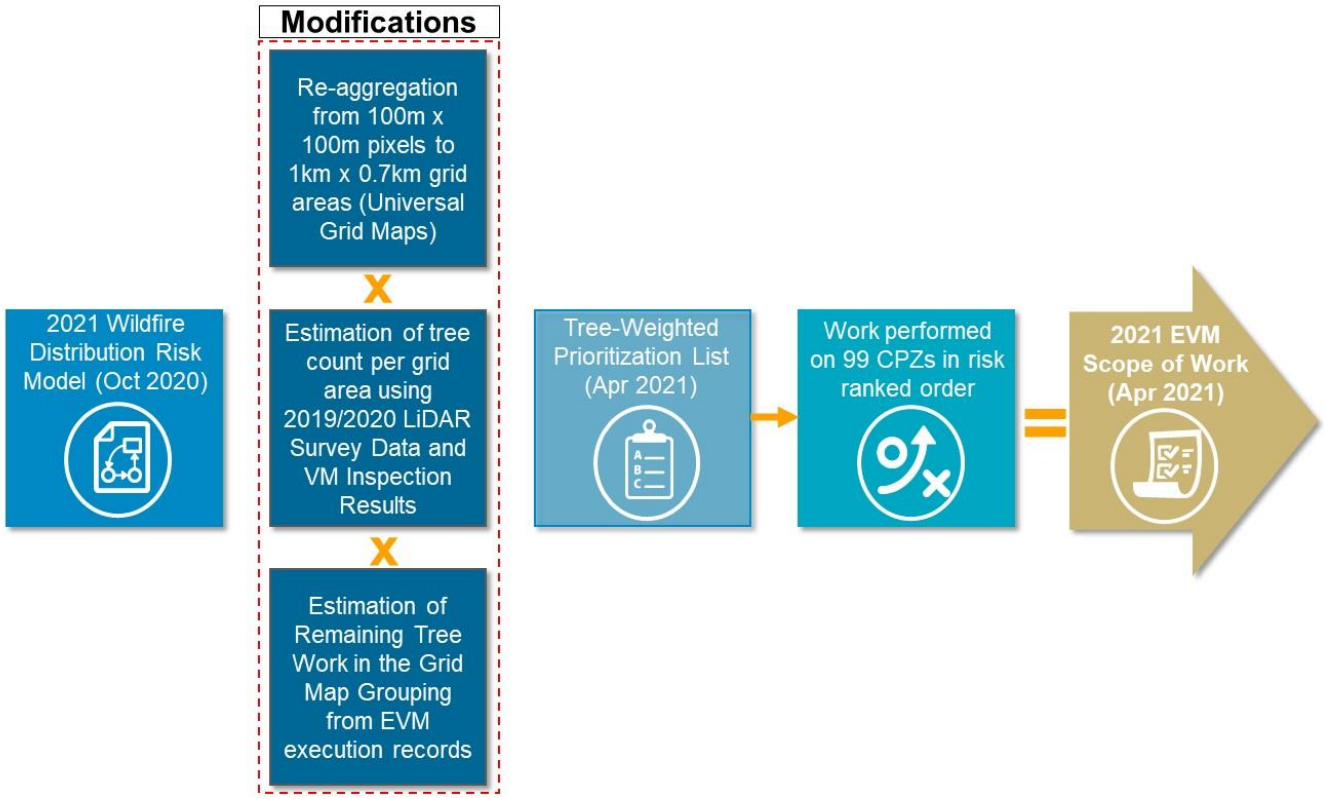


The initial purpose of the 2021 WDRM v2 was to inform PG&E's System Hardening and EVM programs. For System Hardening, the 2021 WDRM v2 assessed Probability of Ignition and Wildfire Consequence which allows PG&E to risk rank (prioritize) the approximately 3,600 circuit segments in HFTD areas for consideration for hardening treatments for the 2021 and 2022 wildfire mitigation programs.

For EVM, we used the 2021 WDRM v2 to inform and risk rank EVM treatments across the approximately 3,200 circuit segments in the HFTD where EVM may be performed. The 2021 WDRM v2 output was then enhanced using LiDAR and vegetation inspection data to develop the EVM Tree Weighted Prioritization which informs the risk ranking of over 2,400 miles of circuit segments.[77] This risk ranking was then used to develop the 2021 EVM Scope of Work. The use of risk modeling in EVM decision-making, including the development of the 2021 EVM Scope of Work, is depicted in Figure PG&E-7.1.B-2 below.

[77] The EVM Tree Weighted Prioritization Model is described in Section 4.5.1.

FIGURE PG&E-7.1.B-2:
RISK MODELING FRAMEWORK FOR 2021 EVM PROGRAM



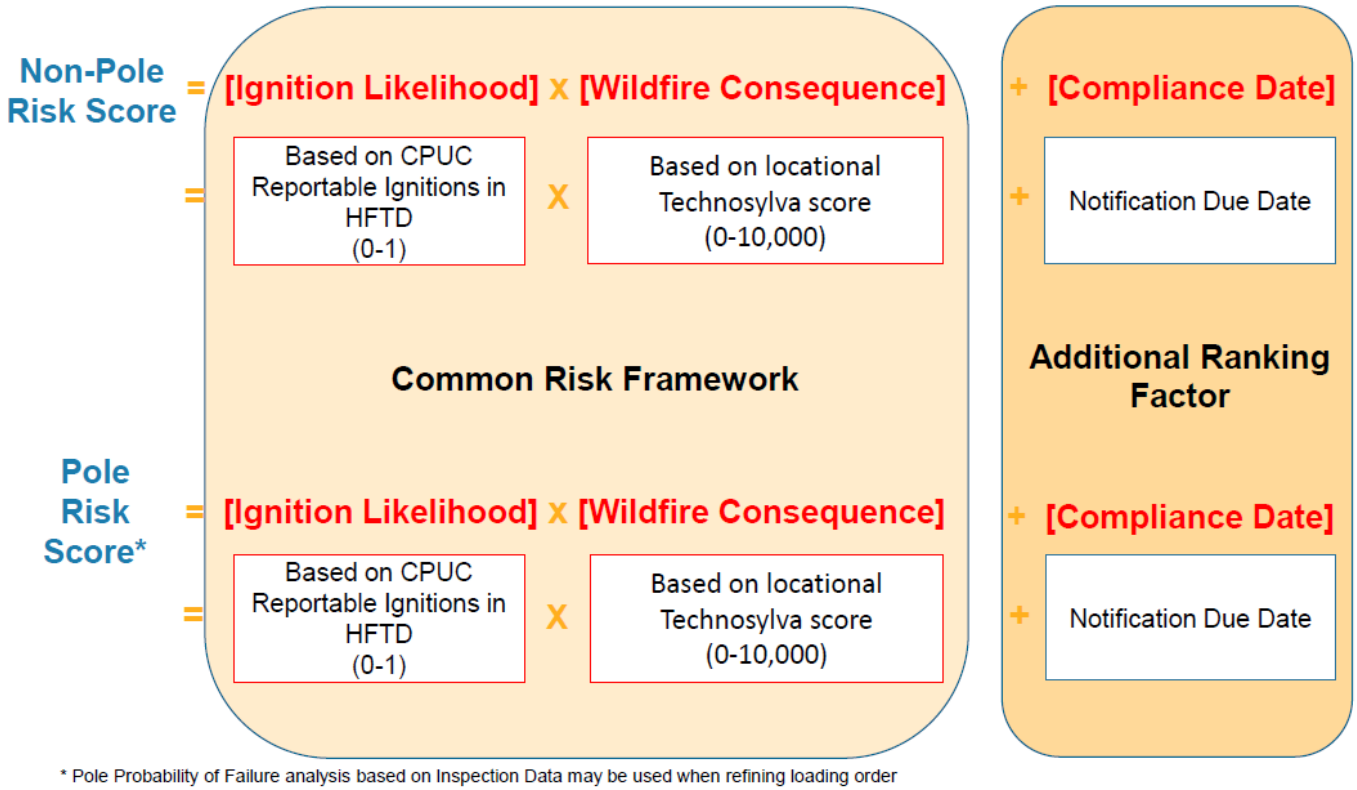
PG&E has undertaken a number of initiatives related to equipment to reduce the potential for wildfire ignition, such as the replacement of non-exempt expulsion fuses in the HFTD areas. To inform the replacement of non-exempt expulsion fuses, for example, we developed a methodology to assess the wildfire consequence at the specific location of each non-exempt expulsion fuse and developed a risk prioritization approach for replacement using the WFC Model.

Another example of where risk modeling is used is in the prioritization of Electric Corrective (EC) tags. In 2021, PG&E implemented a program to proactively reduce the backlog of EC tags generated during the enhanced system inspections performed in recent years. The four different EC tag designations used by PG&E are A, B, E, and F tags which represent the level of severity of the issue identified and specifies a specific timeframe of when corrective actions need to be completed by.

Much of this backlog is related to E tags which are not an immediate safety concern and require corrective action be taken within 36 months from identification in accordance with CPUC General Order (GO) 95. Since EC tags relate to components which are susceptible to a number of potential failure modes, the 2021 WDRM v2 was not the correct tool to use since its primary focus is to predict contact with overhead conductors or failure of these conductors. As a result, PG&E developed a novel approach using the wildfire consequence scores from the WFC Model for each of the specific EC tag locations, together with a likelihood of ignition estimation based on historical ignition data. We also considered the age of these EC tags as an additional factor in the risk

prioritization. The risk modeling framework for EC tag prioritization is reflected in Figure PG&E-7.1.B-3 below.

FIGURE PG&E-7.1.B-3:
RISK MODELING FRAMEWORK FOR 2021 EC TAG PRIORITIZATION



All of these are examples of how we are using risk-modeling to inform decision-making for our WMP initiatives. As our models continue to evolve and improve, we expect that we will continue to develop new applications for these models to WMP initiatives.

7.1.C. Major Investments and Implementation of Wildfire Mitigation Initiatives

C. Include a summary of achievements of major investments and implementation of wildfire mitigation initiatives over the past year, lessons learned, changed circumstances during the 2020-2022 WMP plan cycle, and corresponding adjustment in priorities for the current year. Organize summaries of initiatives by the wildfire mitigation categories listed in Section 7.3.

Lessons learned in 2021 are addressed in Section 4.1.

With regards to changed circumstances in 2021, several events occurred during the year that impacted our wildfire mitigation programs. First, PG&E instituted a new ignition investigation process for CPUC-reportable ignitions in HFTD areas to better identify failure modes and trends related to ignitions in high-consequence areas (please refer to Section 7.3.7.3 for details). This process allowed for a more complete and accurate understanding of PG&E's historical ignition record and provided increased insight on ignitions of consequence.

Second, as a result of the drought and increased climate-driven wildfire activity, in 2021, we announced a program to underground 10,000 miles of distribution lines and implemented EPSS. The undergrounding program and EPSS represent our evolving, data-driven approach to addressing the dynamic wildfire risks that we are facing in Northern and Central California. Our undergrounding program is described in more detail in Section 7.3.3.16 and EPSS is described in more detail in Section 7.3.6.8.

As a result of these changed circumstances and our continuous learning from updated data and analytics, we have adopted the 2022 WMP Initiative Targets found in Tables PG&E-5.3-1(A), and PG&E-5.3-1(B).

Table PG&E-7.1.C-1 below summarizes the achievements of major investment and implementation of wildfire mitigation initiatives in 2021.

TABLE PG&E-7.1.C-1:
SUMMARY OF ACHIEVEMENTS OF MAJOR INVESTMENTS AND IMPLEMENTATION OF WILDFIRE MITIGATION INITIATIVES FOR 2021

Category	Summary of Achievements of Major Investments and Implementation of Wildfire Mitigation Initiatives in 2021
Risk Assessment & Mapping	Improved our Transmission Risk Modeling to provide more standardized wildfire risk mapping and ranking between the various controls and mitigations; Incorporated 2020 data to improve PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models; Improved Distribution Risk Modeling to include: (1) the ability to compare wildfire risks for different risk drivers; (2) the ability to measure the risk reduction of specific mitigations; and (3) wildfire risk values for distribution line locations across all of PG&E's distribution lines; Enhanced the wildfire spread project in 2021 by expanding the forecast horizon from three days to four; Updated the fuel model layers (Technosylva) to include modeling for new vegetation growth in recently burned areas and to account for recent fire disturbances; Created a preliminary version of a circuit isolation zone model; and, Developed an initial PSPS Consequence Model at the circuit level.
Situational Awareness and Forecasting	Made enhancements to numerical weather prediction program including: (1) expanded the historical weather climatology at 2 x 2 km resolution to back-fill all of 2020; (2) explored a methodology to back-fill the climatological data each quarter moving forward; (3) evaluated extending the deterministic forecast to provide another 24 hours of forecast data (from 105 hours currently to 129 hours); and (4) evaluated if the POMMS-EPS ensemble mean is more or less accurate than the deterministic POMMS model; Enhanced our Fuel Moisture Sampling and Modeling efforts by expanding the historical Dead Fuel Moisture (DFM) and Live Fuel Moisture (LFM) climatology at 2 x 2 km resolution to back-fill all of 2020; Evaluated extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data; Installed 308 weather stations; Developed a weather-station specific wind gust model, with particular emphasis on Diablo winds; Installed 153 high-definition cameras; Adjusted the public 7-day forecast to provide more granularity and clarity around the potential for a PSPS event, possibly by county; Expanded SmartMeter Phase 1 for single phase meters to an additional 415,911 meters, covering all 4.5 million single phase meters in our service areas in both HFTD and non-HFTD areas; Implemented SmartMeters Phase 2 to expand coverage of Partial Voltage Detection capabilities to the three phase meters;

TABLE PG&E-7.1.C-1:
SUMMARY OF ACHIEVEMENTS OF MAJOR INVESTMENTS AND IMPLEMENTATION OF WILDFIRE MITIGATION INITIATIVES FOR 2021
(CONTINUED)

Category	Summary of Achievements of Major Investments and Implementation of Wildfire Mitigation Initiatives in 2021
	Deployed Sensor IQ (SIQ) functionality on 500,000 SmartMeters; Completed a 6-month minimum analytic stage capturing all events on the Half Moon Bay 1103 circuit to inform the Distribution Arcing Fault Signature Library project; Maintained staffing levels to meet the SIPT goal of maintaining 40 crews; Finalized the HAWC process to include weather, fires, geosciences, electric and gas operations, as well as generation; and, Expanded the current Active Incidents Dashboard for additional stability, to incorporate new data streams, and to expand the number of viewers.
Grid Design & System Hardening	Launched a plan to underground 10,000 miles or overhead distribution lines in HFTD areas; Replaced 1,429 non-exempt fuses; Installed and SCADA-commissioned 269 new PSPS sectionalizing devices; Installed 41 T-Line SCADA switches benefitting PSPS operations; Replaced 50 MSO devices with new SCADA devices: 44 were replaced with reclosers and were SCADA-commissioned, two were replaced with SCADAMATE-SD switches and SCADA-commissioned, and four MSOs were replaced that did not require SCADA-commissioning; Replaced all remaining distribution line legacy 4C controllers in Tier 2 and Tier 3 HFTD areas; Installed 71 single phase recloser units; Operationalized nine PIH substations to receive temporary generation for 2021 PSPS mitigation; Developed five additional distribution microgrid Pre-installed Interconnection Hubs (PIH); Prepared a total of 37 (five in 2020, and 32 in 2021) Service Centers with permanent or temporary generation; Hardened 210 distribution miles and 104 transmission miles; Replaced 15,465 non-exempt surge arresters; Completed a Rapid Earth Fault Current Limiter (REFCL) Pilot; Began operations of the first Remote Grid site; and, Completed 23.64 trench miles (31.5 circuit miles) of undergrounding as part of Butte County Rebuild program.

TABLE PG&E-7.1.C-1:
SUMMARY OF ACHIEVEMENTS OF MAJOR INVESTMENTS AND IMPLEMENTATION OF WILDFIRE MITIGATION INITIATIVES FOR 2021
(CONTINUED)

Category	Summary of Achievements of Major Investments and Implementation of Wildfire Mitigation Initiatives in 2021
Asset Management and Inspections	Completed enhanced detailed inspections on 480,746 distribution poles in HFTD areas and non-HFTD HFRA; Completed enhanced detailed inspections on 26,826 transmission structures in HFTD areas and non-HFTD HFRA.; Completed infrared inspections on 10,093 miles of distribution lines; Completed infrared inspections on 4,211 HFTD miles (7,587 miles systemwide) of transmission lines; Completed supplemental inspections of 71 distribution substations, 33 transmission substations, and 38 hydro substations; and, Upgraded the intrusive pole inspection program's field hardware and software to enhance recordkeeping and data system integrations.
Vegetation Management and Inspections	Developed the framework for, and began to execute on, the enhanced customer engagement strategy incorporating customer outreach through postcards, door hangers, and automated calls to provide up to five outreach touchpoints; Completed Transmission ROWX on 288.6 miles in HFTD areas, and 25.2 miles in non-HFTD areas; and, Completed 1,983 miles of EVM work, 98% of which was focused on the highest 20% or risk-ranked Circuit Protection Zones.
Grid Operations and Protocols	Implemented the EPSS Program on approximately 11,500 miles of distribution circuits in HFTD areas (45% of the circuits); Disabled automatic reclosers in HFTD areas prior to fire season, and for the duration of the entire fire season; Utilized the Safety and Infrastructure Protection Team (SIPT) to support fire prevention and mitigation activities as well as "on call" status during the summer preparedness period, and utilized our Public Safety Specialists (PSS) to help inform our wildfire mitigation efforts; and, Improved the PSPS re-energization protocols by implementing "all clear zones" and refining external communications and customer notifications processes.
Data Governance	Initiated over 35 different information technology (IT) projects to assist PG&E in wildfire mitigation work; Increased the accuracy and comprehensiveness of data captured for risk events in five critical areas: (1) ignition incident data; (2) equipment failure-caused wire down data; (3) equipment failure-caused outage data; (4) vegetation-caused outage data; and (5) near miss data; Increased the capacity to deliver new, high-quality data objects into Foundry; and, Developed eight new wildfire-related analytic and situational intelligence products.
Resource Allocation Methodology	Expanded RSE scores to more to an additional 232 risk mitigation and control programs; and, Engaged with a third party technical advising group that is performing an assessment of RSE methodologies used in the 2021 WMP.

TABLE PG&E-7.1.C-1:
SUMMARY OF ACHIEVEMENTS OF MAJOR INVESTMENTS AND IMPLEMENTATION OF WILDFIRE MITIGATION INITIATIVES FOR 2021
(CONTINUED)

Category	Summary of Achievements of Major Investments and Implementation of Wildfire Mitigation Initiatives in 2021
Emergency Planning and Preparedness	Hired 41 Linemen and 123 Apprentice Linemen; and, Completed identified trainings for all required personnel to improve PSPS event execution (including Standardized Emergency Management System (SEMS), Access and Functional Needs (AFN), and other critical trainings).
Stakeholder Cooperation and Community Engagement	Engaged with 70 new CBOs, and established 40 new informational CBO partnerships and 18 new resource CBO partnerships; Established an agreement with California network of 211s to provide customers in the AFN community with a single source of information and connection to available resources in their communities; Engaged community stakeholders through offering: (1) Wildfire Safety Working Sessions; (2) workshops that review PG&E's PSPS Policies and Procedures document; (3) listening sessions; and (4) Energy and Communications Providers Coordination Group meetings; Held 39 safety town halls through webinar (due to COVID-19); Completed 87 informational mailings; and, Completed 4 informational videos.

7.1.D. Challenges Associated With Limited Resources

D. List and describe all challenges associated with limited resources and how these challenges are expected to evolve over the next three years.

Limited resources continue to be a significant execution risk facing WMP implementation.

As workload volumes in some key areas grow in 2022 and beyond, including system hardening, we will closely monitor available resource levels in order to complete our wildfire mitigation work. Resource limitations will also likely remain a challenge in areas such as vegetation management, given the volume of work to be performed and the need for skilled and experienced individuals to address the inherent hazards of the job. In addition, legal requirements such as Senate Bill (SB) 247 may impact vegetation management companies and employees in California. It is also difficult to forecast how the labor market and resource capacity/availability within California and the Western United States will change over the next several years given the increased wildfire risk experienced in the Pacific Northwest over the last few years. It is likely that the demand for trained resources will increase. Further, the ongoing COVID-19 pandemic creates uncertainty related to the availability of contract resources who often travel across states or regions throughout the year. We recognize that hiring additional, talented individuals for critical positions now, and providing them with experience and training, will provide significant benefits in the future. Therefore, we are working with community colleges and the International Brotherhood of Electrical Workers (IBEW) to establish training programs to increase the size of our skilled workforce, most notably in vegetation management.

PG&E is also closely monitoring resource limitations related to key “support” functions. A primary example is Geographic Information System (GIS) resources. There are a limited number of these highly skilled, and often very experienced, employees or contractors who can quickly and efficiently navigate utility GIS systems and gather/integrate data from these systems. In light of the GIS data reporting requirements that have substantially increased and evolved, PG&E is assessing if it has, or can acquire, enough qualified, efficient GIS resources to support the critical needs of: (1) ongoing operations; (2) system improvements and enhancements to support more efficient operations; and (3) data reporting requirements and submissions.

PG&E is continually monitoring our resource levels to ensure that we have the resources we need to perform, and support, critical wildfire risk mitigation work. Over the next three years, we anticipate that the COVID-19 pandemic, public health requirements, and other regulations will continue to impact resource availability.

7.1.E. New or Emerging Technologies

Outline how the utility expects new technologies and innovations to impact the utility's strategy and implementation approach over the next three years, including the utility's program for integrating new technologies into the utility's grid. Include utility research listed above in Section 4.4

This section addresses new or emerging technologies including: (1) the impact of our new and emerging technology strategies; (2) implementation approach and integration of new and emerging technologies; and (3) project details on new and emerging technologies.

7.1.E(1) Impact on New and Emerging Technology Strategies

PG&E actively explores new or emerging technologies that can mitigate wildfire risk and associated potential impact on public safety. This section details technology-driven innovations focused on wildfire mitigation consistent with the following definitions:

- New – Technologies or analytical methods enabled through technology that were new to PG&E as described in our 2019 Wildfire Safety Plan (i.e., February 6, 2019) as well as after the release of the 2019 Wildfire Safety Plan, exclusive of 'emerging' technologies.

- Emerging – Pre-commercial technologies or analytical methods, including Technology Demonstration & Deployment projects.[78]

These technologies or analytical methods hold significant promise to advance PG&E's wildfire risk mitigation, bolster operational capabilities, increase the flexibility of the grid, and allow for greater system resiliency. Capabilities targeted through new or emerging technologies include:

- Situational Awareness and Forecasting – New or emerging technologies can enable more accurate forecasting and identification of environmental events and operating conditions that pose a risk to the grid so that critical issues may be dealt with as quickly as possible to avoid the risk of catastrophic wildfires.

- Grid Design and Hardening – New or emerging technologies can enable innovative system hardening techniques (e.g., new grid topologies or new resilience and PSPS avoidance technologies or techniques) to mitigate the risk of fire ignition and potential impacts on public safety.

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[78] The Technology Demonstration and Deployment demonstration project definition was approved by the CPUC in D.12-05-037, p. 37: "The installation and operation of pre-commercial technologies at a scale sufficiently large and in conditions sufficiently reflective of anticipated actual operating environments, to enable the financial community to effectively appraise the operational and performance characteristics of a given technology and the financial risks it presents."

- Asset Management and Inspections – New or emerging technologies can enable automated and improved methods to identify asset or system issues so that high-risk items can be addressed prior to failure.

- Vegetation Management and Inspections – New or emerging technologies can enable more timely and accurate insights on vegetation health, density and proximity to assets allowing PG&E to implement risk-based vegetation management work practices to further ensure high risk areas are efficiently addressed.

- Asset Analytics and Grid Monitoring – New or emerging technologies can leverage data to enable greater insights on asset health to optimize system maintenance and implement proactive measures to reduce the risk of asset failure.

- Foundational Enablement – New or emerging technologies, including grid communication tools and control networks, can enable greater exchange of information required to provide real or near-real-time operational visibility across the grid for enhanced decision-making. These foundational items can also increase the flexibility of the grid, providing fundamental capabilities to advance system resiliency.

The projects described in Section 7.1.E(3) are arranged according to these targeted capability areas above ("Program Areas").

The impacts of new or emerging technologies on utility strategy will vary by project. Information on the strategic enablement of these technologies is detailed further in Section 7.1.E(3). The scope and implementation of these projects are subject to change due to the evolving nature of technology and business needs. There will likely be technologies that develop or mature over the reporting timeframe which PG&E may pursue that are not described in the 2022 WMP.

7.1.E(2) Implementation Approach and Integration of New or Emerging Technologies

The projects discussed in this section are managed as a portfolio of wildfire mitigation-related new or emerging technology projects. Currently 12 of the 26 projects in this portfolio are also administered under PG&E's Electric Program Investment Charge (EPIC) Program.

The EPIC Program, established in 2011 by the CPUC in D.11-12-035, provides PG&E with an opportunity to demonstrate the value of emerging technologies that could advance a broad array of objectives including wildfire safety, grid safety, resiliency, and reliability as well as customer enablement, and integration of renewable and distributed energy resources. The CPUC has established rules that guide the EPIC Program through its various rulings within the program docket. PG&E administers the EPIC Program to comply with the CPUC rules and effective use of the program funding. In selecting emerging technologies for demonstration, we assess criteria that may inform project value and successful implementation, including: (1) alignment to key program objectives; (2) technology novelty; (3) technology readiness; (4) sponsorship and clear path to production; (5) obstacles to implementation; and (6) potential benefits at demonstration and full deployment stages. PG&E also assesses alignment to utility strategic priorities and customer needs to ensure that technologies, if successfully demonstrated, will enable PG&E (and potentially other utilities) to better serve our customers and deliver on program objectives, including enhancements to safety and grid resiliency.

EPIC demonstration projects aid in identifying key requirements and insights to inform broader deployment in a manner that strategically aligns the integration of technologies with existing operations. Given the rapidly evolving energy landscape and the impact of climate change in California, the continuation of technology innovation programs like EPIC is critical to the continued advancements of grid capabilities to enable advancements on safety and resiliency.

Consistent with CPUC guidance, PG&E has relied primarily upon the EPIC Program to demonstrate emerging technologies to improve our ability to mitigate wildfire risk, although the wildfire mitigation new or emerging technology portfolio, as reported on in this section, also includes new technology projects that are not pre-commercial in nature. These projects are funded and managed separately from the EPIC portfolio according to standard (non-EPIC) business planning processes.

The EPIC 3 program cycle now underway is the latest active cycle in PG&E's EPIC Program. In D.21-11-028, the CPUC approved PG&E to continue as a direct program administrator of the follow-on EPIC Program cycle with additional administrative requirements and requires PG&E to file our EPIC 4 investment plans at the strategic initiative level by October 1, 2022 for CPUC review and approval. PG&E anticipates that some of the set of strategic initiatives it files in our EPIC 4 application will relate directly to enabling continued wildfire risk reduction.

7.1.E(3) New or Emerging Technologies – Project Details

This section provides an overview of 26 mitigations that leverage new or emerging technologies, including 22 projects that were previously included in Section 7.1.D in PG&E's 2021 WMP. The four new projects are: (1) EPIC 3.45: Automated Fire Detection from Wildfire Alert Cameras; (2) EPIC 3.46: Advanced Electric Inspection Tools–Wood Poles; (3) EPIC 3.47: Operational Vegetation Management Efficiency Through Novel Onsite Equipment; and (4) High Impedance Fault Detection and Protection.

These 26 projects and their approximate 2022 financial forecast are listed in Table PG&E-7.1.E-1 below. Project details are in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.E_Atch01.pdf.

TABLE PG&E-7.1.E-1:
NEW OR EMERGING TECHNOLOGIES

Program Area	Project Name	Approximate 2022 Project Financial Forecast (Thousands of Dollars)[a]
Situational Awareness and Forecasting	SmartMeter Partial Voltage Detection	N/A (project has moved to production)
	Line Sensor Devices	$8,037
	Early Fault Detection	$4,647[b]
	Distribution Fault Anticipation	$10,351[b]
	EPIC 3.45: Automated Fire Detection from Wildfire Alert Cameras	$1,983[b]
Grid Design and System Hardening	EPIC 3.15: Proactive Wires Down Mitigation Demonstration Project (Rapid Earth Fault Current Limiter)	$428
	Distribution, Transmission, and Substation: Fire Action Schemes and Technology (DTS-FAST)	$20,052
	Remote Grid	N/A (pilot completed)
	EPIC 3.11: Multi-Use Microgrid	$981 (total for these two EPIC 3.11 projects)
	EPIC 3.11: Multi-Use Microgrid (Control of BTM DERs)	
	Clean Gen for PSPS	2022 funding not yet approved
	High Impedance Fault Detection and Protection	2022 funding not yet approved
Asset Management and Inspections	Enhanced Asset Inspections – Drone/AI (Sherlock Suite)	2022 funding not yet approved
	Below Ground Inspection of Steel Structures (Steel Transmission Structure Corrosion Assessment and Mitigation Pilot)	N/A (pilot completed)
	EPIC 3.41: Drone Enablement	$2,550
	EPIC 3.46: Advanced Electric Inspection Tools – Wood Poles	$626
Vegetation Management and Inspections	Mobile LiDAR for Vegetation Management	N/A (pilot completed)
	EPIC 3.47: Operational Vegetation Management Efficiency Through Novel Onsite Equipment	$1,821

TABLE PG&E 7.1.E-1:
NEW OR EMERGING TECHNOLOGIES
(CONTINUED)

Program Area	Project Name	Approximate 2022 Project Financial Forecast (Thousands of Dollars)[(c)]
Asset Analytics and Grid Monitoring	EPIC 3.13: Transformer Monitoring via Field Area Network (FAN)	$1,251
	EPIC 3.20: Maintenance Analytics	$149
	EPIC 3.32: System Harmonics for Power Quality Investigation	$568
	Sensor IQ	$80
	EPIC 3.43: Momentary Outage Information	$1,829
	Wind Loading Assessments	N/A (pilot completed)
Foundational	EPIC 3.03: Advanced Distribution Energy Resource Management System	$704
	Advanced Distribution Management System (ADMS)	$512[(d)]

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(a) Financial forecasts for emerging technology assessment or deployment projects are highly tentative as uncertainty regarding costs and functionality is very high for new technologies. The forecast shown reflects total project costs only (not production costs if the results of the project lead to production), are estimates as of January 2022, and are subject to change, including but not limited to the fact that several of the project cost estimates remain to be determined at this time.

(b) For these three related projects (Line Sensors, Early Fault Detection, and Distribution Fault Anticipation), the forecast shown is capital costs only (no expense), The expense for these three projects is combined and is $2,576.

(c) Financial forecasts for emerging technology assessment or deployment projects are highly tentative as uncertainty regarding costs and functionality is very high for new technologies. The forecast shown reflects total project costs only not production costs if the results of the project lead to production), are estimates as of January 2022, and are subject to change, including but not limited to the fact that several of the project cost estimates remain to be determined at this time.

(d) This figure represents the portion of this project related to wildfire mitigation.

7.1.F. Wildfire Risk Data

F. Provide a GIS layer[79] showing wildfire risk (e.g., MAVF); data should be as granular as possible.

We are including two GIS Feature Classes, as found in 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.F_Atch01, in response to the prompt for Section 7.1.F, separating the views between transmission and distribution. Both maps contain data representing infrastructure with wildfire risk. These Feature Classes represent wildfire risk, which is the product of: a Probability of Failure (Transmission) or Probability of Ignition (Distribution), and wildfire consequence. The wildfire risk values for transmission and distribution assets are relative for each model. Relative risk scores for a Distribution circuit segment and a Transmission line are not necessarily comparable because of the individual methodologies used. The source data for these maps includes:

Source Data:

- Distribution (Feature Class "Distribution_Wildfire_Risk" in 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.F_Atch01):
  - Data source – 2021 WDRM v2 results (Risk Scores in MAVF):
    - 2020 vintage of circuit segments (used in 2021 WDRM v2); extracted from Palantir Foundry on 11/29/2021.
  - In the Feature Class, there is a list of circuit segments ("Circuit_Segment_name"). For each circuit segment, a value representing the wildfire risk can be found in the field labeled "mean_mavf_core_risk". See Section 4.5.1(b) for more details on the model that produces these estimates.
  - 3,632 records have an associated "mean_mavf_core_risk" value, as they reside within the HFTD Tier 2 or Tier 3 areas, and thus were modeled in the 2021 WDRM v2. There are 7,474 records that reside outside of the HFTD Tier 2 and Tier 3 areas, and thus have a null "mean_mavf_core_risk" value.
- Transmission (Feature Class "Transmission_Wildfire_Risk" in 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.F_Atch01):
  - Data source – Spreadsheet provided by Exponent under direction of Transmission Asset Strategy as part of the Operability Assessment program; provided 11/30/2021. This file is date stamped 9/23/2021.
  - Wildfire Risk ("ANNUAL_PFxMAVF_CORE_P90") is developed as the product of: the annualized Probability of Failure (a calculated likelihood that an electric

[79] GIS data that has corresponding feature classes in the most current version of Energy Safety GIS Data Reporting Standard will utilize the format for submission. GIS data that does not have corresponding feature classes shall be submitted in an ESRI-compliant GDB and include a data dictionary as part of the metadata.

transmission asset will fail due to wind gust speed), and Wildfire Consequence (Risk Scores in MAVF).

- Pf (Probability of Failure) from the Transmission Operability Assessment (OA) Model which computes an asset-based fragility (probability of failure due to wind gust speed) by quantitatively assessing the condition (or health) of transmission structures and components and accounting for known degradation mechanisms. Probability is calculated based on an asset fragility curve that is a function of windspeed. Asset failure curves are adjusted from "brand new" based on various factors such as inspection condition, age, environment, and previous. Please see Section 4.5.1.(h) for more details regarding the OA Model.

- P90_MAVF_CORE is produced from the WFC Model defined in Section 4.5.1.(d).

7.1.G. Grid Design and System Hardening Mitigations

G. Provide GIS layers[80] for the following grid hardening initiatives: covered conductor installation;[81] undergrounding of electrical lines and/or equipment; and removal of electrical lines. Features must have the following attributes: state of hardening, type of hardening where known (i.e., undergrounding, covered conductors, or removal), and expected completion date. Provide as much detail as possible (circuit segment, circuit- level, etc.). The layers must include the following:

a. Hardening planned for 2022

b. Hardening planned for 2023

c. Hardening planned for 2024

~~a.~~ b. Hardening planned for 2022 and 2023

Information responsive to this request is found in the table PG&E is providing in response to Remedy PG&E-21-14 in Section 4.6 for planned and scoped 2022 and 2023 System Hardening Projects. This table sets forth both constructed and planned work broken down by work type (overhead, underground, and removal) and provides circuit segment information and Lat/Long starting points for each project. There are additional projects PG&E is currently scoping for inclusion in 2023 but are not included in the updated attachment because the bounds and preliminary designs on those projects are not yet finalized. The data points for these projects have been mapped in a static high level map in response to Section 7.1.H.

c. Hardening planned for 2024

As indicated in response to Remedy PG&E-21-14, the very small amount of undergrounding work PG&E has scheduled for 2024 was originally planned for 2023, but has a longer dependency lead time. We have not yet started selecting undergrounding locations for 2024 workplans. We will begin scoping additional 2024 projects towards the end of the 2nd Quarter in 2022.

Note: PG&E's system of record for planned work projects is SAP, which is not a GIS system. PG&E's GIS systems are maintained for normal operation and status and not for future work proposals. Therefore, requests to produce GIS layers in support of future workplans is an ad-hoc analysis that would require time and significant effort to develop. In addition, including early-stage planning materials into GIS has the potential to create inconsistency and errors among PG&E workstreams and lines of business that rely on GIS information for work planning purposes. Therefore, the provided information constitutes the maximum quickly accessible GIS data points (i.e., Lat/Long of the starting points of the job) presently available.

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80 Energy Safety acknowledges potential security concerns regarding aggregating and presenting critical electrical infrastructure in map form. Utilities may provide maps or GIS layers required by these Guidelines as confidential attachments when necessary.

81 For a definition of "covered conductor installation" see Section 9 of Attachment 2.

7.1.H. Grid Design and System Hardening High-Level Maps

H. Provide static (either in text or in an appendix), high-level maps of the areas where the utility will be prioritizing Grid Design and System Hardening initiatives for 2022, 2023, and by 2032.

Please see Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.1.H_Atch01 for high-level static maps of the areas where PG&E will be prioritizing future Grid Design and System Hardening work in 2022 and 2023. Please note that these plans are a snapshot of PG&E's plans, which may be subject to change to accommodate emerging higher priority system hardening work.

PG&E does not yet have details for all Grid Design and System Hardening initiative work that will take place in 2023. A significant portion of this work is currently being planned in 2022. We have provided maps for 2023 work currently in scope, where possible. We have also provided time estimates for when our 2023 workplans for various initiatives will be completed. However, these estimates are not targets that will be reported in quarterly reports or the Annual Report on Compliance. The scope of the 2023 planned work is subject to change.

PG&E has not yet planned Grid Design and System Hardening work in 2032. While we anticipate that the work will be focused in Tier 2 and Tier 3 HFTD areas (as shown in Figure PG&E 4.1-1), we are continuing to update and refine our risk modeling to adapt to changes in climate and weather. For this reason, current risk projections do not necessarily reflect how we will prioritize work in 10 years.

7.1.I. Asset Management and Inspections GIS Layer

I. Provide a GIS layer for planned Asset Management and Inspections in 2022. Features must include the following attributes: type, timing, and prioritization of asset inspection. Inspection types must follow the same types described in Section 7.3.4, Asset Management and Inspections, and as applicable, should not be limited to patrols and detailed inspections.

Please see Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.1.I_Atch01 for planned Asset Management and Inspections in 2022.

Timing granularity for various inspections listed in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.1.I_Atch01 is not currently available because detailed scheduling is still underway. Inspection timing will be based on risk prioritization and other considerations.

7.1.J. Enhanced Clearances GIS Layer

J. Provide a GIS layer illustrating where enhanced clearances (12 feet or more) were achieved in 2020 and 2021, and where the utility plans to achieve enhanced clearances in 2022. Feature attributes must include clearance distance greater than or equal to 12 feet, if such data is available, either in ranges or as discrete integers (e.g., 12-15 feet, 15-20 feet, etc., OR 12, 13, 14, 15, etc.).

PG&E is providing a file geodatabase "WMP Section Enhanced Clearance Data.gdb" which includes two feature classes. This file geodatabase showing the enhanced clearance data can be found in the attached file, 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.1.J_Atch01.

- EVM_Completed_Segments_2020:
  - This is a list of completed 2020 segments, which includes the segment ID, the Circuit Name, Circuit Protection Zone (CPZ), and segment miles.
  - Data source is an extract from Oracle.
- EVM_Completed_Segements_2021:
  - This is a list of completed 2021 segments, which includes the segment ID, the Circuit Name, CPZ, and segment miles.
  - Data source is an extract from Oracle.

Please see attached file, Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.1.J_Atch02 for the 2022 EVM planned segments.

- EVM_Planned_Segments_2022:
  - This is a list of planned 2022 segments, which includes the segment ID, the Circuit Name, and CPZ, and segment miles.
  - Data source is an extract of segments from Oracle that are in the 2022 EVM scope of work.

7.2 Wildfire Mitigation Plan Implementation

Describe the processes and procedures the electrical corporation will use to do all the following:

7.2.A Monitor and Audit WMP Implementation

A. Monitor and audit the implementation of the plan. Include what is being audited, who conducts the audits, what type of data is being collected, and how the data undergoes quality assurance and quality control.

PG&E monitors and regularly reviews the implementation of the WMP throughout the year. The effort to monitor and audit WMP implementation is supported by the WMP implementation teams, the Community Wildfire Safety Program (CWSP) Program Management Office (PMO), Electric Operations' Quality Team, PG&E's Internal Audit (IA) organization, and Compliance and Operational Assurance (COA) Team.

PG&E's CWSP PMO is responsible for monitoring the overall progress of the WMP workstreams. The PMO produces progress tracking and status updates via a weekly dashboard. These dashboards provide visibility and monitoring as part of PG&E's Lean Operating System. The PMO also produces both a monthly status update and a comprehensive quarterly WMP report and facilitates the quarterly compliance reporting required by the compliance and operational protocols. The PMO provides ongoing oversight and direction to the WMP program leaders. In addition, the status and tracking reports provide our leadership and Board of Directors visibility into the different elements of the WMP and gives them the information they need to monitor and, when needed, make adjustments to WMP programs.

Taking learnings from the issues that we self-identified in 2021, described in more detail in Section 4.1, we implemented a cross-functional team to support the validation of WMP targets and the associated work. This team is comprised of the Line of Business (LOB) subject matter experts, the CWSP PMO, IA, and COA. These teams meet to discuss and develop a common understanding of the WMP commitments and Initiative targets and to determine the evidence needed to verify performance on these commitments/targets.

At the individual WMP program level, PG&E has developed quality monitoring and audit plans tailored to each program. For example, the WMP quality monitoring and audit programs developed for the Distribution System Hardening and EVM work verification programs including 100 percent work verification. For both of these key WMP programs, no miles are recorded as complete in either program until they have been fully verified to be complete. The operating LOB generally validates that the work conducted is accurate and complete while the program data verification is validated by PG&E's COA and IA teams. For defined WMP targets, the LOB is responsible for completing the work associated to the target and providing traceable and verifiable evidence that the work was completed. IA reviews the evidence and provides verification of work completed. COA reviews the processes and procedures of the LOB to validate work quality and the intent of the target is being met through execution. The COA team checks that the work performed provides useful value to operations in mitigating wildfire risk. Taken together, the quality monitoring and auditing program that

PG&E implements validates both the physical completion of work and the quality of the program data.

In addition to the processes outlined above, PG&E also provides implementation information to parties in CPUC proceedings and has a number of external parties that are monitoring our wildfire mitigation activities. PG&E regularly provides updates and information requested to the following:

- Federal Monitor – PG&E's Federal Monitor was previously given responsibility to review PG&E's wildfire mitigation efforts and compliance activities. On January 25, 2022, the Federal Monitorship ended. On January 28, 2022, the CPUC announced that it had selected Filsinger Energy Partners to serve as PG&E's Independent Safety Monitor. According to the scope of work authorized by the CPUC, the Independent Safety Monitor will (1) monitor and alert CPUC staff whether PG&E is implementing the highest priority and risk-driven safety mitigations and (2) monitor PG&E's safety-related recordkeeping and record management systems. In addition to confidential updates to the CPUC staff regarding safety-related concerns, the Independent Safety Monitor will provide public summary reports of PG&E's activities to the CPUC every six months. Filsinger Energy Partners was appointed for a 5-year term per CPUC Resolution M-4855.

- Independent Safety Evaluators – In compliance with the Wildfire Order Instituting Investigation (OII), starting in 2021 and conducted annually for three years, Independent Safety Evaluators working at the direction of the Safety Enforcement Division (SED) will audit and review financial data related to PG&E's Wildfire Safety Plans. Safety Evaluators are separate and distinct from Independent Evaluators provided for in Public Utilities Code Section 8386.3(c). The Safety Evaluator audit reports are provided to the Director of SED and served on the service list for I.19-06-015.

- Independent Evaluator – Starting in 2021, an Independent Evaluator reviews PG&E's compliance with the WMP, as provided in Public Utilities Code Section 8386.3(c).

- Quarterly and Annual Compliance Reporting per the Compliance and Operational Protocols – WMP implementation progress updates are one of the components contained in quarterly and annual filing requirements that are provided to Energy Safety, the CPUC, and other parties.

- Energy Safety Meetings – In addition to quarterly and annual reporting, we also meet frequently with Energy Safety throughout the year to report out and receive feedback on our progress toward certain Initiative targets.

- Data Requests – Throughout the year, we receive numerous data requests from Energy Safety, the SED, the Public Advocates Office of the California Public Utilities Commission (Cal Advocates), and other stakeholders seeking information regarding our WMP implementation. This information allows these stakeholders to monitor and remain informed regarding the progress on our WMP implementation.

7.2.B WMP Deficiencies

B. Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies.

We understand that this section of the 2022 WMP is intended to identify deficiencies in 2021 WMP implementation and to describe how those deficiencies were addressed and corrected. In this section, we address: (1) remedies identified by Energy Safety; (2) issues that PG&E identified in 2021 regarding implementation of the 2021 WMP or earlier WMPs; (3) the Lean Operating System and DOR process; (4) enhanced oversight for EVM; and (5) commitments completed late.

(1) Remedies Identified by Energy Safety

In the Final Action Statement approving PG&E's 2021 WMP, Energy Safety identified a number of remedies which PG&E was directed to address in a Progress Report to be submitted on November 1, 2021 and/or in the 2022 WMP. We submitted our Progress Report on November 1, 2021. An update on the Progress Report remedies and additional issues identified by Energy Safety in the Final Action Statement is provided in Section 4.6.

(2) Issues Identified by PG&E

During 2021, PG&E identified for Energy Safety and the CPUC several issues that involved implementation of and reporting in the 2020 and 2021 WMPs. The details of these self-identified issues, and the corrective action plans to address these issues, are discussed in Section 4.1.

(3) The Lean Operating System and DOR Process

Prior to and during 2021, PG&E identified gaps and areas for improvement concerning our approach to decision-making and communication. These decision-making and communication issues impact the entire organization, including departments and groups addressing wildfire-related issues. As a result of these deficiencies, across our entire organization we have adopted a Lean Operating System designed to drive effective and responsive decision-making and ultimately driving better outcomes for our customers. Our Lean Operating System utilizes visual management which provides a framework to quickly see how programs and key performance indicators (KPI) are performing, by identifying trends, and outlining the work needed to bring an effort back to the desired target state.

In addition, PG&E has established Daily and Weekly Operating Reviews (DOR and WOR, respectively) to identify and address issues and barriers to getting the right work done, meant to involve the people closest to the work in decision-making. The DOR is a short, focused (15 minute) meeting that is designed to bring awareness to exceptions and issues that may be blocking work. Attendees are those that have the authority to make decisions to help remove the barriers. The WOR is an extended meeting (60-minute) involving leadership to review KPIs, provide updates on major programs, and to bring awareness to exceptions that may require leadership intervention.

(4) Enhanced Oversight for EVM

The CPUC initiated step 1 of the Enhanced Oversight and Enforcement Process (EOEP) on April 15, 2021 in Resolution M-4852 (EOEP Resolution) related to PG&E's EVM program. In response to the EOEP Resolution, PG&E submitted a Corrective Action Plan (EVM CAP) and subsequently submitted 90-Day Reports to the CPUC updating the status of the EVM CAP elements. An overview of the lessons learned from the EOEP Resolution and the EVM CAP is provided in Section 4.1. Additional information regarding the EOEP Resolution, the EVM CAP, and our 90-Day Reports is available on the CPUC's website (Enhanced Oversight and Enforcement of PG&E (ca.gov)).

(5) Commitments Completed Late

Our 2021 WMP included 53 commitments. We were able to achieve or exceed 50 of these commitments within the time specified in the 2021 WMP. The remaining 3 commitments were achieved in 2021, but not within the time frame originally specified in the 2021 WMP. In Table PG&E-7.2.B-1 below, we discuss these three commitments and the recovery process so that the commitment could be completed by the end of 2021.

TABLE PG&E-7.2.B-1:
SUMMARY OF COMMITMENTS COMPLETED LATE

Commitment	Description[a]
D.01 – Distribution HFTD Inspections (poles)	This commitment involved enhanced detailed inspections of overhead distribution assets in the following recurrence intervals by July 31, 2021: (1) Tier 3 and Zone 1 – annually; and (2) Tier 2 and HFRA – every three years, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities. This commitment was targeted for completion by July 31, 2021, but PG&E did not complete this commitment by that target date. Although PG&E completed inspections of all assets initially targeted for inspection by July 31, 2021, during record validation, we identified additional poles after July 31, 2021 that should have been inspected. Therefore, as of December 31, 2021, as a result of workplan validation efforts, the target was revised to 480,749 and PG&E completed enhanced detailed inspections on all 480,749 of these targeted distribution poles.[b]
D.03 – Transmission HFTD Inspections (structures)	This commitment involved enhanced detailed inspections of transmission structures and some form of aerial assessment (helicopter, drone, aerial lift, climbing) on the following recurrence intervals by July 31, 2021: (1) Tier 3 – annually; and (2) Tier 2 and High Fire Risk Areas (HFRA) – every three years barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities. This commitment was targeted for completion by July 31, 2021 and PG&E had completed all structures initially targeted for inspection by that date. However, we identified additional structures after July 31, 2021 that should have been included in the initial inspection. These record validation efforts resulted in an additional 19 structures requiring both ground and aerial inspections in which 18 are in Tier 2 HFTD and 1 in Non-HFTD HFRA areas being added to the 2021 workplan target after the July 31, 2021 due date. As of December 31, 2021, all known HFTD and HFRA transmission structure inspections were completed.[c]
I.02 – Trained Workforce for Service Restoration	This commitment included five activities with specific milestone dates for each activity. The first of these five activities was not completed by the target date: to complete Phase III SEMS training (ICS 300 / 400) for all Command staff and select roles in General staff by June 30, 2021. However, as of November 17, 2021, all required Emergency Operations Center (EOC) staff have completed this training.[d] The remaining four activities were all completed on or before the target date.

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(a) These descriptions are from PG&E's Quarterly Notification submitted to Energy Safety on February 1, 2022.

(b) On November 1, 2021, PG&E submitted a Change Order to update the target number of distribution poles for this commitment to 477,309, however, as part of the ongoing record validation the target has since been increased to 480,749, as described above.

(c) On November 1, 2021, PG&E submitted a Change Order to update the target number of transmission structures requiring enhanced detailed inspections and some form of aerial assessment to 26,810, however, as part of the ongoing record validation the target has since been increased to 26,826.

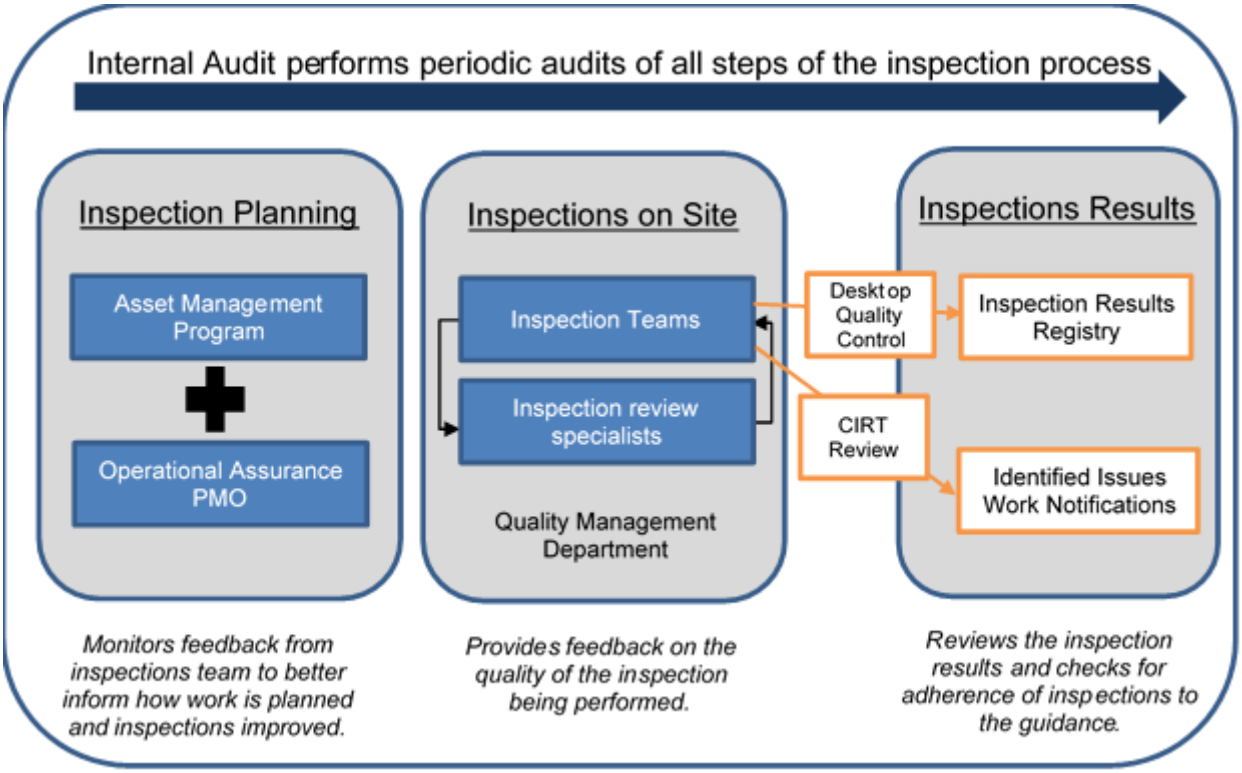
(d) We note that this does not include new team members who assume a Command & General Staff position due to unexpected vacancies on an EOC duty team.

7.2.C Monitor and Audit Inspection Effectiveness

C. Monitor and audit the effectiveness of inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and commission rules.

PG&E has implemented a number of programs, processes, tools, and other control points to review and manage the quality and accuracy of inspection work performed by our employees and contractors. These programs identify anomalies in inspection and patrol results, address any gaps, determine the root cause of any gaps, and implement improvements. Our programs areas are managed by three internal organizations, with several processes and programs implemented by each organization. Since our processes and programs include more than just the quality assurance and quality control, we will refer to these programs collectively in the remainder of this section as our "Inspection Quality Programs." An overview of the points during the inspection cycle impacted by the Inspection Quality Programs is provided in Figure PG&E-7.2.C-1 below.

FIGURE PG&E-7.2.C-1:
INSPECTION QUALITY PROGRAMS



In 2020, PG&E began staffing an inspection Process Quality function responsible for establishing and monitoring process control measures and notifying responsible parties to take corrective measures when predefined inspection quality standards are not achieved. The Process Quality group exists within System Inspections, operating alongside IA and Electric Quality Assurance (QA). To drive intradepartmental

consistency, the Process Quality department is formally documenting governing processes to guide ongoing quality assurance, quality control, and quality verification as it relates to the inspection and patrol tasks.

The Quality Control (QC) team established and successfully implemented its Desktop QC Review program in September 2020. This program currently applies to Overhead Distribution and Transmission Ground inspection methods. All discrepancies found during the QC review are recorded in detail under the specific Inspection checklist section. Specialists suggest recommended corrections/corrective actions as "Follow Up" items in the QC form when applicable. Discrepancies identified during the Desktop review are compiled by the QC Analytics team and dashboards are created and shared weekly with the System Inspection Execution leadership team to track and monitor the quality of contract vendors and their inspectors.

QC has also partnered with the System Inspection Execution team to conduct some post inspection field reviews. A QC Field Verification pilot was recently launched to conduct feasibility studies, and to explore any additional opportunities that may be present with this mode of inspection when compared to the virtual desktop QC reviews. This pilot is in progress for Transmission and Distribution Overhead inspection methods.

In addition to monitoring and auditing inspection effectiveness, we have also developed new tools for our inspectors to help make inspections as effective as possible. For example, in 2021, we implemented significant enhancements to the mobile apps Inspect Electric Transmission (ET)/Electric Distribution (ED) supporting the Field Safety Reinspection (FSR) process by duplicating the Construct App functional within the Electric Corrective (EC)/ Line Corrective (LC) feature. This enablement meant the inspector does not need to use two separate applications. The Inspect ED Detailed Overhead Inspection Checklist was updated to support the 2021 Tree Connect / Tree Attachments standard. Both the Inspect ED and Inspect ET checklists added automation when creating Map Corrections. This automation allows PG&E to stop using 'paper' map correction forms. Another example was the implementation by Asset Strategy and System Inspections of changes to the ET Climbing Checklist, ET Ground Steel Checklist, ET Ground Non-Steel Checklist, and ED Overhead Checklist to adjust language for improved readability, consistency and standardization prior to the start of the 2021 Program year.

In 2021, System Inspection (SI) QC implemented the use of a new database, enabling automated, daily dashboard reporting of KPI and QC metrics. This daily reporting is being integrated into the DOR process. In addition, SI QC enhanced our QC Review forms to capture more granular data regarding discrepancies to further enable analysis and trending more focused on root causes of discrepancies. As results and data are recorded electronically at the time of the inspection, opportunities for analyzing inspection quality are expanded and accelerated. Using digital records, the Process Quality teams can begin to identify potential outliers and identify areas where additional audits or reinspection may be required. Using targeted metrics, PG&E can better identify the need for process improvements, additional training or supervision, and other corrective actions. Inspection process control metrics have been developed and implemented, along with dashboards and review processes.

Additional details regarding monitoring and auditing of inspections, as well as further development plans, are provided in Sections 7.3.4.14 (asset inspections) and 7.3.5.13 (vegetation management inspections).

In 2022, we intend to initiate the next stage of inspection effectiveness with an improved methodology to measure inspection quality and performance. The new methodology will be based on the work of the Process Quality Control Department that has recently been stood up, combined with a new preventive and corrective maintenance analytics platform. The new platform will help drive risk-informed inspection process improvements including: (1) analysis and trends of inspections against asset functional failures; and (2) monitoring effectiveness of inspections that reflect condition of assets.

7.2.D Report in a Format That Matches Across WMPs, Quarterly Reports, Quarterly Advice Letters, and Annual Compliance Assessment

D. Ensure that across audits, initiatives, monitoring, and identifying deficiencies, the utility will report in a format that matches across WMPs, Quarterly Reports, Quarterly Advice Letters,[82] *and annual compliance assessment.*

PG&E is required to provide information regarding our wildfire risk mitigation activities in a variety of reports and forms. Each of those documents, including this one, generally has a prescribed format, information, and set of objectives and metrics defined by the regulator and/or requestor. Several of those reporting forums are identified in the prompt to this question. PG&E agrees that it is in everyone's best interest to standardize and streamline these documents and reports to minimize duplication and confusion, while maximizing the investment of time from all parties in developing, reviewing, and responding to the valuable content of these discussions. PG&E is working to align our reporting and communication about WMP activities across these various reporting forums and will continue to do so.

Our CWSP PMO is the primary department that facilitates and responds to all wildfire mitigation related questions and reports and provides a level of consistency and continuity between document through our leadership. We look forward to partnering with Energy Safety and other parties on continuing to streamline the templates, formats, requirements, and timeframes of all of wildfire mitigation related filings for the benefit of all parties.

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[82] General Rule for filing Advice Letters are available in GO 96-B: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M023/K381/23381302.PDF.

7.3 Detailed Wildfire Mitigation Initiatives

In this section, describe how specific wildfire and PSPS mitigation initiatives execute the strategy set out in Section 5. The initiatives are divided into 10 categories, with each providing a space for narrative descriptions of the utility's initiatives. The initiatives are organized by the following categories provided in this section:

1. *Risk assessment and mapping.*
2. *Situational awareness and forecasting.*
3. *Grid design and system hardening.*
4. *Asset management and inspections.*
5. *Vegetation management and inspections.*
6. *Grid operations and protocols.*
7. *Data governance.*
8. *Resource allocation methodology.*
9. *Emergency planning and preparedness.*
10. *Stakeholder cooperation and community engagement.*

It is not necessary for a utility to have every initiative listed under each category.

7.3.a Financial Data on Mitigation Activities

Report actual and projected WMP expenditure, as well as the risk-spend-efficiency (RSE), for each initiative by HFTD Tier (territory-wide, non-HFTD, HFTD Zone 1, HFTD Tier 2, HFTD Tier 3) in Table 12 of Attachment 3.

The information responsive to this section of the WMP is provided in Table 12. Below, we provide additional notes regarding the information in Table 12.

Financial Spend information:

PG&E has included the requested financial spend information for each initiative in Table 12 in Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01.

Actual costs for 2019, 2020, and 2021 and forecasts for 2022 and 2023 are provided in Table 12. The 2022 and 2023 forecasts are subject to change because of operational drivers and regulatory developments. For example, as PG&E continues to gain experience implementing initiatives, and with the evolution of these initiatives, the forecasts of cost likely will continue to change. Forecasts are also subject to regulatory outcomes and proceedings, including CPUC approval of the scope or timing of a specific initiative. Regarding plans and information for the number of units that will be installed for certain initiatives, these are also subject to change. Actual unit installation and operation can be impacted by delays due to permitting, weather or access, labor availability, and the availability of equipment. PG&E expects that the actual unit numbers will change from forecasts, especially for future years.

In addition, PG&E is providing the following explanation regarding the financial spend information provided:

- Mitigation and control work has been included that spans multiple cost recovery mechanisms including the General Rate Case (GRC), Transmission Owner (TO) rate case at the Federal Energy Regulatory Commission (FERC), Catastrophic Event Memorandum Account (CEMA), Fire Risk Mitigation Memorandum Account (FRMMA), Wildfire Mitigation Plan Memorandum Account (WMPMA), Microgrid Memorandum Account (MGMA), Emergency Consumer Protection Memorandum Account (ECPMA), Electric Program Investment Charge (EPIC), and Wildfire Mitigation Balancing Account (WMBA). Some of these costs have already been approved for inclusion in rates, and some of these costs are still pending review or approval through cost recovery proceedings.

- Financial figures have been mapped to each initiative and/or category based upon the activity being described in Section 7.3 of the 2022 WMP.

- While the primary work performed for wildfire risk mitigation is in HFTD areas, some work and financial costs associated with non-HFTD areas have been included in the financial figures when appropriate.

- The costs reflected are PG&E's best estimate of the costs for the proposed programs as of February 25, 2022. Further changes to 2022 budgets and work

plans are possible and actual costs may vary substantially from these plans depending on actual work completion, conditions, and requirements.

- For the 2021 “Actual”, and 2022 and 2023 “Projected” columns in Table 12, the population of work included in these financial data sets is aligned to the 2022 WMP scope and list of initiatives. Please note that there have been changes in scope for some initiatives from the 2021 WMP to 2022 WMP (for example, PG&E has added/removed initiatives).

- PG&E also pulled in 2019 and 2020 recorded cost and units and adjusted these costs to align to the 2022 WMP initiative list and associated assumptions. Given program changes and as cost tracking evolves over time, high level assumptions were made to recreate 2019 and 2020 data recorded in the 2022 WMP initiative view. For example, in some cases, where data is hard to identify or lacks granularity, we used 2021 or 2022 as proxies to recast for 2019 and 2020.

- 2022 forecasts, for the most part, are tied to the PG&E budget, which could include additional dollars for more work or units. Thus, the units that tie to the financial forecast, and are shown in Table 12, may not be the same “Targeted” units described or committed in the narrative.

Line Miles Treated and Transmission Voltage Definition:

The 2022 WMP Tables include data on the number of “line miles treated” for each initiative. This data has been provided, including estimations, wherever possible. However, there are a few limitations that should be understood for these figures.

First, a number of programs are not primarily defined by line miles but are defined by a number of assets (e.g., the number of structures inspected each year). In these cases, we have reported the actual units and the unit of measure that is applicable to the initiative. Where line miles are the appropriate metric, we have reported miles. For inspection programs that occur on the distribution or transmission lines, we have reported line miles based on the average cycle associated with the respective program.

Second, activities at PG&E substations in HFTDs have been generally assigned as treating zero-line miles, since these activities primarily only impact assets within the substation itself and may or may not have material benefit to the circuit/line miles beyond the substation. The same is true for several programs where assets at just one particular point on the grid are being addressed.

Third, several initiatives are related to improvements, audits, training, methodologies, technology, or analysis. Line miles treated is not an appropriate measure for these types of initiatives.

Finally, throughout the WMP, PG&E references Transmission assets and programs. PG&E defines transmission voltage (for this and other regulatory filings) as being 60 kV or above, PG&E notes this because some of the initiative definitions the WMP Guidelines provide referenced transmission as being “at or above 65kV.” PG&E is unable to reconfigure all of our data to align with a cut-off of 65kV instead of the historically used 60 kV standard and, therefore, when PG&E references transmission that is reflective of assets operating at or above 60 kV.

Year Initiated:

Table 12 (Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01) includes a column labeled “Year Initiated” for each of the initiatives. A number of the “initiatives” identified in the WMP templates include activities and programs that have been underway for a very long time, including routine vegetation management, asset inspections and forecasting a fire potential index. It would be difficult or impossible to pinpoint precisely when PG&E began some of these activities which stretch back decades. Therefore, PG&E has populated this column with either “<2018” for initiatives that were started before the current period of dedicated wildfire mitigation activities began in 2018 and has provided specific years for initiatives that were undertaken since the formation of PG&E’s Community Wildfire Safety Program in 2018.

Regulations:

Table 12 (Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01) includes a column labeled “Current compliance status – In / exceeding with regulations.” For purposes of this column and the adjacent column regarding rules, PG&E has interpreted the term “regulations” to mean CPUC General Orders and federal or state laws. Therefore, we have not included as “regulations” directives and decisions from the CPUC and potentially others that provide guidance or compliance expectations for some of the WMP initiatives.

Risk Quantification:

Regarding risk information, the initiatives in this section have been categorized into Mitigations, Controls, and Foundational Activity. These categories are defined as follows and the columns in Table 12 (see Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01) are populated accordingly.

Mitigations:

This category includes specific additional or enhancement programs, beyond compliance, with specific start and end dates and a project budget, or an additional proposed activity not previously identified. PG&E has calculated RSEs for these initiatives except where currently relevant data is not available. This could be because the initiative is a pilot or otherwise does not capture data found usable for RSE calculation. For mitigations with RSEs, PG&E has provided data at the initiative level, to the best of our ability with currently available data, for columns: ‘Primary driver targeted’, ‘Secondary driver targeted, ‘Estimated RSE in non-HFTD region’, ‘Estimated RSE in HFTD Zone 1’, ‘Estimated RSE in HFTD Tier 2,’ and ‘Estimated RSE in HFTD Tier 3.’

Controls:

This category includes safety and compliance programs that are already in place. These activities are performed at a standard level every year to ensure that our electric

system assets remain in a suitable condition. In the case of controls, it is difficult to determine the wildfire risk level absent of performing the control, for several reasons:

- PG&E has been performing this work for so long that it is challenging to estimate the counter-factual (consequences of number of equipment failures, outages, and ignitions) that might occur if PG&E were not performing these routine control activities

- Some level of this work is required by regulation and supports good utility practice. It is difficult to zero-base budget, benchmark against peer utilities, or otherwise determine the appropriate minimum level of effort and investment for these activities

- PG&E has been tracking program inputs (work hours and resources) and outputs (trees trimmed, inspections performed, circuit miles replaced) as broad programmatic activities, rather than in more granular terms.

PG&E has calculated RSEs for these initiatives except where currently relevant data is not available. For controls with RSEs, PG&E has provided data at the initiative level, to the best of our ability, for columns: 'Primary driver targeted', 'Secondary driver targeted, 'Estimated RSE in non-HFTD region', "Estimated RSE in HFTD Zone 1', 'Estimated RSE in HFTD Tier 2," and 'Estimated RSE in HFTD Tier 3.'

Foundational Activity:

This category includes enablers to mitigations or controls. They are work needed to implement mitigations or information that would be used to better inform the execution of a control (i.e., investments in Information Technology infrastructure or data gathering). Foundational activities generally do not result in stand-alone risk reduction. As a result, foundational initiatives do not have associated risk drivers or RSE values.

PG&E has not calculated RSEs for the majority of these initiatives; however, we have presented RSEs for some foundational initiatives in order to elicit feedback about our approach.

For the majority of Foundational Initiatives, PG&E has not provided data, and has marked as "N/A-Foundational," the columns: "Primary driver targeted", "Secondary driver targeted, "Estimated RSE in non-HFTD region", "Estimated RSE in HFTD Zone 1", "Estimated RSE in HFTD Tier 2," and "Estimated RSE in HFTD Tier 3." For the foundational initiatives where RSEs are calculated, these columns have been populated.

Detailed calculations are provided in RSE Workpapers, see Attachments 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch02-10.

7.3.b Detailed Information on Mitigation Initiatives By Category and Activity

Report detailed information for each initiative. For each initiative, organize details under the following headings:

1. *Risk to be mitigated / problem to be addressed.*

2. *Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized.*

3. *Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized*

4. *Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year*

5. *Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).*

PG&E is providing the information requested in the remainder of Section 7.3.

7.3.1 Risk Assessment and Mapping

7.3.1.1 A Summarized Risk Map Showing the Overall Ignition Probability and Estimated Wildfire Consequence Along Electric Lines and Equipment

OEIS Initiative Definition: Development and use of tools and processes to develop and update risk map and simulations and to estimate risk reduction potential of initiatives for a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

Wildfire risk models and the display of their quantitative output on maps are a key visualization tool for identifying potential risk and risk reduction opportunities on the electric transmission and distribution systems. Pacific Gas and Electric Company (PG&E) has leveraged the Foundry platform to provide spatial map views of the Wildfire Distribution Risk Model (WDRM) and the Wildfire Transmission Risk Model (WTRM) and relevant risk component models. This platform allows for views of the overall risk along the electric system as well as views of the individual probability of ignition values (including the component model composite values) and the wildfire consequence values. A detailed discussion of our wildfire risk models is provided in Section 4.5.1.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop Better Visibility Into Risk – Enables a more data-driven approach to wildfire mitigation workplan development and provides risk visualization for both PG&E employees as well as external stakeholders.

Relation to and Impact on Other Initiatives:

- Wildfire risk models are used for multiple initiatives described in the 2022 Wildfire Mitigation Plan (WMP).
- The Foundry visualizations provide more clarity into the performance of the wildfire mitigation programs and assists in the deployment of fire specialists to assess and evaluate risk locations.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: As wildfire risk models continue to develop and improve to quantify wildfire risk drivers, consequence, and exposure, the visualization of these outputs in the Foundry system is a key step. The Wildfire Risk team works with the Foundry platform to prioritize our portfolio of visualization initiatives.

To date, the WTRM and WDRM have focused on top risk drivers such as contact from vegetation and equipment failures. Modeling improvements are underway and have expanded both the transmission and distribution risk models beyond the High Fire Threat District (HFTD) and High Fire Risk Area (HFRA) areas.

The entire HFTD is currently visualized by risk mapping. Additional development of the visualizations for risk mapping follows the enhancements to the risk modeling capabilities described in Section 4.5.1.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model (WDRM)
- Wildfire Transmission Risk Model (WTRM)
- Energy Safety has initiated a wildfire risk modeling working group as described in Section 4.6, Remedy PG&E-21-02. Based on the outcome of this working group and specific direction from Energy Safety, PG&E may make changes to our wildfire risk modeling approach.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Developed spatial model views in Foundry specific for Enhanced Vegetation Management (EVM) and System Hardening programs. These spatial model views set a foundation for the creation of Work Planning Applications (WPA) in 2022. The WPA aids in the development of the workplan and is a tool to document the steps from model output to final workplan.

Impacts:

- Map views enable better development of project scope at a more granular level.

Lessons Learned:

- Importance of accurate data visualization and GIS data layers to stakeholder groups (e.g., Risk Management, System Hardening, Public Safety Specialists).

Current Year Activities (2022):

While we have not set specific targets for this initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to develop maps in Foundry to visualize risk model outputs and to implement WPAs. PG&E also expects to develop work planning applications for specific programs including – EVM, Transformer Replacement, Pole Replacement, and System Hardening.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Continue to develop more WPAs to facilitate additional WMP workplans.

7.3.1.2 Climate-Driven Risk Map and Modeling Based on Various Relevant Weather Scenarios

OEIS Initiative Definition: Development and use of tools and processes demonstrating medium and long-term climate trends based on the best available climate models demonstrating the most wildfire-relevant impacts (e.g., warming trends, fuel moisture trends, soil moisture trends, vegetation distribution trends). Describe how these trends are being incorporated into risk modeling or other risk-informed analyses.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

Consistent with the direction in California Public Utilities Commission (CPUC or Commission) Decision (D.) 19-10-054, PG&E utilizes the climate scenarios and projections from the most recent Statewide Climate Change Assessment (California Fourth Climate Change Assessment) and focuses on Representative Concentration Pathway (RCP) 8.5 when considering risk driven by climate change. Generally, long-term climate projections are not certain enough, nor temporally or geographically granular enough, to inform operational risk models in a scientifically defensible way. While useful for understanding long-term trends and the range of potential future conditions, currently available climate projections will not, for example, help prioritize Vegetation Management (VM) work for next year. Thus, long-term climate trends are not directly used in our risk modeling for work planning (e.g., VM, System Hardening, etc.) or for operations (e.g., initiating a Public Safety Power Shutoff (PSPS) event, etc.).

As it pertains to recent climate change, multiple climate studies have shown that California has trended hotter and drier in the past several decades, which has led to an increase in fire activity. For example, the California Fourth Climate Change Assessment shows historical trends of temperature, sea level rise, drought, and wildfire have been increasing and are expected to increase in the future due to anthropogenic warming. See Table PG&E-7.3.1-1 below from the California Fourth Climate Change Assessment which summarizes the recent and future trends in several important variables.

We have also seen similar trends in our internal high-resolution historical weather data sets. As discussed in Section 4.4.2, we are working with the San Jose State University (SJSU) Fire Weather Research lab to analyze our 30+ years of 2-kilometer, hourly weather and fuels data with respect to wildfires and diablo wind events. SJSU has found in our dataset that temperatures are increasing, the number of dry days are increasing, and fuel moisture values are declining (likely as a result of the warmer and drying trends). Images from the SJSU study are provided below in Figure PG&E-7.3.1-1. This high-resolution historical dataset was used to train our PSPS models and are thus inclusive of long-term climate signals.

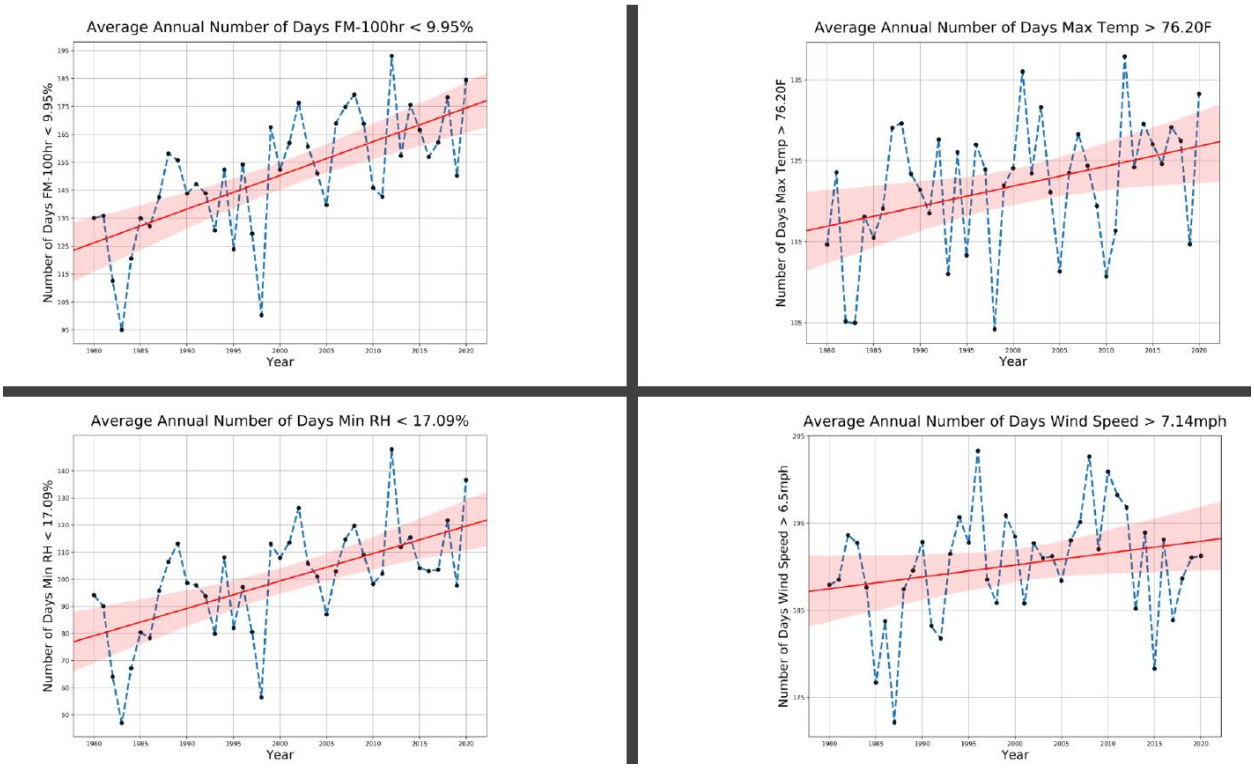
It should be noted that PSPS events occur during weather events, and most typically during a Diablo or Santa Ana wind event. However, long-term trends (climate) play a role as hotter and drier weather, drought and declining fuel moistures exacerbate

potential for catastrophic fires. Our weather models, fuel moisture models, and Fire Potential Index (FPI) Model, which feed into PSPS determinations, were designed to take these trends into account. For example, the FPI Model prediction will trend more severe after periods of hot and dry weather as fuel moistures dry out in dead and living fuels. The fuel moisture models have memory and account for antecedent conditions and thus account for these trends overtime.

TABLE PG&E-7.3.1-1:
QUALITATIVE DESCRIPTION OF CURRENT UNDERSTANDING OF HISTORICAL AND EXPECTED CLIMATE IMPACTS IN CALIFORNIA (CALIFORNIA'S FOURTH CLIMATE CHANGE ASSESSMENT)

CLIMATE IMPACT	HISTORICAL TRENDS	FUTURE DIRECTION OF CHANGE	CONFIDENCE FOR FUTURE CHANGE
Temperature	Warming (last 100+ years)	Warming	Very High
Sea Levels	Rising (last 100+ years)	Rising	Very High
Snowpack	Declining (last 60+ years)	Declining	Very High
Annual Precipitation	No significant trends (last 100+ years)	Unknown	Low
Intensity of heavy precipitation events	No significant trends (last 100 years)	Increasing	Medium-High
Frequency of Drought	No significant trends (last 100+ years)	Increasing	Medium-High
Frequency and intensity of Santa Ana Winds	No significant trends (last 60+ years)	Unknown	Low
Marine Layer Clouds	Some downward trends; mostly not significant (last 60+ years)	Unknown	Low
Acres Burned by Wildfire	Increasing (last 30+ years)	Increasing	Medium-High

FIGURE PG&E-7.3.1-1:
LONG-TERM CLIMATE TRENDS ACROSS THE PG&E TERRITORY
USING PG&E'S 30+ YEAR 2 × 2 KM DATASET



Although operational and meteorological models track conditions in line with climate change trends, at this time the range of long-term climate trends are not explicitly incorporated in the WDRM, WTRM, and Wildfire Consequence (WFC) Model. PG&E has focused our wildfire risk assessment on understanding extant weather conditions, as that allows for the largest improvement to wildfire risk reduction in the near-term. As PG&E participates in the Energy Safety-facilitated risk modeling workshops, our aim is to leverage the climate information that has been collected to integrate long-term climate change trends into wildfire risk models.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative: Long-term trends play a role as hotter and drier weather, drought, and declining fuel moistures exacerbate potential for catastrophic fires. PG&E's weather models, fuel moisture models, and FPI Model, which feed into PSPS determinations, were designed to take these trends into account. For example, the FPI Model prediction will trend more severe after periods of hot and dry weather as fuel moistures dry out in dead and living fuels.

- Relation to and Impact on Other Initiatives: Not applicable.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Climate scenarios and projections generally apply to all of PG&E's service area and are specific to certain kinds of mitigations or initiatives. However, climate impacts and projections may vary within PG&E's service area (e.g., climate projections for the coastal region may vary from climate projections for the Sierra Mountain area).

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The prioritization and updates to the long-term climate modeling are based off updates from ongoing state climate modeling and changes to Cal-Adapt forecasts. Until medium to long term forecasts change (generally every four to five years) the long-term climate assessments will not be re-assessed.

Current Year Activities (2022):

While we have not set specific targets for this initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E expects California's 5th Climate Assessment to be available in 2023 or 2024. At the time that new locally downscaled climate projections are made available, PG&E will utilize the new data consistent with D.19-10-054.

7.3.1.3. Ignition Probability Mapping Showing the Probability of Ignition Along the Electric Lines and Equipment

OEIS Initiative Definition: Development and use of tools and processes to assess the risk of ignition across regions of the grid (or more granularly, e.g., circuits, spans, or assets).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks – Vegetation Contact

Secondary Risk: Ignition Risks – Equipment – Conductor, Support Structures, and Transformers

Ignition probability models, in conjunction with the wildfire consequence modeling from Technosylva, are used to determine and identify wildfire risk at specific grid locations within the HFTD areas, as well as non-HFTD areas (that could support fire propagation) in the electric distribution and transmission system. Since wildfire risk is not uniform across the system, these models produce information that can also be used to identify which locations should be prioritized for specific initiatives and wildfire mitigations.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase Understanding of Where Risk is Located – The ignition probability data provides information that helps identify and delineate areas of increased probability of ignition. Once these areas are identified, PG&E can better plan and coordinate mitigation activities in those areas.

- Develop Better Visibility Into Risk – Separate modules to characterize vegetation and equipment ignition probabilities allow for more detailed insights on the key ignition risks drivers at a location that can better identify the most impactful mitigation to reduce wildfire risk.

Relation to and Impact on Other Initiatives:

- Vegetation Management – There is a specific Vegetation Probability of Ignition Model that is used in conjunction with the Wildfire Consequence Model (WFC Model) to evaluate vegetation related mitigations and inform EVM planning through the EVM Tree Weighted Prioritization Model.

- System Hardening (Underground and Overhead) – There are specific Equipment Probability of Ignition Models that are used in conjunction with the WFC Model to evaluate system hardening related mitigations.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E has focused on developing ignition probability risk modules for vegetation and equipment related ignitions, as these are the leading two causes of ignitions in HFTD areas. The WTRM and WDRM provide a geospatial view of risk to facilitate development of mitigation workplans.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model
- Wildfire Transmission Risk Model
- Energy Safety has initiated a wildfire risk modeling working group as described in Section 4.6, Remedy PG&E-21-02. Based on the outcome of this working group and specific direction from Energy Safety, PG&E may make changes to our wildfire risk modeling approach in the future.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Completed the development of the WTRM and WDRM. Please see Sections 4.5.1(b) and 4.5.1(c) for details on model features and capabilities.

Impacts:

- The WFC Model now assesses all burnable areas within PG&E's service territory, expanding beyond the traditional HFTD Tier 2 and Tier 3 boundaries. Therefore, our risk models output ignition probabilities and consequence scores in an expanded area compared to those of 2021.
- The Vegetation Probability of Ignition Model and the Equipment Probability of Ignition Models described in Section 4.5.1(b) were expanded to include the entire electric distribution system. This informs the overall probability of equipment and vegetation failure in the 2022 WDRM v3.
- Support Structure and Transformer Probability of Ignition modules have been developed and added to the WDRM Equipment Probability of Ignition Model.
- Risk reduction values are developed to estimate the improvement provided by a range of wildfire mitigations. This will enhance the future ability to identify mitigations more specifically by location on the electric grid.
- The WTRM was developed in 2021 and assesses the wildfire risk related to structures and conductors for various risk drivers (hazards and threats) related to PG&E's Transmission system.

Lessons Learned:

- The addition of Light Detection and Ranging (LiDAR) data and tree species data greatly improved the Vegetation Probability of Ignition Model. The Vegetation Probability of Ignition Model was expanded to include the entire electric distribution system.
- Specific algorithms were selected that best suited the characteristics of the risk driver being modeled.
- As discussed in Section 4.5.1(c), a focused effort on data quality has improved the quality of WTRM predictive power for the atmospheric, decay, and wind modules for structures and conductors. This focus on improved data will continue to refine the predictive capabilities of the WTRM.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
A.01	Distribution Modeling Enhancements - Equipment Failure and Contact From Object	Develop additional Distribution Equipment Failure (EFF) and Distribution Contract From Object (CFO) sub-models. Conduct assessment to determine whether newly developed sub-models should be included in the WDRM model.	12/31/2022	Qualitative
A.02	Transmission Modeling Enhancements - Threat and Hazard Risk Drivers	Develop Threat and Hazard (Risk drivers) sub-models that cover: Threats (e.g., Atmospheric corrosion, Underground corrosion, Fatigue, Mechanical Wear, Decay, Contamination, Vibration), and Hazards (primarily Wind). Conduct assessment to determine whether newly developed sub-models are to be included in the WTRM model.	12/31/2022	Qualitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will continue to develop and evaluate effectiveness of additional EFF and CFO modules in 2022. PG&E has selected the next series of models for development and evaluation. Additional EFF and CFO modules will be assessed over the next several years.

7.3.1.4 Initiative Mapping and Estimation of Wildfire and PSPS Risk-Reduction Impact

OEIS Initiative Definition: Development of a tool to estimate the risk reduction efficacy (for both wildfire and Public Safety Power Shutoff (PSPS) risk) and risk-spend efficiency of various initiatives.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Foundational Wildfire Risk

Secondary Risk: Reliability Impacts – PSPS

As discussed in Section 4.5.1, PG&E has several models that measure current risk levels of wildfire and PSPS risk, and some models that can estimate the risk reduction given specific scenarios. For example, the WDRM informs wildfire mitigation plans, system hardening, and EVM by calculating risk scores. In addition, the PSPS Consequence Model informs PSPS mitigation plans to minimize customer impact.

For wildfire mitigation programs and initiatives, such as System Hardening or EVM, PG&E has developed the 2022 WDRM v3, which is described in detail in Section 4.5.1(b). PG&E has made improvements to the WDRM which provide the capability to compare wildfire risks for additional risk drivers as well as measuring the risk reduction for specific mitigation work. These general risk reduction values can be combined with general or specific cost estimates to determine the Risk Spend Efficiency (RSE) for a given mitigation option at a given location. RSE values can provide valuable insights for improved risk-informed decision making and program development. The WDRM will add the ability to estimate the reduction in the ignition probability due to a new or hardened conductor. This will provide improved insights for aligning the right mitigation for locations on the distribution grid.

The PSPS Consequence Model is discussed in Section 4.5.1(i). PG&E has updated the PSPS Consequence Model to include the 2021 PSPS historical lookback. Through the PSPS mitigation planning processes, PG&E is gaining stakeholder feedback and review on the validity of the model results for use in planning purposes.

Finally, PG&E has developed models that can be used to estimate the risk consequence for wildfire and PSPS at the circuit segment granularity.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

For Section 7.3.1.4, the term "initiative selection" is understood to mean how the risk modeling being described assists in the initiative selection of other initiatives.

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Measures risk reduction of ignition reduction efforts.

- Reduce Duration of Events (PSPS/EPSS) – Measures risk reduction of PSPS and EPSS reliability impacts.

Relation to and Impact on Other Initiatives:

- This initiative relates to many other initiatives because it is a foundational analysis that assists in understanding risk levels, but the analysis itself does not directly reduce risk.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Work and/or activities are prioritized based on models such as the WDRM and PSPS Consequence Model.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model
- PSPS Consequence Model

The prioritization and targeted location of EVM and System Hardening mitigation initiatives is informed by the WDRM for the distribution system. For PSPS mitigation planning, PG&E is in the process of identifying PSPS impacts to circuits and adding them to our planning processes using the PSPS Consequence Model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

By September 2021, PG&E completed an initial version of the PSPS Consequence Model that represents PSPS consequences at a circuit level. In Q4 2021, the data and granularity of the PSPS Consequence Model was updated to integrate results of the 2021 PSPS historical lookback.

Impacts:

- Helped better identify circuits of highest risk to begin building out System Hardening and PSPS Mitigation efforts on those lines.

Lessons Learned:

- By developing a PSPS Consequence Model at the circuit level in 2021, PG&E was able to identify top impacted circuits based on historical lookback, which gave better insight for long term PSPS mitigation planning. We are still reviewing the PSPS Consequence Model and will be seeking review and approval of the model from the Wildfire Risk Governance Steering Committee (WRGSC) in 2022.

Current Year Activities (2022):

TABLE PG&E-7.3.1.4-1:
2022 CURRENT YEAR ACTIVITIES OF PSPS CONSEQUENCE MODEL

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
A.03	PSPS Consequence Model	Conduct an assessment of the PSPS Consequence model to inform if it is fit for use to inform PSPS mitigation plans to minimize customer impact.	6/1/2022	Qualitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Future improvements to wildfire mitigation and PSPS risk models are described in Section 4.5.1 and will also be based, in part, on recommendations from the working group being facilitated by Energy Safety.

7.3.1.5 Match Drop Simulations Showing the Potential Wildfire Consequence of Ignitions That Occur Along the Electric Lines and Equipment

OEIS Initiative Definition: Development and use of tools and processes to assess the impact of potential ignition and risk to communities (e.g., in terms of potential fatalities, structures burned, monetary damages, area burned, impact on air quality and greenhouse gas, or GHG, reduction goals, etc.).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences – Acres Burned

In addition to determining whether an ignition is likely to occur or not, it is also critical to understand the impact and potential consequences of an ignition. Some ignitions may have minimal impact on the surrounding area and communities, while other ignitions have the potential to spread. PG&E has adopted the use of Technosylva to simulate fire spread and consequences impacts. These simulations are performed across climatological time horizons to assess the highest risk areas over the long-term, and in the short-term forecast (over the next five days). The outputs from Technosylva are utilized in PSPS assessments, long-term planning models, and real-time fire spread analysis to understand the impacts of the risk, and to better understand the consequence from fires had PSPS not been executed.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase understanding of where risk is located and potential impact.

Relation to and Impact on Other Initiatives:

- PSPS – Fuel data from Technosylva are used in PSPS assessments. See Section 4.5.1(f) for more details.

- System Hardening (Underground and Overhead) – Wildfire simulation outputs from Technosylva are used to develop the WFC Model described in Section 4.5.1(d). The Multi Attribute Value Function (MAVF) result from this model is then combined with Equipment Probability of Ignition Models to produce a risk value.

- Vegetation Management – Wildfire simulation outputs from the Technosylva fire simulation software are used to develop the WFC Model described in Section 4.5.1(e). The MAVF result from this model is then combined with the Vegetation Probability of Ignition Model to produce a risk value.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The WFC Model results are available across all of the HFTD, and HFRA areas identified by PG&E.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The 2020 ground fuels layer was updated to 2030 forecast ground fuels with estimated historical fire scar grow ins.

The 2022 WDRM v3 model includes areas outside of the HFTD, such as the HFRA and "burnable" non-HFTD areas.

Impacts and Lessons Learned:

- For long term planning, fire scars from recent fires should not be included in the vegetation fuel layer. In the 2022 WDRM v3, the fuel layer for recent fire scars have been replaced with 2030 forecast vegetation grow in.

- There are "burnable" areas beyond the HFTD that merit consideration when assessing wildfire risk. The current HFTD map was determined based on fuel layers prior to 2015. Given the dynamic nature of fuels and impacts from climate change such as multi-year drought conditions, a wider spatial view of wildfire consequence is needed.

- The forecast horizon of Technosylva's Wildfire Analyst (WFA) and FireCast (the forecasting mode of their software) was expanded from three to four days to allow for incorporation into PSPS.

- Previously, the consequences of fire spread simulations were not considered for PSPS. Consequences were included in 2021 PSPS decision making under the Catastrophic Fire Behavior (CFB).

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
A.04	Wildfire Consequence Model Enhancements – Ingress/Egress	Develop an approach on how to incorporate ingress/egress into the Wildfire Consequence Model.	12/31/2022	Qualitative
A.05	Wildfire Consequence Model Enhancements – Resistance to Control	Evaluate an approach to incorporate "Resistance to Control" (i.e., TDI) into the Wildfire Consequence Model. Resistance to Control is the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior.	12/31/2022	Qualitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will continue to leverage and refine additional Technosylva capability to inform planning and operational models to improve the effectiveness of wildfire models for planning and operational decisions.

7.3.2 Situational Awareness and Forecasting

7.3.2.1 Advanced Weather and Fire Potential Forecasting and Monitoring

Office of Energy Infrastructure Safety (OEIS) Initiative Definition: Purchase, installation, maintenance, and operation of weather stations. Collection, recording, and analysis of weather data from weather stations and from external sources.

7.3.2.1.1 Numerical Weather Prediction

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

Numerical Weather Prediction (NWP) is a foundational program for Pacific Gas and Electric Company (PG&E). The outputs from our high-resolution weather model drive dead and Live Fuel Moisture (LFM) models, PG&E's Fire Potential Index (FPI) and Ignition Probability Weather (IPW) Models, and fire spread simulations. Data generated from our NWP initiative is utilized daily and in Public Safety Power Shutoff (PSPS) assessments.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: By using numerical weather forecast data, we can better execute daily operations, as well as PSPS events, to reduce the risk of catastrophic wildfire and to provide additional time for our stakeholders and the public to prepare for these events.

Relation to and Impact on Other Initiatives:

- PSPS: High-resolution weather models are used by PG&E and other California utilities to forecast weather and critical fire weather components such as temperature, wind speed, and relative humidity (RH). These models were developed and configured to provide the most accurate output possible for the PG&E territory to date. External high-resolution models available to the public, such as the High-Resolution Rapid Refresh model, do not provide enough lead time or are not as granular (i.e., have coarser resolution). This program is a core and foundational component of PG&E's ability to forecast and execute a PSPS event to ultimately reduce the risk of catastrophic wildfire, while giving the public and stakeholders as much lead time to prepare as possible. The weather model output

is also used by the Nelson Dead Fuel Moisture (DFM) and the LFM models, our FPI, and is also used dynamically in the fire spread simulations produced by Technosylva.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E's weather modeling work is not limited to a particular region. The weather model provides output every 2x2 kilometer (km) across the PG&E system territory. The weather model output is used to drive the Live and DFM Models, and the FPI and IPW Models, which feed into PSPS decision-making.

Risk Models Used or Other Considerations for Prioritization:

- IPW Model
- FPI Model

4) Progress on initiative since the last Wildfire Mitigation Plan (WMP) submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The PG&E Operational Mesoscale Modeling System (POMMS), a version of the Weather Research and Forecast (WRF), has continued to improve from the previous year's version in the following ways:

- The deterministic 2x2 km weather model that provides weather forecasts (e.g., wind, temperature, RH) was increased from 105 hours to 129 hours. This provided additional lead time for PSPS event forecasting.
- POMMS is run four times per day. In 2021, over 1,400 forecasts were produced and processed.
- The POMMS Ensemble Prediction Systems (EPS) is run two times per day. In 2021, over 700 EPS forecasts were produced and processed.

We continued to utilize Amazon Web Services (AWS) cloud computing infrastructure to run and process the weather models.

The historical climatology of hourly weather data at 2x2 km resolution was increased from 30 to 31 years. This data was used to train the IPW and FPI Models.

The climatology of DFM and LFM from multiple plant species at 2x2 km resolution was increased from 30 to 31 years.

<u>Impacts:</u>

- NWP is foundational to PG&E's PSPS and operational decision-making programs.

- Without this initiative, the PSPS program would not be possible in its current form. PSPS sensitivity and look back analyses could not be conducted without the foundational robust climatology.

Lessons Learned:

- Extension of the forecast out to 129 hours provided an additional 24 hours of lead time for upcoming PSPS events.[83]

- A positive development in 2021 was the utilization of cloud computing in AWS. The high-resolution weather models and sub-models (dead and LFM) require significant computing resources. Each day, multiple terabytes of weather, fuels, and PSPS model data are processed through AWS. Our PSPS models were fully deployed and accessed through AWS during each PSPS event. We believe we have built a great foundation in the AWS cloud to further develop and ingest higher resolution models, ensemble prediction and additional sub-models, which we anticipate will significantly increase the size of data processed in the future.

- One area we identified for improvement is the further adoption of ensemble prediction. Our PSPS models and sub-models are driven by a high-resolution deterministic weather model that is updated four times per day. During events, the forecast outputs from the deterministic model can change run-to-run and locations near our trigger values for PSPS may come in (above guidance) and out of scope (below guidance) from a modeling perspective. These changes can be challenging due to the time-requirements and operational considerations to inform counties, agencies, stakeholders, and staff accordingly for a potential PSPS event.

- In 2022, we are evaluating the use of ensemble mean output from our high-resolution weather model ensemble to drive our PSPS models and sub-models. This may provide more accurate output and have less variability in the forecast.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
B.01	FPI and IPW Modeling – Revision Evaluation	Evaluate running the FPI and IPW Models with the ensemble mean output of the POMMS-EPS.	9/1/2022	Qualitative

[83] However, it should be noted that, as with all forecasts, weather forecasts decrease in certainty the farther out in time they are predicted.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E plans to continue our NWP efforts and to annually update our models.

7.3.2.1.2 Fuel Moisture Sampling and Modeling

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

The moisture content in living and dead vegetation is a critical component of PG&E's FPI Model and fire danger models used by state and federal fire agencies. In order to assess the FPI hour by hour multiple days in advance, high-resolution DFM and LFM models are needed. The outputs of the models are used in the FPI Model, which inform PSPS decisions.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: Fuel moisture forecast data is a foundational data set needed for PSPS and operational decision-making.

Relation to and Impact on Other Initiatives:

- PSPS: DFM and LFM forecasts are inputs into PG&E's FPI Model, which is a core component of PSPS assessments. Working with external experts, these models were enhanced to provide hourly output across PG&E's entire modeling domain at 2x2 km resolution to provide more granular output and a longer lead time than is publicly available. This gives PG&E the ability to assess the potential for PSPS events with a longer lead time leading to more advanced noticed of potential PSPS events.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: There is no regional prioritization regarding this work. The fuel models provide output across the entire PG&E territory. The fuel model output is utilized in the FPI Model, which feeds into PSPS decision-making.

Risk Models Used or Other Considerations for Prioritization:

- FPI Model

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E achieved the following to enhance our fuel moisture sampling and modeling efforts:

- Expanded the historical DFM and LFM climatology at 2x2 km resolution to back-fill all of 2020.
- Extended the deterministic DFM and LFM forecast to provide another 24 hours of forecast data for more advanced warning of potential PSPS conditions.
- Continued the LFM sampling program in 2021 by sampling LFM at least 30 locations across PG&E's territory to bolster situational awareness and build historical datasets.
- Evaluated sampling DFM using moisture probes as observations of DFM 100hr and DFM 1000hr fuels are very sparse.
- A detailed description of the development of our fuel moisture sampling and modeling efforts can be found on pages 451 through 455 of PG&E's 2021 WMP.

Impacts:

- Fuel moisture prediction is foundational to PG&E's PSPS and operational decision-making programs.
- Without this initiative, PSPS would not be possible in its current form. PSPS sensitivity and look back analyses could not be conducted without the robust climatology.
- Extension of the forecast out to 129 hours provided additional lead time of upcoming PSPS events; however, weather forecasts become more uncertain the farther out in time.
- Using cloud computing in AWS to post-process the vast quantities of weather data was extremely successful in 2021 and AWS will continue to be utilized in 2022.
- LFM models can be constructed with remote-sensing techniques.

Lessons Learned:

- Extension of the DFM and LFM forecasts provided additional lead time of upcoming PSPS events.
- We continue to benefit from having deployed our weather models and fuel moisture models in the AWS cloud. The high-resolution weather models and sub-models (dead and LFM) require significant computing resources and the computing environment in 2021 was very stable.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E plans to continue our fuel moisture sampling and modeling efforts and to annually update our models.

7.3.2.1.3 Weather Stations

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative. This section includes a description of weather stations and addresses Actions PGE-43 (Class B): and PGE-44 (Class B):

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

There is high wildfire risk across many remote areas within PG&E's 70,000 square mile service territory. California contains thousands of microclimates in which wind patterns differ based on location and topography (e.g., on a ridge, in a canyon, or on a valley floor). As weather events unfold, such as in Diablo wind events, the complex dynamics of wind and terrain alignment, as well as boundary layer height, may result in downslope windstorms where wind speeds accelerate down mountain ranges and topographic features. Although there are hundreds of RAWS (Remote Automatic Weather Station) and NWS Weather Stations in remote areas of California, there are many locations where micro-scale effects can occur that could lead to devastating consequences. The PG&E weather station network provides additional weather station network coverage to verify weather conditions on the ground and build datasets to improve future models. These stations are directly used during PSPS events.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: Weather stations provide better visibility into weather conditions in specific locations. Due to the extreme topography of California and the vast number of micro-climate and local effects, a dense weather station network is needed. These stations are used to verify conditions during a PSPS before lines are deenergized and to confirm the weather is safe before lines are reenergized.

Relation to and Impact on Other Initiatives:

- PSPS: Data from weather stations installed in PG&E's service area are used to help forecast and monitor for high fire risk weather conditions. This data helps inform implementation of additional precautionary measures such as PSPS.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E has dedicated a meteorologist to lead the station siting effort of each weather station. At a high level, this involves selecting the geographic location where weather stations can be installed on PG&E poles and towers. Next, pole and tower loading calculations are performed to ensure the pole/tower can adequately handle the additional forces a weather station installation will produce. Site visits are then conducted, and pictures are taken to ensure optimized weather data output. An evaluation of needed permits to install the weather station are then conducted and pursued. Finally, the weather station is installed once final signoff is provided by the PG&E meteorologist weather station lead.

The majority of weather stations are installed in the Tier 2 and Tier 3 High Fire Threat Districts (HFTD); however, some weather stations will be installed in non-HFTD areas as well for overall situational awareness. Our weather station program has multiple goals that feed into aiding our real time situational awareness and predictive capabilities, and having representative stations across the entire territory, including in non-HFTD areas, is crucial.

PG&E's service territory contains a large non-HFTD area, the Central Valley, that is entirely surrounded by Tier 2 and Tier 3 HFTDs. non-HFTD areas still need station observations to maintain a complete situational awareness picture. For example, as the northern Diablo winds begin, we typically observe northerly winds increase in the western Sacramento Valley before winds propagate into the HFTDs near the North Coast, North Bay Area and East Bay Area. Having some stations in non-HFTD areas gives meteorologists the ability to see and then track the winds as they develop across the non-HFTD western Sacramento Valley prior to them impacting Tier 2 and Tier 3 HFTD areas.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-year lookback.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E installed 308 additional weather stations. This brings the lifetime total to over 1,300 installed stations. By the end of 2021, there was a PG&E weather station roughly every 20 distribution circuit miles in Tier 2 and Tier 3 HFTDs.

In 2021, PG&E also added the ability to explore and visualize the weather station data from most stations every 30 seconds.

Impacts:

- The weather station network continues to grow and provide PG&E with valuable intelligence during PSPS events.

Lessons Learned:

- The use of 30-second observations allowed us to issue the weather “all-clear” notification faster in some instances. Without the 30 second observations, we would need to wait up to 10 minutes for the next weather station reading (from PG&E stations), and up to an hour for RAWS readings.
- In remote, heavily forested areas, it is often challenging to find locations that are adequately exposed to the wind, which is a requisite for weather station placement.
- We began installing stand-alone weather stations on non-PG&E land that require a weather station and a pole placement. These stations are installed to help address the issue above, as well as provide broader coverage for enhanced situational awareness.
  - It has been challenging to install weather stations on private property due to customer refusals.
  - Installing stations in United States Forest Service (USFS) lands has also been a challenge due to the permitting lead-time and environmental review required cost with each station.
- As more lines are undergrounded, weather stations may need to be removed and relocated.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
B.02	Weather Stations – Installations and Optimizations	Install or Optimize 100 weather stations. A unit is deemed "installed" when it is in service and verified as operating when initially installed. A unit is deemed "optimized" when a weather station is moved from an existing location to a new location for the purposes of improving our understanding of the weather conditions in the area.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Evaluate changes needed to the weather station network on an annual cadence. For example, PG&E has legacy weather station networks in the non-HFTD areas that are used for gas demand forecasting. It would be ideal to consolidate this legacy weather station network into the new wildfire weather station network for operational efficiency.

7.3.2.1.4 Wildfire Cameras

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

High-definition (HD) cameras are used by California Department of Forestry and Fire Protection (CAL FIRE), USFS, PG&E, and other local agencies to identify, confirm, and track wildfires and general conditions (based on fire behavior and associated weather risks) in real time. Cameras allow firefighting agencies to quickly confirm fire reports, assess size and spread of the fire, and inform deployment of fire suppression resources to affected areas. PG&E also utilizes these cameras to assess a fire's potential impact to PG&E assets and provide support of the responding fire agency.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences (Acres Burned)

Secondary Risk: Ignition Consequences (Structures Impacted)

Wildfire cameras are used by CAL FIRE, the California Governor's Office of Emergency Services, USFS, PG&E, and other local agencies to identify, confirm and track wildfires and general conditions (based on fire behavior and associated weather risks) in real time. Cameras allow firefighting agencies to confirm wildfire reports quickly, assess size and spread of the fire, and evaluate where to deploy fire suppression resources in affected areas. PG&E can also utilize these cameras to assess a fire's impact to communities and our assets. PG&E's long-term goal has been to install up to 600 cameras across PG&E's service territory to provide approximately 90 percent viewshed coverage of HFTD areas (Tier 2 and Tier 3) by the end of 2022. The majority of the cameras are sited in Tier 2 and Tier 3 HFTD areas. However, some cameras are sited in non-HFTD locations in order to provide excellent viewsheds into Tier 2 and 3 areas. Finally, there are cameras that are sited in non-HFTD areas that offer valuable views of potential fire spread into Tier 2 and Tier 3 HFTD areas.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions: This visual intelligence is useful to fire agencies and PG&E because the cameras allow for "size up" of a fire. Size up includes gaining a visual of fire behavior and fire direction. This intel will allow fire agencies and PG&E to apply the appropriate tactics, including resources and equipment, to the response.

- Develop better visibility into risk: As described above, this visual intelligence is useful to fire agencies and PG&E because the cameras allow for "size up" of a fire. Size up includes gaining a visual of fire behavior and fire direction.

- Increase understanding of where risk is located: The number of cameras and the associated camera features will help fire agencies and PG&E have a better understanding of the risk to PG&E assets and communities. The high-definition cameras have pan, tilt, and zoom capabilities which allow PG&E and fire agencies to gain an understanding of a fire's location which allows for quicker response.

Relation to and Impact on Other Initiatives:

- PSPS: When located in areas targeted for potential PSPS events, HD cameras can provide situational awareness of abnormal conditions, including local field conditions.

- Enhanced Powerline Safety Settings (EPSS): When located in targeted EPSS areas, HD cameras can provide situational awareness of potential abnormal conditions, including ignitions.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Sites are identified by PG&E and the ALERTWildfire consortium with input from stakeholders such as PG&E's Public Safety Specialists (PSS) and fire agencies. PG&E reviews and authorizes potential site installations to assure alignment with the program objectives where the majority of cameras are sited in Tier 2 and Tier 3 HFTD areas. Some cameras are sited in non-HFTD locations with excellent viewsheds into Tier 2 and 3. Lastly, there are cameras that are sited in non-HFTD areas that offer views of potential fire spread into Tier 2 and Tier 3 areas.

Risk Models Used or Other Considerations for Prioritization:

- HD camera installations require agency and other regulatory approvals. USFS, the State of California, local cities and counties, the Bureau of Land Management, and private landowners are all examples of approving entities. The installation of cameras will be impacted by the duration associated with these approvals.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E installed an additional 153 cameras. This brings the total number of HD cameras installed to 502, out of the 600 life-time total target for this initiative.

Impacts:

- The HD camera network continues to grow and provide fire agencies and PG&E with valuable intelligence.

Lessons Learned:

- The team will continue to focus on HFTD areas and engage the appropriate agencies to gain support for installations.

Knowing that the camera network continues to grow past manual monitoring capabilities, PG&E engaged two artificial intelligence and machine learning companies, as well as ALERTWildfire, in proof-of-concept pilots to determine if nascent early detection technology can quickly identify fires. Preliminary indications demonstrate that the potential for early detection is possible. Additional piloting will be needed to incorporate this technology into PG&E's operational processes. We have identified this is a potential short-term process improvement below.

Impacts:

- The proof-of-concept pilots demonstrated there is potential for AI/ML (Artificial Intelligence/Machine Learning) early fire detection. The team also garnered early understanding of how this technology could integrate into current processes.

Lessons Learned:

- These learnings can be applied to a planned 2022 and 2023 Electric Program Investment Charge project.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
B.03	High Definition Cameras – Installations	Install 98 new cameras that are facing HFTD Tier 2 or Tier 3 viewsheds. In the case a site is destroyed and a camera can be replaced/relocated nearby with a different visual coverage than the original, this will count as a new installation.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Process Improvements (2023-2028) – Continued evaluation and optimization of camera placements. PG&E will continue to partner with ALERTWildfire to reassess our wildfire camera network coverage. PG&E welcomes input from agencies such as CAL FIRE, USFS, and local fire agencies for wildfire camera deployment to maximize their impact on enhancing public safety and improve emergency response efforts. There will be incremental additions to support agency location requests and PG&E location optimization.

Continued exploration and potential implementation of AI technology, as described above. PG&E continues to look for opportunities to pilot nascent technologies, such as nighttime fire detection and integration of re-spread modeling capabilities.

7.3.2.1.5 Fire Detection & Alerting

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences

PG&E needs to be situationally aware of all wildland fire activity occurring within our territory regardless of causation. Satellite fire detections provide valuable information to the utility and the public regarding the presence of new fires and the spread of existing fires in a timely fashion. This information can be used to ensure the safety of utility workers in the area, help identify assets at risk and provide situational awareness as to the burn severity and rate of spread. A satellite-based fire detection system is also much more cost effective than the prior solution, which was fixed-wing flight patrols.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions: PG&E's Meteorology team deployed a fully operational state-of-the-art satellite-based fire detection and alerting system in 2019 and enhanced the system in 2020 by adding more satellite data. PG&E developed the system to incorporate new fire detection data feeds as they become available. PG&E is working directly with industry leading fire detection algorithm developers and experts from the Space Science Engineering Center at the University of Wisconsin Madison to procure a customized feed of satellite fire detection data specific to California, with the lowest latency available.

Relation to and Impact on Other Initiatives:

- EPSS: Satellite fire detections can provide situational awareness of ignitions and fire propagation.

- PSPS: Satellite fire detections can provide situational awareness of ignitions and fire propagation.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: There is no regional prioritization with regards to this work. The GOES-West and GOES-East (Geostationary Operational Environmental Satellite) satellites scan the entire continental United States every five minutes and thus provide new fire detection data in five minute intervals.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E continued to develop an external application available to the public where PG&E's satellite detection data can be found: https://pgefdp.lovelytics.info/pge_fire_app/. In addition, we continue to actively share this data with Technosylva, who has developed an application called Wildfire Analyst Enterprise. This application is used by other California utilities and CAL FIRE. PG&E has allowed all stakeholders using this application in California to access and visualize PG&E's fire detection data free of charge.

In 2021 PG&E also partnered with Sonoma Technology Inc. to improve existing fire occurrence datasets using satellite fire detection technology.

In 2022, PG&E plans to operate the system with no major enhancements or planned changes.

Impacts:

- The use of fire detection data has been valuable to build an enhanced fire occurrence dataset. This dataset is then used to train our FPI Model.

Lessons Learned:

- Satellite fire detection continues to be a valuable source of information to track the lifecycle of fires from start to finish.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – There are currently no new targets planned for this initiative in 2022. Continued operations of existing system are anticipated.

7.3.2.1.6 Other Meteorology Tools and Upgrades

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

In addition to the tools and programs discussed in the previous sections, the meteorology tools and upgrades outlined below help PG&E gain further situational awareness as it relates to weather intelligence across the PG&E service area, including: (1) High Performance Cloud Computing; (2) Medium- to Seasonal-Range Diablo Wind Forecasting; (3) Addressing Weather Forecast Model Uncertainty; (4) PG&E Lightning Detection Network (PLDN); and (5) Information Sharing.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: Each of the initiatives described in this section allows us to advance situational awareness capabilities as well as enable process and computation of extremely large datasets.

Relation to and Impact on Other Initiatives:

- PSPS: Each of the initiatives described below allows us to advance situational awareness capabilities as well as enable process and computation of extremely large datasets.

- High Performance Cloud Computing: The meteorology data PG&E processes and computes exceeds multiple terabytes per day. In order to process, store and visualize these large datasets, we migrated our weather prediction capabilities to the cloud in 2021. This migration allows us to expand our processing and data storage needs dynamically and prepare for the near future where data sizes and computation demands are expected to increase.

- Medium to Seasonal Range Diablo Wind Forecasting: Diablo winds have been responsible for most of the catastrophic fires in Northern California history. These are analogous to Santa Ana winds across Southern California. In 2020, PG&E developed an experimental short-range (two to four weeks) Diablo wind forecasting system and, in 2021, deployed a seasonal Diablo wind forecasting system.

- Addressing Weather Forecast Model Uncertainty: To address uncertainty in weather forecast modeling, PG&E employs multiple methods. First, PG&E leverages numerous sources of global and high-resolution forecast model data and

compares results to determine forecast alignment. Another method applied is ensemble prediction. PG&E leverages outputs and visualizations from the European Centre for Medium Range Weather Forecasts Ensemble Prediction System (EPS), which is comprised of 50 model members as well as operates a high-resolution weather model EPS.

- PLDN: PG&E operates several lightning detection sensors that feed into a larger network: The Global Lightning Network. Cloud to ground lightning strikes can cause utility outages, as well as result in fire ignitions. For example, from June 20 to 21, 2008 more than 20,000 lightning strikes occurred resulting in more than 2,000 fires. Another catastrophic lightning outbreak occurred in 2020, resulting in many of the largest fires in California history. PG&E also developed a custom internal application that displays lightning strikes in real time and allows a user to customize alerts received for just specific areas of interest. PG&E continued to operate this system in 2021.

- Information Sharing: In 2021 PG&E shared weather data, fire detection information, camera data, and PSPS potential forecasts with stakeholders and the public. PG&E values the role state, county and federal agencies (e.g., CAL FIRE, NWS, Predictive Services) play in communicating fire danger and risk to the general public.

- PG&E currently shares the following information daily:

  - Data collected from over 1,300 weather stations every 10 minutes;

  - Live feeds from alert wildfire cameras;

  - Fire detection information publicly, and directly with the California National Guard, CAL FIRE, other investor-owned utilities and county and municipal fire agencies; and

  - PG&E's 7-day PSPS forecast and discussion available at pge.com/weather.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E performs this work across the entire service territory. There is no regional prioritization for this work.

Risk Models Used or Other Considerations for Prioritization:

- This initiative is foundational.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E Meteorology expanded it use of the PG&E – AWS cloud to process meteorological data. The entire meteorology PSPS model data pipeline (high resolution weather, IPW Model, FPI Model) was developed on PG&E's AWS infrastructure.

Impacts:

- Positive impacts on our ability to process, store and deliver vast quantities of weather, fuels, and PSPS data.

Lessons Learned:

- The PG&E AWS environment has provided enhanced scalability, resiliency and responsiveness compared to on-premises infrastructure.

In 2021, PG&E continued development of an experimental short-range (two to four weeks) Diablo wind forecasting system.

In 2021, PG&E also worked with an external partner to develop and deploy a seasonal Diablo wind forecast. These forecasts provided an outlook on the projected number and frequency of Diablo wind events in the upcoming season compared to the number of normal events per month.

Impacts:

- Short and long-range forecasting of Diablo wind events continued in 2021.

Lessons Learned:

- The phase and magnitude of the Madden-Julian Oscillation was shown to be a potential predictor of upcoming Diablo wind events by both internal and external research.

In 2021, PG&E continued our deployment of an in-house high-resolution model POMMS-EPS based on the POMMS model. This package includes eight model members that provide hourly forecasts at 2 km resolution across the PG&E territory.

PG&E has found value in evaluating output from multiple deterministic and ensemble weather models to assess forecast uncertainty. The complete list of models that PG&E leverages can be found in Section 7.3.2.1.1. We will continue to leverage multiple weather models to determine the uncertainty in a forecast as well as continue to evaluate our own POMMS EPS.

Impacts:

- We continue to explore ensemble weather prediction by evaluating the performance and creating data visualizations.

Lessons Learned:

- Our preliminary research shows that our ensemble mean predictions are more accurate in general than deterministic output.

- Our PSPS models could be forced with each of the eight ensemble members to provide a range of outcomes, but that would increase data costs and size by a factor of eight. We plan to explore forcing our PSPS models and sub-models with ensemble mean output in addition to the deterministic model.

PLDN: There are no 2021 improvements to note as part of this initiative. PG&E plans to continue operating and maintaining lightning sensors deployed across the PG&E territory in 2022.

Impacts:

- No impacts were observed; the PLDN remained operational in 2021.

Lessons Learned:

- Lightning detection systems continue to remain very valuable to understand where cloud to ground lightning strikes are occurring in near real-time.

In 2021, PG&E continued our operational implementation of a publicly available 7-day forecast on the potential of implementing a PSPS. This forecast is published daily by an operational meteorologist or fire scientist from PG&E. The forecast is customized for PG&E utility operations and provides an overview for a potential PSPS event in the next seven days as determined from an analysis of forecasted weather, the potential for wind-related damage, and fuel moisture content in dead and live vegetation.

The forecast was enhanced in 2021 by providing a 7-day look ahead of the PSPS potential by county; however, PSPS decisions are made at more granular levels with more detailed information shared with state, county and local officials as well as the public, once more detailed analysis is performed. The forecast is presented in one of four discrete categories for each geographic zone:

Not Planned – No PSPS event is currently planned.

Elevated – An upcoming event (typically a period of adverse weather combined with dry fuels) is being monitored for an increased potential of a PSPS event.

PSPS Watch – The PG&E Emergency Operations Center (EOC) is activated for a reasonable chance of executing PSPS to reduce public safety risk in a given geographic zone due to a combination of adverse weather and dry fuel conditions. A PSPS watch is typically only issued within 72 hours before the anticipated start of an event.

PSPS Warning – The PG&E EOC is activated and customers in areas being considered for PSPS have been or are being notified. This level indicates execution of PSPS is probable given the latest forecast of weather and fuels and/or observed conditions. PSPS is typically executed in smaller and more targeted areas than PG&E geographic

zones. This level does not guarantee a PSPS execution as conditions and forecasts may change.

Impacts:

- The 7-day forecast was re-tooled from geographic zones to counties to make it clearer to customers and stakeholders on the potential for a PSPS event.

Lessons Learned:

- To our knowledge, we are the only utility that provides a public 7-day look-ahead on the potential for a PSPS event.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Not Applicable – There are no short-term improvements planned at this time.

7.3.2.2 Continuous Monitoring Sensors

OEIS Initiative Definition: Installation, maintenance, and monitoring of sensors and sensorized equipment used to monitor the condition of electric lines and equipment.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.2.2.1 – Electric Transmission SEL T400L
- 7.3.2.2.2 – SmartMeter Partial Voltage Detection
- 7.3.2.2.3 – Distribution Fault Anticipation (DFA) and Early Fault Detection (EFD) Technology
- 7.3.2.2.4 – Sensor IQ (SIQ)
- 7.3.2.2.5 – Line Sensor Devices
- 7.3.2.2.6 – Distribution Arcing Fault Signature Library
- 7.3.2.2.7 – Distribution Transmission Substation: Fire Action Schemes and Technologies (DTS FAST)

7.3.2.2.1 Electric Transmission SEL T400L

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks (Equipment; structures)

Secondary Risk: Ignition Risks (Equipment, conductor)

Bolted transmission electrical faults (when the conductors are considered connected to ground) can result in extreme heat, sparks, and molten material with the potential to cause a wildfire ignition. Using data from transmission monitoring technology could reduce potential hazards and improve public safety.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Line monitoring non-tripping travelling wave relays (SEL T400L's) were installed on selected transmission lines to capture high frequency travelling waves emitted by faults or other electric system anomalies. The SEL T400L relay is the only device providing automatic line monitoring for incipient faults. Thus far, vulnerable locations along the transmission line have not been identified by the relay prior to the condition evolving into a bolted transmission electrical fault.

Relation to and Impact on Other Initiatives:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: To implement this pilot initiative, PG&E installed the subject relays on transmission lines in the Northern and Southern Sierra regions, in both HFTD and non-HFTD areas. PG&E chose these transmission lines because they lent themselves to quick installation of the relays on a limited budget, which provided the fastest path to data acquisition. The lines were also selected based on their historically high level of fault activity.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Electric Transmission SEL T400L: Installation of T400L relays on three Transmission lines are complete. An additional two Transmission lines had Information Technology (IT) functions completed in Q4 2021.

Impacts:

- The devices have been used to validate and improve on fault location estimates. This has helped our teams find fault locations and issue repair tags for at risk equipment. However, the installed relays have not yet produced any actionable incipient fault data. T400L relays with C37.94 communications will not be installed on additional Transmission lines due to the lack of incipient faults detected.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

This Initiative will not continue in 2022 and so no future plans, targets and/or goals are being reported.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – This initiative was completed in 2021. Currently there are no plans to continue this initiative in 2022.

7.3.2.2.2 SmartMeter Partial Voltage Detection (Formerly Known as Enhanced Wires Down Detection)

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks (Equipment; Conductor)

Secondary Risk: Reliability Impacts (Ignition risk – Equipment; Conductor)

Prior to implementing SmartMeter technology, Control Center Operators and Dispatch were not provided with information on partial voltage conditions which indicate loss of phase/conductor on the distribution circuit. In addition, SmartMeters only informed Control Center operators of full power out conditions. PG&E has now enabled single phase SmartMeters to send real time alarms occurring in the Distribution Management System under partial voltage conditions (25 percent to 75 percent of nominal voltage). Detection of partial voltage conditions allows Control Center operators to dispatch field personnel to locations where equipment may be in a condition that increases wildfire risk.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce lag in information from hazard events – This enhanced situational awareness can help detect and locate downed distribution lines more quickly to enable faster response. Faster response may reduce the amount of time a line is down and allow first responders to more quickly extinguish wire down related ignitions, if they occur.

- Reduce consequence of potential ignitions – Receiving alerts of potential wire down conditions earlier can allow quicker response and reduce consequence.

- Increase understanding of where risk is located – In some cases, SmartMeters can locate broken conductor within several spans.

Relation to and Impact on Other Initiatives:

- Control Center Operations – The outage alerts from the SmartMeters are relayed to the Control Center which helps to scope the extent and type of outage.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: SmartMeter technology is software-based and can be deployed across PG&E's service territory, including all HFTDs. However, deployment will not be limited to HFTDs.

The continuation of partial voltage expands coverage of the detection algorithm from the initial 4.5 million single phase meters to an additional 365,000 three phase SmartMeters. This will provide coverage to more areas and allow for the detection of additional types of partial voltage conditions, including four wire circuits.

Risk Models Used or Other Considerations for Prioritization:

- Risk models are not used as this is utilized throughout the service territory wherever there is an applicable meter.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Partial Voltage Detection development, deployment, and operations – By the end of Q2 2021, deployment was complete to 415,911 meters (exceeding the original goal of 365,000 meters). Filtering/tuning of alerts was completed in DMS and partial voltage capability for three phase meters deployed to production.

We have also been notified of the patent award (U.S. Patent No. 10,877,083) for the method of using partial voltage condition on three-wire circuits to detect and localize wire down and other partial voltage conditions in March 2021.

Impacts:

- Enabling fast trip settings on line reclosers will impact this system's functionality by opening all three phases simultaneously and clearing most single phase faults normally protected by fuses. However, while safety is not impacted, restoration times may be increased.

Lessons Learned:

- In some areas where SmartMeter network coverage is not optimized for outage detection, not all outage notifications are received.

Current Year Activities (2022):

The system is operational and has transitioned into an active maintained application. Ongoing activities include software maintenance and activities to ensure continuing coverage on future meter models.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E completed all planned implementation of this technology to all applicable meters by June 30, 2021.

7.3.2.2.3 DFA and EFD Technology

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment; Conductor)

Secondary Risk: Ignition Risks (Ignition Risk – Vegetation Contact)

In some cases, non-equipment failure type outages (where no problems are found) indicate the presence of latent conditions that can result in more significant issues or a fire risk in the future, if left unresolved. There are also other power flow anomalies/disruptions that are indicative of incipient faults. Since these issues lack visibility and sensitivity, they are difficult to perceive using existing detection methods and patrol techniques. More advanced monitoring methods – such as the utilization of DFA and EFD technology which measure different electrical parameters over the distribution circuits – along with analytical methods, may be able to detect these issues early in their degradation mode.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: Addressing latent or incipient issues in their early stages may remove many of the conditions that cause wildfires. With the ability to proactively detect failing conditions as they evolve and eliminate them quickly, PG&E can better reduce the risk of wildfire.

- Reduce lag in information from hazard events: The DFA and EFD sensors may also be able to more quickly detect and locate aggressively failing components during high-risk conditions and allow field crews and fire protection personnel to more immediately respond and minimize wildfire risks.

Relation to and Impact on Other Initiatives:

- Other: Line sensors can be used in combination with these two sensor technologies to help locate issues. Line sensors, DFA, and EFD are part of a larger distribution monitoring sensor system to detect incipient issues and potentially improve restoration during fast trip setting periods.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The technology deployment will be prioritized to the highest fire risk areas, beginning with the highest fire risk circuits. PG&E will then roll out the technology to all fire risk areas on a full circuit-based deployment.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

DFA Deployment Ramp-up: 2021 was the start of a ramped-up mass deployment for DFA technology. Sixteen additional DFA sensors were installed in 2021 for a total of 23 units. DFA is being scaled up to a level higher than previously operated by any utility. It requires additional process refinements and operational enhancement. In 2021, standards product approval and installation methods work were initiated.

Impacts:

- The sensors deployed in the pilot are continuing to provide insights and increasing understanding of the wide extent of their usefulness. Due to the complexities and uniqueness of the PG&E system, there are additional customization challenges that will need to be addressed for each deployment.

Lessons Learned:

- Due to the complexities and uniqueness of the PG&E system, there are additional customization challenges that will need to be addressed for each deployment.

EFD Continuation Pilot: EFD is also being deployed on a larger scale than it was previously. There is additional development work required to simplify deployment, along with operational enhancements to utilize the data generated. As we have seen with other emerging technologies, these challenges may impact the scope and speed of deployment. In 2021, standards product approval and installation methods work were initiated. Due to global parts shortages, equipment arrived in mid-December.

Impacts:

- Insights from the pilot deployments will be used to determine the usefulness & operational viability of the technology.

Lessons Learned:

- Standards design and deployment development takes time due to complexity of the PG&E distributions system.

DFA Technology and EFD Expansion: Each of these technologies is emerging. Deployment was ramped-up in 2021. If deployment of technology is determined to be operationally viable, PG&E's long-term goal is to deploy EFD and DFA sensors on a total of over 600 circuits in Tier 2 and Tier 3 HFTD areas, mitigating 28,000 total line miles (20,200 miles in Tier 2, 7,800 miles in Tier 3), across several WMP/General Rate Case (GRC) cycles.

Impacts:

- The pilot systems, when combined with other initiatives, have already identified wildfire risk issues on the small number of circuits installed.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
B.04	Distribution Fault Anticipation (DFA) – Installations	Install 40 Distribution Fault Anticipation (DFA) sensors on circuits feeding into HFTD areas or HFRA. One sensor per circuit at initiating substation.	12/31/2022	Quantitative
B.05	Early Fault Detection (EFD) – Installations	Install Early Fault Detection (EFD) sensors on 2 circuits feeding into HFTD areas or HFRA.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028):

EFD optimization/expansion – The EFD technology is nascent and provides data that has not been previously available. Continued efforts and refinement of the technology will be added to better detect incipient issues and to provide faster response time.

DFA optimization/expansion/continued use – Leveraging the more established implementation of the DFA technology and building on the 20-year continual advancement by the Texas A&M Electrical Power System Engineering, PG&E will use the existing indication detection methods as well as add newly developed detection algorithms to reduce sources of wildfire ignition. Since the DFA product is more mature and commercialized, it is readily deployed in larger volumes and more f circuits will be added to operations. This coverage will provide broader awareness of conditions.

EFD/DFA combined optimization – As these systems continue to be implemented, new methods, accuracy, efficiencies, and optimization analytics will be applied to extract maximum benefit. PG&E continues to work with each of the technology vendors to

increase effectiveness of the locational and predictive functionality, and to develop more operationally efficient platforms with the vision of deploying the technology to all HFTD circuits. It has also been observed that the two technologies are complementary in that they each detect different elements of failure conditions. The intent is to seamlessly integrate them together and automate the functionality into existing operating systems.

EFD Optimization/expansion/broad system integration – As the EFD system deployment establishes stability, continued refinements to its detection algorithms will be implemented on top of the systems already existing functionality. With each added feature, the ability to proactive and reactively address wildfire risk conditions. Integration into core operations will continue. If determined to be operationally viable, the strategy is to deploy this technology to over 600 HFTD circuits over the next eight to 10 years, covering multiple GRC planning cycles. These technologies will also be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

DFA Expansion/continued use/broad system integration – DFA will continue to be deployed to over 600 HFTD circuits over the next eight to 10 years, covering multiple GRC planning cycles. These technologies will also be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

7.3.2.2.4 Sensor IQ (SIQ)

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment; Transformers)

Secondary Risk: Ignition Risks (Equipment; Conductor)

The SIQ software works with existing SmartMeters to capture and store high resolution, real-time, and granular load voltage and outage data to enable predictive maintenance data analytics. SIQ does not currently have a direct impact for wildfire reduction. However, we anticipate the additional data source may provide an analytical methodology to detect early-stage equipment failure resulting in voltage and other meter detectable conditions including, loose conductor splices, failing/overloaded transformers, momentary secondary and primary vegetation contact. The goal is to decrease overall wildfire ignition risk by detecting early-stage equipment failure and conducting repairs before infrastructure fails.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: PG&E believes useful and valuable wildfire related data can be obtained from SmartMeters. The current SmartMeters are only able to capture limited lower frequency and less comprehensive real time data. PG&E has worked to harness as much intelligence from the meters as possible in the current configuration. The SIQ software is expected to provide higher resolution data and additional data fields that can be set to report in real time, allowing for a more insightful view of undesirable changes that could negatively impact PG&E equipment. Early awareness of degrading conditions can allow for a prompt response and help reduce the risk of potential wildfire ignition sources.

Relation to and Impact on Other Initiatives:

- Other: System monitoring and proactive incipient fault reduction.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The pilot will be prioritized to cover circuits in the HFTDs. Since this is a software solution, it can be deployed almost concurrently over the entire area.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable. No risk model is used for prioritizing.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

SIQ deployment and analysis – PG&E has SIQ capability deployed on all planned SmartMeters (500,000) and expects to complete the full evaluation for how to use this technology in 2022.

Impacts:

- Deployment of sensor profiles complete and data collection initiated. Impacts to wildfire mitigation pending completion of machine learning analysis.

Lessons Learned:

- None at this time, as this program is not sufficiently developed to provide lessons learned.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022 we plan to continue to assess the performance and functionality of SIQ data in identifying incipient conditions that may cause wildfire.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028):

Use analytics and machine learning to detect failing/impacted equipment early and prevent it from causing wildfire ignition. PG&E will use an advanced data analytics and machine learning platform to evaluate the data from the SIQ pilot. The data from the pilot will then be ingested into another advanced data analytics and machine learning platform. Several focused efforts on various event types will be conducted to determine if we can improve our ability to find loose conductor splices, failing/overloaded transformers, and momentary secondary or primary vegetation contact.

Operations integration of high-resolution meter data to all SmartMeters. If the technology proves to be effective in early detection of fire risks, the deployment of this tool may be extended to continue coverage past the currently planned pilot for the 500,000 pilot meters, including possibly deploying it to all 5.5 million electric SmartMeters across PG&E's service territory.

7.3.2.2.5 Line Sensor Devices

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment; conductor)

Secondary Risk: Ignition Risks (Vegetation Contact)

Existing detection methods and patrol techniques miss non-equipment failure types since they lack visibility and sensitivity. Non-equipment failure type outages (no problem found) are indicators, in some cases, of latent conditions that could result in more significant issues or fire risks if left unresolved. There are also other power flow anomalies/disruptions that may be indicative of incipient faults. Advanced monitoring methods that measure different electrical parameters over the distribution circuits can harness these advanced sensors with analytical methods to find conditions early in their degradation mode.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase understanding of where risk is located: Line sensors are primary conductor mounted devices that continuously measure current in real time, report events as they occur, and in some cases the current waveform of grid disturbances. If they can be detected, PG&E could remove conditions that might cause a wildfire by addressing latent or incipient issues in their early stages. By proactively detecting and resolving failing conditions quickly, before they evolve, we can reduce risk of causing a wildfire.

- Reduction duration of events (PSPS/EPSS): Line sensors can improve the ability to locate faults on circuits with devices configured in EPSS and potentially reduce the time to restore power.

Relation to and Impact on Other Initiatives:

- EPSS: Line sensors are the next generation fault indicators (covered in Section 7.3.2.3) with additional functionality and communication capabilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Building from our Smart Grid Pilot Program, PG&E began deploying 801 line-sensing devices on 60 key circuits in 2019 at Tier 2

and Tier 3 HFTD areas in Humboldt, North Bay, North Valley, Sierra, Sonoma, and Yosemite Divisions. Efforts were focused on reducing wildfire risk and improving public safety by monitoring the grid continuously, performing analytics on captured line disturbance data, identifying potential hazards and, when necessary, dispatching field operations to proactively patrol, maintain, and repair failing field conditions or assets. These efforts intend to expand coverage of the technology first to the highest fire risk areas. Continuing deployments have focused on the highest risk ranked circuits with an additional 40 to 70 circuits covered each year.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable – Risk model is not used to prioritize.
- Coordination of other system hardening activities will impact the sequence of deployment of line sensors. PG&E is carefully aligning these adjacent activities and adjusting as necessary.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Line Sensor expansion and operations: In 2021, PG&E installed and operationalized line sensors on 67 circuits in Tier 2 and Tier 3 HFTDs. PG&E continued benchmarking with other leading utilities and manufacturers to learn alternatives to improve our predictive analytics and preventative operational practices, while evaluating new and/or emerging technologies. Standards activities addressed encompassed installation, sourcing, and ongoing operations.

Impacts:

- Line sensors continue to be used to identify incipient outages and latent issues with daily monitoring. Advances were explored using line sensors to help identify fault locations during and after EPSS outage events.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
B.06	Line Sensor – Installations	Install Line Sensor devices on 40 circuits feeding into HFTD areas or HFRA to cover mainline and major tap lines in areas meeting minimum load requirements and within cellular coverage areas to provide visibility.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – Using an engineering approach, PG&E will identify additional circuits in Tier 2 and Tier 3 HFTD areas and redesign an optimal line sensor device footprint to further support wildfire mitigation. PG&E will strategically deploy, gain further experience, and operate state of the art systems and technologies to continuously monitor the grid and analyze data to prevent asset failures and reduce risk. The intent is to deploy line sensors on a total of 600 to 800 circuits in Tier 2 and Tier 3 HFTD areas, mitigating 28,000 total line miles (20,200 miles in Tier 2 and 7,800 miles in Tier 3), across several WMP/GRC cycles. To handle the additional amount of data, we will need to integrate into an automated analytics and detection platform. This analytics platform will cross analyze the data from other relevant sources, including SmartMeters, other distribution sensors, asset history, and meteorology. Our goal is to access as much visibility of circuit conditions as possible so we can react, identify issues as they appear in the data and remove incipient issues before they become fire risks. Other areas of improvement include refining sensor settings and detecting methodologies based on continuous evaluation of event data.

As PG&E continues to evaluate this technology, it is simultaneously building a strategy to deploy it on 600 to 800 HFTD circuits over the next 8 to 10 years covering multiple WMP/GRC planning cycles. This technology will also be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

7.3.2.2.6 Distribution Arcing Fault Signature Library

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment; Conductor)

Secondary Risk: Ignition Risks (Vegetation Contact)

Until recently, the ability to collect extremely high-resolution data waveforms (the unique signature) from a broad range of fault events and precursors has been limited to the equipment available. In addition, deconstructing and analyzing these waveforms requires significant analytics and computer processing power. This level of effort has been a challenge within a utility environment. In order to have analytical and machine learning tools that can react to specific types of events, the faults need to be known and understood. Utilization of this method on a distributed analytics platform allows the high volume of data to be locally processed and improves detection time, enabling future control technologies to take accurate segmentation action.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: This research and development (R&D) project is the foundation for this data collection. This project is intended to better identify the signatures of incipient fault conditions. Once this high-resolution sensor data waveform library is built it will assist in identifying events caused by incipient fault conditions as they occur. By understanding and detecting these conditions, PG&E can build better tools and methods to reduce or correct risks by proactive maintenance or real time protective circuit de-energization. This project takes advantage of a cooperative effort between PG&E's distribution operational system subject matter experts and two Department of Energy national labs using technologies originally built for Department of Defense analytical expertise used to solve hyper-complex problems. The technology includes installing a high-fidelity optical sensor technology on a distribution feeder. The optical sensors, with immunity to electromagnetic interference and instrument transformer saturation, will provide high-frequency sampling of voltage, current, temperature, pressure, vibration, and acoustic variables. The Distribution Arcing Fault Signature Library will inform PG&E about the types and resolutions of sensors needed to detect incipient fault conditions on the distribution system and intervene with proactive maintenance to reduce wildfire risks.

Relation to and Impact on Other Initiatives:

- Related to DFA sensor system (see Section 7.3.2.2.3) as the waveform library generated in this project could be used to further enhance DFA waveform classification.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Since this is purely an R&D project, the initial scope of deployment will be on a single circuit that has a high occurrence of faults with a wide range of causes. The circuit includes sections that are within the Tier 2 and Tier 3 HFTD areas.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable – Risk model not used in prioritization.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Sensor data acquisition and categorization: The specialized sensor installation was completed in December 2020. By end of 2021, the project had completed a six month minimum analytic stage capturing all events on the installed circuit (Half Moon Bay 1103).

Impacts:

- Initial monitoring of the system has collected a wide variety of waveforms that are difficult to categorize.

Lessons Learned:

- After completing the R&D project at the end of 2021, the AH&PC team performed a strategic assessment of the results. PG&E has determined that the outcome of the pilot was not sufficient to develop a comprehensive fault signature library applicable to the larger incipient fault analytics tools that will be used to proactively detect and mitigate conditions that might result in a wildfire. No future actions are planned at this time.

Current Year Activities (2022):

This Initiative will not continue in 2022 and so no future plans, targets and/or goals are being reported.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – Not Applicable. This initiative was completed in 2021.

7.3.2.2.7 Distribution Transmission Substation: Fire Action Schemes and Technologies (DTS FAST)

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Vegetation Contact)

Secondary Risk: Ignition Risks (Equipment; Structures)

The objective of the DTS FAST system is to identify and communicate risks related to vegetation fall-in and encroachment, as well as infrastructure failure (i.e., falling/leaning pole or conductor line failure). Although the objective in the years 2020 and 2021 was to install the system on transmission lines, the program has shifted towards distribution wood poles. The 2022 distribution pilot effort will focus on installing Light Detection and Ranging (LiDAR) and other sensors—placed at designated locations in HFTDs—on wood poles so as to monitor both vegetation risk and infrastructure failure and send alerts when specific conditions are met.

The program will perform system test and integration of distribution sensors to test vegetation risk on distribution lines prior to deployment in Dublin, CA.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized.

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions.
  - Provides the benefit of real-time awareness on encroaching or falling vegetation identified by DTS FAST sensors.
- Increase understanding of where risk is located.
  - Can provide notification if there is a fire or flames in the nearby vicinity, either caused by PG&E infrastructure or otherwise.

Relation to and Impact on Other Initiatives:

- Ignition Prevention:
  - Sensors are placed at designated locations where there is heavy vegetation and the risk of vegetation fall-in is high. The sensors will be able to detect if fallen trees or branches have crossed a sensor plane and send an alert to the Supervisory Control and Data Acquisition system about this occurrence. Remote cameras can view the area in real-time and operators can take appropriate action.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: This work is targeting HFTD Tier 3 areas. Specifically, in areas of dry and heavy vegetation on un-hardened infrastructure and where EVM has not occurred.

Risk Models Used or Other Considerations for Prioritization:

Vegetation Management Outage Summary: The Vegetation Management team develops a yearly outage summary file that reflects the vegetation related outages on distribution lines. This data contains outages from the Integrated Logging Information System (ILIS) Vegetation Management Database. The outages are a subset of the total ILIS outages, where ILIS determines if it were a caused by vegetation. The data contains information related to the environment that caused the outage such as the species of tree, the dimensions of the object that caused the event, the cause of the triggering event (encroaching vegetation, branch fall-in, branch blow-in, tree fall, third party, PG&E contractor, and others), and other pertinent information related to the outage.

A DTS FAST internal risk model will be created once data gathering is achieved, post-installation.

Exceptions could include a lack of standards approval of design on distribution poles. Also, installation on HFTD Tier 2 areas or in areas that do not have existing communication access (e.g., 3G/4G). Weather constraints can also limit our ability to perform installations.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

A pilot to test configuration and settings on Transmission was done in 2020.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

The 2022 distribution pilot effort will focus on installing Light Detection and Ranging (LiDAR) and other sensors—placed at designated locations in HFTDs—on wood poles so as to monitor both vegetation risk and infrastructure failure and send alerts when specific conditions are met.

5) Future improvements to initiative:

Short-Term Improvements (2023-2028) – Expansion of the DTS FAST technology across distribution wood poles in HFTD Tier 2 and Tier 3 areas. The integration of the DTS FAST system into composite pole design in locations where wood poles will be replaced with composite poles.

7.3.2.3 Fault Indicators for Detecting Faults on Electric Lines and Equipment

OEIS Initiative Definition: Installation and maintenance of fault indicators

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Reliability Impacts

Fault indicators help trouble-persons locate distribution faults such as failed conductor. Fault indicators are installed to shorten outage times and facilitate restoration. They do not prevent ignitions and are not a WMP Initiative.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized.

Primary Benefits of Initiative:

- Increase understanding of where risk is located – Once a fault has occurred on PG&E's Distribution System, fault indicators assist troubles-persons in locating the fault location.

Relation to and Impact on Other Initiatives:

- PG&E does not leverage fault indicators for wildfire mitigation. They are used in a reactive, ad hoc fashion to assist in more timely restoration of future outages. Fault indicators are not directly part of PG&E's WMP. Related technology that PG&E is leveraging to assist with the proactive detection of potential or future faults, which may be able to prevent equipment failure and ignitions, are discussed in Section 7.3.2.2.5.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Fault indicators are installed by trouble-persons based on their knowledge of the circuit. Additionally, the Engineering and Operation teams may decide where to install fault indicators based on how to best troubleshoot outages on a particular circuit.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

A specific installation goal did not exist as fault indicators were installed when needed.

Impacts:

- Fault indicators that were installed aided in service restoration.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E will continue to install fault indicators when needed.

5) Future improvements to initiative:

Short-Term Improvements (2023-2028) – Continue to install fault indicators ad-hoc, as operationally necessary. Continue to explore more advanced technology such as line sensors (see Section 7.3.2.2.5). The intended benefit of this work is to improve fault locating and to reduce service restoration time.

7.3.2.4 Forecast of a Fire Risk Index, Fire Potential Index, or Similar

OEIS Initiative Definition: Index that uses a combination of weather parameters (such as wind speed, humidity, and temperature), vegetation and/or fuel conditions, and other factors to judge current fire risk and to create a forecast indicative of fire risk. A sufficiently granular index is required to inform operational decision-making.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Consequences

Secondary Risk: Ignition Risks

The FPI Model is used to understand and predict the potential for large and catastrophic fires to occur across the PG&E territory. The FPI Model is used for daily operational decisions to reduce ignition risks and is one of the main components of the PSPS decision making framework. The FPI Model methodology and features are discussed in Section 4.5.1(f).

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events: The FPI Model drives daily fire mitigation decisions per utility standards. It is also used in each PSPS assessment.

Relation to and Impact on Other Initiatives:

- PSPS: The FPI Model is used as a daily and hourly tool to drive operational decisions to reduce the risk of utility-caused fires. On a day-by-day basis, the FPI Model informs crews what precautions must be taken to reduce the risk of fire ignitions as directed by Utility Standard TD-1464S. The FPI Model also informs the potential need and execution for PSPS.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The FPI Model is run across the entire PG&E service territory, but decisions based on the FPI Model are prioritized for HFTD and HFRA areas.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-Year Lookback.

- The FPI Model is used in forecast mode as an input into PSPS decision making. In addition, historical FPI values are also used in the 10-Year PSPS Lookback.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Enhancements to FPI Model: The FPI Model was significantly enhanced in 2021. We utilized the weather and dead and LFM climatology datasets that were extended through 2020.

An enhanced fire occurrence data set that leverages satellite fire detection was utilized to train the FPI Model on sub-daily fire growth instead of the final fire size.

Impacts:

- Model performance was improved by incorporating machine learning techniques.
- Enhanced fire occurrence datasets that utilize fire detection datasets improve our understanding of fire growth and fire spread.

Lessons Learned:

- We found value in testing numerous features and new variables to boost model performance.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – Not Applicable

7.3.2.5 Personnel Monitoring Areas of Electric Lines and Equipment in Elevated Fire Risk Conditions

OEIS Initiative Definition: Personnel positioned within utility service territory to monitor system conditions and weather on site. Field observations are required to inform operational decisions.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Vegetation Contact)

Secondary Risk: Ignition Consequences (Acres Burned)

In response to Senate Bill 901, PG&E established in-house fire protection services who are trained and certified in safety and infrastructure protection. The Safety and Infrastructure Protection Teams (SIPT) apply fire retardant to combustible utility infrastructure (poles, buildings, etc.) during wildfires to protect these assets from fire damage. The SIPT program supports mitigation of fire ignition risks and consequences as described more below.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: Collecting weather and fuels data supports PSPS decision making before, during, and after the event. Information collected by SIPT helps eliminate the need for a PSPS or shortens the overall duration of such an event.

- Reduce duration of events (PSPS/EPSS): Collecting weather and fuels data supports PSPS decision making before, during, and after the event. Information collected by SIPT helps eliminate the need for a PSPS or shortens the overall duration of such an event.

- Reduce consequence of potential ignitions: Providing standby fire protection resources for PG&E crews performing work in Tier 2 and Tier 3 HFTD areas during elevated risk conditions can reduce the consequences of a PG&E caused ignition.

- Focus mitigations on highest risk locations: Providing standby fire protection during elevated risk conditions can reduce the consequences of a PG&E caused ignition to PG&E assets.

Relation to and Impact on Other Initiatives:

- PSPS: SIPT plays an important role during PSPS events. When PG&E activates for a PSPS event, SIPTs are deployed to collect valuable weather and fuel data. The observations include date/time and location specifics for the following conditions: tree/branch movement, flying debris, conductor movement, and wind

speed. This information is then reported to the Hazard Awareness and Warning Center (HAWC) and shared during the EOC's PSPS decision-making meetings. With input from meteorology, the HAWC determines Field Observation locations within targeted PSPS zones. The number of field observers vary from event to event depending on the total number of miles, surrounding terrain, facility attributes and number of PSPS zones within the scope of the event. Observations provide qualitative information on the potential for PSPS de-energization conditions and the possibility of triggering outages sooner than expected. Observations also provide information to support weather "all clear" conditions which are necessary to authorize post-PSPS patrol and restoration activities. Upon request, SIPT can utilize weather data and local conditions to calculate ignition potential based on existing firefighting standards. SIPT resources may also be redeployed from performing Field Observations to support other safety needs during a PSPS event.

- Other: Providing standby fire protection resources for PG&E crews performing work in Tier 2 and Tier 3 HFTD areas during elevated risk conditions has the potential to reduce the consequences of a PG&E caused ignition.

- Other: The SIPT collects localized LFM data, which informs PG&E Meteorology's Utility FPI model and helps guide PG&E's operational decisions.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- SIPTs are located throughout the PG&E service territory with a primary focus in Tier 2 and Tier 3 HFTD areas.

- Weather observation locations during PSPS events are determined by weather forecasts and impacted geographic area.

- Crew support decisions are based on an assessment of the Fire Prevention Index rating, type of work being performed, work activity location, and SIPT availability.

- Data collection locations for LFM sampling are determined by Meteorology and are performed on a scheduled basis.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable – A risk model has not been developed for this work.

- SIPT crew availability impacts prioritization. If crews are not available due to injury, illness, or emergency activity, adjustments are required for any prioritization process.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

SIPT maintained minimum staffing levels to support fire prevention and mitigation activities (40 crews and 40 engines and associated equipment).

Impacts:

- SIPT was effectively staffed to manage the overall workload.

Lessons Learned:

- Additional SIPT crews can provide more capacity to support this initiative. SIPT has been authorized to increase staffing by 22 full-time employees in 2022, increasing overall program budgeted headcount to 130.

In 2021, minor technology improvements were made to the SIPT viewer to improve data capture for both routine and emergency work. Specifically, new users were added to the SIPT drop-down lists for all work types (i.e., daily, emergency, and field observation forms). Additionally, the tech name field was re-labeled in the daily work, field observation and emergency work forms.

Impacts:

- Improved efficiency and accuracy of data collection.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Continue to assess SIPT staffing levels, as appropriate to provide additional fire prevention and fuel hazard reduction capability, reduce incident response time, and increase SIPT depth to support multiple large incidents.

Add a dedicated facility for a base of SIPT operations. Provide necessary logistical support for SIPT organization.

Planning to determine upgrades to existing equipment (engines) and enhancements to the overall program. Develop a risk-informed business case to determine if increases to staffing and or equipment is recommended.

7.3.2.6 Weather Forecasting and Estimating Outage Probability on Electric Lines and Equipment

OEIS Initiative Definition: Development methodology for forecast of weather conditions relevant to utility operations, forecasting weather conditions and conducting analysis to incorporate into utility decision making, learning and updates to reduce false positives and false negatives of forecast PSPS conditions.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks

For the purposes of PSPS we built a model to assess the outage and ignition probability given the forecasted weather in space and time. This outage model is called the Ignition Probability Weather (IPW) Model, which was significantly upgraded in 2021. The outage probability outputs are transformed into an ignition probability based on the type of outage driver and its historical propensity to cause an ignition. The IPW Model is used in unison with the FPI Model to assess the need for PSPS. PSPS is initiated when there is a high probability for ignitions combined with a high probability of catastrophic fires in both space and time.

Please note that the IPW Model is used to forecast the need for PSPS across a very short time horizon in which weather modeling applies. The IPW Model answers the question of "where will an outage and ignition most likely occur over the next five days hour by hour." PG&E has also developed seasonal outage and ignition probability models that feed into long-term planning. This model answers a separate question "where is an outage and ignition most likely to occur over the next year". The IPW Model methodology and features are discussed in Section 4.5.1(g).

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk: The IPW models provide visibility on where outage and ignition risks are greatest every hour at 2x2 km resolution.

Relation to and Impact on Other Initiatives:

- PSPS: IPW is used in unison with the FPI in PG&E PSPS framework. IPW and FPI are combined in both space and time to form PG&E's Catastrophic Fire Probability Model for Distribution.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: There is no regional prioritization in the initiative. The IPW models provide output across the entire PG&E service territory.

Risk Models Used or Other Considerations for Prioritization:

- IPW Model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The IPW Model was trained using the latest climatological outage and weather data. The IPW Model core is a new novel machine learning model and framework. IPW relates outage potential for ignitions through the cause classes.

Impacts:

- Not Applicable

Lessons Learned:

- Use of machine learning models has yielded positive results in terms of model performance.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – Annual updates to the IPW model framework.

7.3.2.7 Hazard Awareness & Warning Center

OEIS Initiative Definition: Not Applicable. This is not an OEIS-defined initiative. This is an initiative that PG&E is adding to the 2022 WMP to describe the Wildfire Safety Operations Center (WSOC).

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition consequences (Acres burned).

Secondary Risk: Ignition consequences (Structures impacted).

To effectively respond to wildfire threats within the service territory, PG&E established the Wildfire Safety Operations Center (WSOC) in 2018. In 2021, the WSOC began the transition to an all-hazards center and will now be called the Hazard Awareness & Warning Center or HAWC. From a wildfire perspective, the HAWC remains an operating unit which serves as PG&E's central information hub for all wildfire-related data. The HAWC team monitors, analyzes, and initiates wildfire mitigation and response efforts throughout the service area. The HAWC team monitors for fire ignitions across PG&E's service area in real time using weather information, wildfire camera data, social media, and data from local and state first responders. The HAWC also collects data from PG&E field personnel, including the PSS and the SIPT. Once it has confirmed that wildfire activity (including size and spread) may impact assets and communities in the service territory, the HAWC communicates this information to company leadership and impacted operating centers. PG&E then deploys utility resources to affected areas to further assess the size and spread of the wildfire, as well as support wildfire mitigation and other emergency efforts.

The data gathered at the HAWC serves as a critical source of information regarding ongoing wildfire conditions. The HAWC generates and distributes internal notifications or reports via text message or email on incidents that have met established criteria. Information includes wildfire status, threatened or involved PG&E assets, and incident location. The report is sent to a predetermined internal distribution list made up of PG&E field staff, control center personnel, executive staff, supporting lines of business (LOB) and other responders. These notifications facilitate the internal sharing of critical incident information in order to effectively respond to fire threats in a coordinated fashion. The HAWC has established notification protocols for communicating fire threat information to various operations centers within PG&E, such as Gas Control, Electric Grid Control, Electric Distribution Control, IT, Corporate Security and Power Generation. The HAWC also coordinates with PG&E's PSS team, which interfaces with CAL FIRE, USFS and other agencies to help coordinate the overall response to wildfire threats. The HAWC and PSS team share information regarding ongoing fires and new ignitions that have a potential impact to PG&E facilities. The real time risk information communicated to internal operation centers, field employees and affected public safety partners allows PG&E to act swiftly to protect PG&E assets and communities from wildfires.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – The HAWC team has access to many information flows. With the maturation of HAWC processes and technologies, the team is able to further educate the enterprise on the wildfire risk, including fire behavior

- Reduce consequence of potential ignitions – The HAWC's ability to monitor wildfires and communicate and coordinate overall response allows quicker EOC and SIPT response to wildfires, thus reducing the overall impacts and consequences of a fire.

- Reduce lag in information from hazard events – The HAWC utilizes improved technology (i.e., integration of internal and external information sources such as satellite detections and IRWIN hits) and coordinates with field teams to accelerate the information gathering for fire. This allows the HAWC to communicate awareness sooner.

Relation to and Impact on Other Initiatives:

- PSPS – During a PSPS event, the HAWC provides weather and fire-related intelligence to EOC Command and General staff and the broader emergency structure groups (e.g., operations emergency centers). This intelligence includes fire status, PSS field intelligence, and SIPT field observer localized condition information.

- EPSS – The HAWC provides intelligence on potential fire activity or other identified anomalies in areas with EPSS enabled and real time outages happening. This information is shared via email and during incident command calls.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The HAWC monitors and communicates wildfire threat information for the entire PG&E service territory. The HAWC communicates the HFTD Tier rating for each fire as part of their status update process.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Continued maturation of monitoring and reporting. HAWC team strengthened processes with field team (PSS, Safety and Infrastructure Protection Team) to ensure full support for hazard events such as wildfires, PSPS events, and debris flow and land movement events. Notification processes were updated to ensure core LOB are receiving the notification and awareness needed to respond to hazards.

Transition to All-Hazard Center: WSOC began the transition to the HAWC (Hazard Awareness and Warning Center) and brought in debris flow, land movement, earthquake, and tsunami events into the scope of our monitoring. Notification processes were developed for new hazards being monitored HAWC procedures were updated to include an all-hazard focus.

Impacts:

- Closer ties with PSS, SIPT, Meteorology, Geosciences, Electric Incident Investigation (EII), Electric LOB, Gas LOB and Generation LOB has allowed the HAWC to better understand the reporting priorities and increased overall situational awareness.

- Established close partnerships with the Geosciences and Meteorology teams to ensure support for debris flow and land movement events. The HAWC communicates awareness of debris flow, land movement, earthquake, and tsunami events.

Lessons Learned:

- Early engagement and transparency with the subject matter experts and the multiple LOBs is important for a successful implementation.

Expansion of the availability and usability of the Active Incident Dashboard (AID) – The HAWC technology team worked closely with IT to expand the user base for the AID.

Impacts:

- The AID has increased awareness across the enterprise to provide field teams, control centers, and leadership access to the latest hazard (e.g., fires, land movement) intel from the HAWC.

- AID increased awareness and reduced information latency had positive impacts for all stakeholders. This reduced the inquiries coming into the HAWC and allowed the analyst and leadership teams to focus on monitoring and response.

Lessons Learned:

- Continue to take a user-centric approach when building out functionality to ensure technology meets needs of the users.

Internal Situation Reporting improvements: HAWC team has updated Incident Reporting process, including implementation of a Daily Awareness Hazard dashboard and a Senior Leader Briefing document to ensure awareness of hazards and incidents as they occur.

Impacts:

- Incident Reporting process was reviewed by PSS team and HAWC and updates were made to improve information to flow with reduced friction. The Daily Awareness Hazard dashboard and Senior Leadership Briefing document ensure awareness across the enterprise of current hazards impacting the enterprise.

Lessons Learned:

- Early engagement and transparency with the subject matter experts and the multiple LOBs is important for a successful implementation.

Expansion of center responsibilities and increase in personnel: The center expanded in 2021 as predicted and now has 32 full-time employee positions supporting the overall mission.[84]

Impacts:

- There will be an additional three all hazard analysts and one business system specialist brought on board in the first part of 2022 to complete the expansion and provide full staffing complement of 36 employees. Please note this headcount includes Director, technology, and process staff.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

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84 Please note actual headcount at a given point in time may be lower due to attrition and the timeline required to fill positions.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Assess the processes for continuous improvement: Intended benefit is for processes to be more efficient and information flow is improved.

Technology Improvements – The process will include reviewing new technologies to determine if they will provide a benefit. For example, the team will evaluate technology and applications that provide quicker and more frequent awareness of risks.

7.3.2.8 Meteorology Analytics/Operations Center

This PG&E sub-initiative has been removed from the 2022 WMP. For updates on the 2021 progress, please refer to the Q4 2021 Quarterly Initiative Update.

7.3.3 Grid Design and System Hardening

7.3.3.1 Capacitor Maintenance and Replacement Program

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing capacitor equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Low voltage conditions can cause increased current loads on conductors, potentially leading to excessive wire sag, which can pose a fire ignition risk and possibly damage customer and PG&E equipment. Capacitors can improve low voltage conditions. Once deployed, capacitors are maintained to ensure proper operations and mitigation of any risks associated with the failure of the capacitor itself.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Annual inspections can validate the proper operation and safety of capacitors deployed in PG&E's system. The benefit of maintaining the capacitors is to ensure they are working effectively to prevent ignitions from low voltage/wire sag issues. An additional benefit is to ensure that the capacitors themselves are running safely and will not create ignitions themselves.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PG&E's capacitor maintenance and replacement program is one part of PG&E's overall asset inspection and repair work. The TD-program is governed by Utility Procedure TD-2302P-05. The procedure classifies maintenance tasks for electric overhead and underground equipment, including capacitor banks. As indicated, the capacitor maintenance and replacement program is intended to reduce the risk of capacitor failure.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Annual inspections are performed on all distribution capacitor banks regardless of geography or other factors. The actual location of capacitors is determined based on system conditions. Planning engineers perform capacity reviews generally targeting capacitors for areas with known low voltage conditions such as long rural circuits or areas with high inductive loads due to large air conditioning or industrial power usage.

Risk Models Used or Other Considerations for Prioritization:

- Per Utility Procedure TD-2302P-05, annual inspections are performed on all distribution capacitor banks for potential maintenance regardless of geography or other factors. Therefore, no risk modeling is performed. Any capacitor bank that requires removal from service will be either replaced or removed if not required (determined by Distribution Planning).

4) Progress on initiative since the last Wildfire Mitigation Plan (WMP) submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Annual Capacitor Bank Inspections – PG&E inspected all distribution capacitor banks as governed by our internal standards.

Impacts:

- Capacitor bank inspection and testing confirmed the safe operation of the equipment and helped PG&E resolve any issues identified in order to reduce potential ignition risks.

Lessons Learned:

- The annual inspection and testing of capacitor banks helps resolve any issues with the equipment, and if any are found, they are addressed through repair or replacement of the capacitor bank through system notifications (work tags).

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E will continue to complete our annual Capacitor Bank Inspection/Testing. We plan to inspect all distribution capacitor banks in PG&E's system as part of the capacitor maintenance program.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E is investigating approaches to add updated and Supervisory Control and Data Acquisition (SCADA)-enabled controllers to all capacitors. Remote operation capability will allow PG&E to address operational needs in real time. Without remote capability, capacitors are either operated manually or automatically through their controllers (time-based settings).

PG&E is also investigating removing or using switches on fixed bank capacitors – Fixed bank units can pose a potential safety risk to utility personnel due to having to remove a

capacitor bank from service manually versus the use of a controller (where the operator can move away from the pole).

7.3.3.2 Circuit Breaker Maintenance and Installation to De-Energize Lines Upon Detecting a Fault

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing fast switching circuit breaker equipment to improve the ability to protect electrical circuits from damage caused by overload of electricity or short circuit.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – Public Safety Power Shutoff (PSPS)

PG&E's maintenance and replacement program ensures that circuit breakers are properly installed and maintained to prevent operational failures. A circuit breaker failure may result in an increased risk of ignition, as improper operation typically increases the time it takes to interrupt a line fault. Operational failure may also impact reliability as it would take longer to restore power after an outage.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – This initiative focuses on planned maintenance and installation of substation circuit breakers to ensure their safe operation as designed. Improperly maintained circuit breakers are prone to operate slowly or not at all. The risk of a slow trip operation, or failure of a circuit breaker to operate, may result in the increased probability of an ignition event both inside and outside of substations.

- PSPS/EPSS – The risk of a circuit breaker failure to close may result in the increased duration of both planned and unplanned outages.

Relation to and Impact on Other Initiatives:

Asset Inspection and Repair – Section 7.3.4.15 is a related initiative which identifies substations where supplemental inspections are performed to identify any safety, reliability, or ignition related risks. Corrective issues identified through supplemental inspections on circuit breakers are addressed through the corrective repair process and tracked in Sections 7.3.3.12.1 and 7.3.3.12.2.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Substation circuit breaker maintenance and replacements are not targeted based on regional location. The maintenance and replacement program applies to all substation circuit breakers in the PG&E system, including those installed in substations located in High Fire Threat District (HFTD) areas.

Risk Models Used or Other Considerations for Prioritization:

Not Applicable Risk Model – The maintenance of circuit breakers is governed by PG&E Utility Standard TD-3322S Circuit Breaker Maintenance Template and PG&E Utility Procedure TD-3322M Substation Maintenance and Construction Manual Circuit Breakers Booklet. This standard defines the required maintenance tasks and the frequencies in which the tasks are performed. This procedure defines maintenance tasks for circuit breakers from visual inspections to more complex mechanisms, compressor, hydraulic system services, and overhauls. Some maintenance activities are triggered by time-based frequencies and others by conditions.

Because the program uses some condition-based triggers such as oil sample results and actual performance in addition to time-based intervals to initiate maintenance tasks such as mechanism service and overhauls, the intervals are not strictly time-based, some frequencies between maintenance tasks can be variable.

This work is governed by California Public Utilities Commission (CPUC) GO-174, the California Independent System Operator Field Maintenance Practices (see Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section 7.3.3_Atch01) and Western Electricity Coordinating Council FAC-501 compliance requirements.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Transmission and Distribution Substation Circuit Breaker Maintenance – In 2021, there were 946 maintenance tasks targeted for circuit breakers located in HFTD areas. 971 preventative circuit breaker maintenance tasks were completed on circuit breakers located in HFTD areas exceeding the original 2021 target, and one circuit breaker maintenance task will carry over into 2022.

Impacts:

- The successful completion of circuit breaker maintenance tasks provided assurance that circuit breakers operated properly when needed and reduced the probability of a wildfire ignition.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E has approximately 630 transmission and distribution circuit breaker maintenance tasks in HFTD areas planned for 2022. The planned maintenance includes circuit breaker exercises, mechanism services and overhauls. Additional condition-based planned maintenance may be triggered during 2022. In addition to ongoing circuit breaker maintenance in 2022, circuit breakers will be identified, prioritized, and proactively replaced based on condition, performance, capacity, and other factors.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – The circuit breaker maintenance program is periodically evaluated and adjusted based on equipment performance trends. The intended benefit of periodic evaluation is further improvement of equipment operation and reduced equipment failures. Currently, there are no planned changes to the circuit breaker maintenance program.

7.3.3.3 Covered Conductor Installation

OEIS Initiative Definition: Installation of covered or insulated conductors to replace standard bare or unprotected conductors (defined in accordance with General Order (GO) 95 as supply conductors, including but not limited to lead wires, not enclosed in a grounded metal pole or not covered by: a "suitable protective covering" (in accordance with Rule 22.8), grounded metal conduit, or grounded metal sheath or shield). In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12 kilovolts per inch (kV/in) dry) and impact strength (20 foot-pound (ft-lb)) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

The installation of covered conductor in both primary and secondary systems can help reduce the occurrence of phase-to-phase contacts (when lines come in contact with each other) either directly or through a medium such as a tree branch, eucalyptus bark, palm fronds, animal/bird, or a foreign object, which may result in a wildfire ignition.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Targeted covered conductor installation is being performed as part of PG&E's System Hardening Program (Section 7.3.3.17) and in reconstruction work performed in the HFTD and High Fire Risk Area (HFRA) designated areas to address the risk of wildfire ignition. In addition to wildfire-related safety benefits, the elimination of these numerous transient type outages also has the potential to improve reliability, the overall health of power systems, and facility life expectancy.

- To develop the effectiveness assumptions for covered conductor installations associated with the System Hardening standard installation as described in Section 7.3.3.17.1, Question 3.c, SMEs identified 4,336 distinct outage types by using all known combinations of basic cause, supplemental cause, equipment type, and equipment condition (i.e., vegetation, branch, conductor, etc.). SMEs then identified whether system hardening via covered conductor installation would eliminate, reduce significantly, reduce moderately, reduce minimally, or would not have an effect on the likelihood of a certain type of outage leading to an ignition. Each of the categorizations were assigned a quantitative value based on the

likelihood of the outage leading to an ignition and applied against historical outage and ignition data showing an effectiveness of 62 percent. This value is used in Risk Spend Efficiency (RSE) calculations for overhead hardened facility risk benefit versus other alternatives such as undergrounding as described in Section 7.3.3.16, Question 3.d.

Relation to and Impact on Other Initiatives:

- Covered Conductor is just one of the System Hardening methods used by PG&E to prevent wildfire risk. Other System Hardening methods include line removal, undergrounding electrical lines, remote grids, and other types of overhead hardening (including pole replacement, replacement of non-exempt equipment etc.). For further information regarding PG&E's overall System Hardening program, please see Section 7.3.3.17.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Targeted covered conductor installation is being performed as part of PG&E's System Hardening Program (Section 7.3.3.17.1) and in reconstruction work performed in the HFTD and HFRA designated areas. PG&E utilizes the same design criteria to install covered conductor as part of other planned work completed in the HFTD areas, such as New Business, Work Requested by Others (WRO), capacity, and reliability if installation or replacement of conductor is required. This design is discussed in Section 7.3.3.17.1, Question 3.c.

While System Hardening is not targeted in non-HFTD areas, covered conductor installation or System Hardening may be considered for Buffer Zones immediately adjacent to HFTD boundaries, or in response to reliability issues in non-HFTD areas, to limit the impacts due to recurring outages. This is a very effective mitigation for many transient type outages such as eucalyptus bark, palm fronds, birds, animals, branches, and mylar balloons. Because this installation also includes covered jumpers, animal protection, and eliminates most exposed energized components, it is also effective to mitigate many phase-to-ground type outages. This is an effective mitigation in areas prone to these types of impacts where undergrounding or other mitigations are not as cost-effective. Examples of these more cost-effective areas are those with minimal tree fall-in risk with more short grassy fuels, where ingress/egress risk is low, limited PSPS risk, or in extreme terrain where undergrounding is not feasible. It is moderately effective against third party impacts that cause line slap and some tree-fall scenarios where the volume of overstrike trees is low.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model (WDRM) – This risk model is used to inform engineers where specific circuit segments rank in relation to all circuit segments within the HFTD areas. The ranks of the circuit segments within this model define the highest risk circuit segments for pro-active project selection. This model is also used to aid in the prioritization of projects when developing workplans and schedules.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

As indicated above, targeted covered conductor installation is performed as part of PG&E's System Hardening Program. Therefore, please see the discussion of the System Hardening Program in Section 7.3.3.17.1, Question 4 for 2021 progress on covered conductor installation and current year (2022) plans.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – See the response to question 5 of the System Hardening Program in Section 7.3.3.17.1 for program details. It is expected that as we progress into more undergrounding construction that options including overhead covered conductor will become less prevalent. This shift relies on PG&E's ability to scale up and innovate underground construction methods as well as construction management process improvements to make undergrounding more cost effective.

In Section 9.3 of Energy Safety's *Attachment 2: 2022 Wildfire Mitigation Plan Guidelines* Template, the electrical corporations were directed to include additional information in Section 7.3.3.3 regarding covered conductor installation reporting. Below, we provide responses to the seven issues identified by Energy Safety for inclusion in this section.

In Section 7.3.3.3, Covered Conductor Installation, report on the following key information for covered conductor installation. This information must be derived from utility-specific programs and supplemented by the findings of the covered conductor working group.

1) Methodology for installation and implementation

See the System Hardening Program in Section 7.3.3.17.1, Question 3.d for details on how this method of system hardening (covered conductor) is selected vs other system hardening methods. Our approach to implementation is described below.

Base System Hardening Projects

Once a project, or a group of overhead System Hardening projects, is scoped by Asset Management and approved by the Wildfire Risk Governance Steering Committee (WRGSC), covered conductor projects go through the following major phases to completion:

- Estimating and Design;
- Dependency (Permitting, Land Rights and Environmental Review);
- Construction Resourcing and Contracting;
- Construction; and

- Document and Close Out.

In addition to the phases described above, each project is audited and inspected by a Quality Assurance (QA) department for fire safety risk assessment, and fully reviewed by an Internal Audit (IA) department for documentation and scope completion. Completed miles are only counted when they pass QA and IA.

Fire Rebuild/Emergency Events

These System Hardening projects arise from hardening scope after a fire or other emergency event in HFTD Tier 2 and Tier 3 areas. Due to the need to rebuild assets quickly to serve the community, all the steps described above in base System Hardening are accelerated. These projects can take many resources away from base System Hardening projects in order to safely restore customers and rebuild affected areas as quickly as possible. The same QA and IA requirements apply for these accelerated projects.

Other

This group consists of projects identified in other programs that qualify as System Hardening because they are in Tiers 2 and 3 and have been designed and constructed per the hardening standard, such as WRO and Capacity projects. These projects can be new line extensions or upgrades to existing infrastructure such as to serve a new load or support road widening by California Department of Transportation (CalTrans). The same QA and IA requirements apply. New construction or re-construction projects would include covered conductor installations.

2) Design and design considerations (such as selection of type of covered conductor, additional hardware needed for installation, pole strengthening or replacements, etc.)

See the response to Question 3 of the System Hardening Program in Section 7.3.3.17.1 for details on design considerations for covered conductor.

3) Implementation (including timeframes, prioritization, contractor and labor needs, etc.)

Table PG&E-7.3.3-1 below provides details regarding each overhead hardening project phase. Durations are an approximate estimate in months for the average project of 1-2 miles. Actual durations can vary significantly from project to project.

The table represents base overhead System Hardening projects after scoping is completed. As mentioned above, Fire Rebuild occurs on a faster cycle. In addition, the table below is for all overhead System Hardening projects and is not limited to the installation of covered conductor alone. PG&E does not have separate time estimates for covered conductor work alone.

TABLE PG&E-7.3.3-1:
OVERHEAD SYSTEM HARDENING PROJECT DURATION TIMELINE

Phase	OH Duration	Notes
Scoping (Preliminary, Field, and Final)	4 months	Scoping determines the method of hardening. Most projects have multiple hardening methods considered.
Estimating and Design	3 months	Detailed plans (estimate and design) are created. This is performed by both contractor and internal estimators.
Dependency (Permitting and Land Rights)	4 months	All necessary permits (CalTrans, Bureau of Land Management, local agencies etc.) and land rights are obtained.
Construction Resourcing and Contracting and Scheduling	2 months	Projects are assigned to either internal employees or contractors. Vendors are selected primarily through a unit price mechanism by region. Projects are scheduled once they are released to construction.
Construction	4 months	Construction activities are completed per construction standards. QA inspectors ensure each project is built to fire hardening standard right along the crews to provide immediate feedback if necessary without waiting for the project to be fully complete. Clearances (planned outages) are taken when necessary to complete the projects.
Document and Close Out	3 months	Gather all project documentation for completion including construction packages. Process mapping changes of new assets into Geographic Information System. Close out project.

4) Long-term operations and considerations (including maintenance, long-term effectiveness and feasibility, effectiveness monitoring, etc.)

PG&E does not have a separate covered conductor maintenance program. However, like bare conductor, covered conductor is inspected for visual concerns as part of our standard GO 165 inspections. In collaboration with the joint working group with San Diego Gas & Electric Company (SDG&E) and Southern California Edison Company (SCE), best practices development is underway to focus on maintenance, inspection, and replacement of covered conductor.

Effectiveness modeling of overheard hardening continues to make progress. Besides the estimated effectiveness of 62 percent most recently discussed in PG&E's 2023 General Rate Case filing, in 2021 PG&E started to analyze our hardened facilities' performance relative to actual outages, incidents, and ignitions to refine our strategy and improve the scope and design of the Overhead Hardening Program. PG&E is also looking to analyze the performance of any hardened facilities that experience a wildfire to validate assumptions about the life expectancy and effectiveness of hardened facilities in various conditions. The Overhead Hardening Program is relatively new and has installed a relatively small number of miles compared to PG&E's overall distribution system which makes it difficult to have the amount of data needed to have statistically

significant results from this type of analysis. Initial analysis is limited to counts of outages at the circuit segment level that compare annual average outages from 2015-19 (pre-overhead hardening) to 2020 (hardened) total count of outages where overhead hardening was completed in 2019. While the calculated outage reduction percentage (used as a measure of recorded effectiveness) matches the initial 62 percent estimated effectiveness, the results are understood to be preliminary and to lack the geospatial accuracy needed for a truly recorded effectiveness. Lastly, PG&E considered including ignitions, and incidents such as a wire down, or PSPS incidents (damage/hazard) in hardened sections to further evaluate the effectiveness of the Overhead Hardening Program, however the data scarcity was even greater for these types of events that are even less common than outages.

Going forward, PG&E's focus is to find ways to better capture the geographic location of a fault, and, if applicable, the damage and broken equipment. Industry-wide, fault location has historically been assigned to the device that operated (where the fault was detected) and not necessarily the actual coordinates where the fault occurred. This improvement in the quality of spatial data will ensure a more precise analysis of areas where overhead hardening has been completed.

PG&E remains committed to exploring ways to best calculate effectiveness and has established a biannual monitoring cadence with our WRGSC to review continued improvement. In addition, PG&E is currently developing a more consistent approach to evaluating the long-term risk reduction and cost-effectiveness of covered conductor deployment with the California's investor owned utilities (SDG&E and PG&E, SCE, PacifiCorp, Bear Valley Electric Service, Inc., and Liberty Utilities). Coordination with other utilities will enable a better discernment of the long-term risk reduction effectiveness of covered conductor to reduce the probability of ignition, assess its effectiveness compared to alternative initiatives, and assess its potential to reduce PSPS risk in comparison to other initiatives.

5) Key assumptions

The following are key assumptions that PG&E has made as part of this discussion of covered conductor installation:

- Covered conductor is installed as part of overhead reconstruction or new construction within the HFTD areas (i.e., excludes maintenance and typical emergency response).
- PG&E defines high risk as work targeted:
  - Based on the 2021 WDRM for System Hardening;
  - To mitigate for PSPS events; and
  - To rebuild after Fires and Major Emergencies within HFTD.
- Numerous alternatives are considered alongside covered conductor installation as part of the System Hardening program.

- Covered conductor installation is not considered the preferred alternative in areas with significant tree fall-in risk, where exclusion from PSPS is preferred, and where intumescent or otherwise fire resilient poles will not provide ingress/egress risk benefit.

- Table PG&E-7.3.3-1 above represents an average duration of work activities, but on any given project there is a wide range potential duration. Weather impacts, more cumbersome permitting / dependencies and extended easement acquisitions can significantly impact these durations. It also assumes that materials are readily available for covered conductor installation and other system hardening materials.

- System Hardening effectiveness measures are averages assumed over time. The environment, local impacts, weather and climate change will impact any recorded measures as time progresses.

6) Cost effectiveness evaluations (including cost breakdown per circuit mile, comparison with alternatives, etc.)

Covered conductor is one component of the overhead System Hardening strategy. Covered conductor and potential alternatives may or may not be feasible for all potential locations due to project characteristics. The costs of covered conductor, and potential alternatives, are evaluated on a project-by-project basis. See Section 7.3.3.17.1 for more details on the evaluation process.

The unit cost provided below in Table PG&E-7.3.3-2 is for overhead system hardening completed in 2021.

TABLE PG&E-7.3.3-2:
AVERAGE UNIT COST FOR OVERHEAD SYSTEM HARDENING
(FIGURES FOR SYSTEM HARDENING WORK COMPLETED IN 2021)

Type of Work	Miles Completed	Total Cost	Unit Cost ($/circuit mile)
Overhead	111	$120,140,988	$1,082,309
Base System Hardening	96.9	$108,980,668	$1,124,870
Fire Rebuild	14.1	$11,160,321	$790,313

7) Any other activities relevant to the covered conductor installation

PG&E evaluates covered conductor installation as part of overhead system hardening against wildfire mitigation activities, as described in more detail in Section 7.3.3.17.1 Question 3d.

7.3.3.4 Covered Conductor Maintenance

OEIS Initiative Definition: Remediation and adjustments to installed covered or insulated conductors. In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12 kV/in dry) and impact strength (20 ft-lb) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Covered conductor maintenance, which occurs as part of routine overhead maintenance conducted through PG&E's GO 165 Program, is focused on the identification, assessment, prioritization, and documentation of the current condition of PG&E's covered conductor facilities. Although installation standards and procedures should help minimize the covered conductor risks and make them comparable to those of bare conductor, inspection/maintenance helps to identify any locations where the jacket could be damaged, thereby reducing its insulative properties.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Covered conductor maintenance occurs as part of PG&E's GO 165 Program and looks to identify potential conditions during patrols and inspections of PG&E's distribution facilities, and any conditions that may occur as a result of operational use, degradation, deterioration, environmental changes, or third-party actions.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PG&E does not have a separate covered conductor maintenance program. Like bare conductor, covered conductor is inspected for visual concerns as part of our standard GO 165 inspections. When issues are found, PG&E replaces any degraded or damaged covered conductor rather than attempting to repair it. Accordingly, maintenance of covered conductor is focused on inspecting the conductor and, when necessary, replacing the conductor if the wire has been damaged using the standard job aid for inspections.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Covered conductor maintenance is performed anywhere covered conductor is installed and found to have conditions requiring maintenance after inspection. The majority of the covered conductor is found in the Tier 2 and Tier 3 HFTD areas and Buffer Zones. HFTD areas receive a higher frequency of GO 165 inspections, so these regions receive more attention to address failing assets.

Risk Models Used or Other Considerations for Prioritization:

- Risk Model: Most covered conductor in the system has been installed in HFTD areas. A detailed inspection of PG&E distribution assets is performed every year in Tier 3 HFTD areas and Zone 1, every three (3) years in Tier 2 HFTD areas, and every five (5) years in non HFTD areas.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E inspected and monitored covered conductor conditions as part of our GO 165 inspection program throughout our service territory.

Impacts:

- To the extent maintenance issues were identified during inspections, a tag would have been issued and work performed consistent with the tag rating for the issue.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E will continue to maintain, repair and/or replace covered conductor pursuant to our established condition based maintenance programs.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Currently, there are no planned changes to the covered conductor maintenance program.

7.3.3.5 Crossarm Maintenance, Repair, and Replacement

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing crossarms, defined as horizontal support attached to poles or structures generally at right angles to the conductor supported in accordance with GO 95.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment - Conductor

Crossarm failure has the potential to drop energized conductors to the ground, as well as other falling hazards from the top of utility poles. These situations can create the potential for an ignition. PG&E identifies failing crossarms (e.g., broken/damaged, decayed/rotten, burnt, loose conditions) primarily through GO 165 inspections and patrols, and conducts repair or replacement at the identified locations. The wooden crossarms are replaced with composite crossarms providing an additional level of longevity for crossarms.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – GO 165 mandated inspections and patrols lead to the identification of crossarms that are deteriorated and require replacement. The replacement of deteriorated crossarm helps prevent fire ignition and hazards to the public from falling wires and parts.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PG&E has an extensive condition monitoring program for overhead assets, including crossarms, in accordance with requirements in GO 165. PG&E conducts annual patrols in urban areas and bi-annual patrols in rural areas, visually looking for damaged equipment and other defects on the distribution overhead system. A detailed inspection is performed every five (5) years in non-HFTD areas, every year in Tier 3 HFTD areas and Zone 1, and every three (3) years in Tier 2 and HFRA to look for any damaged or deteriorated equipment.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: As indicated above, HFTD areas receive a higher frequency of GO 165 inspections, so these regions receive more attention to address potentially failing assets such as crossarms. In addition, maintenance in Buffer Zones is included as work being done for this program.

Risk Models Used or Other Considerations for Prioritization:

- Prioritization of crossarm replacement is determined by the severity of field conditions and the subsequent classification of tags, resulting from patrols and inspections (i.e., A tags get priority over B tags, etc.) as discussed in Section 7.3.3.12.4.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E inspected crossarms as part of our GO 165 inspection program throughout our service territory.

Impacts:

- In 2021, PG&E identified and completed repairs or replacements of approximately 10,946 deteriorated crossarms.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We currently plan to continue to install composite crossarms at locations identified by GO 165 Inspections and Patrols.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – If successful, PG&E may expand the proactive replacement of wood crossarms with composite crossarms in HFTD areas on poles with elevated risk of pole fires due to insulator tracking. Composite crossarms can potentially reduce the risk of pole fires caused by contaminated insulator tracking.

7.3.3.6 Distribution Pole Replacement and Reinforcement, Including with Composite Poles

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing distribution poles (i.e., those supporting lines under 65kV), including with equipment such as composite poles manufactured with materials reduce ignition probability by increasing pole lifespan and resilience against failure from object contact and other events.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment - Structures

Secondary Risk: Ignition Risk – Equipment - Conductor

Distribution poles are inspected and evaluated to determine their condition to support pole mounted equipment and safely keep energized conductors in the air. When early detection of deterioration is discovered, the distribution poles are remediated through replacement or reinforcement, which reduces ignition probability.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus mitigations on highest risk locations – When inspecting distribution poles, PG&E gains an understanding of what decay and degradation mechanisms poles are experiencing and where the poles that are experiencing decay are located. PG&E can compare this location specific information to the wildfire ignition consequence profiles and prioritize mitigation efforts, which include replacing and reinforcing poles. PG&E focuses mitigation efforts on the highest risk locations to effectively reduce the wildfire ignition risk system-wide.

- Develop better visibility into risk – When inspecting distribution poles, PG&E gains understanding of the internal and external pole condition. PG&E also gains an understanding of what decay and degradation mechanisms the poles are experiencing, which increase the probability of premature pole failures. This understanding helps us quantify the overall system risk of potential pole failures due to decay and degradation, which helps to build risk profiles. In addition, understanding the internal and external pole condition and subsequent decay and degradation mechanisms helps show where PG&E has risk. This allows us to develop mitigation plans, which include pole replacement and reinforcement.

- Reduce frequency of all types of ignition events – When inspecting distribution poles, PG&E identifies degraded poles, which have a higher probability of failure. Through mitigation efforts, including replacing and reinforcing poles, PG&E can reduce the probability and frequency of pole failures, which reduces the chances of a wildfire ignition event.

Relation to and Impact on Other Initiatives:

- The failure of a distribution pole creates the risk of a potential wires down event and ignition risk. To address the risk of a distribution pole failure, PG&E has an extensive condition monitoring program for wood poles in accordance with requirements of GO 165. We conduct annual patrols in urban areas and bi-annual patrols in rural areas, visually looking for damaged poles and other defects on the distribution overhead system. PG&E performs a detailed inspection every five (5) years in non-HFTD areas, every year in Tier 3 HFTD areas and Zone 1, and every three (3) years in Tier 2 and HFRA to look for external damage or deterioration, as well as an intrusive inspection approximately every 10 years to identify internal or below ground decay that may be present in the pole. PG&E also identifies and repairs pole top damage especially woodpecker damage.

- The pole replacement program replaces poles that PG&E has determined are degraded. PG&E has used both wood and non-wood or composite poles as replacements. Composite poles in conjunction with covered conductor and exempt equipment are less susceptible to cause an ignition if branches or trees fall onto the conductor, and they are less likely to spark and start a fire. Ancillary benefits of composite poles are that they retain their strength if exposed to wildfire temperatures, they are lighter to carry into remote areas, they are less prone to woodpecker, insect, and fungus rot, they do not need intrusive pole testing, and they do not need hazardous disposal when removed.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Poles identified for remediation each year by the various inspection programs are scheduled for replacement or reinforcement. Replacements are performed on Electric Corrective (EC) tags. The EC tags are given a priority when created. Priority B EC tags are considered urgent and typically executed within 90 days of creation. Priority E EC tags are considered routine and are prioritized using the Wildfire Distribution Risk Model (WDRM), where pole replacements are prioritized based on the wildfire ignition likelihood and consequence. In addition, pole replacements are also prioritized based on CPUC commitments, self-reports, or other regulatory conditions. Reinforcements are typically worked the following calendar year. This means that poles identified in 2021 will typically be reinforced in 2022. Poles identified for reinforcement are in good condition, except for decay around the groundline. By installing a steel truss and banding it to these poles, PG&E can restore the strength of the pole to 100 percent.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year Actual Progress (2021):

Actual Progress (2021):

Through our inspection programs, PG&E identified at least 9,800 poles for replacement and 4,100 poles for reinforcement in 2021.

In 2021, PG&E replaced 16,359 poles and reinforced 3,012 poles.

Impacts:

- Not Applicable

Lessons Learned:

- Reinforcements are demand-driven work, so there is always the possibility that PG&E's reinforcement forecasts will not be reached. The volume of poles identified to need reinforcement in 2020 were less than anticipated, so the volume of reinforcements in 2021 was lower than originally forecast. Because the volume of poles requiring reinforcement was less than the original forecast, this was not considered a missed target.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E will continue to inspect poles consistent with the timing described above and will replace and/or reinforce poles as needed.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E has developed a Support Structure Module that is a component of the 2022 Wildfire Distribution Risk Model (WDRM) v3 specific to the probability of failure of support structures including poles, and this will be used to inform prioritization and replacement workplans for 2023. This model is discussed in Section 4.5.1(b).

PG&E plans to continue to review and evaluate improved manufacturing techniques from composite pole manufacturers as information about these techniques becomes available. However, at this time, PG&E has no plans to expand the application of composite poles except for areas that require them such as environmental or extreme loading conditions.

7.3.3.7 Expulsion Fuse Replacement

OEIS Initiative Definition: Installations of new and California Department of Forestry and Fire Protection (CAL FIRE)-approved power fuses to replace existing expulsion fuse equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk

Reduce consequence of potential ignitions: The replacement of non-exempt equipment with exempt equipment will reduce fire risk since the exempt equipment is considered "non-expulsion" and does not generate arcs/sparks during normal operation.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The inspection, maintenance, repair, and replacement of non-exempt expulsion fuses on assets reduces ignition risk through replacement with exempt fuses.

Relation to and Impact on Other Initiatives:

- Ignition Components – Non-exempt equipment is equipment that may generate electrical arcs, sparks, or hot material during its normal operation. The replacement of non-exempt equipment with exempt equipment will further reduce fire risk since the exempt equipment is considered "non-expulsion" and does not generate arcs/sparks during normal operation. By using exempt fuses, we can reduce the potential for vegetation ignitions due to molten material spread beneath PG&E facilities.

- Vegetation Clearing – As mentioned in Section 7.3.5, PG&E performs Vegetation Control (Pole Clearing)—the removal of vegetation around T&D poles—on poles where non-exempt equipment exists. This work is performed in accordance with PRC Section 4292, which requires the utility to maintain a firebreak of at least 10 ft in radius (out from the pole) up to 8 ft up from the ground in "State Responsibility Areas" (SRA) during designated fire season. The replacement of non-exempt equipment with exempt equipment can reduce the need for vegetation clearing work.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: HFTD areas are the focal point for the non-exempt fuse replacement program, specifically Tier 2 and 3 HFTD areas.

- Risk is eliminated when non-exempt fuses are replaced with exempt fuses. Based on engineering studies and asset strategy engineering learnings from non-exempt fuse replacements in 2021, there are circuit dependencies and bundling opportunities where non-HFTD non-exempt fuses and exempt fuses are also replaced as part of the full circuit-level work package. Planning replacement work at the circuit level is necessary to ensure the circuit will be safely protected by the fuses and other protective devices which also improves reliability.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Consequence Model – Fuses were ranked by the highest average consequence score of fuses by circuit. Fuses were then prioritized for replacement based on their consequence rank. However, the deployment of EPSS may impact the risk model prioritization that is currently being used.

- When planning non-exempt fuse replacement, engineers conduct coordination studies to ensure protective devices are adequate to operate during the maximum available fault current and ensure that devices will properly operate in sequence to isolate the fault and minimize customer impact. In some cases, replacing existing non-exempt fuses with exempt fuses will disrupt the protection scheme for that circuit and require complex analysis or studies to essentially redesign the protection on that circuit. In these cases, the replacement of non-exempt fuses may be delayed until such an analysis can be completed.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Unit Completion: Our 2021 WMP commitment was to replace 1,200 non-exempt fuses/cutouts identified on poles in Tier 2 and Tier 3 HFTD areas. We completed this commitment by replacing 1,200 units by November 18, 2021. Work continued through the month of December and at the end of 2021, PG&E had replaced 1,429 non-exempt fuses. Other programs such as System Hardening, and Pole Replacement will also address the replacement or removal of non-exempt fuses as needed.

Impacts:

- Reduced ignition risk in Tier 2 and Tier 3 HFTD areas.

Lessons Learned:

- Manual coordination is required as part of the engineering process for replacement of some non-exempt fuses – additional planning time is required to prepare for the replacement of those non-exempt fuses in the future

- Due to circuit dependencies and bundling opportunities for non-exempt fuse replacements, non-HFTD non-exempt fuses and/or exempt fuses are also replaced as part of the full circuit work package to allow the circuit to have better coordination and reliability.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.01	Expulsion Fuse – Removal	Remove 3,000 non-exempt fuses/ cutouts identified on distribution poles in HFTD areas or HFRA.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E plans to maintain the 2022 pace of replacing expulsion fuses (~3,000 per year) with the potential to increase, which will more rapidly decrease ignition risks on circuits in PG&E territory, while factoring in potential impacts of EPSS on locations identified for replacement. In the next 5-year period, we anticipate replacing all known non-exempt fuses (approximately 13,000).

In rare cases, circumstances (like emergency repairs) require PG&E to install a new non-exempt fuse during work performed outside of this initiative. To minimize these situations PG&E will also evaluate changes in our procedures to reduce the installation of non-exempt fuses in HFTD areas.

7.3.3.8 Grid Topology Improvements to Mitigate or Reduce PSPS Events

OEIS Initiative Definition: Plan to support and actions taken to mitigate or reduce PSPS events in terms of geographic scope and number of customers affected, such as installation and operation of electrical equipment to sectionalize or island portions of the grid, microgrids, or local generation.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.8.1 – Distribution Line Sectionalizing;
- 7.3.3.8.2 – Transmission Line Sectionalizing; and
- 7.3.3.8.3 – Distribution Line Motorized Switch Operator (MSO) Pilot.

7.3.3.8.1 Distribution Line Sectionalizing

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Secondary Risk: Ignition Risk – Equipment – Conductor

The installation of remotely operable SCADA sectionalizing devices and manually operated sectionalizing devices on the distribution system can support PG&E's ability to segment the distribution circuits close to designated meteorology shutoff polygons to reduce the customer impact and scope of PSPS events which are used as a last resort to avoid ignition risks.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce potential ignitions – During PSPS events distribution sectionalizing devices are utilized to isolate high risk areas from safe-to-energize areas to minimize the scope of these events that are used as a last resort to avoid all types of ignition risks.

- Focus mitigations on highest risk locations – Utilizing the PSPS 10-year Lookback Model, new automated sectionalizing devices have been selected at locations with highest risk and highest frequency of PSPS occurrence.

- Reduce number of customers impacted – By selecting new sectionalizing device locations to isolate the distribution circuits close to designated meteorology shutoff polygons, this helps to reduce the customer impact and scope of PSPS events.

- Reduce duration of events (PSPS/EPSS) – Utilizing automated sectionalizing devices, rather than depending on manually operated devices, helps to segment the distribution circuits more effectively by allowing the device to be operated remotely as close to the prescribed shutoff time as possible. Additionally, reducing the scope of PSPS events reduces the inspection and restoration time to allow power to be restored more quickly once the severe weather has passed.

Relation to and Impact on Other Initiatives:

- PSPS – PSPS events can cause significant disruption to communities and customers. PG&E will continue to segment our circuits more effectively through these automated devices to minimize the number of customers impacted. PG&E plans to continue enhancing our distribution segmentation strategy to isolate the distribution circuits close to designated meteorology shutoff polygons to reduce the

customer impact and scope of PSPS events which are used as a last resort to avoid ignition risks

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The highest priority locations are those with the highest frequency of PSPS occurrence based on the PSPS 10-year Lookback Model, and locations that minimize the most customers impacted (either via switching/load transfer opportunities or installation close to the designated meteorology shutoff polygons).

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-yr Lookback – Utilizing the PSPS 10-year Lookback Model, new automated sectionalizing devices have been selected at locations with the highest risk and highest frequency of PSPS occurrence. Selecting these locations to isolate the distribution circuits close to designated meteorology shutoff polygons helps to reduce the customer impact and scope of PSPS events.

- Distribution sectionalization installations that have fewer permitting requirements are generally prioritized higher. Permitting requirements such as CalTrans or Federal Aviation Administration (FAA) permits tend to be slower; therefore, projects with these permit requirements will still be worked on but have the risk of not being completed by the target date.

- Distribution sectionalization installations are also prioritized based on whether they can be installed by September 1 because that is generally the start of "peak" PSPS season.

- Recently, moisture intrusion issues have been identified in some of the "Viper" branded reclosers that have been installed on the PG&E system. After significant rains in the fall of 2021, this issue, which impacts the functionality but not the safety of these devices, was identified in several locations. Since this program leverages Viper reclosers at many proposed locations, repair work for reclosers experiencing moisture intrusion is included as part of this initiative to ensure we maintain proper functionality of these devices so that they are operational to aid in reducing the scope of PSPS events and normal distribution grid management.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Through August 2021, we had completed construction and SCADA commissioned 257 new PSPS sectionalizing devices, exceeding the 2021 target of 250 devices, before the September 1 start of "peak" PSPS season. A total of 269 PSPS sectionalizing devices were constructed and SCADA commissioned by December 31, 2021.

Impacts:

- The new automated sectionalizing devices installed have improved both safety and efficiency by allowing PG&E to operate them remotely via SCADA when needed during a PSPS event and avoiding a truck-roll, rather than dispatching a T-Man to manually operate the device on-site.

- We estimate that the new sectionalizing devices will collectively avoid approximately 13,000 customers from experiencing a sustained outage when/if they are used during future PSPS events.

Lessons Learned:

- The primary devices used as PSPS Distribution sectionalizing devices—the latest generation of automated reclosers—are complex and newer to PG&E's system and construction teams. As such, we have identified some quality issues during the construction of these devices that require either re-work before the devices can be placed into service or, for more minor issues, "go-backs" to resolve non-safety related issues at a later date. PG&E continues to work with our construction crews on the proper installation of these devices to reduce quality issues, but we also leverage a 100 percent quality inspection approach for devices installed within this program. Every installed device is field audited and if issues are identified they are categorized into one of two groups: (a) safety or operational issues that would prevent the device from safely performing its function (of allowing automated sectionalization of the electric distribution system) are immediately remediated before a device is "commissioned" and considered complete and ready for operations; (b) lower priority issues or improvements to the constructed equipment (which will not impact safety or operations) are flagged for a "go-back" repair to be completed at a later date and are tracked until adequately completed. As of early February 2022, there are 9 sectionalizing devices that were constructed and commissioned in 2021 that are still under review within the "go-back" process. These items are anticipated to be resolved within 60 days. As our familiarity with these devices grows, we anticipate that the volume of quality issues will shrink.

- This program has focused on devices that can be remotely operated via SCADA control for the past few years. PG&E has recently found that it may not be feasible to install these types of automated devices in some locations that may benefit from sectionalization devices. Therefore, PG&E is considering installing manually operated PSPS distribution sectionalizing devices, as discussed in the Future Improvements section below.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.02	Distribution Sectionalizing Devices – Install and SCADA commission	Install and SCADA commission 100 new PSPS SCADA enabled Distribution Sectionalizing devices.	9/1/2022	Quantitative

The 2022 target is considerably lower than previous years because the device locations that have the most impact have already been installed, and now PG&E is refining locations closer to the edges of the historical meteorological lookback boundaries.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E plans to continue installing sectionalizing devices as needed to mitigate PSPS impacts. However, as noted above, many of the highest impact locations have already been sectionalized so there may be lesser benefit (in terms of number of customers likely to benefit from such devices during PSPS events) as compared to work performed in prior years. PG&E will continue to install new sectionalizing devices closer to refined meteorological shutoff boundaries and learn what areas of the community to analyze for further granular sectionalizing. Within the next 10 years, it is expected that all HFTD/HFRA locations will essentially be fully sectionalized for the purposes of PSPS scope mitigation.

PG&E is considering the installation of manually operated PSPS distribution sectionalizing devices: Manually operated sectionalizing devices are much less expensive and are suitable for more field locations than automated devices, which require (a) bucket truck access, and (b) communications access, which isn't possible in more remote portions of our service territory. PG&E is evaluating whether installing manual sectionalizing devices may be useful during smaller scale PSPS events, when field resources are not as limited, to allow PG&E additional tools to shrink the size of PSPS events.

7.3.3.8.2 Transmission Line Sectionalizing

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Secondary Risk: Ignition Risk – Equipment – Structures

PG&E has been installing remote-operated SCADA sectionalizing devices on our transmission system to support the ability to segment the transmission circuits traversing HFTD areas. This will allow operational flexibility to reduce the scope and impact of PSPS events.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- PSPS – PSPS events can cause significant disruption to communities and customers. PG&E plans to continue implementing a transmission segmentation strategy to minimize the number of customers impacted during future PSPS events by providing the ability to narrow down the segments of a circuit to de-energize.

- System Hardening (Underground and Overhead) – Typically, a replaced or newly added SCADA switch will also be installed on a new structure. These new assets, typically replacing older or less up-to-date assets, will have the effect of system hardening discussed in Section 7.3.3.17.2.

- Customer Reliability – Switches provide additional operating flexibility for transmission lines, which can be used to help restore customer power during other outages (e.g., winter storms). This can help reduce the overall impact to customers throughout the year.

Relation to and Impact on Other Initiatives:

- Reduce number of customers impacted – If a transmission asset needs to be de-energized during a PSPS event, having no switches or ability to sectionalize the transmission line means that the entire line must be de-energized for that asset. Having sectionalizing ability, particularly on lines with tapped customers, provides the flexibility to only de-energize a portion of the line with the at-risk asset, rather than the entire line. This means that customers may remain in-service while still de-energizing the necessary portions of the line during PSPS events. However, the number of customer impacts avoided during a PSPS event depends on weather and asset health at the time of the PSPS event.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Prioritization of new or upgraded transmission sectionalizing devices is based on circuit HFTD location, likelihood of potential de-energization during future PSPS events (based on a study of 10-years of weather data), and potential customer impact. Switch upgrades are typically identified at line junctions and substations, where operational flexibility may be most beneficial.

Execution of switch installations is dependent on constraints in addition to the overall program priority. Access challenges, permitting issues, and clearance restrictions are key drivers of the order switches may be installed.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-year Lookback Model – The lookback studies provide historical context regarding which lines and segments may be most prone to future PSPS involvement based on the latest transmission line PSPS scoping criteria. This helps prioritize the most frequently impacted areas for SCADA enhancements, where appropriate.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

We achieved our 2021 target to install 29 switches by September 1, 2021. In addition, we installed 12 T-Line SCADA switches benefitting PSPS operations after September 1, 2021 for a 2021 total of 41.

Impacts:

- The switches were installed in order to be available during 2021 PSPS events from 9/1 onward. However, there was no need to use them for the season given the scope of the particular events.

Lessons Learned:

- Clearance coordination between multiple programs, other reconductor projects, and tag work were impacting clearance availability and timely schedules. The SCADA team addressed this issue by increasing cross-program work planning and coordination across multiple lines of business partners to identify all clearance needs as early as possible to optimize efficiencies.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.03	Transmission Line Sectionalizing – Install and SCADA commission	Install and SCADA commission 15 transmission line switches on lines that traverse the HFTD areas. The switches themselves may not be located in the HFTD areas but can be used to support customer impact reduction.	9/1/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Completion of the HFTD SCADA Program: Approximately 200 HFTD switches remain to be added or upgraded to achieve full sectionalizing capability of the HFTD transmission system. Prioritization of these switches will continue to be assessed based on the updated PSPS 10-Year Lookback.

7.3.3.8.3 Distribution Line MSO Program

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Transformers

Secondary Risk: Reliability Impacts – PSPS

MSO switches were initially installed on PG&E's distribution system in mid-2019 as sectionalizing devices with the ability to reduce the scope of PSPS events. Despite these switches being understood to meet CAL FIRE's exempt criteria for not posing an ignition risk during normal operation, PG&E crews identified a risk that some MSO switches were reported to exhibit an arc flash during operation. PG&E halted further installations of MSO switches in late 2019.

PG&E has eliminated the risk of ignition from the operation of MSOs by implementing guidance document TD-076253-B005 "De-Energized Operation of Inertia SCADA MSO". Implementation of this control requires that any operation of the device (either open or close) be done while the device is de-energized to mitigate all risk of ignition. A consequence of being restricted to operating MSOs only while in a de-energized state is that a more upstream/source-side device must be operated instead, which results in more customers being affected by the PSPS event or other outage.

This sub-initiative was introduced in the 2021 WMP as a pilot program to determine what next steps to take with the previously installed MSOs going forward. The implementation of guidance document TD-076253-B005 created the control to eliminate the risk of ignition from the operation of MSO switches going forward. In addition to this control, to restore the full capability expected from these devices, PG&E has concluded that the remaining MSOs located within HFTD areas, or which serve line sections that feed into HFTD areas, should be replaced for grid operational flexibility and reliability in the near future. These MSOs will be replaced with various other devices including SCADA-enabled Reclosers, newly introduced SCADAMATE-SD Switches, or standard manually operated Underarm Sidebreak (US) Switches. Based on this determination, for the 2022 WMP this sub-initiative is changing from a pilot program to a replacement program.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus mitigations on highest risk locations – The identified MSOs addressed within this sub-initiative may be needed during PSPS events to sectionalize and isolate high risk circuit segments. They are located within HFTD areas or are serving line sections that feed into HFTD areas.

- Reduce number of customers impacted – With the procedural controls already in place that prevent ignition risk from these devices, the replacement with new device types will not have wildfire risk reduction benefits. However, replacement of the MSOs will provide improved grid operational flexibility and reliability and have some PSPS scope benefits since the new devices can be operated while energized which could reduce the scope of customers within the PSPS event.

Relation to and Impact on Other Initiatives:

- PSPS – MSOs are restricted to being operated only while in a de-energized state. Therefore, during a PSPS event, a more upstream/source-side device must be opened instead. This results in more customers being affected by an outage until the MSO can be opened manually while de-energized. Once the MSO is operated, then the upstream/source-side device can be closed, re-energizing the customers up to the MSO location. By replacing MSOs these additional customer outages can be avoided.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: All remaining MSOs that are located within HFTD areas, or which serve line sections that feed into HFTD areas, are planned to be replaced in the coming years. Initially, the first locations to be replaced will be those that can be replaced with SCADA-enabled Reclosers and have limited permitting restrictions. After the standards to allow for the use of new SCADAMATE-SD switches are finalized in 2022, these devices can be folded into the replacement plan as well. Locations that may require lengthy permitting (with agencies like CalTrans, FAA or others) will likely be executed after 2022. PG&E is also seeing some device availability limitations that may delay the completion of some locations. PG&E began MSO replacements in 2021 and anticipates the replacements will continue beyond 2022.

Risk Models Used or Other Considerations for Prioritization:

- A risk model was not utilized for this initiative. After identifying the risk via actual field experiences, PG&E undertook an evaluation of this equipment. During testing of an MSO switch in PG&E's lab environment to replicate the reported field conditions, the MSO switch exhibited an arc flash during both its opening and closing operation. As discussed, PG&E halted further installations of MSO switches. After further testing, PG&E determined that the current version of MSO switches would no longer be installed, and we are taking the remedial actions described above, ultimately to eliminate all of them.

- One execution challenge is that some MSOs are installed on "riser" poles (locations where the powerline transitions from the underground system to the overhead system). These locations must be replaced with the newly introduced SCADAMATE-SD switch because Reclosers are prohibited from being installed on riser poles due to space requirements. The electronic controller to be used with the SCADAMATE-SD switch was still being tested and finalized for approval as of Q4 2021. In addition, the vendor of this electronic controller is currently experiencing

supply delays and is in the process of relocating its facility to ultimately improve the availability of these devices. Therefore, the overall SCADAMATE-SD package is not expected to be ready for widespread usage throughout PG&E until mid-2022 or later which will delay the ability for PG&E to replace a portion of the existing MSOs, particularly those on riser poles.

- Another execution challenge with all these equipment replacement projects is permitting requirements, especially locations that may require a CalTrans permit or an FAA permit which have lengthier lead-times.

- PG&E had originally targeted to replace all MSOs by the end of 2022, and while 50 were replaced in 2021 and additional devices will be replaced in 2022, the electronic controller supply delays and challenges with approving the new SCADAMATE-SD have resulted in a delay of the overall completion of all MSO devices beyond 2022. Despite this extension of the MSO replacement timeline, the wildfire ignition risk from these devices has been mitigated by the operating procedure (TD-076253-B005) issued to prevent the operation of these devices while energized.

- Recently, moisture intrusion issues have been identified in some of the “Viper” branded reclosers that have been installed on the PG&E system. After significant rains in the fall of 2021, this issue, which impacts the functionality but not the safety of these devices, was identified in several locations. Since this program leverages Viper reclosers at many proposed locations, repair work for reclosers experiencing moisture intrusion is included as part of this initiative to ensure we maintain proper functionality of these devices so that they are operational to aid in reducing the scope of PSPS events and normal distribution grid management.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed 50 MSO replacements. Two of the replacement devices were SCADAMATE-SD Switches and the remaining were Viper Reclosers and standard manually operated US switches.

2021 was considered a pilot year for this MSO initiative. We knew that MSOs could be replaced with Reclosers at non-riser locations. We also wanted to explore the possibility of retrofitting MSOs with vacuum-bottle technology and introduce the new SCADAMATE-SD switch especially for riser locations.

The SCADAMATE-SD switch pilot has continued throughout 2021 and is expected to reach a point for widespread usage in approximately mid-2022 or later.

<u>Impacts:</u>

- Not Applicable

<u>Lessons Learned:</u>

- The MSO vacuum-bottle pilot was completed in Q1 2021 and proved to be unsuccessful. Therefore, the pilot was abandoned as a solution for retrofitting previously installed MSOs.

- By the end of 2021, PG&E completed the majority of the testing of the electronic controller for the new SCADAMATE-SD switch which will allow for the approval and standards development process to move forward.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.04	Distribution Line Motorized Switch Operator (MSO) – Replacements	Replace at least 50 of the 104 remaining Motorized Switch Operators that are located within or are energizing line sections that feed into HFTD areas or HFRA.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – All remaining MSOs that are located within HFTD areas or are serving line sections that feed into HFTD areas are expected to be replaced during 2023 and 2024, at which time this Initiative will be completed.

7.3.3.9 Installation of System Automation Equipment

Office of Energy Infrastructure Safety (OEIS) Initiative Definition: Installation and replacement of electric equipment with remote capability that provides operations with the ability to control and monitor circuit status. This includes the ability to remotely change device settings like disabling automatic reclose on recloser and FuseSavers (switching devices designed to detect and interrupt faults and can reclose automatically to detect if a fault remains, remaining open if so).

For this initiative, Pacific Gas and Electric Company (PG&E or the Utility) has several sub-initiatives including:

- 7.3.3.9.1 – Installation of system automation equipment; and
- 7.3.3.9.2 – Installation of single phase reclosers.

7.3.3.9.1 Installation of System Automation Equipment

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Reliability Impacts

High impedance faults are conditions where line to ground faults do not draw a large enough fault current (a function of contact resistance to ground) that a protective device can reliably sense and trip the circuit offline, these situations can create a potential ignition source. The installation of the SCADA equipment protecting Tier 2 and 3 HFTD areas will enable the use of protective features designed to address high impedance fault conditions as well as integrating into PG&E's centralized distribution control system with current communication protocols.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Under this distribution system automation initiative, new SCADA reclosers will have new micro-processor controllers which will provide enhancements on existing high impedance fault detection and communication protocols, plus additional protection setting groups and single phase metering that will enable future Advanced Distribution Management System functions and overall operating flexibility.

- During PSPS events when Line Reclosers with Form-4C controllers are completely de-energized, the actual position of the reclosing functionality is automatically reset from disabled to enabled once the device is re-energized following the PSPS event. This creates a potential ignition risk where PG&E had intended for the reclosing function to be disabled but it is now re-enabled. To avoid this problem, this program changed out all reclosers with legacy 4C controllers in HFTD areas in 2021 to eliminate this risk.

- In 2022, this initiative will install enabled reclosers at substations serving line sections that feed into the HFTD. In 2022, this program scope will address all remaining substations that do not have SCADA-enabled protection but have circuits with line sections going into Tier 2 and Tier 3 areas. These are older substations whose equipment is largely too old to cost effectively install SCADA on the circuit breaker. Reclosers will be installed on circuit outlets (just outside the substation) essentially acting as a "SCADA Breakers" which will allow remote disabling of reclosing when required. This 2022 program scope is referred to as the "Wildfire Non-Reclose program".

- In addition, during the wildfire season after reclosing has been disabled, if the SCADA-enabled recloser opens due to a potential line fault but the conditions are assessed to be low risk (for example a low FPI rating in the area being served) then the Distribution Operator will have the ability to remotely close in this via SCADA to restore customers immediately, instead of waiting for a PG&E troubleman or crew to visit the site.

Relation to and Impact on Other Initiatives:

- PSPS – During wildfire season, PG&E disables the reclosing functionality on Line Reclosers to help mitigate fire ignition. However, during PSPS events when Line Reclosers with Form-4C controllers are completely de-energized, the actual position of the reclosing functionality will automatically reset from disabled to enabled once the device is re-energized following the PSPS event creating an ignition risk. To avoid this problem the automation program changed out all 4C recloser controllers in 2021.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: In 2022, PG&E is installing SCADA reclosers just outside substations serving Tier 2 and 3 HFTD areas. The 2022 locations have been selected because these are the last remaining substations that do not have SCADA control.

Risk Models Used or Other Considerations for Prioritization:

- The 2022 scope is a defined population as described above and was not prioritized using a risk model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E replaced all known 81 legacy line reclosers with 4C controllers in Tier 2 and 3 HFTD areas.

Impacts:

- The increase in new SCADA equipment installations expands PG&E's system automation initiative and will avoid ignition risk associated with 4C legacy controllers having reclosing re-enabled following a PSPS event.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.05	SCADA Recloser Equipment – Installations	Install 17 substation SCADA enabled reclosers on circuits serving line sections that feed into HFTD areas or HFRA, barring any exceptions due to connectivity issues necessary to SCADA enable the recloser.	12/31/2022	Quantitative

Note: There may be connectivity issues for some SCADA reclosers that will require manual setting updates, but there is still benefit in installing the recloser to get the sectionalization on the circuit.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – This sub-initiative will be completed in 2022. Therefore, no further improvements are currently planned.

7.3.3.9.2 Single phase reclosers

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Reliability Risks

A single phase recloser is a flexible, cost-effective, intelligent device which can replace fuses and act as a single phase recloser with the capability to trip all phases (i.e. open and stop power flowing through all two or three phases if just one phase experiences a fault) reducing the risk associated with a wire down event where the downed wire could remain energized due to a back-feed condition from another phase of the circuit.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The single phase recloser will open all phases for the initial line to ground fault and reduce the risk of ignition from a back-feed condition. A single phase recloser can be installed with SCADA allowing for remote operation including non-test and open and close capability. This allows PG&E to investigate outages and restore power more quickly.

Relation to and Impact on Other Initiatives:

- Ignition Components – Single phase recloser locations include both Exempt and Non-Exempt fused cutout locations.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The program identifies locations for single phase recloser device installations based on the following criteria: (1) in Tier 2 or Tier 3 HFTD areas; (2) areas that experienced one or more wire down outages in the last 10 years; and/or (3) locations where fused cutout have experienced elevated fire potential (R3, R4, or R5, which are elevated fire risk classifications).

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E installed 71 sets of single phase reclosers, exceeding the 2021 target of 70.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.06	Fuse Savers (Single Phase Reclosers) – Installations	Install 80 single phase recloser sets in HFTD areas or HFRA.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Voltage Powered Alternative and Technological Improvements*:* PG&E will continue to work with manufacturers to develop a cost-effective single phase recloser that is voltage powered and does not have minimum load limitations which will allow for more universal application. We will also explore other devices that are applicable to other system protection or ignition mitigation needs.

7.3.3.10 Maintenance, Repair, and Replacement of Connectors, Including Hotline Clamps

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing connector equipment, such as hotline clamps.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Connector failure can lead to a wires down condition and wires down can lead to a risk of ignition.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative

- Reduce frequency of all types of ignition events – The inspection, maintenance, repair, and replacement of deteriorated connectors on assets reduces ignition risk through a lower frequency of connector failure.

Relation to and Impact on Other Initiatives:

- Asset inspection and Repair – Connectors are visually inspected during enhanced inspection every year in Tier 3 HFTD areas and every three (3) years in Tier 2 HFTD areas. Through PG&E's infrared inspections, distribution connectors are identified that may be compromised, Electric Corrective tags are generated based on these infrared findings, and connectors are replaced as needed.

- System Hardening (Underground and Overhead) – As part of other programs such as pole replacement, new business, system hardening, and capacity and reliability, distribution lines must be built to current standards which includes new and improved connectors.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Inspection of connectors through infrared or overhead inspections includes maintenance in Buffer Zones, HFTDs, and throughout PG&E's system. See Sections 7.3.4.4 and 7.3.4.5 for more information on PG&E's infrared inspection program. Connector/splice tags created are prioritized within HFTDs but also by Facility/Damage/Action (FDA) condition (Temperature Differential, Corroded, Burnt, Incorrectly Installed).

Risk Models Used or Other Considerations for Prioritization:

- Inspection and maintenance of connectors is completed on other programs, such as overhead inspections, PG&E's infrared inspection program, and System Hardening. Therefore, no risk model is used specifically for work prioritization for this initiative.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E continues to maintain, repair and/or replace connectors, including hotline clamps. There are no other specific progress metrics for this initiative.

Impacts:

- Not applicable

Lessons Learned:

- Not applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We plan to maintain, repair and/or replace connectors pursuant to our established condition based maintenance programs. We also plan to replace existing connectors with new equipment on facilities that are hardened as part of the System Hardening Program.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E's standards team meets regularly with industry representatives at trade shows and Institute of Electrical and Electronic Engineers committees to evaluate new technology and products. Fire resilient connectors are one of the items that has received attention recently in industry discussions.

7.3.3.11 Mitigation of Impact on Customers and Other Residents Affected During PSPS Event

OEIS Initiative Definition: Actions taken to improve access to electricity for customers and other residents during PSPS events, such as installation and operation of local generation equipment (at the community, household, or other level).

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.11.1 – Generation for PSPS Mitigation:

  This sub-initiative provides an overview of microgrids and back-up generation to mitigate the impact of PSPS events. PG&E provides more detail concerning five programs:

  A) Generation Enablement and Deployment;

  B) Temporary substation microgrids;

  C) Temporary distribution microgrids;

  D) Back-up power for individual critical customer facilities, small essential business, and residential customers; and

  E) Community Resource Centers.

- 7.3.3.11.2 – Substation activities to enable reduction of PSPS impacts;

- 7.3.3.11.3 – Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers; and

- 7.3.3.11.4 – Fixed Power Solutions (FPS) (Permanent Back-Up Power for Individual Facilities)

7.3.3.11.1 Generation for PSPS Mitigation

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

A) Generation Enablement and Deployment

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Secondary Risk: Reliability Impacts – Enhanced Powerline Safety Settings (EPSS)

Our Temporary Generation (TG) organization focuses on the safety of internal and contractor crews during deployments, operational readiness and PSPS activations and reporting data and invoicing process. The TG Project Management Office (PMO) also supports the TG organization.

Together this organization is responsible for the procurement of generation equipment and the operational readiness of the four PSPS TG workstreams: Substation Microgrids; Distribution Microgrids; Back-up Power Support; and Community Resource Centers (CRC). The team coordinates, organizes, and establishes a single source of reporting regarding the operational readiness of procured TG in relation to the four workstreams. The TG PMO will also staff, coordinate, and train Emergency Operations Center (EOC) TG members for PSPS event response along with other major emergency events.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Establish a permanent organization structure to ensure uniformity year over year from a safety, operations, program management and reporting status that supports the reduction of customer impacts during PSPS events.

Relation to and Impact on Other Initiatives:

- The TG Organization is responsible for operationalizing the associated four workstream sub-initiatives: Substation Microgrids, Distribution Microgrids, Back-Up Power Support, and Community Resource Centers.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The PSPS 10-year Lookback analysis is utilized to identify direct and indirect impacts to circuits which helps inform which locations may be best to position TG units.

The TG Field team and Distribution Operations Engineers then study those locations for operability by location, mobilizing TG equipment, and interconnecting to the grid to ensure make-ready use at these locations.

Risk Models Used or Other Considerations for Prioritization:

PSPS 10-year Lookback – The PSPS 10-year Lookback identifies historical weather conditions that warrant PSPS activation and determines what type of impacts would have been identified given current grid topology. This helps determine the frequency and customers impacted during historical PSPS' that may have remained energized if not for the transmission de-energization.[85]

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E operationalized the following:

- Substation Microgrids – 9 operational;
- Distribution Microgrids – 8 operational (5 newly-developed in 2021, 4 sites developed 2019-2020);
- Back-Up Power Support – made-ready 9 Intensive Care Unit (ICU) Hospitals and 3 Voter Tabulation Centers;
- Ad-Hoc deployments during PSPS Events; and
- Community Resource Centers – procured generation for 112 indoor locations and managed refueling during PSPS events.

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85 PG&E described the methodology and results in our most recent iteration of the PSPS 10-Year Lookback in supplemental testimony served in Application (A.) 21-06-022 (PG&E Application Proposing a Long-Term Procurement Framework for Substation Microgrid Solutions) on December 17, 2021. PG&E also applied that iteration of the PSPS 10-Year Lookback in an illustrative, hypothetical manner in supplemental testimony served to parties in A.21-06-022 on January 31, 2022. Finally, the PSPS 10-Year Lookback was used to determine that no TG should be reserved for specific substation microgrids in order to mitigate PSPS outages in 2022, as further described in Advice Letter (AL) 6486-E, served in A.21-06-022 and Rulemaking 19-09-009 on January 31, 2022.

Impacts:

- Due to the weather conditions in 2021, none of the substations where generation was staged were utilized in the 2021 PSPS season.

Lessons Learned:

- Pre-staged PSPS TG was able to be utilized for other use cases such as governor requested capacity events, atmospheric river events, snow events and wildfire support.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to continue to perform potential in-event deployments.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Improved analysis to minimize the number of potential impacted substations, ICU Hospitals, and Voter Tabulation Centers: Year over year improvement to analytical data including the PSPS 10-yr Lookback and system improvements have reduced the number of potentially impacted facilities, thus reducing the number of locations that receive pre-staged TG.

Continue to evolve cleaner generation opportunities: We will continue to work with other internal stakeholders to develop long-term “clean” alternatives to diesel TG.

B) Temporary Substation Microgrids

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

De-energization due to PSPS can create public safety risks for customers, as well as broader impacts for communities. Keeping safe-to-energized customers powered, by proactively acquiring temporary generators and staging them at substations for use as temporary microgrids when impacted by upstream transmission level PSPS outages, can mitigate this risk. Temporary substation microgrids are focused on keeping customers online when the substation serving them is impacted by an upstream transmission line de-energization and the substation still has safe-to-energize load.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce number of customers impacted – Proactively acquire and deploy TG to select substations to mitigate the number of customers impacted during PSPS events.

- Improve coordination with customers – Continue to improve customer notification process utilized during PSPS events to allow for customer impacts solved by substation mitigation generation.

Relation to and Impact on Other Initiatives:

- PSPS – The substation mitigation initiative is a direct correlation with the PSPS initiative as the substation effort mitigates would be customer outages that result from de-energization of upstream transmission level PSPS outages.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The PSPS 10-yr Lookback analysis is utilized to identify direct and indirect impacts to circuits which helps inform which substations may be best to position TG units. Operability by location is then studied by our TG Field teams and Distribution Operations Engineers. The minimum guidance criteria requires ten or more impacts over 10 years with 100 or more safe to energize potential customers.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-yr Lookback – The PSPS 10-year Lookback identifies historical weather conditions that warrant PSPS activation and determines what type of impacts would have been identified given current grid topology. This helps determine the frequency and customers impacted during historical PSPS events that may have remained energized if not for the transmission de-energization.

- Planned utility improvements that impact Transmission Operability during high wind events – Analysis is performed to look at planned vegetation and transmission improvements that could be utilized to mitigate or reduce the frequency of the impacts identified in the PSPS 10-year Lookback.

- Subject matter input from – TG Field Operation, Transmission and Distribution Control Centers help to inform the field operability and actual logistics of deploying TG to specific substations. Items to consider are available land at a specific site, the ability to sectionalize substation circuits as to not energize into Tier 2 and 3 areas and an engineer study to determine/ensure fault duty.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- In 2021, PG&E operationalized 9 substation microgrids.

Impacts

- Due to the weather conditions in 2021, none of the substations staged for TG were utilized in the 2021 PSPS season.

Lessons Learned:

- Pre-staged PSPS TG was able to be utilized for other use cases such as governor requested capacity events, atmospheric river events, snow events and wildfire support.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

For 2022, PG&E will not be pursuing TG for substation microgrids. Using the site selection criteria of 10+ impacts with 100+ safe-to-energize customers, one site met this threshold. This site was further studied to determine if another grid solution could reduce the historical direct impacts to the substation in the PSPS lookback. PG&E determined there are SCADA enabled switches available on this line that could potentially isolate the substation from the structures that have historically exceeded the transmission scoping guidelines during several lookback events. This effectively removed the need to procure substation TG for 2022.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Improved analysis to minimize the number of potential impacted substations: Year over year improvement to analytical data, including the PSPS 10-yr Lookback and system improvements. These improvements have reduced the number of potentially impacted substations, thus reducing the number of substations that receive pre-staged TG.

C) Temporary Distribution Microgrids

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

De-energization due to PSPS can create public safety risks for customers, as well as broader impacts for communities. Keeping communities and “main street corridors” energized helps to mitigate these risks. Temporary distribution microgrids aim to

support communities by energizing “main street corridors” with shared services and critical facilities when the distribution lines serving these areas are de-energized as a result of a PSPS event.

Though each distribution microgrid varies in scale and scope, the following design features are likely for each:

- Devices used to disconnect the distribution microgrid from the larger electrical grid;
- A pre-determined space for backup generation and equipment to allow for rapid connections (e.g., Pre-Installed Interconnection Hub (PIH)); and
- The use of temporary generators allowing PG&E to shorten the design and construction time typically required to ready a permanent microgrid for operation.

2) Initiative selection (“why” engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- PG&E’s temporary distribution microgrids are designed to reduce the number of customers impacted by PSPS events and support community resilience by powering a cluster of shared resources (e.g., commercial corridors and critical facilities within the energized zones) so that those resources can continue serving surrounding residents during PSPS events.

Relation to and Impact on Other Initiatives:

- PSPS – The focus of Temporary Distribution Microgrids is to, where feasible, help mitigate the potential impact of service interruptions to shared community services during PSPS operations in safe-to-energize ‘downtown’ corridors.

3) Region Prioritization (“where” to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as “high-risk”) and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E reviews circuits with ten or more impacts per the latest version of PG&E’s 10-year lookback and identifies communities with clusters of shared services (i.e., those involving food, fuel, healthcare, and shelter) and critical facilities served by electrical infrastructure that would likely be safe to energize during PSPS events. To determine whether distribution microgrids present viable, effective near-term mitigation measures for a particular location, PG&E also reviews locations for implementation feasibility (i.e., land availability and construction complexity) and the potential to be served by alternative grid solutions.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-year Lookback – To determine the appropriate locations for distribution microgrids, PG&E identifies distribution circuits most likely to be impacted by PSPS events in the future, based on foundational data analysis of 10 years of historical weather events. This "historical 10-yr PSPS lookback" takes historical weather events and builds the associated PSPS events that would have occurred, including both transmission and distribution impacts.

- PG&E may choose to adapt plans to complete or operate a Distribution Microgrid to match the latest PSPS 10-year Lookback data. Because Distribution Microgrids include permanently installed infrastructure (i.e., PIHs) whose design, construction, and useful life spans beyond a single year, updates to the PSPS 10-year Lookback may result in changes to forecasted PSPS frequency for a given Distribution Microgrid. If it becomes less likely that PSPS will impact a site, PG&E may consider altering plans to complete construction of the site or proactively procuring TG to operate a completed site.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Generation for PSPS Mitigation (Temporary Distribution Microgrids):

- Five incremental PIHs were developed in 2021 – Georgetown, El Dorado County; Pollock Pines, El Dorado County; Foresthill, Placer County; Magalia, Butte County; and Middletown, Lake County

- Eight total Distribution Microgrids with constructed PIHs were ready to operate in 2021, the five sites listed in prior bullet plus – Angwin, Napa County; Calistoga, Napa County; and Shingletown, Shasta County

- One additional Distribution Microgrid was made ready to operate through a temporary configuration without a PIH – Placerville, El Dorado County

- One additional Distribution Microgrid PIH completed construction in December 2021, and will be made ready to operate in 2022 – Colfax, Placer County

Impacts:

- Four Distribution Microgrids were in scope and operated during 1 PSPS event in 2021 (August 17), supporting critical and shared services such as fire stations, medical facilities, grocery stores, and cellular towers as indicated in Table PG&E-7.3.3-3 below.

TABLE PG&E-7.3.3-3:
DISTRIBUTION MICROGRID USAGE IN 2021

Distribution Microgrid	Quantity of Service Points Energized	Critical and Shared Services Include:
Shingletown (Shasta County)	83	Medical clinic, fire station, police station, post office, grocery, hardware store, pharmacy, banks, motel, water treatment plant
Magalia (Butte County)	34	Medical clinic, water district pumps, church, fire station, sheriff station, grocery, gas station, restaurants, cell tower, pharmacy
Calistoga (Napa County)	1,556	Medical facility, fire station, police station, post office, banks, schools, markets, restaurants, fairgrounds, restaurants
Angwin (Napa County)	48	Fire station, post office, medical office, student housing

Lessons Learned:

- PG&E piloted hybrid TG solutions pairing inverter-based technology with diesel generators at two Distribution Microgrids in 2021 (battery + diesel generator at one site, linear generator + diesel generator at the other site). The lessons learned through these pilots will inform ongoing efforts to integrate alternatives to diesel into PG&E's TG portfolio for PSPS mitigation.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.07	Temporary Distribution Microgrids	Make operationally-ready at least four additional Distribution Microgrid Pre installed Interconnection Hubs (PIH). This target will include one PIH that completed construction in December 2021 and will be made ready to operate in 2022.	12/31/2022	Quantitative

The Distribution Microgrid in Colfax (Placer County) which was constructed in 2021 will be made ready to operate in 2022 and contribute to our 2022 target of four additional Distribution Microgrid PIHs.

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety. PG&E expects to continue working on other microgrid programs such as the Community Microgrid Enablement Program (CMEP). CMEP provides incremental technical and financial support to communities seeking to develop their own microgrids for critical facilities and vulnerable customer groups. The support includes technical expertise and cost offsets to pay for the cost of distribution system upgrades to enable the

safe islanding of a microgrid. The CMEP was authorized by the CPUC in D.20-06-017 and Resolution E-5127.

In 2022, pending CPUC approval, PG&E plans to launch a Microgrid Incentive Program, which will fund clean community microgrids that support the critical needs of vulnerable populations most likely to be impacted by outages. This program will be targeted specifically for disadvantaged and vulnerable communities.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E currently is not forecasting construction of new temporary distribution microgrids through the 2020 GRC-authorized program (49M 'Resilience Zones') for 2023-2028. Instead, PG&E is shifting our focus during this time on improving the operation of existing Distribution Microgrids during PSPS events and advancing other microgrid programs (see CMEP referenced in prior section).

The intended benefit of focusing on operational improvements is to improve the experience of customers and communities with Distribution Microgrids, as well as to reduce costs and emissions associated with the TG to energize these sites. See Generation Enablement and Development in subsection A for a description of the operational and administrative activities related to successfully executing TG operations for Distribution Microgrids and other workstreams.

As PG&E continues to advance our understanding of evolving PSPS risk and matures our PSPS mitigation program, we will continue to evaluate the need for additional temporary distribution microgrids as well as permanent generation through other microgrid programs (see CMEP referenced in prior section).

D) Back-Up Power for Individual Critical Customer Facilities, Small Essential Businesses, and Residential Customers

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts - PSPS

Secondary Risk: Reliability Impacts – EPSS

Critical Facilities – The loss of power at certain critical customer facilities during a PSPS event could pose significant public health and safety risks, especially for prolonged outages (48 + hour). PG&E coordinates with critical facilities, such as hospitals, telecommunication providers, and transportation agencies, among others, to further understand and more effectively plan for the impacts of PSPS events on the ability to safely operate these facilities.

Backup Power Transfer Meter Pilot – To minimize public safety impacts during a PSPS event, PG&E developed and patented the Backup Power Transfer Meter (BPTM) to improve grid resiliency, as well as provide customer safety and resiliency. The pilot program benefits customers by improving grid resiliency as well as improving safety.

The BPTM enables customers to temporarily power their home from a generation source when the utility grid power is off. BPTM is similar to an auto-transfer switch that senses and switches to generator power when utility power is off and automatically switches back to utility power when available. The device is installed at the customer's electric panel. It is capable of sensing and transferring customers' home load to the backup power source when the utility power is off grid and vice versa. This meter is utilized primarily for smaller loads generally targeted for residential customers.

Backup power for small essential business and residential customers – The loss of power for small essential business and residential customers with access and functional needs or who are reliant on power for well pumps could pose public and individual health and safety risks. PG&E provides a variety of programs to assist small essential business customers and residential customers with access and functional needs with backup power options such as the Generator and Battery Rebate Program, Disability Disaster Access and Resources Program (a partnership with CFILC), and the Portable Battery Program.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Other – As a general policy, PG&E does not offer backup generation to individual facilities. However, PG&E's policy allows for granting exceptions for critical facilities when a prolonged outage could have a significant adverse impact to public health or safety, and the individual critical customer facility's backup generation and/or emergency plan fails.

- Other – The BPTM provides electric customers with the most economical option to use their back up power source (e.g., generator, backup battery, other backup power sources). This transfer switch functionality will increase the flexibility of single-site microgrids. Specifically, the BPTM will automatically detect an outage and allow customers the option to use their back up power source (e.g., generator, back-up battery, other power back up power sources) until normal grid power is restored. See Section 8.2.2 for more information on BPTM.

- Other – The Generator and Battery Rebate Program allows Medical Baseline and well pump customers in HFTDs to receive rebates after purchasing qualified portable generators or batteries to power their critical equipment. The Disability Disaster Access and Resources Program and the Portable Battery Program provide fully subsidized portable back-up batteries to customers with access and functional needs in HFTD areas as a means to power medical equipment to maintain health and safety and live independently.

Relation to and Impact on Other Initiatives:

- PSPS – PG&E is committed to coordinating with critical facilities, such as hospitals, telecommunication providers, and transportation agencies, among others, to further understand and more effectively plan for the impacts of PSPS events on the ability to safely operate these facilities. The pilot program minimizes safety impacts during a PSPS event. The Generator and Battery Rebate Program, Disability Disaster Access and Resources Program, and the Portable Battery Program provide critical back-up power for small essential businesses and residential customers to provide customer safety and resiliency.

- EPSS – The BPTM pilot program minimizes safety impacts during an EPSS outage. The pilot program was developed to improve grid resiliency, as well as provide customer safety and resiliency.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

Critical Facilities – PG&E supports individual critical customer facilities through two distinct processes: (1) ad hoc support during an event; and (2) pre-staged sites.

During a PSPS event, ad-hoc backup power support may be requested. For in-event ad-hoc backup power support, customers submit a request for mobile backup generation through their PG&E contact or account manager to our EOC. The request is reviewed, and a determination is made as to whether a prolonged outage for the requesting customer would either directly or indirectly affect public health or safety. Customers are notified of approval/denial of TG requests via email. In addition, the customer contact listed on the request connects with the TG branch Secondary Lead via phone to discuss technical details of the deployment and walk-through timing and the process. There is no predetermined prioritization of these customers, and the location is dependent on the scope and location of the ongoing weather event.

While there is no predetermined prioritization, PG&E's account managers execute additional in-event outreach to sites where power loss may impact public health and safety to ensure the site has an emergency plan and/or backup power strategy in place. If these sites are unable to execute their emergency plan, a request for backup power deployment is routed to our EOC.

Working with agencies, local governments, and others, PG&E may pre-stage sites, including Hospitals and Voting Tabulation Centers. PG&E places backup generation at these sites to mitigate some or all of the impacts of a PSPS event.

Fixed Power Solutions (FPS) Backup Power Transfer Meter Pilot – PG&E is prioritizing installation of BPTMs in Tiers 2 and 3 HFTDs.

Backup power for small essential business and residential customers – PG&E is prioritizing generator and battery rebates as well as fully subsidized portable back-up batteries in Tiers 2 and 3 HFTDs.

Risk Models Used or Other Considerations for Prioritization:

- No risk models referenced for the Customer Care sections of this initiative.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Outreach to Critical Facilities and Infrastructure: In 2021, PG&E conducted two rounds of direct, in-person outreach to all assigned critical facilities and infrastructure customers. Representatives collected updated contact information, provided data and consultation to support critical facility provider readiness, and responded to inquiries on backup power needs as identified. PG&E sent a letter follow-up letter on August 26, 2021 to all critical facilities and infrastructure customers, reminding them to update any changes to their contact information and that PG&E does not provide backup power and to have a mitigation plan in place.

From March 19 to March 31, outreach was conducted to Water Agencies frequently impacted by PSPS. During June 15 to July 15, contact was made to out Transmission, Wholesale and Muni customers. Outreach efforts were also made to County Office of Emergency Services (OES) in July, as well as readiness webinars held for each Public Safety Partner segment.

Impacts:

- Critical facilities and infrastructure customers were more willing to engage with their PG&E representative to create a mitigation plan for potential PSPS impacts in 2021, compared to previous years.

- There was an increase in desire for self-reliance from frequently impacted customers.

Lessons Learned:

- Customers are adapting to the mitigation plan and PSPS, therefore resulting in less of a need to provide End-of-Year listening sessions, which has shifted our transition to post-season engagement opportunities, allowing our customers to provide feedback, an informal discussion with their PG&E representative, or a stand-alone sector meeting including key stakeholders in a particular business sector to discuss feedback and potential solutions.

- FPS Backup Power Transfer Meter Pilot – In 2021, PG&E launched the Backup Power Transfer Meter (BPTM) pilot to install 50 devices into customers' homes. These customers were participants of the Generator and Battery Rebate Program (GBRP) with compatible generators. The pilot was a success, as PG&E installed over 80 devices in 2021 and is planning on installing more in 2022.

- Generator and Battery Rebate Program – In 2021, PG&E expanded the previous Generator Rebate Program by including additional eligible customers, as well as introducing a new leveled rebate structure, along with adding portable batteries to the Qualified Products List. In addition to well pump customers, PG&E added Medical Baseline and small/micro non-critical care essential business customers in Tiers 2 and 3 HFTDs. As a result of the expanded program, PG&E paid over 1,200 rebates to eligible customers in 2021.

- Disability Disaster Access & Resources Program – In 2021, PG&E continued our partnership with the California Foundation for Independent Living Center's (CFILC) Disability Disaster Access and Resources (DDAR) Program to perform outreach to the disability and aging communities. In addition to portable batteries, other resources were provided such as personalized emergency plans, hotel lodging, transportation, and food vouchers. The 2021 accomplishments include 2,405 assessments completed,1,371 batteries delivered, and 3,058 resources provided.

- Portable Battery Program – The 2021 accomplishments for the Portable Battery Program include 7,531 assessments completed and 5,135 batteries delivered to income-qualified Medical Baseline customers residing in HFTD areas or who have experienced 2 or more PSPS events.

Current Year Activities (2022):

We have not established any targets for this Initiative in 2022. We do currently plan to continue to perform the activities related to this Initiative described in this section. However, those activities will not be included in our quarterly reporting to Energy Safety.

We will be undertaking the following activities in 2022:

- Support Critical Customers with Backup Power Support in exceptional circumstances/Critical Facilities and Infrastructure Plan – PG&E will continue to support critical customers with backup power support in exceptional circumstances, utilizing our policy to determine eligibility and prioritization. During the first half of 2022, PG&E will continue our direct engagement with critical customers and in coordination with counties to provide consultative support for readiness and resiliency for potential power loss as a result of a PSPS event and other emergencies.

- Install BPTMs – In 2022, PG&E will continue to install BPTMs to customers who have participated in the Generator and Battery Rebate Program with compatible generators and may also potentially offer these devices to general market customers in Tiers 2 and 3 HFTDs, and those impacted by EPSS.

- Generator and Battery Rebate Program – In 2022, PG&E will continue to offer leveled rebates to customers, but potentially decrease the highest level in order to maximize coverage. PG&E will explore expanding eligibility for this program to the same eligible customer groupings (Well Pump, Medical Baseline, and small/micro non-critical care essential business customers) for those customers impacted by EPSS that does not overlap with Tiers 2 and 3 HFTDs.

- Disability Disaster Access & Resources Program – The DDAR Program will continue to offer a variety of resources to qualified customers in High Fire Threat Districts or who reside in areas that are likely to be impacted by PSPS. Resources will include batteries, hotel stays, food vouchers, gas cards, transportation, and other resources. The DDAR program will expand program eligibility to provide support to customers who use durable medical equipment and assistive technology that is required to live independently.

- Portable Battery Program – PG&E plans to continue delivering portable batteries to qualifying customers. PG&E will explore expanding eligibility for this program to non-income-qualified MBL customers in HFTD areas or impacted by 2 or more PSPS since 2020.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Improvements to the program will include continuing to explore clean generation solutions and right-size portfolio of available generation to the anticipated volume of requests.

Based on the 2022 BPTM Pilot, PG&E will size our 2023-2028 BPTM accordingly to support customers impacted by PSPS and EPSS. The result will be scaled BPTM based on 2022 performance and customer feedback.

After the 2022 program year, PG&E will evaluate any changes needed to the Generator & Battery Rebate Program, Disability Disaster Access & Resources Program and Portable Battery Program to meet the needs of small essential businesses and residential customers at risk of being impacted by PSPS and EPSS.

E) Community Resource Centers

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

To minimize customer impacts during a PSPS event, PG&E opens CRCs to provide a safe place to access electricity. We have mitigated this risk by ensuring all indoor CRCs in potential PSPS areas are equipped with pre-staged backup power throughout the PSPS season.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Other – While CRCs do not reduce the number of impacted customers, they do mitigate the burden of PSPS on those impacted by providing a safe, American Disability Act (ADA) accessible place to access electricity.

Relation to and Impact on Other Initiatives:

- PSPS – PG&E opens CRCs from 08:00 to 22:00 during PSPS events to provide affected customers and residents a safe, ADA accessible space to access electricity.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Site Criteria/Locations:

Pre-identified CRC sites are located throughout the service territory in areas where PSPS events may occur. When identifying potential CRC locations, PG&E consults with regional, local, and tribal governments, county OES, advisory councils, public safety partners, representatives of the disability and Access and Functional Needs communities, senior citizen groups, business owners, CBOs, and public health and healthcare providers. For details on PG&E's CRC site selection process, site criteria and resources available at CRCs, see Section 8.2.1.

TG is pre-staged at indoor sites without existing provisions for backup power. Doing so ensures that indoor CRCs may be opened quickly when needed.

PG&E will continue site reviews and improvements, including ADA accessible improvements and electrical upgrades, at additional CRC sites as needed. In accordance with D.21-06-034, PG&E will file an updated CRC plan (for both fixed facility and mobile locations) within the 2022 Pre-Season Report no later than July 1, 2022.

Risk Models Used or Other Considerations for Prioritization:

- No risk models are referenced for Customer Care initiatives.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E pre-staged 87 generators to support indoor CRC sites and ultimately activated 25 unique indoor CRC sites with TG during PSPS events in 2021. Some CRC sites were activated multiple times to support different PSPS events in 2021. More information regarding progress on the CRC program can be found in Section 8.2.2.

Impacts:

- Approximately 9,500 people visited a CRC during the 2021 PSPS season.

Lessons Learned:

- PG&E will continue evaluating additions or changes to our indoor CRC portfolio while taking into consideration factors such as potential PSPS scope, communities impacted by 2021 PSPS events and input from counties and tribes.
- PG&E will continue to review the program for efficiencies and ways to improve the customer experience.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E will continue evaluating additions or changes to our indoor CRC portfolio while taking into consideration factors such as potential PSPS scope, communities impacted by 2021 PSPS events, and input from counties and tribes. PG&E will continue to review the program for efficiencies and ways to improve the customer experience.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will continue to meet all Phase 1-3 PSPS Guidelines regarding CRCs, with a specific focus on new Phase 3 Guideline requirements to meet compliance obligations and continue to support communities impacted by PSPS events.

7.3.3.11.2 Substation Activities to Enable Reduction of PSPS Impacts

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Secondary Risk: Ignition Consequences – Population Impacted

Substation activities that enable the reduction of PSPS impacts include the installation or upgrade of protection equipment and automatic sectionalizing devices at various substations to improve operating flexibility thereby minimizing the frequency, scope, and duration of PSPS events.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Relation to and Impact on Other Initiatives:

- PSPS – The PSPS initiatives aim to minimize the frequency, scope, and duration of PSPS events by facilitating the protection and restoration of substations while avoiding the unintended consequence of power shut-off in areas that do not require it.

Primary Benefits of Initiative:

- Reduce duration of events (PSPS/EPSS) – PG&E has identified substations requiring protection upgrades that enable the reduction of PSPS impacts by replacing distribution power transformer bank's high-side voltage fuse protection with a circuit switcher or circuit breaker. The upgraded equipment will allow substation faults to be cleared faster since a blown fuse requires human intervention as opposed to the remote and automatic switching capabilities of a circuit switcher or circuit breaker.

- Reduce number of customers impacted – This PSPS initiative also reduces the number of customers impacted because the upgraded equipment may increase the loading capability of the bank and Distribution Operation switching capabilities. This also allows for operational flexibility when switching in the field.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

The 10-year lookback was used to identify the substations impacted by PSPS events. Once identified, PG&E's System Protection group and Substation Maintenance groups performed additional analysis to determine the specific work needed. A single substation (Rincon) was identified for work in 2021 and 2022. Although the frequency of events modelled at Rincon is low, PG&E plans to continue this work for its operational benefits.

Substations requiring protection upgrades relays for substation equipment operate within overlapping layers of protection zones that are set in such a way that the timing allows the relay to operate in a structured sequence. For example, when a line is taken out of service, PG&E is required to maintain coordination within the remaining energized zone. If the substation equipment (i.e., fuse) within the remaining energized zone does not have the ability to coordinate with the upstream relays, then either the decision is made to de-energize the equipment, remain with the coordinating deficiency, or, if the equipment cannot be adequately protected, then remove it from service.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-year Lookback – Other impacts may include new PSPS regulatory requirements or changes to the PSPS area that would initiate a revision of the 10-year Lookback.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E identified one substation for system upgrades to mitigate PSPS impacts. The work is being completed in two phases. Bank 2 (Phase 1) of the project was released to operation in December 2021 and Bank 1 (Phase 2) has been identified as a 2022 project.

Impacts:

- During 2019 events, the existing fuse at Rincon Bank 1 was not providing optimal low side protection resulting in the remote protection of the 12 Kilovolt buses. This put additional load at risk, but the risk was only present in the largest events. A separate project to replace Bank 1 itself has been initiated through capacity that would render the existing fuse protection incompatible. Therefore, PG&E is coordinating the Bank 1 and protection upgrade replacements.

Lessons Learned:

- A key lesson learned is the need to reserve clearance enabling equipment early, such as the mobile transformer, to avoid delays to the project schedule.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.08	Rincon Transformer Fuse – Replacement	Replace the fuse with a circuit switcher on the Rincon Transformer Bank 1.	06/01/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Process Improvements (2023-2028) – Plans are in place to review future PSPS Lookback updates to identify any new areas in need of additional study or mitigation. Additionally, future plans include the review and replacement of additional transformer high-side fuses with circuit breakers or circuit switcher across select substations.

7.3.3.11.3 Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Operational inadequacies were exposed when PSPS events impacted PG&E Service Centers & Materials Distribution Centers, which affected our efforts to restore power to our customers quickly and efficiently once the "all-clear" was provided. Our Emergency Back-up Generation Project aims at equipping our sites with an emergency generation system capable of backing up the entire campus, thereby operating at full potential when on generator power during a PSPS event.

The length of time the generator can sustain the facility depends on the length of the outage. However, each generator is sized to run for 72 hours, depending on the electric load of the facility. Refueling is also an option if the outage goes past the 72 hours.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- When completed, the electrical reconfiguration and additional equipment installed at these selected locations will allow these sites to operate with the same amount of functionality as they would if they were being fed from their normal source (utility power). This will ensure that restoration efforts being performed by operational personnel working out of the site can carry on unimpeded.

Relation to and Impact on Other Initiatives:

- Other: PG&E Service Centers & Materials Distribution Centers Hardening: PG&E sites located in, or in close proximity to, HFTD areas will be equipped with an emergency generation system capable of backing up the campus in its entirety during a prolonged outage event. Additionally, PG&E Service Centers located in non-HFTD areas that support neighboring sites located in HFTD areas were also included for emergency generation system upgrades.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: This project has been split into three phases, with each phase being targeted for execution based on priority and opportunities. The sites were prioritized based on the population of employees working out of the facility

and its adjacency to HFTD areas. Sites included in Phase One were sites with higher populations of employees and within or close to HFTD areas. Sites further away from HFTD and with a lower employee count were de-prioritized and managed in Phase Two and Three of the program. In terms of opportunity, there were several sites that had dependencies clear faster, which presented an opportunity to move up in the construction schedule for completion.

Risk Models Used or Other Considerations for Prioritization:

- Sites were selected based on proximity to HFTD areas which are prone to PSPS events. By ensuring these sites are fully operational during an extended power loss event, we maximize our operational efficiency during restoration efforts, thereby minimizing outage times for impacted customers.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

A cumulative total of 37 sites were completed by end of 2021 (5 of the 37 sites were completed in 2020). Completed sites have a fully-operational emergency backup system in place. The backup system will allow the site to operate with the same level of functionality as if they were being supplied by their normal power source.

Impacts:

- Ensured operational efficiency at completed sites by improving reliability of the electrical grid.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.09	Emergency Backup Generation – Equip PG&E Service Centers & Materials Distribution Centers	Equip 15 PG&E Service Centers or Materials Distribution Centers sites with emergency backup generation to allow the sites to operate with the same amount of functionality as they would if they were being fed from their normal utility power source.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Due to global supply chain issues as a result of the Coronavirus Pandemic, there are significant impacts to generator production lead times, which may impact the completion of six additional sites. These sites have the potential of being postponed to 2023.

7.3.3.11.4 Fixed Power Solutions

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts - PSPS

Secondary Risk: Reliability Impacts - EPSS

Fixed Power Solutions (FPS) is a new PG&E initiative to enhance our suite of customer resiliency offerings to provide permanent backup power solutions to customers that are frequently impacted by PSPS and EPSS outages. The goal of FPS is to provide long term mitigation of the impacts of outages at the lowest cost to vulnerable customers.

PG&E is testing whether FPS can enhance our ability to quickly and cost effectively mitigate outage risk for customers. The solutions will be deployed in conjunction with other multi-customer solutions and can provide comprehensive solutions to help customer mitigation over a longer time horizon than portable solutions. PG&E will provide support for customers to implement permanent resiliency solutions, with a focus on those that lack the financial resources to invest in permanent backup power solutions. PG&E will also ensure that the FPS offerings leverage other customer programs and evaluate the opportunity for installed projects to provide multiple value streams (e.g., – customer bill reduction) to further reduce program costs.

In 2022, PG&E will focus the Residential FPS offering on solar and storage solutions for Medical Baseline customers in HFTD areas. PG&E will prioritize incentives for low-income customers,[86] renters, and other customers that face barriers in adopting solutions on their own. Other technologies (including natural gas and propane generators) will be considered in the future based on customer needs or site location constraints (e.g., no space for solar).

The non-residential FPS offering will reflect the bespoke resiliency needs of critical facilities and schools by providing a suite of permanent resiliency solutions to meet customer needs. FPS non-residential will include enhanced resiliency assessments to identify opportunities to invest in comprehensive resiliency projects and incremental support to ensure that customers with their own back-up power solutions can support their needs.

To deliver this initiative, PG&E will leverage market actors and solutions, as well as PG&E's experience coordinating and managing customer programs. The program will be coordinated with other customer programs to support cost. PG&E will help customers to identify and leverage outside sources of funding including federal funding and private funding to ensure that ratepayer dollars are effectively leveraged.

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86 Customer's enrolled in California Alternate Rates for Energy/Family Electric Rate Assistance.

In the future, PG&E will continue to identify a suite of technology and incentive structure options for FPS. As part of this effort, PG&E will work to ensure that technologies that support clean backup power solutions are integrated into FPS, as these technologies are proven to mitigate the impact of outages on customers. For example, the emerging Vehicle-Grid Integration technologies show promise in potentially mitigating customer outages at lower cost.

Fossil fuel-based backup generation may also be utilized when clean solutions are not feasible (e.g., customer load is greater than solar and storage capacity); however, PG&E will prioritize clean technology, including technologies that are enabled under the Self-Generation Initiative Program (SGIP). New solutions will be tracked and added to the program when commercially available.

PG&E notes that in most instances, grid-based solutions will be more advantageous for all of the customers on a circuit that could be impacted by PSPS or EPSS. FPS will be deployed in situations where the critical customer is unable to be mitigated by a grid solution or providing individual customer solutions will be less expensive than the alternatives.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce number of customers impacted – FPS supports PG&E's efforts to mitigate the impacts of PSPS and EPSS outages that customers may experience in connection with wildfire mitigation efforts. FPS will be prioritized for customers that are unlikely to be mitigated through a grid solution and may continue to face PSPS outages or outages in response to EPSS in their areas

Relation to and Impact on Other Initiatives:

- PSPS – FPS will provide permanent backup power solutions to prioritized customers that are impacted by frequent PSPS events in HFTD areas.

- EPSS – FPS will provide permanent backup power solutions to customers that are frequently impacted by EPSS outages in HFTD areas.

- System Hardening (Underground and Overhead) – FPS are permanent, long term solutions and where installs occur needs to be coordinated with grid mitigations.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: FPS solutions will be targeted based on data from the PSPS Consequence Model and EPSS Reliability Impact analysis in coordination with system hardening work. This analysis will help inform prioritization for all circuit (HFTD and non-HFTD) locations.

PG&E will focus on customer need, feasibility of solutions (e.g., is the customer facility able to host a solution), and program capacity. PG&E will also refine the program based on operating results, customer feedback and market innovations.

Risk Models Used or Other Considerations for Prioritization:

- PSPS Consequence Model
- EPSS Reliability Impact analysis

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E has been engaging with third-parties to understand capacity and approach and has begun negotiations for vendors.

PG&E has reviewed the San Diego Gas & Electric Company FPS for best practices and coordination. PG&E and the other electrical utilities coordinate on bi-weekly calls to discuss customer mitigation programs.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E currently plans to begin implementation of the program including:

a. Scoping of customer solutions;

b. Customer journey mapping;

c. Engagement and solicitation of implementation partners;

d. Coordination opportunities with other proceedings and customer offerings; and

e. Determination of the best mechanism to ensure that program can be scaled a way that supports customer affordability.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will focus on developing metrics for the FPS initiative to measure success to ensure that investments achieve maximum benefits and ensure ratepayers funds are being used properly.

Through the Clean Energy Finance Options (CEFO) proceeding (Rulemaking (R.) 20-08-022), PG&E will be submitting a financing proposal that will enable more customers to invest in resiliency solutions more easily and reduce the cost of customers mitigations.

7.3.3.12 Other Corrective Action

OEIS Initiative Definition: Other maintenance, repair, or replacement of utility equipment and structures so that they function properly and safely, including remediation activities (such as insulator washing) of other electric equipment deficiencies that may increase ignition probability due to potential equipment failure or other drivers.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.12.1 – Distribution substations;
- 7.3.3.12.2 – Transmission substations;
- 7.3.3.12.3 – Maintenance, Transmission;
- 7.3.3.12.4 – Maintenance, Distribution; and
- 7.3.3.12.5 – Other corrective action, Maintenance, Generation Substation.

7.3.3.12.1 Distribution Substation

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – Public Safety Power Shutoff (PSPS)

PG&E performs corrective repairs and equipment replacements identified through maintenance and inspections of substations located in HFTD areas. This work is intended to correct deficiencies identified to ensure that substation equipment operates as designed.

PG&E also has an animal abatement program focused on mitigating animal-related contact events within substations. This program addresses the risk associated with an arc-flash fire caused by animal contact with energized components that may propagate outside of HFTD substations resulting in wildfire.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Number of Customers Impacted – PG&E conducts maintenance and inspections in substations located in Tier 3 and Tier 2 HFTD areas, High Fire Risk Area (HFRA) and Zone 1 areas. These inspections identify deficiencies with substation equipment and components. The corrective repair and replacement work is performed to reduce the risk of equipment failure or mis-operation.

- Reduce Frequency of Ignition Events – Corrective repair and replacement work reduces the risk of catastrophic failure of equipment that may result in a fire propagating outside the substation.

The installation of animal mitigation products is designed to protect against animal caused arc flash events within the substation. Animal-related arc flashes are mitigated by installing animal guards on exposed energized components of substation equipment. Substations with animal guards have shown to be effective in minimizing the number of animal-related arc flash events, thus reducing the risk of wildfire.

Relation to and Impact on Other Initiatives:

The Supplemental Substation Inspection Program described in Section 7.3.4.15 is a related initiative as conditions requiring corrective actions and animal abatement gaps and issues are identified through inspections.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

In 2022, prioritization of work will be identified and initiated for execution under three classifications:

1. Corrective Actions – Corrective work is prioritized and completed based on equipment condition/risk of failure. As needed repairs are identified through inspection, conditions are evaluated individually and assigned a Line Corrective (LC) notification repair priority code (A, B, E, or F) with specified due dates.

2. Small Scale Animal Abatement (Single Equipment) – Animal abatement issues are managed by the responsible substation maintenance headquarters using the LC notification process. These notifications are prioritized based on an in-field assessment of the condition found. Typically, LC tags generated for animal abatement are completed within one year of the issue being identified.

3. Large Scale Animal Abatement (Large Section or Entire Substation) – Animal abatement equipment is applied to substations with qualifying outdoor distribution voltage equipment. There are projects to abate equipment that has not previously been abated, to re-abate deteriorated equipment, and to add abatement to areas where it is missing. These can be initiated based on LC notifications, through direct feedback from maintenance headquarters, or recommendations from Subject Matter Experts (SME). These projects are prioritized using historical animal contact events, substation voltage, customer counts, defensible space completion status for probability, and Technosylva consequence scores as defined in WMP Section 7.3.4.15. The high-priority projects are incorporated into the five-year workplan.

Risk Models Used or Other Considerations for Prioritization:

- Execution Considerations – The primary execution challenge is normally seasonal operational limitations that impact our ability to remove equipment from service to make the repairs. Other issues that may delay repair work include material availability.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Corrective Repairs: In 2021, there were 1,892 Distribution Substation corrective repairs identified for substations located in HFTD areas. 1,308 orders were completed in 2021 and 584 remain in progress.

Impacts:

- The completion of these repairs ensures that substation equipment operates properly when needed and reduces the probability of a wildfire ignition.

Lessons Learned:

- Not Applicable.

Animal Abatement: In 2021, the animal abatement program targeted 26 distribution substations needing animal abatement. 27 distribution substations were completed in 2021. This completes a total of 75 targeted large scale distribution substation animal abatement projects.

Impacts:

- Substations that have animal abatement installed have a lower probability of animal-caused ignition events.

Lessons Learned:

- Leveraging historical flashover events and strategy improvements to inform future animal abatement projects will further reduce ignition risk.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E will continue performing corrective repairs and animal abatement activities:

- Corrective Repairs – PG&E has 584 LC notifications from 2021 in progress, and other corrective repair notifications will be generated through the inspections process on an ongoing basis. They will be tracked and prioritized using the LC notification process throughout 2022.

- Animal Abatement – In 2022, PG&E will continue to execute small scale animal abatement as identified through the LC notification process. We will also continue to monitor animal abatement project triggers in transmission substations to identify and prioritize additional large-scale project as needed. PG&E will continue installation of animal abatement in all new construction projects (i.e., transformer replacements, bus conversions and other temporary and permanent installations).

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short Term Process Improvements (2023-2028): PG&E will continue to evaluate and analyze the effectiveness of the animal abatement program and abatement products used.

Four additional distribution substations have been identified as needing large-scale animal abatement projects in HFTD areas. They are in progress to be prioritized for implementation in the 5-year workplan.

7.3.3.12.2 Transmission Substation

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – PSPS

PG&E performs corrective repairs and equipment replacements identified through maintenance and inspections of substations located in HFTD areas. This work is intended to correct deficiencies identified to ensure that substation equipment operates as designed.

- The Substation Transmission animal abatement program is similar to the Substation Distribution animal abatement program described in Section 7.3.3.12.1.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Number of Customers Impacted – PG&E conducts maintenance and inspections in substations located in Tier 3 and Tier 2 HFTD areas, HFRA and Zone 1 areas. These inspections identify deficiencies with substation equipment and components. The corrective repair and replacement work is performed to reduce the risk of equipment failure or mis-operation.

- Reduce frequency of ignition events – Corrective repair and replacement work reduces the risk of catastrophic failure of equipment that may result in a fire propagating outside the substation.

The installation of animal mitigation products is designed to protect against animal caused arc flash events within the substation. Animal-related arc flashes are mitigated by installing animal guards on exposed energized components of substation equipment. Substations with animal guards have shown to be effective in minimizing the number of animal-related arc flash events, thus reducing the risk of wildfire.

Relation to and Impact on Other Initiatives:

Section 7.3.4.15 Supplemental Substation Inspection Program is a related initiative as conditions requiring corrective actions and animal abatement gaps and issues are identified through inspections.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

- See Section 7.3.3.12.1 above describing prioritization.

Risk Models Used or Other Considerations for Prioritization:

- Execution Considerations – The primary execution challenge is normally seasonal operational limitations that impact our ability to remove equipment from service to make the repairs. Other issues that may delay repair work include material availability.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- Transmission/Hydro Substation: Corrective Repairs – In 2021 there were 1,736 Transmission Substation corrective repairs identified for substations and hydro facilities located in HFTD areas. 1,294 substation repairs were completed in 2021 and 300 substation repairs remain in progress. The 142 remaining repair notifications for hydro facilities are in progress and addressed in Section 7.3.3.12.5.

- Animal Abatement – In 2021, the animal abatement program targeted five transmission substations needing animal abatement. Six transmission substations were completed in 2021. One animal abatement project was transferred to power generation in 2021. This completes the total of 10 out of 11 targeted large scale transmission animal abatement projects.

Impacts:

- The completion of these repairs ensures that substation equipment operates properly when needed and reduces the probability of a wildfire ignition.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E will continue performing corrective repairs and animal abatement activities:

- Corrective Repairs – PG&E has 300 LC notifications from 2021 in progress, and other corrective repair notifications will be generated through the inspections

process on an ongoing basis. They will be tracked and prioritized using the LC notification process throughout 2022.

- Animal Abatement – In 2022, PG&E will continue to execute small scale animal abatement as identified through the LC notification process. We will also continue to monitor animal abatement project triggers in transmission substations to identify and prioritize additional large-scale project as needed. PG&E will continue installation of animal abatement in all new construction projects (i.e., transformer replacements, bus conversions and other temporary and permanent installations).

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-Term Process Improvements (2023-2028) – PG&E will continue to evaluate and analyze the effectiveness of the animal abatement program and abatement products used.

None of transmission substations have been identified as needing large-scale animal abatement projects in HFTD areas.

7.3.3.12.3 Maintenance, Transmission

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

Maintenance of electric transmission assets, particularly those located in HFTD areas, is an integral part of mitigating the risks associated with wildfire. Additionally, there is typically increased public and employee safety and customer reliability with repair or replacement transmission assets.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Completing repair, replacement, and life extension to transmission assets provides the benefit of reduced probability of failure for critical components that could potentially ignite a wildfire.

Relation to and Impact on Other Initiatives:

- Asset Inspections – The majority of corrective maintenance notifications are identified as a result of transmission asset inspections and patrols (described in Sections 7.3.4.2, 7.3.4.5, 7.3.4.10, and 7.3.4.12).

- System Hardening (Underground and Overhead) – Completion of maintenance corrective notifications in addition to System Hardening projects and programs (Section 7.3.3.17.2) have the effect of transmission system hardening by repairing or replacing assets with identified concerns.

- PSPS – Completion of maintenance corrective notifications directly inform the Operability Assessment (OA) model, which is used in transmission line scoping decisions during PSPS events.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative: Prioritization of maintenance tags are based on severity of the issues found, fire ignition potential (i.e., asset-conditions impacting issues associated with HFTD areas and HFRA), probability of failure (annualized OA)

and the Wildfire Consequence Model. As conditions are identified, they are given a time-based priority based on guidance in PG&E's Electric Transmission Preventative Maintenance Manual. For certain tags (E and F priority tags), additional prioritization occurs based on the damage found. Time dependent conditions (meaning that the damage can worsen with time) with ignition potentials are typically prioritized before other non-time dependent, non-ignition potential tags. Execution of the prioritized work plan would also have to address other factors such as clearance availability, access, work efficiency, etc.

RISK MODELS USED OR OTHER CONSIDERATION FOR PRIORITIZATION:

- Operability Assessment – Annualized probability of transmission asset failure from OA is combined with the Wildfire Consequence Model to help inform the wildfire risk of each tag. Work may be bundled by lines with highest wildfire risk for execution efficiencies.

- Maintenance tag status is currently reported quarterly to the California Public Utilities Commission (CPUC or Commission), as well as to the California Independent System Operator (CAISO). Maintenance tags follow timing guidance from General Order (GO-95 and internally from the Electric Transmission Line Inspection and Preventive Maintenance (ETPM) Program (TD-1001M and associated documents).

- For asset condition time-dependent tags that may be beyond PG&E internal due-dates, Field Safety Reassessments (FSR) are used. These FSRs evaluate the current condition of a "B", "E" or "F" notification that may have deteriorated in the time between the original finding and the present date. For notifications that are past due, FSRs ensure that the risk posed by the condition documented by the notification has not increased over time, or if it has increased, the notification is reprioritized for prompt resolution.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- Other Corrective Action, Maintenance, Transmission – This program reached its 2021 goal to close out all ignition-related notifications in HFTD areas found before 2020 and all time-dependent ignition-related notifications found in 2020 in high fire spread areas, in addition to any new urgent priority notifications identified in 2021.

Impacts:

- HFTD tag completion volume in 2021 reduced the ignition-related tag backlog enough to allow elimination of the backlog in 2022.

Lessons Learned:

- June, July, August, and September are the months where most tags have been completed. Q1 is the time of less activity. It is beneficial to have the maintenance inspection plans available earlier in the year.

Current Year Activities (2022):

- While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

- In 2022, PG&E has a plan to complete approximately 8,500[87] notifications within HFTD areas, not including any urgent priority notifications that may be identified in 2022

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-Term Process Improvements (2023-2028):

As data is collected through maintenance tags and FSR results, trending analysis will allow for understanding of deterioration rates of specific asset conditions and used to influence future inspection frequency and prioritization. Trending of notification find rates can also influence the maintenance strategy for specific lines or sections. This information will also be utilized in the programmatic approach for repair and replace (capital vs. expense) decisions. It also helps provide validation for asset health modeling such as the Wildfire Transmission Risk Model.

PG&E will continue to seek reductions in unit costs of maintenance tag work, capitalization where appropriate, and maintenance tag and/or project execution bundling when possible.

PG&E will continue to investigate new designs/asset types that may require less maintenance.

87 Tag completion, in general, may be dependent on "reasonable circumstances" outlined in GO-95 Rule 18.B.1.b. Execution risks include material long lead times, permitting, access and clearance constraints, and potential loss of resources (e.g., due to potential high priority emergent work, COVID-19 limitations, etc.).

7.3.3.12.4 Maintenance, Distribution

OEIS Initiative Definition: ***Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.***

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

The distribution overhead enhanced inspection program is used to identify potential asset failures and gain a better understanding of asset condition for asset maintenance and replacement. Electric Corrective (EC) notifications resulted from the enhanced inspection process. These maintenance notifications can help reduce asset ignition risk by correcting identified asset hazards, degraded conditions, and non-standard concerns.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase Understanding of Where Risk is Located – These enhanced inspection protocols have resulted in a significant increase in the quantity of EC notifications. The maintenance (or replacement) work done because of the inspections mitigates ignition risk associated with distribution facilities in the HFTD or HFRA area.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Inspections are performed with enhanced inspection protocols as described in Section 7.3.4.1. Enhanced inspection activities lead to corrective actions taken on issues identified during the inspections. Since 2019 Wildfire Safety Inspection Program (WSIP), distribution assets have been inspected more rigorously than in previous years based on a Failure Modes and Effects Analysis (FMEA) approach. Additional inspection types that lead to corrective actions are described in Sections 7.3.4.4 and 7.3.4.11.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

The EC maintenance notifications generated through the enhanced inspection program are assigned a priority based on the potential safety impact. PG&E uses the following priorities:

A. Conditions that require immediate action;

B. Conditions that generally need to be addressed within three months from the date a condition is identified;

E. Conditions that need to be addressed within 12 months from the date the condition is identified or within six months for conditions creating a fire risk located in Tier 3 HFTD areas; and

F. Conditions that need to be addressed within five years from the date the condition is identified.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model (WDRM): Given the high number of identified tags since 2019, PG&E utilized a risk informed prioritization approach to address the highest risk issues on PG&E's facilities. The largest volume of identified corrective actions are E and F tags. Through May 2021, PG&E prioritized execution of E and F tags based on ignition risk circuit prioritization. Starting June 2021, the WDRM is being used to assign risk points to each corrective notification to prioritize work.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

As of December 31, 2021, the following HFTD tag progress has been made since 2019:

- WSIP Generated Tags – 144,784 tags had been created, 72,904 had been closed (repairs have been completed) and 71,880 remain open; and

- Non WSIP Generated Tags – 193,556 tags had been created, 71,759 had been closed (repairs have been completed) and 121,797 remain open.

Open tags will continue to be worked in a risk-based priority including new tags generated through the 2021 inspection program. Priority A and B tags are expected to be completed by the required due date. Any tag that contains a "time dependent" element for a pole structure that is not being inspected in 2022 and cannot be completed by the due date will receive an FSR.

Impacts:

- The tag prioritization approach will reduce the risk of ignitions in HFTD areas.

Lessons Learned:

- Tags that are upgraded to Priority B need to be vetted to ensure the upgrade is reflective of a deteriorated condition needing to be addressed within three months.

- Tags that are not upgraded in priority but have additional conditions present need to be coded in a structured fashion to analyze and prioritize accordingly.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We plan to establish the work down approach to determine the backlog of tags that have resulted from the enhanced inspection process.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-Term Improvements (2023-2028) – We are evaluating combining tags as part of larger projects or cluster with neighboring planned work to gain execution efficiencies.

7.3.3.12.5 Other Corrective Action, Maintenance, Generation Substation

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

This initiative includes corrective repairs and equipment replacements identified through maintenance and inspections of generation substations located in HFTD areas. This work is intended to correct deficiencies identified and ensure that generation substation equipment operates as designed. These maintenance notifications are key to reducing asset ignition risk by correcting identified asset hazards, degraded conditions, and non-standard concerns. Repairs include, but are not limited to, implementation of animal abatement tags as identified through enhanced inspection.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – PG&E conducts maintenance and enhanced inspections in generation substations located in HFTD areas. These inspections identify deficiencies with substation equipment and components. The repair and replacement work are performed to reduce the risk of an equipment failure or mis-operation.

Relation to and Impact on Other Initiatives:

- Section 7.3.4.16 Supplemental Hydro Generation Substation Inspection Program includes enhanced supplemental inspections for substations located within Tier 3 and Tier 2 HFTD areas, HFRA and Zone 1. These sites are inspected using a risk and consequence prioritization. Findings from the supplemental inspections are then converted into corrective actions.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

- Other Corrective Actions – Corrective work is prioritized and completed based on equipment condition/ risk of failure. As needed repairs are identified, conditions are evaluated individually and assigned a notification repair priority code (1, 2, 3 or 4) with specified due dates. The repairs are scheduled for completion prior to the due date associated with the repair priority code. Notification priority codes are

completed according to the following timelines 1: 30 days, 2: 90 days, 3: up to 365 days, 4: beyond 365 days.

Risk Models Used or Other Considerations for Prioritization:

- Other Corrective Actions – Corrective work is prioritized based on risk and completed based on the prioritized schedule. As needed repairs are identified, conditions are evaluated individually and assigned a repair priority code and due date. The repairs are scheduled for completion prior to the due date based on the repair priority code.

- Additional Compliance and/or Execution Considerations – The primary execution challenge is normally seasonal operational limitations that impact our ability to remove equipment from service to make the repairs. Other issues that may delay repair work include material availability, labor resources and funding constraints.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, there were 517 Hydro Substation corrective repair notifications identified for substations located in HFTD areas. At the end of Q4, 375 of these notifications were completed.

Impacts:

- The completion of these repairs ensures that substation equipment operates properly when needed and reduces the probability of a wildfire ignition.

Lessons Learned:

- Ensure that corrective actions are linked to specific SAP equipment identification numbers for efficient tracking and execution of repairs.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E aims to continue performing corrective repairs and animal abatement activities, as detailed below:

- Corrective Repairs – PG&E has 142 notifications from 2021 in progress that will be prioritized and tracked to completion using the H1 process. This is in addition to any new corrective repair notifications generated though ongoing inspections.

- Animal Abatement – In 2022, Power Generation will define and scope our Animal Abatement Program which will include the one EO animal abatement project referenced in Section 7.3.3.12.2 for implementation in 2023 and beyond.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Power Generation is currently planning to implement animal abatement projects identified and scoped in 2022 and will utilize the risk model for prioritization as referenced in Section 7.3.3.12.2 for transmission substation animal abatement projects.

7.3.3.13 Pole Loading Infrastructure Hardening and Replacement Program Based on Pole Loading Assessment Program

OEIS Initiative Definition: Actions taken to remediate, adjust, or install replacement equipment for poles that the utility has identified as failing to meet safety factor requirements in accordance with GO 95 or additional utility standards in the utility's pole loading assessment program.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

PG&E started our pole loading program to reduce the risk of potential fire ignitions resulting from pole failures by evaluating poles to ensure that each pole meets GO 95, Rule 44 strength requirements throughout its service life, both when initially installed and while in service despite changing conditions, impacts from maintenance activities, attachment additions, and potential wood strength degradation. Replacing overloaded poles eliminates the risks associated with pole failure, including potential ignition risk. This program also reduces risk by providing asset intelligence to identify locations that require corrective actions driven by pole safety factors and/or due to limitations in withstanding wind speeds.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus Mitigations on Highest Risk Locations – When performing pole loading calculations, PG&E gains understanding of when poles are overloaded, which increases the probability of failure of the poles. PG&E also gains the understanding of where the overloaded poles are located and can compare that to the wildfire ignition consequence profiles. This increased understanding helps to prioritize mitigation efforts, which includes replacing and reinforcing poles. PG&E can focus mitigation efforts on the highest risk locations to effectively reduce the wildfire ignition risk system wide.

- Develop Better Visibility Into Risk – When performing pole loading calculations, PG&E gains understanding of when poles are overloaded, which increases the probability of failure of the poles. This understanding helps to quantify the overall system risk of potential pole failures due to overloading, which helps to build risk profiles. In addition, understanding the pole loading system-wide helps to indicate where PG&E has risk to enable development of mitigation plans, which include pole replacement and reinforcement projects.

- Reduce Frequency of All Types of Ignition Events – When PG&E performs the pole loading calculations and discovers that the pole is overloaded, that pole has a higher probability of failure. Through mitigation efforts, including replacing and

reinforcing poles, PG&E can reduce the probability and frequency of pole failures, which reduces the changes of a wildfire ignition event.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – During a pole's service life, pole loading calculations are performed when load is added to a pole or if a suspected overload condition is observed during inspection. Pole loading calculations are performed in O-Calc software during the design phase to ensure poles are sized correctly to satisfy GO 95 requirements. When poles are analyzed and determined to be overloaded or the pole loading evaluation indicates that the pole does not satisfy GO 95 requirements, a pole replacement tag or other electric corrective tag is initiated to correct the condition.

- Asset Inspection and Repair – Please see Section 7.3.3.6 regarding distribution pole replacement and reinforcement, including with composite poles, relates to this initiative.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

PG&E's pole loading program has focused on assessments of poles in the Tier 2 and 3 HFTD areas with the goal to be fully implemented (100 percent poles analyzed) in these areas by 2024. Poles located in non-HFTD areas will follow, with the goal to be fully implemented (100 percent poles analyzed) by 2030.

Risk Models Used or Other Considerations for Prioritization:

- When performing the pole loading calculations, PG&E utilizes Light Detection and Ranging (LiDAR) data and field collected imagery from the recent system inspections to update the baseline models. PG&E is prioritizing analysis of the poles in the HFTD areas and building the annual plans based on the previous year's LiDAR and system inspection data captures.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed pole loading analysis of approximately 61,000 poles, all of which are considered the highest risk poles, either due to the pole characteristics or location in HFTD areas.

PG&E switched vendors for this work in 2021. Contracts took longer than expected and the new vendor had to complete an extensive pilot to establish a solid foundation based on high quality pole loading calculations. In addition, the vendor had to continually on-board new personnel, which required training on the engineering requirements.

Missed units will be made up future years (2022 to 2024), to ensure the program remains on-track for timely completion of analyzing all HFTD poles by the end of 2024.

Impacts:

- PG&E switched vendors for this work. The extensive pilot focus on quality and building a strong foundation for the program with the new vendor delayed the overall production.

Lessons Learned:

- This year was extremely important for PG&E in building a strong foundation for the performance of quality pole loading analysis.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to perform pole loading calculations for approximately 180,000 poles. This volume includes an additional 20,000 poles originally forecast to be completed in 2021.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-Term Improvements (2023-2028) – PG&E is working with the pole loading calculation software vendor to enable analysis of multiple pole models together, which would allow the model to link physically connected spans for structural loading analysis. This enhancement will allow for the linking of pole loading calculation models, so that when one model is updated it automatically updates the surrounding pole models. The benefit of this enhancement enables more accurate pole loading calculation models, so that PG&E can comprehensively understand the pole loading conditions of all poles system wide.

PG&E is working with the vendor to increase support and personnel to increase the volume of poles assessed annually to make up from the missed units in 2021.

7.3.3.14 Transformers Maintenance and Replacement

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing transformer equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Transformers

PG&E's GO 165 Program, which covers distribution transformer maintenance, is primarily focused on the identification, assessment, prioritization, and documentation of abnormal conditions, regulatory conditions, and third party caused infractions that can negatively impact safety or reliability. A proactive approach to removing transformers before they fail will prevents potential ignitions. Transformers that are not properly monitored, maintained, or inspected pose a greater risk of arcing or causing an ignition.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Risk of Potential Ignitions – Electric Program Investment Charge (EPIC) 3.13 monitors oil temperature of overloaded transformers. This emerging technology in this project allows replacement of the transformer before the unit fails or causes an ignition.

- Reduce Risk of Potential Ignitions – EPIC 3.20 uses smart meter data and machine learning to predict transformer failures before they occur. This emerging technology detects possible energy theft, internal windings failures, and imminent failure. This will allow replacement of the unit before any ignition occurs from unit failure.

Relation to and Impact on Other Initiatives:

- Other – EPIC 3.13: This initiative is related to EPIC 3.13 transformer oil temperature monitoring via Field Area Network.

- Other – EPIC 3.20: This initiative is related to EPIC 3.20 emerging technology leveraging smart meter data for maintenance analytics.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

This program covers PG&E's entire service area. However, while the scope of the inspection is the same, the frequency for HFTD and non-HFTD areas is different. Inspections occur annually in Tier 3 HFTD areas and Zone 1, every three years in Tier 2

HFTD areas, and every five years in Non-HFTD areas. Every location is visited at least once every five years.

Risk Models Used or Other Considerations for Prioritization:

- WDRM – Repair or replacement of overloaded transformers is prioritized using the WDRM which utilizes the probability of failure multiplied by consequence to derive a risk score. Consequence scores are based on the Technosylva model, which are also included in the WDRM.

- Additional transformers to be replaced may include disadvantaged communities, or high probability of failure in other locations such as Non-HFTD areas. Other overloaded transformers may include those that are impacted by solar arrays or multiple plug-in electric vehicles.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E replaced 81 overloaded transformers.

Impacts:

- PG&E was able to replace 81 overloaded transformers which mitigated reliability and safety risks.

Lessons Learned:

- Risk models were developed in 2021 to identify transformers that are at greater risk of failure based on probability of failure times consequences. This method has been adopted for use in 2022.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E plans to continue replacing overloaded transformers using the WDRM prioritization.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-Term Improvements (2023-2028) – PG&E is ramping up to replace transformers proactively. Over time, the anticipated benefit will be a reduction of transformers replaced on emergency.

PG&E will move from a run to failure mode in order to reduce ignition exposure and decrease customer impacts by reducing outage minutes.

PG&E will also make use of EPIC 3.13, and 3.20. EPIC 3.13 uses heat sensors to identify overloaded transformers. EPIC 3.20 uses smart meter data to predict transformer failure. Transformers will be replaced using these models. Replacing transformers before they fail is the intended benefit.

7.3.3.15 Transmission Tower Maintenance and Replacement

OEIS Initiative Definition: Remediation, adjustments, or installations of new equipment to improve or replace existing transmission towers (e.g., structures such as lattice steel towers or tubular steel poles that support lines at or above 65 kilovolt (kV)).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

Maintenance, repair, life extension, and replacement of transmission towers, particularly those located in HFTD areas, are integral means of mitigating risk associated with wildfire. In addition, there is typically increased public and employee safety and customer reliability when repairing or replacing steel structures.

Transmission tower activities include the following:

- Transmission tower repair includes maintenance tags to mitigate a variety of deficiencies such as bent or loose steel members, foundation cracks, loose hardware, etc. Mitigation of these tags in HFTD locations can reduce wildfire risk.
- Transmission tower coating, specifically for structures in areas subject to atmospheric corrosion, are engineered with chemical compounds, such as corrosion inhibitors, designed for these corrosive environments which enable long term corrosion protection of the steel, protection from UV exposure, and resistance to abrasion, ensuring years of protection.
- Transmission tower cathodic protection uses a technique to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded sacrificial metal to act as the anode. The sacrificial metal then corrodes instead of the protected metal. For structures needing large protection requirement, where passive galvanic cathodic protection is not adequate, an external DC electrical power source is used to provide sufficient current.
- Steel towers may also be replaced based on condition, where repairs or life extension would not be effective.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- <u>Reduce frequency of all types of ignition events</u> – Completing repair, replacement, and life extension to transmission steel structures provides the benefit of reduced probability of failure for critical components that could potentially ignite a wildfire.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Enhanced inspections and discretionary transmission line inspections such as below-grade inspections and ultrasonic measurement of steel poles provide both maintenance tags covered in this section, as well as condition information useful for risk modeling of the assets. Risk may inform additional inspection, repair, life extension or replacement. (This work is described in Sections 7.3.4.2, 7.3.4.5, 7.3.4.10, and 7.3.4.12)

- System Hardening (Underground and Overhead) – Other initiatives, such as conductor replacement, may be bundled together with steel structure replacement when either required by engineering, or for efficiency and dual asset condition needs between conductor and structure. Completion of steel structure work also have the effect of transmission system hardening. (See Section 7.3.3.17.2)

- Public Safety Power Shutoff (PSPS) – Completion of maintenance notifications directly inform the Operability Assessment (OA) model, which is used in transmission line scoping decisions during PSPS events.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Prioritization of maintenance tags are based on severity of the issues found, fire ignition potential (i.e., asset-conditions impacting issues associated with HFTD areas and High Fire Risk Area (HFRA)), probability of failure (annualized OA) and wildfire consequence (Technosylva Multi Attribute Value Function). As conditions are identified, they are given a time-based priority based on guidance in PG&E's Electric Transmission Preventative Maintenance Manual. For certain tags (E and F priority tags), additional prioritization occurs based on the damage found. Time dependent conditions (meaning that the damage can worsen with time) with ignition potentials are typically prioritized before other non-time dependent, non-ignition potential tags. Execution of the prioritized work plan would also have to address other factors such as clearance availability, access, work efficiency, etc.

Prioritization of asset life extension and replacement focuses on high-risk steel structures. Many factors feed into determination of high-risk steel structures—including prior inspection conditions, environmental factors (such as location in an HFTD area or corrosion zone), age, structure design, prior outages, prior repairs, wildfire consequence, public safety consequence, etc.

Risk Models Used or Other Considerations for Prioritization:

- OA – Annualized probability of transmission asset failure from OA is combined with the Wildfire Consequence Model to help inform the wildfire risk of each tag. Work may be bundled by lines with highest wildfire risk for execution efficiencies.

- Maintenance tag status is currently reported quarterly to the CPUC, as well as to the California Independent System Operator. Maintenance tags follow timing

guidance from GO-95 and internally, the Electric Transmission Preventive Maintenance (TD-1001M and associated documents).

- For asset condition time-dependent tags that may be beyond PG&E internal due-dates, Field Safety Reassessments (FSR) are used. These FSRs evaluate the current condition of a "B", "E" or "F" notification that may have deteriorated in the time between the original finding and the present date. For notifications that are past due, FSRs ensure that the risk posed by the condition documented by the notification has not increased over time, or if it has increased, the notification is reprioritized for prompt resolution.

- Tag completion, in general, may be dependent on permitting, weather, third parties, and other reasons outlined in General Order (GO)-95 Rule 18.b.1.b

- Execution risks include material long lead times, permitting and clearance constraints, and potential loss of resources due to potential high priority emergent work.

4) Progress on initiative since the last Wildfire Mitigation Plan (WMP) submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Through 2021, approximately 5,770 notifications associated with steel structures in HFTD areas have been closed, including approximately 900 urgent (A or B) priority notifications identified in 2021. The 2021 target for HFTD tower maintenance tags was completion of 4,000 tags that were open at the end of 2020 in addition to any new urgent priority tags identified in 2021. Through 2021, there were approximately 190 tags closed that were associated with steel structure painting within HFTD areas.

Impacts:

- HFTD tag completion volume in 2021 reduced the ignition-related tag backlog enough to allow elimination of the backlog in 2022.

Lessons Learned:

- The original estimate for painting tags was provided using a unit cost that was not representative of the true cost of painting.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

For 2022, approximately 3,400 tags[88] associated with steel transmission structure repair have been prioritized for completion within HFTD areas, excluding Paint & Coating tags, and not including any urgent priority tags that may be identified in 2022.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Pilot new inspection methods – Newer inspection methods such as below grade inspection, ultrasonic measurement of steel poles, and corrosion climbing assessments are covered under Section 7.3.4.10, but are specific to understanding condition of steel structures.

Pilot new life extension methods – Use of foundation fiber wrap on steel tower foundations can provide life extension reinforcement to the towers.

Trending Maintenance Information – As data is collected through maintenance tags and FSR results, trending analysis will allow for understanding of deterioration rates of specific asset conditions and used to influence future inspection frequency and prioritization. Trending of notification find rates can also influence the maintenance strategy for specific lines or sections. This information will also be utilized in the programmatic approach for repair and replace (capital vs. expense) decisions.

88 Execution risks can include material long lead times, permitting and clearance constraints, access constraints and/or potential loss of resources (e.g., due to potential high priority emergent work, COVID-19 limitations, etc.).

7.3.3.16 Undergrounding of Electric Lines and/or Equipment

OEIS Initiative Definition: Actions taken to convert overhead electric lines and/or equipment to underground electric lines and/or equipment (i.e., located underground and in accordance with GO 128).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Reliability Impacts – PSPS

California, along with other western states, continues to experience an increase in wildfire risk and a longer wildfire season. The drought, hotter temperatures, and higher winds have significantly increased the risk of catastrophic wildfires. To respond to this challenge, in July 2021, PG&E announced a multi-year program to underground 10,000 distribution circuit miles in and near high wildfire risk areas.

PG&E's undergrounding efforts, and other wildfire safety measures, will make our system safer and more resilient to better serve customers and respond to the state's evolving climate challenges. Building and expanding PG&E's electric distribution system underground will not only help eliminate wildfires caused by overhead equipment failures, but it will also help to reduce the need for and/or frequency of PSPS outages and Enhanced Powerline Safety Settings (EPSS), improving system reliability under the full range of weather and fire risk conditions. Undergrounding will also help protect trees and the ecological, environmental, and other benefits they provide.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Undergrounding electric distribution lines in high fire-risk areas is the best long-term solution for keeping customers and communities safe. Placing overhead lines underground reduces ignition risk by approximately 99 percent.

- The benefits of undergrounding also include wildfire risk reduction, a potential decrease in the need for PSPS and EPSS outages, improved reliability, a reduction of emergency activations during winter storms, less vegetation management work in areas with undergrounded facilities in the future, and beautification of hometowns.

Relation to and Impact on Other Initiatives:

- Undergrounding is one of PG&E's System Hardening methods described in Section 7.3.3.17.1.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E is prioritizing undergrounding in areas where it can have the greatest impact on reducing wildfire risk and PSPS outages for customers, including identified critical facilities. As risk models and conditions evolve, PG&E will adjust prioritization so that the highest wildfire risk areas continue to be addressed.

PG&E also considers a variety of other factors for undergrounding prioritization including topography (including accessibility for ingress and egress of areas), geology, constructability (land rights/easements, community traffic/access impacts, etc.), existing infrastructure (such as the number of services and transformers), reliability, and the potential of trees falling into lines. When possible, we are prioritizing undergrounding efforts in areas that will address multiple areas of concern at the same time (e.g., wildfire risk, PSPS frequency, topography etc.)

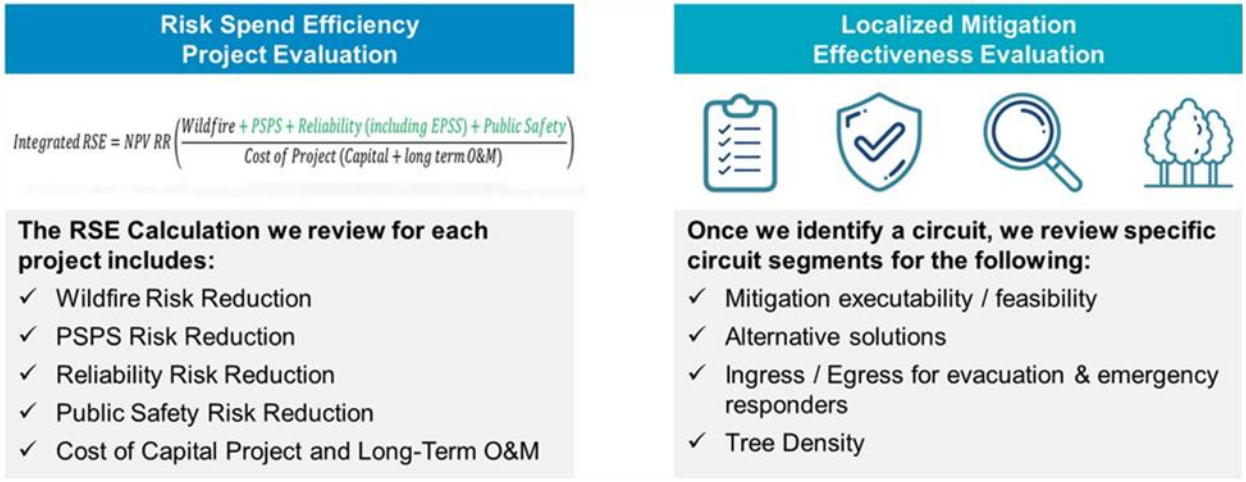
Engineering an underground electric system requires designing the system around existing water, natural gas and sewer / stormwater drainage systems, as well as planning for future road widening. PG&E is working closely with customers and local, state, federal, tribal and regulatory officials to address these issues as part of this program.

PG&E is currently developing scoping criteria that will more quickly and efficiently identify the highest risk areas, assess where undergrounding is a feasible and effective solution, and prioritize and sequence undergrounding work that is designed to reduce system risk based on several factors including:

- Existing risk models
- Topology or other geological/land/environmental/cultural sensitivities
- Critical facilities, ingress/egress considerations, public safety and permitting or easement restrictions

Once a circuit is selected for system hardening, including undergrounding, we evaluate each proposed project quantitatively and qualitatively with a focus on mitigating the maximum amount of risk effectively and efficiently as indicated in Figure PG&E-7.3.3-1 below. After projects are identified, they will be sequenced for execution to balance risk reduction and executability.

FIGURE PG&E-7.3.3-1:
QUANTITATIVE AND QUALITATIVE CRITERIA APPLIED TO UNDERGROUNDING AND SYSTEM HARDENING PROJECTS



As demonstrated by our 10,000-mile program, PG&E is making a fundamental shift in our system hardening work and using undergrounding as the preferred option after line removal or remote grid, where appropriate. While undergrounding is the preferred mitigation for its risk reduction and other benefits, we will also use other mitigations. In some instances, overhead system hardening may be a more appropriate mitigation method because of environmental factors in certain areas. For example, in areas with more grass and fewer strike potential trees, PG&E may determine that overhead hardening work is faster, and more cost effective, than undergrounding. In addition, some remote or inaccessible areas may be cost prohibitive to underground. These areas may be better suited for a remote grid solution, especially if limited customers are involved.

Risk Models Used or Other Considerations for Prioritization:

- WDRM – As noted above the Wildfire Distribution Risk Model is used to inform prioritization for the Undergrounding initiative

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Prior to the 10,000-mile undergrounding announcement, PG&E had multiple undergrounding projects already underway. In 2021, PG&E completed 73 miles of undergrounding work. These miles will count for the 10,000-mile undergrounding goal.

Since July 2021, PG&E has done extensive work to validate the existing 2022 and 2023 undergrounding work plans, including identifying opportunities to increase the amount of undergrounding work that will be done in the future. PG&E has benchmarked with utilities across the country and has engaged key stakeholders who will continue to provide feedback, support, and collaboration to shape the undergrounding program.

PG&E formed an Undergrounding Advisory Group, which is comprised of stakeholders representing the following sectors: environmental and land stewardship, social justice and policy, transportation, agriculture, labor, utilities and telecommunications, access and functional needs, public safety, and counties and tribes. Members were selected based on their expertise and ability to advise on large-scale planning around issues related to infrastructure, wildfire response, permitting, climate change and the environment, community engagement, and public safety.

Impacts:

- As a result of this work, PG&E has a plan in 2022 to more than double the amount of undergrounding work compared to 2021.

- As shown in response to Remedy PG&E 21-14 in Section 4.6, PG&E has significantly expanded the planned undergrounding miles currently in scope for 2023. We are still working on mileage to add to our 2023 plan. We currently have a very small amount of undergrounding work scheduled for 2024. This work was originally planned for 2023 but has a longer dependency lead time. We have not yet started selecting undergrounding locations for 2024 workplans.

Lessons Learned:

- In August 2021, PG&E initiated a Request for Information (RFI) from domestic and international project, engineering and construction firms. The RFI requested information from these firms on their undergrounding experience including construction methods, cost assumptions, equipment and materials, program risks, safety, technology innovations, program structure, labor, and other related topics. Through this process, we gleaned insight and information on the importance of establishing an integrated program management office (PMO), the value of updating, standardizing and streamlining design and construction standards to safely and efficiently scale the program, opportunities to grow and develop the qualified workforce needed to execute the work, the prevalence of existing and emerging tools, technologies, materials and equipment that can help PG&E drive safe and efficient execution of the work and the criticality of early and frequent collaboration with all stakeholders.

- We are exploring opportunities to bundle work into larger blocks, make changes to our existing standards, reduce cycle times, deploy new materials and equipment that can improve and expedite construction and partner with telecommunications companies and agencies on joint trench opportunities.

Current Year Activities (2022):

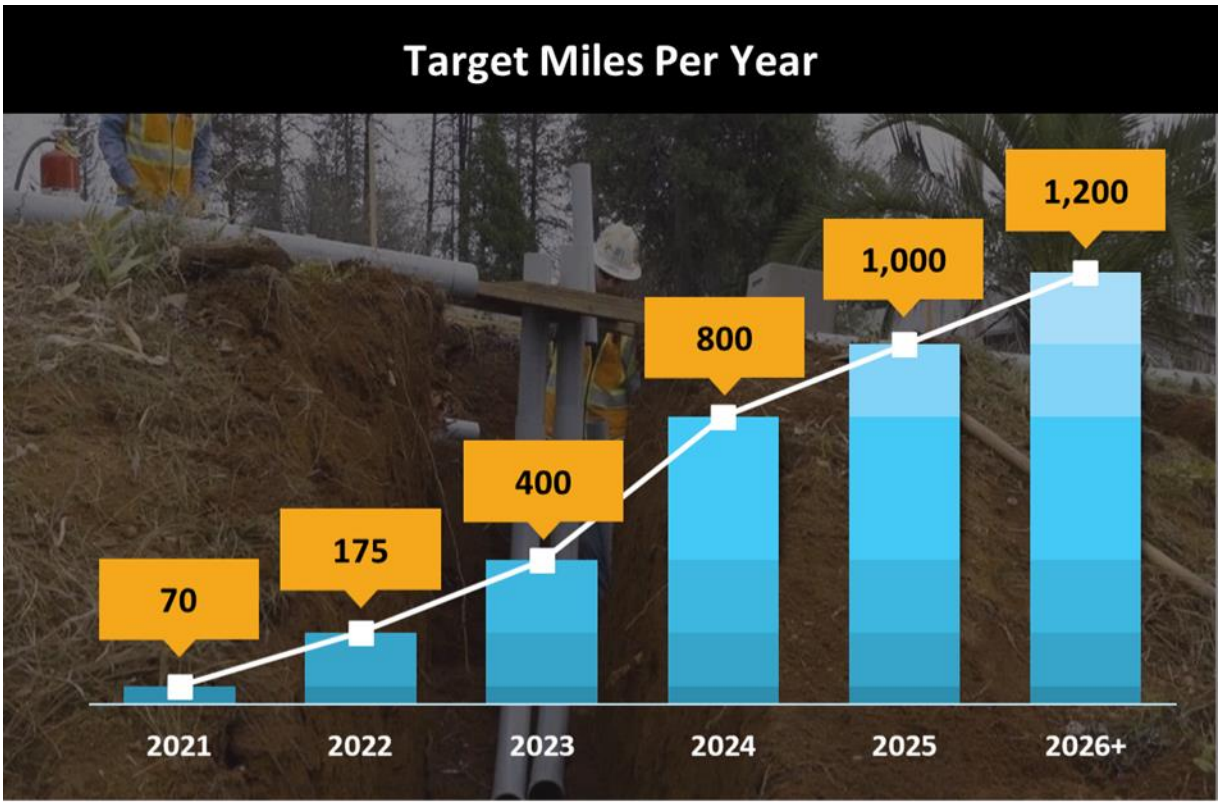
ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.10	10K Undergrounding	Complete at least 175 circuit miles of undergrounding work. The 175 circuit mile target includes undergrounding taking place as part of both System Hardening (Section 7.3.3.17.1), Butte County Rebuild efforts (Section 7.3.3.17.6) including a small volume of previously hardened overhead lines that are being placed underground, and any other undergrounding work performed in HFTD or fire rebuild areas.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

The prioritization methodology for selecting underground projects will continue to evolve over time as PG&E assesses asset and area risk and as new risk models are approved and applied. Our goal is to significantly increase underground miles annually, ramping up to 1,200 miles or more of undergrounding per year by 2026. Our current forecast for ramping up the undergrounding program is reflected in Figure PG&E-7.3.3-2 below.

FIGURE PG&E-7.3.3-2:
CURRENT UNDERGROUNDING FORECAST



As noted in Figure 7.3.3-1, the selection criteria for undergrounding mileage are based on Risk Spend Efficiency (RSE) and localized mitigation effectiveness. RSE factors in wildfire risk mitigation, PSPS mitigation, and other factors over project costs, while localized mitigation effectiveness considers project feasibility and alternative solutions and other items.

It is also important that we coordinate undergrounding work for risk reduction with other identified or future needs on a given circuit or segment. For 2023 work plans currently in development, PG&E is coordinating with other identified program work on the circuits that are currently in scope for undergrounding. For example, we evaluate outstanding electric corrective (EC) tags as well as other equipment related wildfire mitigation work plans for the same areas.

Longer term, we will be assessing and addressing the multiple needs facing the electric system on a given circuit or segment. Consideration of these current and future needs will deliver the greatest value in risk reduction and other customer benefits for every customer dollar invested.

In the coming years, PG&E also expects undergrounding to substitute for some previously anticipated overhead system hardening and vegetation management work. As we scope undergrounding mileage to achieve risk reduction, given the multi-decade service life of modern underground assets, we will also be assessing and addressing other current and future needs on a given circuit or segment. For example, we will want

to ensure that conductor and other assets installed in the early 2020s are sized to meet increased electrification driven by policy and/or customer preference in the 2030s. Consideration of these future needs will deliver the greatest value in risk reduction and other customer benefits for every customer dollar invested. Moving forward, we anticipate implementing a holistic action plan to ensure the undergrounding program delivers on its full potential by:

- Investing in training and expanding the qualified workforce for estimating/designing/constructing future underground projects;
- Implementing new planning systems and strategies to efficiently identify and scope the work;
- Deploying new standards for design and construction of underground lines that optimize the type of materials and equipment used and construction methodologies deployed and reflect the local environment (urban vs. rural);
- Deploying new and innovative tools, equipment and technologies to safely increase production rates and reduce costs;
- Building strong partnerships with existing and new material suppliers to ensure availability of materials;
- Partnering with internal natural gas teams, as well as water, sewer, phone and internet providers and agencies to joint trench and share costs, where possible; and
- Strategically packaging work, including longer sections of circuits, to take advantage of economies of scale in construction.

In Section 9.4 of Energy Safety's *Attachment 2: 2022 Wildfire Mitigation Plan Guidelines* Template, the electrical corporations were directed to include additional information in Section 7.3.3.16 regarding undergrounding implementation. Below, we provide responses to the seven issues identified by Energy Safety for inclusion in this section.

In Section 7.3.3.16 Undergrounding of electric lines and/or equipment, report on the following key information for undergrounding implementation. This information must be derived from utility-specific programs.

1) Methodology for installation and implementation

Once a high-risk overhead circuit segment has been identified, PG&E's engineering and field teams develop and analyze possible hardening solutions (i.e., undergrounding, asset removal, relocation, overhead hardening) for that circuit segment. Several possible solutions are analyzed. The recommended approach is then reviewed and approved by PG&E's Wildfire Risk Governance Steering Committee (WRGSC) before we begin designing, permitting, and constructing the approved hardening project.

Implementing undergrounding projects requires scoping circuits that meet the criteria specified above, selecting exact work location segments, and constructing projects. As stated above, we are targeting undergrounding work in high wildfire risk areas and

areas frequently impacted by PSPS events. Exact work site selection is based on a variety of RSE and local mitigation effectiveness factors, as outlined above in Figure PG&E-7.3.3-1.

PG&E continues to explore new technologies to make undergrounding more efficient to improve value, as well as our mitigation effectiveness. Our current planned methods for undergrounding installation include in Table PG&E-7.3.3-4 below:

TABLE PG&E-7.3.3-4:
PLANNED METHODS FOR UNDERGROUNDING INSTALLATION

Install Method	Areas	Pros	Cons
HDD (horizontal directional drilling)	All areas, specifically areas where trenching is prohibited or costly, water crossings, environmental concerns, rail, and highway crossings. Non-Joint Trench	Can be very effective if conditions are favorable due to reduced restoration cost. In good soils a high footage can be completed daily. No spoils export or import backfill needed.	Cross bore (third-party crossing is added dependency. Produces by- product of bentonite drill mud. Limited on lengths and turns due to soil type and machine capability.
Conventional Open Trench (Excavator and Backhoe)	All areas, specifically in joint trench or areas of congested 3rd party utilities. PG&E only multi duct systems.	Forecastable results after years of data. Can address unforeseen conflicts. Very adaptable for diverse designs.	Limited daily footage. Currently requires import, export, soil testing and typically largest restoration cost if in urban areas.
Mechanical Excavation (rock wheels and chain trenchers)	Typically, rural areas, non-improved roads, areas of non-3rd party UG conflicts.	Very high production can self-clean trench. Often can produce suitable native backfill. Narrow trench with less areas of disturbance. Reduced crew count. Low unit cost per foot.	Areas with many UG conflicts are difficult to work. Mobilization cost are higher than typical equipment, so work needs to be bundled. Some issues with trench depth or width depending on equipment availability.
Vibratory Plow	Rural areas or un-improved ROW in urban areas only.	Highest production of any other method. Lowest cost per unit on civil work. When work is scoped and designed for plows many miles per week can be completed with 1 machine.	Highest mobilization costs. Specific areas must be scoped and designed for work. Difficulty for multi-duct and joint trench but not impossible.

Materials and additional equipment innovations are being explored. For example, a recently piloted approach to undergrounding is using Cable in Conduit (CIC). CIC methodology involves laying conduit with the cable already inside. CIC works best on longer runs in rural areas with fewer customer connections and typically when there is only electric infrastructure being installed (no gas or other utilities in the trench). The benefits of CIC include more efficiency for significantly longer runs, especially in rural areas, and improved construction optionality upon installation. CIC materials can be used for all of the construction methodologies outlined above.

2) Design and design considerations (such as permitting requirements, additional hardware needed for installation, etc.)

Engineering an underground electric system requires designing the system around existing water, natural gas, telecommunications, and sewer/stormwater drainage systems, as well as planning for future road widening. As PG&E scales the underground program, we have the opportunity to innovate and evolve our approach to these important design considerations. There are various considerations for undergrounding feasibility that we take into consideration when planning new projects including:

- Geology (soil conditions), topography, and other geological/land/environmental considerations that vary significantly across our service territory; PG&E's service territory is home to over 700 protected or endangered species and over 1,800 protected or endangered plants.

- Tribal lands and tribal cultural considerations; PG&E is privileged to serve 101 tribes across our service territory and partnering with them to address their specific needs is key to the program's success

- Our critical facility customers, ingress/egress considerations for communities in HFTD areas, general public safety, and traffic management considerations

- Permitting with local and State agencies and Caltrans as well as Federal Land considerations associated with the Bureau of Land Management and the National Parks Service etc.; PG&E's service territory covers millions of acres of federal, state, and other agency or protected lands

- Procurement and availability of construction materials as the underground program scales significantly in 2022 and beyond

- Coordination with joint pole/joint trench tenants, including telecommunication companies

3) Implementation (including timeframes, prioritization, contractor and labor needs, etc.)

As stated above, PG&E plans to complete at least 175 miles of undergrounding in 2022 with a goal of increasing our underground miles annually, reaching 1,200 miles per year by 2026.

Because system hardening work is generally identified 12 or more months before construction, the decision tree that was used for selecting between various distribution system hardening methods (e.g., undergrounding, covered conductor, line removal etc.) for 2022 work was not changed to incorporate our updated 2022 goals of expanding EPSS and undergrounding. (See Section 7.3.3.17.1, Question 3(d) for additional information regarding considerations for different system hardening methods.) In 2022, PG&E is focusing undergrounding work in areas with high ignition risks and the likelihood for future PSPS events. A static map of the undergrounding work in scope for 2022 is included in response to Section 7.1.H. In addition, more detailed information regarding 2022 undergrounding work, including specific locations and risk rankings, can

be found in the spreadsheet provided in response to Remedy PG&E 21-14 in Section 4.6.

For planned work in 2023 and beyond, PG&E anticipates adjusting our system hardening decision tree to place a greater emphasis on undergrounding. We will do this by eliminating the option of installing intumescent-wrapped poles to address ingress and egress risk. In addition, we plan to implement vegetation reviews in areas with vegetation density below the current threshold for undergrounding to determine whether, in fact, undergrounding is a good option. The ability to mitigate reliability risks from EPSS may also be included in our decision-making process.

To support our proposed accelerated rate of undergrounding, we plan to:

- Use skilled and qualified internal and external resources to complete the work and scale the program, in partnership with represented labor partners;
- Look at opportunities to update, design and construction standards and work process improvements; and
- Proactively manage supply chain issues to mitigate current risks associated with global supply chain issues; we are working with our engineers and our suppliers to develop alternative solutions that meet our business requirements. We are also working to expand the supplier base for materials.

Table PG&E-7.3.3-5 below provides a timeline and general description for each undergrounding project phase. This table is based on our current small sample size of completed undergrounding projects. Durations are an approximate estimate in months for the average project, some phases occur concurrently, and actual durations vary significantly from project to project.

TABLE PG&E-7.3.3-5:
APPROXIMATE PROJECT DURATION TIMELINE UNDERGROUNDING

Phase	UG Duration	Notes
Scoping (Preliminary, Field, and Final)	4 months	Scoping determines the method of hardening. Most projects have multiple hardening methods considered.
Estimating and Design	6 months	Detailed plans (estimate and design) are created. This can be performed by either contract or internal estimators.
Dependency (Permitting and Land Rights)	9 months	All necessary permits (CalTrans, BLM, local agencies etc.) and land rights are obtained.
Construction Resourcing and Contracting and Scheduling	3 months	Projects are assigned to either internal construction crews or contractors. Vendors are selected primarily through a unit price mechanism by region. Projects are scheduled once a resource has been identified and dependencies are completed to allow construction start.
Construction	9 months	Construction activities are completed per construction standards. QA inspectors (with the construction crews) ensure each project is built to standard and provide immediate feedback if necessary without waiting for the project to be fully complete. Clearances (planned outages) are taken when necessary to complete the projects and tie-in customers to the newly installed assets.
Document and Close Out	3 months	Gather all project documentation for completion including the final, as-built construction package. Mapping of the new assets into PG&E's GIS maps. Close out project.

Undergrounding projects have a long lead time. Projects that we are currently scoping will likely be executed in 2023 and 2024. We believe it is important to have additional work in scope in the event we encounter execution challenges. In addition, optimizing and shortening cycle time is a key area of focus in the scaling of the undergrounding program.

4) Long-term operations and considerations (including maintenance, long-term effectiveness and feasibility, effectiveness monitoring, etc.)

The baseline expected lifespan of modern undergrounded lines is approximately 50 years. However, in many cases, newer underground lines are expected to last much longer because of engineering innovations like application of jacketed cable. Certain environmental conditions can impact the lifespan of underground lines and equipment including proximity to fault lines, flooding and saltwater intrusion and groundwater quality. To ensure PG&E's electrical system is functioning properly, a detailed inspection (including infrared) of subsurface underground equipment would be performed on a 3-year cycle. Currently, PG&E performs detailed inspection (including infrared) of pad-mounted equipment every three years, instead of every five years as required by GO 165. Patrols would continue to be performed on an annual basis.

Based on the findings from these inspections and patrols, we will repair and maintain installed undergrounding lines accordingly.

Vegetation management needs are also expected to reduce as undergrounding assets become more prevalent. There are over 8 million trees within striking distance of our lines and in the past year we removed approximately 300,000 trees and trimmed approximately one million trees. Many of these trees that require vegetation management work are in HFTD areas where undergrounding work is being targeted. As PG&E increases undergrounding efforts, vegetation work and the associated costs can be reduced and, for some circuit segments, eliminated.

5) Key assumptions

Below are some key assumptions relevant to the undergrounding initiative described in this section:

- When evaluating potential undergrounding projects, the primary objective is to target undergrounding in the areas where the wildfire threat and PSPS impacts have been the highest. This is currently based on the 2021 WDRM v2 and the 10-year PSPS lookback, and will be based on updated risk models and PSPS lookbacks as these are finalized, approved, and available for use in the planning process.

- Alternative solutions, such as overhead hardening or remote girds, are considered along with undergrounding.

- Estimated timelines for projected undergrounding work assume materials are readily available and that a workforce is available to perform the work.

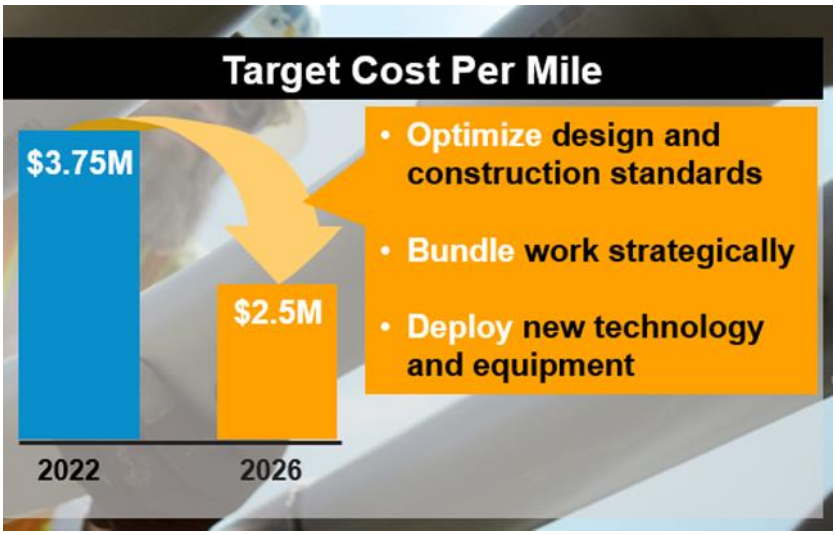
- Costs will vary depending on environment/ground conditions, rural versus urban, construction complexity, permitting and other factors.

PG&E will also take into account locations where constructability, including but not limited to, permitting, land rights and community impacts are most optimal, when planning, sequencing, and executing undergrounding work.

6) Cost effectiveness evaluations (including cost breakdown per circuit mile, comparison with alternatives, etc.)

In the past, undergrounding has been done on a limited basis. Thanks to achievements on undergrounding projects in recent years, undergrounding will now play a much more prominent role in PG&E's ongoing efforts to harden the electric grid. PG&E's goal is to substantially reduce the cost of undergrounding. In the past, the cost has been over $4 million per circuit mile. We are currently targeting a reduced average cost of $3.75 million per circuit mile in 2022 and aim to reach $2.5 million per circuit mile by 2026, as shown in the Figure PG&E-7.3.3-3 below.

FIGURE PG&E-7.3.3-3:
UNDERGROUNDING COST TARGETS



In the areas where PG&E will underground in the coming years, PG&E believes that undergrounding is the most economically beneficial long-term option for our customers. The cost of converting an overhead distribution powerline to an underground powerline depends on several variables, such as density of nearby residences and businesses, surrounding vegetation, the number of powerlines involved, other existing structures underground, terrain, road width (work access), nearby sidewalks (to comply with the Americans with Disabilities Act) and other environmental, land and permitting issues. As reflected in Figure PG&E-7.3.3-3, we expect the unit cost of underground will decline over time through new standards for design and construction, bundling work in large packages, reducing project cycle times, and deploying new and innovative tools, equipment, and technology. This, coupled with reduced operations and maintenance costs, results in economic benefit for customers.

PG&E is committed to completing this work safely and affordably and we are realizing efficiencies that have reduced the average cost per mile and will continue to do so as the program grows. PG&E is reviewing the current portfolio of work and, where possible, shifting focus from overhead hardening to undergrounding to achieve our milage targets.

Finally, PG&E anticipates that increasing undergrounding work across HFTD areas in our service territory will reduce the need for certain vegetation management activities. As a result, we expect to reduce the future costs associated with vegetation management as the scale of undergrounding increases.

7) Any other activities relevant to the undergrounding implementation

Undergrounding is considered alongside numerous other wildfire mitigation activities in System Hardening as described in Section 7.3.3.17.1, Question 3d.

7.3.3.17 Updates to Grid Topology to Minimize Risk of Ignition in HFTDs

OEIS Initiative Definition: Changes in the plan, installation, construction, removal, and/or undergrounding to minimize the risk of ignition due to the design, location, or configuration of utility electric equipment in HFTDs.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.17.1 – System Hardening – Distribution;
- 7.3.3.17.2 – System Hardening – Transmission;
- 7.3.3.17.3 – Non-Exempt Surge Arrestor Replacement Program;
- 7.3.3.17.4 – Rapid Earth Fault Current Limiter;
- 7.3.3.17.5 – Remote Grid; and
- 7.3.3.17.6 – Butte County Rebuild Program.

7.3.3.17.1 System Hardening – Distribution

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

PG&E's System Hardening Program focuses on the mitigation of potential catastrophic wildfire risk caused by distribution overhead assets. This program targets the highest wildfire risk miles and applies various mitigations such as line removal, conversion from overhead to underground, application of remote grid alternatives, mitigation of exposure through relocation of overhead facilities, and in-place overhead system hardening. For 2022, the highest wildfire risk miles are separated into four categories:

1. The top 20 percent of circuit segments as defined by PG&E's 2021 WDRM v2 for System Hardening,

2. Fire and Major Emergency rebuild within HFTD,

3. PSPS mitigation projects; and

4. Locations identified by PG&E's Public Safety Specialist (PSS) team as presenting elevated wildfire risk.

PG&E also considers secondary risks and benefits as part of the System Hardening Program effort such as PSPS impacts, egress/ingress routes to support fire department response times and public safety, past fire history and effects on available fuels, current system condition, environmental risks to reconstruction activities, and general accessibility considerations to enhance employee safety.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

Distribution overhead assets represent high ignition risk due to a combination of a high exposure area (overhead assets traversing HFTD areas) and proximity to risk factors such as vegetation. For utility equipment, estimated distribution related ignitions per circuit mile are 1.6 times that of transmission related ignitions. For vegetation drivers, estimated distribution ignitions per mile are up to 6x greater than for transmission circuits.

PG&E's System Hardening Program is an important initiative that can reduce wildfire ignitions caused by distribution facilities. The System Hardening Program targets the highest wildfire risk miles as identified by PG&E's 2021 WDRM v2 for system hardening (the WDRM is explained in further detail in Section 4.5.1(b)), and targets overhead structures impacted directly by wildfires, those areas most impacted by PSPS or areas identified by PG&E's Public Safety Specialists as posing elevated wildfire risk. There are several ways that locations are identified for system hardening including:

- Circuit segments with the highest wildfire risk using the 2021 WDRM v2
- Locations where past events have identified deteriorated overhead conductor;
- New Business, WRO, and Capacity projects in HFTD/HFRA areas;
- Projects to mitigate the need for PSPS in certain areas;
- Fire damaged line sections requiring rebuild; and
- Idle facilities, remote grid installations, or other line removal opportunities.

Relation to and Impact on Other Initiatives:

The System Hardening Program includes initiatives discussed in Sections 7.3.3.3 (covered conductor installation), 7.3.3.16 (undergrounding), and 7.3.3.17.5 (remote grids). These initiatives are evaluated as alternatives under the System Hardening program when scoping the risk mitigation most appropriate for a targeted circuit segment.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: As discussed above, the System Hardening Program identifies locations to perform this work based primarily on PG&E's 2021 WDRM v2. Projects are prioritized at the circuit segment level. In addition to the highest priority segments based on the risk model, projects are also included in the system hardening portfolio when needed to address overhead structures damaged directly by wildfires (described in subsection (e) below), those areas most impacted by PSPS and locations identified as being at elevated risk by PG&E's Public Safety Specialist team.

The following mitigation options (subsections (a)-(c)) are considered for each circuit segment when developing a System Hardening Program project. The evaluation process for these system hardening alternatives is discussed in subsection (d). Finally, this section also describes PG&E's consideration of Buffer Zones in system hardening (subsection (e)).

(a) Line Removal and Remote Grid:

Complete removal of an existing overhead distribution line will fully eliminate the fire risk associated with that line and is therefore explored for every identified system hardening project. A line removal mitigation can be applied in various ways. The simple application of this mitigation alternative is for known, or suspected, idle facilities that are not currently serving customer load. PG&E follows the procedures and requirements in Utility Procedure: TD-2459P-01 "Idle Facility Program" to investigate potential idle facilities and determine if they can be permanently removed. Another line removal alternative is the rearrangement or re-alignment of the existing circuit path to serve customers through an alternate route. PG&E reviews the targeted circuit segment for

redundant distribution ties in high-risk areas. It may be possible for the removal of certain circuit segments to have little impact on operational flexibility and provide the most cost-effective measure to reduce wildfire risk. Finally, a future removal opportunity lies with the application of the Remote Grid alternative discussed in Section 7.3.3.17.5.

Line removal is able to fully eliminate the wildfire ignition risk of a line while, at the same time, typically being much less expensive than other system hardening methods. Accordingly, line removal is a preferred method of system hardening, in the limited locations where it is feasible.

(b) Relocation of Overhead to Underground:

PG&E will relocate existing high-risk overhead distribution lines to underground as part of this mitigation. Please see Section 7.3.3.16 for more specific details regarding underground work. In particular, our response to Question 3 within Section 7.3.3.16 addresses where undergrounding is being prioritized in PG&E's service territory.

(c) Overhead Hardening:

Historically, the most frequently used method for system hardening has been overhead hardening. Overhead system hardening can be done more quickly than many other alternatives through existing land rights and easements. After analyzing projected performance of overhead hardened facilities on more than 4,600 outage types, it is projected that overhead system hardening will reduce 62 percent of the distribution overhead asset ignitions from either equipment failures or due to external contact such as vegetation.

PG&E prioritizes overhead system hardening work in areas where the following work can be completed:

- Primary and Secondary Covered Conductor Replacement – Replacement of bare overhead primary (high voltage) conductor and associated framing with conductor insulated with abrasion-resistant polyethylene coatings (sometimes referred to as covered conductor or tree wire). This can be an effective mitigation of wildfire ignitions on distribution lines. Installing covered conductor can help reduce the likelihood of faults due to line-to-line contacts, tree-branch contacts, and faults caused by animals. Installing covered conductor on secondary lines has similar benefits as for primary lines.

- Pole Replacements – All existing poles are evaluated for the strength requirements to withstand the new heavier covered conductor. Often the majority or all poles on a circuit segment will need to be replaced to support the new, heavier covered conductor and associated equipment. When poles need to be replaced alternate materials are considered as PG&E has tested and confirmed that composite poles and intumescent wrapped poles have increased fire damage resiliency to reduce the risk of a pole failure during a wildfire.

- Replacement of Non-Exempt Equipment – Replacement of existing primary line equipment such as fuses/cutouts and switches with equipment that has been certified by California Department of Forestry and Fire Protection (CAL FIRE) as low fire risk is another component of our System Hardening Program. This replacement

work eliminates overhead line equipment and devices that may generate exposed electrical arcs, sparks, or hot material during their operation.

- Replacement of Overhead Distribution Line Transformers – Upgrading transformers to those that contain "FR3" dielectric fluid as part of PG&E's current equipment standards (PG&E implemented the transition from mineral oil to FR3 in 2014) can also be an effective wildfire ignition mitigation. Newer transformers are filled with fire resistant "FR3" insulating fluid, a natural ester derived from renewable vegetable oils—providing improved fire safety, transformer life, increased load capability, and environmental benefits. In addition, new transformers are manufactured to achieve higher Department of Energy electrical efficiency standards.

- Framing and Animal Protection Upgrades – Replacing crossarms with composite arms, wrapping jumpers, and installing animal protection upgrades reduce the risk of animals contacting electric equipment and pole related ignition risks.

- Vegetation Clearing – Vegetation is a critical component of the System Hardening Program. To access our facilities to construct the hardened assets it often requires significant undergrowth clearing, which removes vegetation on the ground directly beneath the lines. In addition, some of the previously mentioned components of a system hardening project require additional clearance space to execute. Regulatory requirements mandate 4 feet of clearance between primary electric equipment and vegetation all year long, so that if there is a change to a line's route, including using taller poles or wider cross-arms, the vegetation must be cleared to be consistent with any changes and provide the required clearing for new overhead lines.

In 2022, PG&E is still prioritizing overhead conductor system hardening, including covered conductor replacement, as the primary means of distribution system hardening. However, as explained in Section 7.3.3.16, going forward, we will be placing a greater emphasis on undergrounding overhead lines in and near high fire threat areas to harden our distribution system.

(d) System Hardening Process – Alternatives Consideration by Location and Final Design

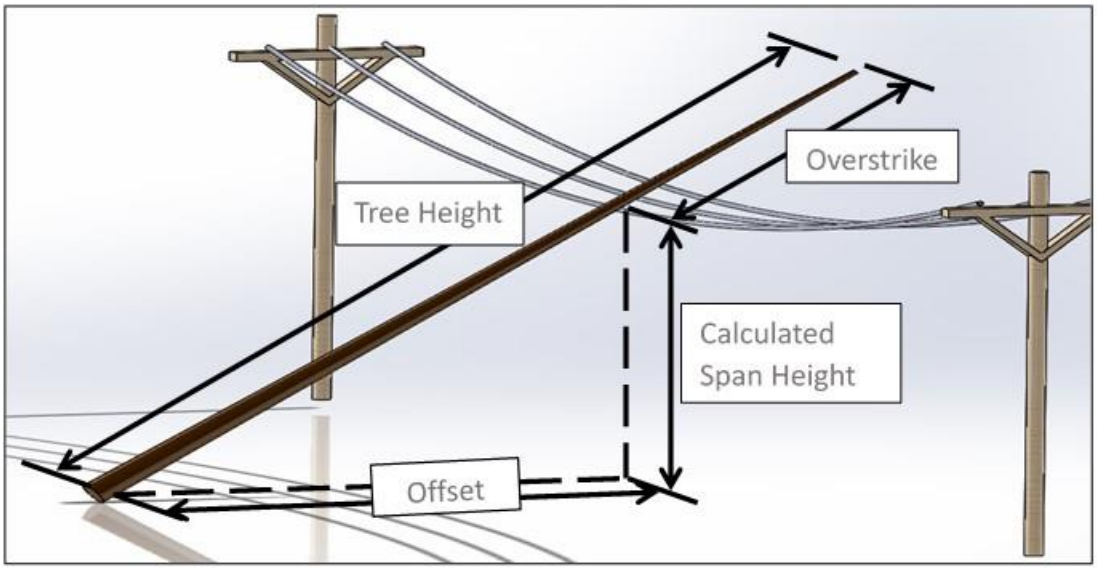
Once a circuit segment, or a portion thereof, is targeted for system hardening, PG&E's Distribution Planning Engineers develop three primary alternatives for construction: (1) all underground; (2) all overhead; or (3) a hybrid alternative utilizing the specific hardening alternative thought to be the best fit for each section in the project. Line removal options are also considered during this scoping phase, where it is feasible.

The system hardening project design options are brought to a scoping desktop review team made up of various experts to discuss and analyze the system hardening criteria set forth in Figure PG&E-7.3.3-1 including, but not limited to, wildfire, PSPS, reliability, and public safety risk reduction as well as project costs. Mitigation effectiveness is also evaluated based on executability concerns, alternative solutions, ingress/egress issues, and tree density.

The tree strike potential factor is analyzed by PG&E's Applied Technical Services team. LiDAR data is processed to extract precise pole, wire span, and fall-in tree geospatial

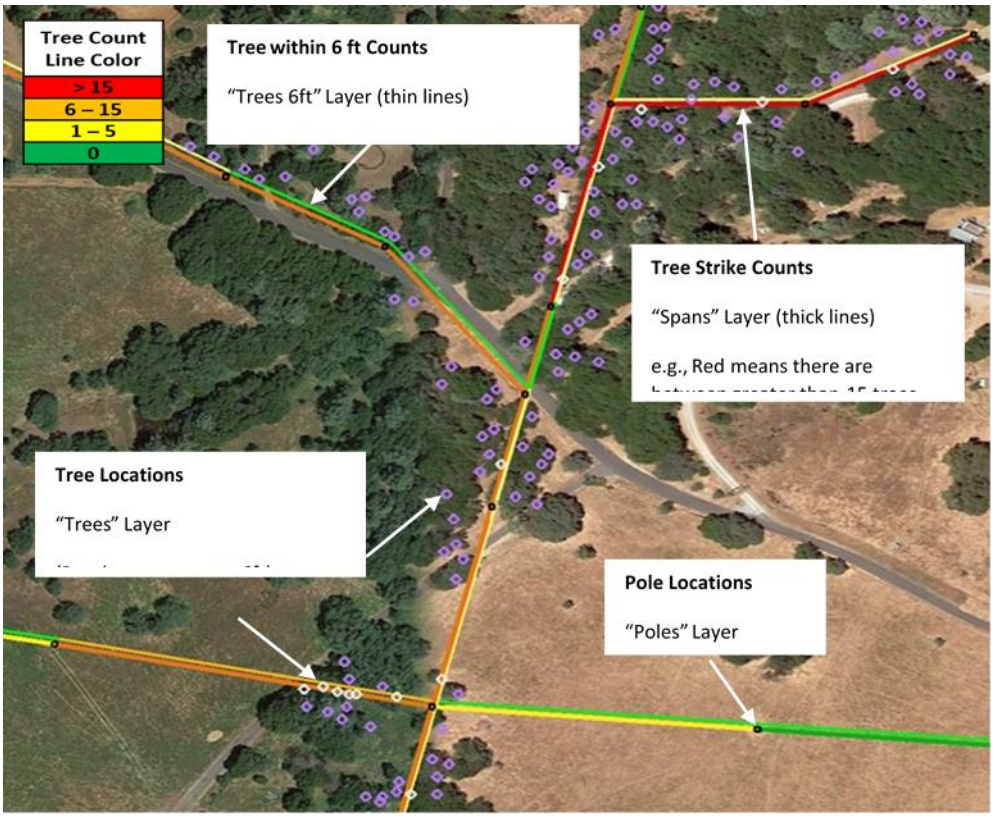
information. This data is processed into an excel spreadsheet to determine Tree-span-pole associations. The tree strike threat is calculated as the number of fall-in trees in each span that can touch and break the line. A “fall-in tree” is a tree that is tall enough to potentially strike and break the hardened the span regardless of wind direction (i.e., when there is a non-zero overstrike). Figure PG&E-7.3.3-4 shows an example of the overstrike assumptions used to calculate this risk.

FIGURE PG&E-7.3.3-4:
OVERSTRIKE ASSUMPTIONS USED TO CALCULATE RISK



Spans are then ranked based on the number of fall-in trees in each span. The results are outputted to Google Earth for visualization. The lines are color coded to represent the number of fall-in trees that can touch and break the line: Red for greater than 15, Orange for 6 to 15, Yellow for 1-5, and green for 0. Figure PG&E-7.3.3-5 below is an example of the fall-in tree count and color coding for a potential system hardening project. Cost and constructability are key considerations for the final mitigation alternative that is chosen, but it is important to know and assess this tree fall-in potential risk as it is the largest single remaining risk for an overhead line that has been hardened.

FIGURE PG&E-7.3.3-5:
TREE COUNT AND COLOR CODING FOR POTENTIAL SYSTEM HARDENING



Ingress, egress, fuel types and past fire history are also determined and provided by PG&E's Public Safety Specialist (PSS) to the field scoping desktop meeting. The PSS team are PG&E's field fire risk experts, many of them with significant first responder experience that help inform PG&E's decision-making process. They analyze the area with a fire fighters' mindset to better understand the fuel types in the area, the historical fires, and the main egress and ingress routes. These experts are invaluable in providing analysis and first-hand experience in these areas, often working with local fire officials to understand the risks and available mitigations. Within the field scoping desktop meeting, it is often recommended to protect main egress routes through undergrounding, relocation, or installation of fire resilient poles. Areas where an ignition may be hard to spot are often areas a relocation may be chosen to ensure response times for local first responders are minimized.

The execution of these projects must consider the various environmental and other conditions found in HFRAs. Land and environmental specialists analyze the alternatives provided prior to the desktop meeting and Google Earth images are provided to aid in the analysis. Where significant environmental risks, water features, endangered species, and habitats, known cultural areas, and local agencies required for the new rights are identified, appropriate scope, schedule, and cost impacts are discussed to aid in the decision making.

Projected PSPS impacts are also analyzed by the meteorology team and provided to the project scoping team to aid in the understanding of past potential frequency and

customer impact. In areas where eight or more events would have been experienced, or greater than 1,200 annual customer meters are projected to be impacted, the design alternative for undergrounding is strongly recommended due to the potential PSPS mitigation benefits. At the time we scoped the 2022 System Hardening projects, this represented approximately the top 25% of customers impacted by PSPS. This avoided PSPS benefit can still be difficult to capture in all cases due to the radial (i.e. "one-way") nature of the majority of PG&E's distribution system. If lines that are targeted for hardening are undergrounded, but the source of electricity is still coming from overhead lines that are likely to be de-energized, the PSPS savings may not be realized until significantly more work is done.

Utilizing all this information, the field scoping team will review the design alternatives provided, make changes as necessary, and provide a final field scope document to the estimating team. An estimator then performs a field check to analyze the assumptions made during the field scoping desktop meeting to confirm viability, constructability, and execution risks associated with the mitigations chosen.

Once the design alternatives have been vetted to this level, a final economic analysis is performed creating net present values for the lifetime costs of each design approach, including long-term maintenance needs and costs including annual vegetation management, inspections, etc. A final recommendation and associated documentation are then submitted to PG&E's WRGSC to review the project scope, RSE and related analysis. The WRGSC provides guidance and approval for the projects that the System Hardening Program should execute upon and the mitigation action to be taken on each project. Once approved, these projects are scheduled for final design, permitting, and execution.

(e) Urgent Fire Rebuild Targeted for System Hardening

During PG&E's emergency response to a wildfire that has damaged our overhead or underground assets, several alternatives may be considered when restoring services to customers. The following guidance has been provided to the Grid Design Engineers, estimators, and assessment leads when choosing the best rebuild alternative tailored to the needs of the area. These alternatives are provided in the order of consideration for each segment and circuit for evaluation:

- Removal – Radial tap lines that are identified as Idle Facilities or circuit back-ties that are not required by our design standards for operational flexibility should not be rebuilt or they should be removed;

- Remote Grid or Customer Self-Provided Standalone Power System (SPS) – Lines may not be rebuilt where there are isolated customer(s) in Tiers 2 and 3 HFTD areas fed by greater than a half mile of distribution line that, if removed or not rebuilt, could be served remotely through temporary generation solutions until a permanent SPS is installed;

- Underground – Distribution primary conductor in an accessible area with adequate space and rights to facilitate underground infrastructure. Many of the considerations discussed in Section 7.3.3.16 (Undergrounding) are considered when evaluating the appropriateness of rebuilding assets underground. Please note that temporary

generation may be required to support immediate customer power restoration while the underground planning and construction project progresses;

- Overhead Hardening in a Different Location – Distribution primary conductor through rural, heavily wooded, or inaccessible terrain should be evaluated for relocation to a road or more accessible location. Temporary generation may be required to support immediate customer restoration while the planning and construction progresses;

- Overhead Hardening in Place – This solution is appropriate for primary distribution overhead conductor in Tiers 2 and 3 HFTD areas where >4 spans require full reconstruction or large sections of intermittent damage (generally greater than 50 percent of the segment) requires rebuild. These lines often represent mainline or major customer lines where customers cannot be effectively supported with generation or switched to alternate sources of power and serve large sections of customers and/or critical facilities;

- Restore in Place – When intermittent damage is found without significant rebuild required; and

- All of the Above – Some combination of all of the above depending on the circumstances for a given circuit.

Once an entire segment has been assessed, the Grid Design Engineer works closely with the Estimating team to document the damage notifications into a Google Earth image to clearly identify the damage found on the distribution assets. Then routes are determined, and initial recommendations are made for protection, switches, and wire size. These designs are sent to estimating to discuss with the incident commander at base camp, to distribution planning for fuse sizes and protection settings, and to land and environmental to begin the process of easement acquisitions and dependency clearing. In some cases, more time dependent alternatives may be rejected in favor of quicker mitigations to support customers by quickly restoring service to a community, for example when the use of local, temporary generation until new assets can be constructed is not practical. The incident commander at the assigned base camps has final authority to ensure that customer needs are being met. This process is included in the PG&E Emergency Response Guidance Document Library as EMER-4004S "Requirements for System Hardening During Emergency Response."

(f) Buffer Zones

In addition to work performed in HFTD areas, PG&E may also perform system hardening into "Buffer Zones." Buffer Zones are areas immediately adjacent to an HFTD area. Because a specific distribution line may continue from an HFTD area into a Buffer Zone, hardening the line may include both hardening HFTD and Buffer Zone portions of the line.

Risk Models Used or Other Considerations for Prioritization:

- 2021 WDRM v2

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

As indicated in the 2021 WMP, PG&E switched over from REAX to Technosylva as our Wildfire Consequence Modelling tool in 2021. The Wildfire Consequence Model was incorporated into the 2021 WDRM v2. This change and other associated improvements in our modeling, data, and understanding of fire risk, led to a shift in thinking about where to target system hardening resources.

As presented in the 2021 WMP, the highest wildfire risk miles were separated into three categories:

1. The top 20 percent of circuit segments as defined by PG&E's 2021 WDRM v2 for System Hardening;

2. Fire and Major Emergency rebuild within HFTD; and

3. PSPS mitigation miles.

PG&E targeted 180 miles in 2021 and completed approximately 210 miles which includes undergrounding, removal, and overhead hardening. See Table PG&E-7.3.3-6 below for historical System Hardening work completed from 2019 to 2021.

TABLE PG&E-7.3.3-6:
HISTORICALLY-COMPLETED SYSTEM HARDENING MILES

	Historical Completed Miles			
Year	OH	UG	Removal	Total
2021	147.1	40.1	23.3	210.5
2020	334.1	4.6	3.4	342.1
2019	131.7	6.8	32.6	171.1

Note: The 2021 System Hardening UG total shown here does not include any undergrounding that took place as part of the Butte Rebuild.

PG&E has a target that 80 percent of the system hardening miles be highest risk miles (Category 1 above) and 10 percent must be performed through undergrounding or asset removal over the 3-year period from 2021-2023.

Although PG&E hardened fewer miles in 2021 than in 2020, PG&E used 2021 to rebuild our pipeline of projects for 2021-2023 in alignment with the new risk model. Over 1,300 miles have been identified, scoped, and approved to proceed. In doing so, the pace of system hardening will increase substantially going forward.

See Table PG&E-7.3.3-7 below for System Hardening Miles that have been scoped for future work.

TABLE PG&E-7.3.3-7:
SCOPE APPROVED SYSTEM HARDENING MILES

	Scope Approved Miles			
Year	OH	UG	Removal	Total
2022	407.3	204.6	34.7	646.6
2023	278.5	108.7	54.1	441.3
2024	0.0	0.8	16.3	17.1

Note: Scope approved miles are representative of current work plans as of February 4, 2022. The scope approved miles exceed 2022 WMP targets to account for unanticipated challenges in execution. The 2022 scope approved mileage for undergrounding does not include Butte County rebuild mileage. Scope approved miles for 2023 do not represent targets.

As indicated, we currently have a very small amount of undergrounding work scheduled for 2024. This work was originally planned for 2023 but has a longer dependency lead time. We have not yet started selecting undergrounding locations for 2024 workplans. As project schedules are better defined, the work plan forecasts will continue to change.

Impacts:

- Changes to the risk model creating downstream impacts for the current year work plan where engineering, design and other system hardening activities were compressed in 2021
- Although less system hardening miles were completed in 2021, updates to the risk model were incorporated into current year work plan, which resulted in a higher risk reduction than if PG&E stayed with the current miles scoped under the previous risk model

Lessons Learned:

- Changes to future risk models should inform future year work plans, and minimize making in-year changes to the work plan to mitigate work plan disruptions

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.11	System Hardening – Distribution	Complete at least 470 circuit miles of system hardening work which includes overhead system hardening, undergrounding and removal of overhead lines in HFTD or buffer zone areas with the exception of any mileage being undergrounded and tracked separately as part of our Butte County Rebuild efforts (Section 7.3.3.17.6).	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – In addition to increasing the pace of system hardening work in upcoming years, as PG&E continues to develop our risk models, we will be able to incorporate more data sets, make further programmatic refinements and better scope and target our System Hardening Program. We will be analyzing hardened facilities performance with regard to actual outages, incidents, and ignitions so that we can continue to refine our strategy and improve the scope of the System Hardening Program. Performance of hardened facilities that experience a wildfire will also continue to validate assumptions on life expectancy and effectiveness of hardened facilities (like intumescent wrapped poles) in various conditions.

PG&E's more recent improvements to underground unit cost will also change the alternative analysis comparisons such that undergrounding will be more pronounced in future targeted system hardening work beginning in 2023 and beyond. The anticipated update to the WDRM in 2022 will inform the 2024 System Hardening workplan including undergrounding. In addition, improvements in protection schemes—such as Rapid Earth Fault Current Limiters (REFCL) and EPSS —may allow for a reduced level of work required to make safe a line in a high risk area. Finally, we will seek closer alignment of our system hardening efforts with PSPS mitigation opportunities.

7.3.3.17.2 System Hardening – Transmission

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Ignition Risk – Equipment – Structures

PG&E does not have a single, specific System Hardening program for transmission assets. Rather, transmission related programs harden PG&E's transmission system and mitigating ignition and wildfire risk. Work described in this section either lessens wildfire risk by: (1) replacing or reinforcing assets, (2) removing electrical assets from HFTD areas, (3) sectionalizing or providing alternate means of customer service, or (4) reducing wildfire risk by mitigating hazards such as vegetation or animal contact.

PG&E's programs that are related to hardening the transmission system are described in several other WMP sections, such as maintenance notifications (Sections 7.3.3.12.3 and 7.3.3.15), which include items such as asset replacements, life extension and repairs and animal protection upgrades, sectionalizing devices (Section 7.3.3.8.2) and vegetation clearing in rights-of-way (Section 7.3.5.3). These initiatives either help reduce wildfire risk through prevention of asset failure or provide operational flexibility to help reduce customer impact during PSPS events.

Additionally, other programs related to hardening include:

Conductor Replacement – Replacement of conductor in HFTD areas reduces wildfire risk. This initiative represents conductor mileage replaced on lines traversing HFTD, based on forecasted in-service dates in 2022. Mileage may be added in the event of emergent in-year conductor replacements, and execution concerns, such as supply-chain limitations on material or clearance availability may impact total completed mileage in 2022. Some mileage may have partial construction in 2021, but may be counted towards 2022 upon the project release to operations.

Line De-energization, Grounding and Removal – PG&E follows the procedures and requirements in Utility Procedure:TD-1003P "Management of Idle Electric Transmission Line Facilities Procedure" to investigate potential idle facilities. When these facilities are identified and confirmed to be within an HFTD area with no operational needs, they are prioritized for de-energization, grounding, and/or removal. Grounding of an already de-energized line addresses residual wildfire risk of induction from nearby energized line(s), until conductor removal or repurposing of the facilities can occur. Transmission lines may also be considered for temporary or seasonal de-energization depending on the operating needs and wildfire risk of the line.

Transmission lines may be removed as part of the idle facility process, or through other work such as line re-routing or re-building. As referenced in SED-6, PG&E is preparing a 10-year plan to remove permanently abandoned transmission lines in connection with the settlement of the Kincade Fire with the CPUC's Safety and Enforcement Division. Removal of energized lines reduces overall exposure to wildfire risk.

Transmission System Islanding and Temporary Substation Microgrid (as needed) – In some high wildfire risk scenarios, such as PSPS events, transmission islanding schemes and temporary substation microgrid may be the used to mitigate wildfire risk and reduce customer impact. The islanding schemes (such as the Caribou Power House or Humboldt Bay Power Plant Islands) allow a local area of transmission lines and substations to stay energized via local generation, as the system's primary transmission line sources are de-energized for wildfire safety purposes. The temporary substation microgrid focuses on serving substations that have safe-to-energize load. Both of these mitigations allow for those at-risk lines to be de-energized for wildfire risk mitigation, while keeping customers energized.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Asset replacement type of "hardening" reduces the probability that an asset will fail and cause a wildfire. This reduction can be a combination of replacing aged, degraded assets, as well as providing more robust, up-to-standard designs. Asset removal "hardening" eliminates wildfire risk by removing the energized electrical components. Asset life extension "hardening" provides extra strength/life to assets, reducing the probability of asset failure/ignition. Asset hazard mitigation "hardening" reduces the probability of an energized asset contacting birds or vegetation and in turn those contacts causing ignitions. For example, new equipment may have larger clearances, installation of bird mitigation, or removal of strike potential trees may help reduce risk of asset failure and ignition.

- Reduce number of customers impacted – Customer impact reducing measures such as transmission line sectionalizing and islanding lessen the number of customers that may experience interruptions during PSPS events (or other reliability/outage events).

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – The transmission system is hardened when inspections and repairs are completed – meaning that risks are identified and corrected, leading to both lower overall wildfire risk, as well as intelligence to de-energize transmission assets due to asset health concerns during PSPS events.

- Vegetation Management – Clearing of vegetation around transmission assets can reduce wildfire risk (thus providing the effect of system hardening) due to vegetation contact.

- PSPS – Providing alternate means of power for customers during PSPS events provides a level of resiliency to the transmission system. Specifically, temporary system islanding schemes allow for at-risk lines to be de-energized for wildfire risk mitigation, while keeping customers energized. Sectionalizing Devices can also help isolate customers and reduce PSPS impact.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: For some programs discussed in this section, the prioritization will be described in its main WMP section – transmission maintenance (Section 7.3.3.12.3 and 7.3.3.15), sectionalizing devices (Section 7.3.3.8.2) and vegetation clearances (Section 7.3.5.3).

Urgent fire rebuilding and System Islanding and Temporary Substation Microgrids are deployed on an as-needed basis. For example, part of the Caribou area 60 kV lines required rebuilding after the Dixie Fire.

The work identified in the 2022 target represents in-flight conductor replacement or removal projects that are projected to be in-service in 2022. Only work within HFTD areas are included in this target, though work outside of HFTD may be necessary to release new conductor into service (depending on the segmentation of the line, some lines may span both HFTD and non-HFTD areas within the same segment).

Conductor replacement projects may be prioritized based on several factors, such as asset health, wildfire consequence, public safety factors, system capacity needs and compliance requirements (e.g., GO 95 ground clearance considerations).

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable – Multiple factors are considered for in-flight conductor replacement and removal work within the 2022 target.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Replace/Remove Conductor Miles – In 2021, PG&E completed 93.8 miles of conductor replacements and 10 miles of conductor removals. All this work took place on lines traversing HFTD areas.

Impacts:

- Removed conductor mileage eliminates asset-ignition related wildfire risk in those locations. Additionally, replaced assets will generally have a lower probability of failure since they are up to current design standards and lack time-based degradation such as corrosion or wear.

Lessons Learned:

- Align on clearly defined metric definitions and track each project scope based on HFTD and non-HFTD mileage completion.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.12	System Hardening – Transmission	Remove or replace 32 circuit miles of transmission conductor on lines traversing the HFTD areas or HFRA.	12/31/2022	Quantitative

Overall, the 2022 targets for conductor replacement and removal are lower than 2021 because Conductor projects typically span multiple years; therefore some years have more mileage placed into service than other years. Interim risks are continuously managed through inspection and maintenance programs.

Some in-progress projects are forecasted in service towards the end of 2022, which are not included in the target given significant execution challenges. Execution challenges include material availability (long lead times have about doubled), clearance availability, permitting, and competing resources with emergent work such as fire rebuild projects.

PG&E notes that this target includes line miles for permanently abandoned transmission lines that will be removed as part of the Administrative Consent Order and Agreement between the CPUC's Safety and Enforcement Division and PG&E to resolve the 2019 Kincade Fire.[89]

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Continue to improve the risk-based approach for new conductor projects – PG&E is working to focus new projects on targeting highest risk conductor assets. Additionally, for projects driven by other factors such as capacity, we will consider wildfire risk and asset health drivers when scoping the project, to bundle work and address multiple risks at once. This may include utilization of the Wildfire Transmission Risk Model as a factor for prioritization.

Consider deployment of additional life-extension methods to strengthen asset health – Using shunt splices on conductor or fiber wrap on degraded tower foundations may help prolong useful asset life, while still focusing on replacement for the highest risk assets.

Efficiency Improvements – PG&E is seeking to reduce unit costs of maintenance tag work, capitalization where appropriate, and maintenance tag and/or project execution bundling when possible.

89 Res.SED-6.

7.3.3.17.3 Non-Exempt Surge Arrester Replacement Program

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

The surge arrester sub-initiative is a program that replaces existing non-exempt surge arresters with exempt surge arresters, which have less propensity to cause a fire ignition. In addition, while PG&E performs replacements, we separate transformer and surge arrester grounds at these locations.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – Mitigating non-exempt surge arresters involves replacement with new surge arresters which are considered CAL FIRE exempt and certified as equipment which reduces the likelihood of an ignition during normal operation. In some instances, surge arresters have already been replaced under other projects, such as new business or fire resiliency projects. In these instances, the surge arrester program considers these a "mitigated" location.

The surge arrester program not only replaces non-exempt surge arrestors, but also addresses potentially deficient grounding at each location. The initial reason for the surge arrestor program was to provide separate grounds on poles where surge arrestors and transformers were co-located and shared a single ground. By separating the grounds, lightning strikes and other surges can now safely dissipate to their dedicated surge arrester ground, while not affecting the separately grounded transformer co-located on the same pole.

Relation to and Impact on Other Initiatives:

- Ignition Components – The Surge Arrester program utilizes CAL FIRE approved arresters which are certified to reduce the likelihood of ignition.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The surge arrester program is targeting replacement of non-exempt surge arresters in Tier 2 and Tier 3 HFTD areas where known grounding issues exist. Within this list of known locations, construction resources are allowed to strategize their schedule of work locations based on efficiency

and available crews by divisions. Once HFTD areas are completed in 2022, this program will be expanded to non-HFTD areas throughout PG&E's service territory.

Risk Models Used or Other Considerations for Prioritization:

- As PG&E moves towards non-HFTD areas, it will look for bundling efficiencies targeting locations where there are a greater volume of locations/crews to efficiently complete replacement of the non-exempt arresters. At this time, there is ongoing work by the Risk team to develop a prioritization model for replacements in non-HFTD areas.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E targeted at least 15,000 Surge Arrester replacements in 2021 and exceeded this goal with 15,465 completed.

Impacts:

- Mitigating non-exempt surge arresters with exempt equipment has reduced the likelihood of an ignition during normal operation in HFTD areas.

Lessons Learned:

- Plan and execute the work earlier in the year. PG&E experienced various delays in 2021 and had to execute more of this work in Q4 than originally planned, to allow for optimal cost and execution.

- This work can be in hazardous terrain. The selection of construction resources based on a strong safety record and supporting ongoing safety efforts is important.

- PG&E enhanced our documentation and data integrity for this program in 2021 and can continue to make enhancements in 2022 to provide clearer documentation guidelines to ensure that all current and historical documentation is centrally stored in a system of record for all stakeholders to access.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.13	Surge Arrestor – Removals	Remove all of the remaining non-exempt surge arrestors in HFTD areas (based on the known population of 4,590 surge arrestors as of January 1, 2022) through replacement with exempt equipment.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next

five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will continue non-exempt surge arrester replacements where there is a common ground beyond HFTD areas to improve grounding systems and reduce ignition risk across our service territory.

Completion of the program is currently anticipated to be within this 5-year window for non-HFTD areas (and will be completed in 2022 for HFTD areas).

7.3.3.17.4 Rapid Earth Fault Current Limiter

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks – Equipment - Conductor

Secondary Risk: Ignition Risk – Vegetation Contact

A high impedance fault like a wire down or tree contact could remain undetected and become an ignition source. In addition, high impedance line to ground faults on distribution circuits are difficult to detect with traditional overcurrent protection devices. Rapid Earth Fault Current Limiter (REFCL) systems are intended to address these risks by detecting line to ground faults and limiting the fault current to below ignition thresholds.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus mitigations on highest risk locations – At the distribution substation level, REFCL can reduce the frequency of ignition events for faults (or outages) related to line contact to ground and also detect high impedance ground faults which are difficult to detect with traditional overcurrent protection systems.

Relation to and Impact on Other Initiatives:

- Not applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Potential REFCL sites are ranked by the 2021 WDRM and substation feasibility screening for constructability of REFCL. The highest risk locations which are feasible for REFCL installation are to be targeted first.

Risk Models Used or Other Considerations for Prioritization:

- WDRM – The WDRM estimates wildfire risk values for circuit segments of the overhead distribution system in PG&E's HFTDs to provide insights into the locations with high wildfire risk by risk driver to inform the development of mitigation programs.

- There are multiple system requirements for REFCL to operate. REFCL installation is only possible at substations meeting the following criteria: the distribution circuits out of that substation use a 3-wire construction; there are less than 30 miles of

primary underground cable per substation transformer bank; and the substation must have sufficient space to construct and operate the multiple pieces of equipment that make up a REFCL system.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The Calistoga REFCL pilot project finished construction in 2020. In 2021, PG&E attempted to commission and test the REFCL technology in Calistoga. PG&E completed an elevated voltage stress test and one field ground fault test which demonstrated that REFCL technology can be effective at reducing fault currents to below fire ignition levels.

After the initial positive tests, the Calistoga REFCL pilot demonstration was stalled due to the failure of the substation REFCL equipment. In addition, PG&E had difficulty obtaining replacement equipment from various overseas suppliers due to supply chain issues and the ongoing COVID-19 pandemic.

Impacts:

- REFCL technology could not be fully evaluated beyond the initial testing because of the equipment failure and supply chain issues. As a result, PG&E is looking to further study REFCL capabilities after obtaining replacement supplies and making repairs and modifications at the Calistoga site in 2022.

Lessons Learned:

- PG&E should use gang operated switchgear and protective devices instead of single pole operated devices for REFCL installations.
- PG&E should consider the use of domestically available equipment for future REFCL installation to avoid foreign supply chain issues.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do not currently plan to install any additional REFCL systems at this time. PG&E plans to repair and rebuild the REFCL installation at Calistoga to complete additional pilot evaluation. If the additional pilot is successful, PG&E will look for opportunities to place REFCL into full service as well as evaluate whether any additional sites are appropriate for future installations.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – If the demonstration of the existing system is successful at the current pilot location, PG&E will then work to optimize design and construction processes for further deployment. However, due to the nature of this pilot—first resonant grounded system in North America—successful implementation is not guaranteed and may take longer than currently anticipated.

7.3.3.17.5 Remote Grid

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – EPSS

A Remote Grid is a concept for utility service using standalone, decentralized energy sources and utility infrastructure for continuous, permanent energy delivery, in lieu of traditional wires, to small loads, in remote locations, at the edges of the distribution system. Throughout PG&E's service territory, pockets of isolated small customer loads are currently served via long electric distribution feeders, some which traverse HFTD areas and require significant annual maintenance, vegetation management, or system hardening solutions. The Remote Grid Program will remove these long feeders and serve customers from a Remote Grid. This reduction in overhead lines can reduce fire ignition risk as an alternative to or in conjunction with system hardening and other risk mitigation efforts. In addition to reducing wildfire risk, Remote Grid can be a cost-effective solution as compared with the expense and capital costs for the rebuild of fire-damaged infrastructure or other system hardening alternatives.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The primary goal of the Remote Grid program is to reduce wildfire ignition risk by reducing the need for overhead distribution lines in HFTD. Remote Grids that allow for the removal of lines in high wildfire risk areas could provide benefits to both the customers served by Remote Grids and to all distribution customers who will benefit from the cost-effective elimination of wildfire risks associated with distribution lines that run for significant distances through HFTD areas to serve a small number of remotely located customers. The elimination of these lines will reduce the likelihood of fire ignition due to damage or failure of such lines.

- In addition to acting as an alternative to conventional system hardening approaches for the hardest to reach customers at the end of distribution lines, Remote Grid helps to reduce wildfire risk and provide a cost-effective solution for the rebuild of fire-damaged or destroyed infrastructure in HFTD areas where their restoration may still pose a risk of ignition.

  Remote Grid projects are evaluated based on their ability to reduce risk at a lower cost per risk unit (i.e., RSE) vs alternative risk mitigation strategies quantified by projected lifetime costs and risk units in the WDRM.

- Focus mitigations on highest risk locations – Initial Remote Grid project locations were selected to provide immediate risk mitigation value at a reduced cost when compared to alternative risk mitigations.

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead) – The Remote Grid Program is a component of PG&E's broader System Hardening Program. Deployment of Remote Grids and subsequent elimination of overhead lines reduces fire ignition risk, as an alternative to or in conjunction with, system hardening and other risk mitigation efforts.

  PG&E's Remote Grid Initiative will validate and develop Remote Grid solutions as standard offerings that can be considered alongside or as an alternative to other service arrangements and/or wildfire risk mitigation activities such as system hardening.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Initial Remote Grid project locations were selected to validate a range of Remote Grid configurations while simultaneously providing immediate risk mitigation value at a reduced cost when compared to alternative risk mitigations. In 2019 and 2020, PG&E undertook an extensive review of all distribution feeders in Tier 2 and Tier 3 HFTD areas and developed a preliminary screening protocol to identify potential Remote Grid projects where this alternative service method could deliver superior risk-spend efficiency and overall cost reduction (including reduced capital costs). PG&E prioritized sites for detailed evaluation based on a combination of factors including:

- Located at the end of a radial distribution line;
- Consisting of a small number and size of customer loads;
- Historically served by a long section of line;
- Preliminary feasibility assessment based on initial customer outreach and desktop screening for technical viability and constructability of a SPS;
- Potential cost savings: Remote Grid vs preferred alternative risk mitigation strategy (e.g., hardened overhead distribution or underground conversion); and
- Risk ranking of line segment(s) to be eliminated or hardened.

From this list of preliminary screening results, PG&E has applied criteria including customer receptivity, solar access (shading), civil constructability, and site accessibility to identify initial Remote Grid projects which are likely feasible for this early stage of Remote Grid deployment.

Risk Models Used or Other Considerations for Prioritization:

- The WDRM was used to identify project line segments based on Circuit Protection Zone prioritization and compute relative project RSE to identify projects where Remote Grid can reduce more risk on lifetime-cost basis than hardened conductor solutions.

- When considering selection criteria for potential remote grid projects, the Remote Grid Program may prioritize projects with a higher likelihood of achieving completion in a timely manner. Some characteristics that can influence likelihood of project success include site-specific permitting constraints, physical construction limitations, and the need for customer acceptance of this alternative service model. Initial projects have been delayed due to unforeseen permitting delays due to presence of threatened species. Additional sites under consideration are undergoing detailed feasibility assessment to address constructability and customer acceptance before down selecting to a complete set of initial projects. For this reason, the program is currently prioritizing projects serving fewer customers due to challenges with soliciting Supplemental Provisions Agreements from multiple parties given that a project cannot proceed if a single party declines service from the SPS.

- Another exception to the normal progression of PG&E deploying Remote Grids is addressed by a tool called the Line Elimination Incentive Program (LEIP). Namely, where a particular site or customer factors render construction of a Remote Grid infeasible, a structure to mutually agree to discontinue PG&E service may deliver the same wildfire risk reduction benefit. Where both PG&E and the customer agree, such a structured incentive payment can successfully eliminate the overhead line and associated ignition risk. This rare but useful tool may continue to yield benefits for some locations where the development of Remote Grid projects would otherwise hit an impasse and other system hardening methods show unfavorable RSE.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Initial 2021 Remote Grid – 1 Remote Grid commissioned and operational June 3, 2021

Impacts:

- PG&E completed commissioning on our first project, the Briceburg Remote Grid, which went operational on June 3, 2021.

- The Remote Grid facilitated restoration of service to 5 customers who lost power due to the Briceburg fire in 2019.

- Over 4,000 hours of safe, operational, and uninterrupted runtime.

Lessons Learned:

- Development of this SPS helped the Remote Grid Program refine its design criteria and development process through close coordination with the project vendor and internal stakeholders.

- The Remote Grid Program developed an internal operational model for lifetime ownership and maintenance of Remote Grids for the Briceburg SPS that will be applied to future projects in the Program as they come online.

Five Projects Bid for Request for Proposals (RFP) – Competitive solicitations for SPS units and maintenance services through 2021 RFP

Impacts:

- The Remote Grid Program executed a competitive RFP solicitation for five projects (seven SPS units) and selected four out of five projects for execution

- The Remote Grid Program has identified two qualified vendors to execute projects at competitive rates.

Lessons Learned:

- This process helped provide key market data on project costs, optimize SPS design criteria, and refine project contracting approach and terms.

- This process has allowed the Remote Grid team to identify qualified vendors for future work and develop an understanding of execution timelines for upcoming projects.

Four Remote Grid Projects in Detailed Engineering Design – Four Remote Grid projects (five SPS units) undergoing detailed design. Two of these SPS units are planned to complete in 2022.

Impacts:

- The Remote Grid Program initiated detailed design work on four of the Remote Grid projects bid for RFP.

Lessons Learned:

- This process has enabled the Remote Grid Program to refine its project contracting, design, and deployment processes.

- This process also facilitated improvements to the Program's customer engagement strategies and permitting approaches.

CPUC Approval of PG&E Remote Grid Program – CPUC Approval of Supplemental Provisions Agreement, Preliminary Reporting Requirements, and Generalized Programmatic Approach.

Impacts:

- PG&E obtained CPUC approval for the Supplemental Provisions Agreement and other key program regulatory elements via Res.E-5132 on March 18, 2021.

- Resolution E-5132 defined preliminary annual program reporting requirements.

- PG&E will fulfill this annual reporting requirement by March 31, 2022 in compliance with the Resolution.

Lessons Learned:

- This Approval facilitated improvements to the Customer Supplemental Provisions Agreement process

- This Approval helped define key tracking and reporting needs for Program execution.

Site Selection Criteria and Scoping Process Approved – Working with the System Hardening Program, the Remote Grid Program received Advanced Authorization and Scope Approval for 58 SPS units across 31 distribution segments from the WRGSC. These projects have been approved for preliminary design evaluation and customer engagement, but the Remote Grid Program does not expect all these projects to achieve deployment due to customer acceptance attrition and other project development risks that are fully dispositioned later in the project development cycle. The projects that turn out to be feasible and economical to construct, and which receive approval from all customers involved, will proceed to be contracted throughout 2022 as they progress, with online dates expected in 2023 depending on the final scope of each project. In addition, the Remote Grid program expects additional projects to come into the development pipeline as new distribution segments are scoped.

Impacts:

- The Remote Grid Program worked with the System Hardening Program to advance proposed projects through the System Hardening Scoping process developed for the WRGSC.

- The Remote Grid Program developed a process for estimating lifetime costs of SPS units to identify and compare the estimated risk mitigation values and total lifetime costs of Remote Grid and hardened conductor solutions.

Lessons Learned:

- The Remote Grid Program identified key refinements to the Program’s site selection and scoping process to improve multi-year planning.

- Remote Grid deployment faces numerous challenges that can impede successful and timely deployment. It is necessary to develop an alternative hardening method when scoping each potential Remote Grid project to mitigate unforeseen impediments to successful execution.

Failure Modes and Effects Analysis (FMEA) Risk Assessment Completed – Completed a Failure Modes and Effects Analysis risk assessment for PG&E's initial SPS design

Impacts:

- The Remote Grid Program completed an ignition risk assessment for PG&E's initial SPS design, involving 11 PG&E staff members and five consultant SMEs.

- This process included a FMEA and Hazard Identification processes for an SPS asset design from PG&E's current standard specification.

Lessons Learned:

- The results of this assessment facilitated improvements to system design and an assessment of system risk relative to other electric distribution assets.

Remote Grid Technology Testing at PG&E's Applied Technology Services (ATS) Facility – Remote Grid constructed and commissioned a Test Stand and fully functional SPS at ATS

Impacts:

- Remote Grid constructed and commissioned a Remote Grid test stand for evaluating Remote Grid component technologies, with a focus on power quality, protection, and control characteristics of small grid-forming inverters.

- Complete evaluation of one grid forming inverter model using the Remote Grid test stand.

Lessons Learned:

- Through testing, the Remote Grid Program identified preferred device configurations to ensure component interoperability and optimize Remote Grid performance.

4 miles of overhead lines eliminated via the LEIP – Five customers participated in the program to facilitate elimination of 4 miles of overhead wire.

Impacts:

- The Remote Grid Program and Microgrid Pricing and Policy Strategy Team developed a structure for the LEIP to allow PG&E to work with customers on a mutually satisfactory outcome that would facilitate overhead wire removal in HFTD areas.

- The LEIP allowed PG&E to avoid rebuild and hardening of 4 miles of overhead line, culminating in the removal of this line.

Lessons Learned:

- PG&E has developed strategic approaches to line elimination through an incentive payment structure for instances where Remote Grid service might be infeasible and hardening or rebuilding distribution service carries a significant risk or cost component.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.14	Remote Grid – Operate New SPS Units	Operate 2 new Remote Grid Standalone Power System (SPS) units	12/31/2022	Quantitative

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety. PG&E expects to execute contracts for design and construction for new Remote grids with 2023 online dates. PG&E also plans to submit our first Annual Reporting Requirement on Project Development to the CPUC in 2022 in accordance with Resolution E-5132.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Build robust pipeline of Remote Grid projects in development – The Remote Grid program is developing the capabilities to grow its impact through scalable, repeatable implementation of new projects based on the learnings gained from initial projects. These capabilities include building out a pipeline of projects that will come online in future years.

The program expects to grow from 1 SPS unit deployed in 2021 to 2 SPS units deployed in 2022 and on towards approximately 15 projects in 2023, followed by additional growth in the overall number of systems deployed annually in 2024-2025. The project development process is a major focus for this scale-up, including refinement of steps for engaging customers and completing initial design sufficient to secure customers' optional approval to participate in the program. Contracting with solar/storage/generator vendors is the subsequent process step for these projects, and the growing pipeline aims to reach the milestone of having executed such contracts for 15 more SPS units in 2022 which would come online in 2023 and beyond. Reaching this contract execution milestone for such pipeline projects will enable PG&E to scale up the Remote Grid Program year over year until the program reaches maturity and continues to facilitate line elimination efforts at a higher steady state annual quantity.

Develop Master Services Agreement contracting model – Execution of projects with pre-qualified vendors through the use of Contract Work Agreements under a Master Services Agreement will facilitate execution at large scale and reduce project development timelines, increasing the volume of projects PG&E can complete annually in 2023 and beyond.

Standardize monitoring and control software platform for SPS operations – PG&E is seeking to define & procure the operational technology tools needed to monitor and control SPS assets in the field. A procurement effort now ongoing will deliver a

standard platform for the Utility to interface with the growing Remote Grid fleet. This enhancement will reduce integration costs of new vendors and equipment and improve performance consistency.

Seek CPUC approval to continue the Remote Grid program once the program reaches the 2 MW cap – PG&E will seek addition program approval from the CPUC to develop additional Remote Grid systems beyond the 2 MW cap specified in Resolution E-5132. This will enable continued execution of Remote Grids to support grid hardening efforts.

Selectively pursue opportunities for the LEIP – Where particular site or customer factors render construction of a Remote Grid infeasible, PG&E will pursue mutual agreements to discontinue PG&E service for select locations where other system hardening methods have a less favorable RSE than the LEIP option. Where the development of Remote Grid projects would otherwise hit an impasse, this activity can successfully eliminate the overhead line and associated ignition risk.

7.3.3.17.6 Butte County Rebuild Program

OEIS Initiative Definition: Not Applicable. This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment - Conductor

Secondary Risk: Reliability Impacts - PSPS

The 2018 Camp Fire devastated the Town of Paradise and surrounding areas in Butte County. As a result of the fire, the Butte County Rebuild Program is focused on undergrounding the electric distribution within the Town of Paradise and lower Magalia. This will reduce future ignition risks, reduce future PSPS events, and reduce the chance of PG&E infrastructure impeding egress routes during an emergency as happened during the Camp Fire due to downed power poles.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The planned underground work will reduce ignition risk due to removing overhead conductor.
- Reduce number of customers impacted by PSPS events – As the planned underground is executed over the next several years, it will enable undergrounded areas of Paradise to remain energized during PSPS events

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead) – Undergrounding is one of the techniques PG&E uses for system hardening. For further details regarding PG&E's undergrounding efforts see Section 7.3.3.16 and for PG&E's system hardening work, please see Section 7.3.3.17.1.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The planned underground work in the Town of Paradise and lower Magalia started in 2019 and is planned to be complete in 2025. Generally, the work within the planned underground footprint is prioritized as follows:

- Coordinating with the Town of Paradise, Butte County and Caltrans to ensure our underground projects occur before planned road work.
- Prioritizing underground areas with deactivated gas which will reduce the need for customers to remain operating temporary propane.

- Sequencing the work in a manner that minimizes traffic impacts to the community.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable. This work is being executed inside the fire footprint and prioritized as noted above based on community and customer needs.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021 the Butte County rebuild completed 31.5 underground miles, as measured by circuit miles. This figure does not include a small volume (approximately 1.4 circuit miles) of previously hardened overhead lines that were placed underground.

In 2020, the mileage of undergrounding work recorded was 22.2 miles completed in only HFTD areas, as measured by trench miles. Since that time, the Butte County Rebuild Program switched to using circuit miles as the reported unit of measure to be in alignment with the System Hardening program and now includes mileage from non-HFTD areas. The rational for including non-HFTD areas is the entire Butte Rebuild program footprint is a fire rebuild area, thereby indicating an elevated wildfire risk.

Table PG&E-7.3.3-8 below summarizes the Butte Rebuild mileage comparison through different lenses including using trench-feet and circuit-feet as well as broken out by HFTD and non-HFTD areas.

TABLE PG&E-7.3.3-8:
ACTUAL AND FORECAST BUTTE REBUILD MILES

	2020 Actual		2021 Actual		2022 Target	
Butte Rebuild Mileage	Trench Miles	Circuit Miles	Trench Miles	Circuit Miles	Trench Miles	Circuit Miles
In HFTD	22.2	26.4	17.3	22.4	20.8	32.8
Non-HFTD	7.1	10.2	6.3	9.1	14.2	22.2
Total	29.3	36.6	23.6	31.5	35.0	55.0

The difference between the two unit of measures is that one trench foot is defined as one foot of underground trench that includes electric distribution primary cable regardless of the quantity of primary cable. Whereas circuit-feet measures every foot of primary cable installed underground, which is sometimes installed with multiple cables installed in the same trench. The use of circuit miles as the primary measure matches the System Hardening program and matches the primary reporting of “miles” in the WMP data tables (e.g. when WMP data tables ask for number of “miles” PG&E reports circuit miles).

Impacts:

- Reduced ignition risks in Tier 2 and 3 HFTD areas in Butte County.

Lessons Learned:

- Using base maps drawings that show existing underground facilities, land rights, and physical features to initiate the electric design reduces design timeframes, produces consistent design drawings and avoids construction issues.

- Leveraging “right of entry” forms with customers can allow construction on private property to begin ahead of the final acquisition of the land easement. This can allow construction to begin sooner.

- Issuing program specific contracts (Master Services Agreements) with unit-based pricing increases cost stability and reduces our construction contract procurement timeframes.

- Increasing the pool of qualified contractor resources supports execution of increased work volumes and aids in driving competitive pricing and work delivery.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
C.15	Butte County Rebuild – Undergrounding	Complete 55 circuit miles of undergrounding work as part of the Butte County Rebuild program.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

This program is currently forecasted to complete all identified work in 2025 but this forecast could change due to various factors. The program will continue to make improvements as part of PG&E’s overall undergrounding initiative.

7.3.4 Asset Management and Inspections

7.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment

OEIS Initiative Definition: In accordance with GO 165, careful visual inspections of overhead electric distribution lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Starting in 2020, Pacific Gas and Electric Company (PG&E or the Company) incorporated the enhanced detailed inspection approach developed in the Wildlife Safety Inspection Program (WSIP) across our entire Overhead Inspection Program. Enhanced detailed inspections (i.e., detailed Inspections) of overhead distribution assets seek to proactively identify corrective work on or imminent failures of equipment which could create fire ignition if left unresolved or allowed to "run to failure." Proactive identification of Level 2 and Level 3 General Order (GO) 165 concerns also permits PG&E to evaluate potential investments in wildfire risk mitigation activities such as system hardening, enhanced vegetation management, or reconductoring, among other programmatic tools.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – In addition to identifying incipient equipment issues which may result in an ignition, the detailed inspections also improve our visibility to field conditions which may inform us of new programmatic asset risk management responses or guidance clarifications. During detailed inspections, PG&E collects a substantial number of digital records and photo documentation regarding the condition of distribution assets. In 2022, the continuation of the digital records collection and photo documentation will enable ongoing asset registry improvements, identification of corrective work on asset components, and inform potential investments in wildfire risk mitigation activities.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PG&E's practice, prior to 2020, of completing inspections on a time-driven cadence by plat map has been enhanced to address the increased risk from overhead asset or component failure in High Fire Threat Districts (HFTD) or High Fire Risk Areas (HFRA) areas. Moreover, the scope of inspections has expanded to identify potential equipment issues that could result in a wildfire ignition. PG&E's prior inspection practice resulted in a corrective notification creation rate of 11 percent for distribution facilities. Our current detailed

inspection protocols yielded corrective notification creation rates of 23 percent in 2020 for distribution facilities and 17 percent in 2021.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative – Selection criteria of structures for each detailed inspection cycle is driven by factors such as public safety concerns, location, system operating criticality, and overall risk. Structures in Tier 3 and Zone 1 HFTD areas are inspected annually. Structures in Tier 2 HFTD areas and HFRA areas are inspected every three years.

Risk Models Used or Other Considerations for Prioritization:

- In general, PG&E schedules detailed inspection activities in HFTD or HFRA areas to be completed earlier in the year, by July 31. This provides time, if necessary, to make repairs prior to fire season.

- The resulting prioritization for detailed inspections of structures, by circuit segment, is coupled with operational field knowledge and constraints, including restricted physical access periods and coordination with other preventive maintenance programs, such as patrols, to develop an annual schedule for completion.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Detailed Inspection Checklist: In 2021, detailed inspections of overhead distribution structures, which exceeded the minimum requirements of GO 165, included the following: (1) digitized capture of detailed visual inspection via checklists and photographic documentation from a ground vantage point; and (2) digital checklists that align to the Failure Modes and Effects Analysis (FMEA) for the structure, associated equipment, and equipment components. Both objective and subjective criteria were used to evaluate the condition of the assets and identify corrective actions.

PG&E completed detailed inspections of 100 percent of distribution poles in Tier 3 HFTD and Zone 1 areas and 33 percent of the distribution poles in Tier 2 HFTD and HFRA areas.

Although PG&E completed inspections of all assets initially targeted for inspection by July 31, 2021, during record validation, we identified additional poles after July 31, 2021

that should have been inspected. As of December 31, 2021, we had completed enhanced detailed inspections on all 480,749 of these targeted distribution poles.[90]

A process is in place to solicit feedback and make edits to the Detailed Inspection Checklist. Changes are included in annual inspector training.

Impacts:

- The digital records gathered during detailed inspections have enabled ongoing asset registry improvements.
- Digital records are also enabling refinement of inspection checklists.

Lessons Learned:

- Change requests to the Detailed Inspection Checklist can be submitted from multiple teams, the process of vetting them needs to be streamlined to approve and process changes in advance of the start of the subsequent year. Correlation between digital inspection records, corrective maintenance actions, and pending failures of asset components should be analyzed more closely to establish better inspection effectiveness metrics.

System Inspection Validation Effort – In June 2021, an initiative was launched to establish a recurring validation of the Asset Registry to assess the most recent inspection date of each distribution pole and identify additional poles to include in the inspections plans to meet GO 165 and WMP commitments.

Impacts:

- The validation effort has improved our Asset Registry and is being used to inform next year's inspections plan.
- The definition of a structure requiring an overhead detailed inspection has been documented at the Asset Registry attribute level.
- Enhancements to the inspection management tool and inspection mobile application have been identified with some being implemented for 2022. For example, the inspection checklist was updated to support the Tree Connect/Tree Attachments standard. Additionally, automation was introduced for map corrections that allows PG&E to stop using paper map correction forms.

Lessons Learned:

- Updates to the Asset Registry need to occur in the Geographic Information System (GIS) and Systems Applications and Products (SAP) concurrently so that they may show up correctly in the inspection tools.

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90 On November 1, 2021, PG&E submitted a Change Order to update the target number of distribution poles for this commitment to 477,309; however, as part of the ongoing record validation the target has since been increased to 480,749.

- Data governance of relevant data attributes of PG&E's pole structures, such as installation date and HFTD, including data accuracy, that inform next inspection date is essential to meet regulatory commitments.
- Inspection frequency of maintenance plans and the compliance due date of the poles assigned to them need to be regularly monitored to ensure alignment.
- The Asset Registry is continually changing and therefore continual validation is needed to ensure assets are placed on the required inspection frequency.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.01	Detailed Inspections – Distribution	Complete detailed inspections on a minimum of 396,000 distribution poles, which were identified in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any poles discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any poles discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target.	7/31/2022	Quantitative

- PG&E plans to continue to improve the Detailed Inspection Checklist to be used for the 2023 work plan. PG&E also expects to update the Technical Basis Document for 2023.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

High Risk and Consequence Enhanced Inspection Strategy – Future improvements to detailed inspections of overhead distribution electric lines and equipment will focus on broader incorporation of enterprise information such as risk models, evolution of questionnaires and technology, alignment with programs such as System Hardening, and continued insourcing of inspection resources. Future improvements may also include further integration of data sets and systems to expedite data corrections identified during the inspection task and to improve inspection effectiveness. This could include further integration with GIS, SAP, and asset risk models that either provide or utilize data collected from inspections or patrols, from performance of corrective work, or from asset failure analysis.

We are also evaluating improvements that include: (1) reviewing or revising inspection cycles in alignment with the latest wildfire consequence modelling; (2) updating inspection criteria and wording to increase objectivity and deliver more consistency between evaluators; and (3) evaluating our corrective work prioritization thresholds to more directly mirror GO 95 Rule 18 (Levels 1, 2, 3 versus PG&E's historic A, B, E, F prioritization).

Finally, PG&E may make investments in emerging technologies such as Machine Learning and Artificial Intelligence for visual data recognition and analysis. Long-term recurrence intervals for HFTD and HFRA assets may be tailored based upon more comprehensive asset health and risk models, such that the inspections are deployed on an as needed basis, rather than the current annual and triennial cycles, respectively. Concurrently, PG&E plans to continue development of long-term internal staffing models that limit reliance upon external vendor personnel and provide more consistency in workforce cycle over cycle. This includes reintroduction of Knowledge Assessments for measuring the skill and competence of the Qualified Company Representative (QCR) hired or contracted to perform asset inspections.

7.3.4.2 Detailed Inspections of Transmission Electric Lines and Equipment

OEIS Initiative Definition: Careful visual inspections of overhead electric transmission lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks – Equipment - Structures

Secondary Risk: Ignition Risks – Equipment – Conductor

Enhanced detailed inspections (i.e., enhanced inspections) of overhead transmission assets seek to proactively identify and treat pending failures of asset components which could create a fire ignition if left unresolved or allowed to "run to failure." Proactive identification of Level 2 and Level 3 GO 95 concerns are then prioritized by risk and consequence as discussed in regard to maintenance in Sections 7.3.3.12.3 and 7.3.3.15.

Enhanced inspections for transmission assets involve at least two detailed inspection methods per structure: ground and aerial. In addition to the ground and aerial inspections, climbing inspections are also required for 500 kilovolt (kV) structures or as triggered. All these inspection methods involve detailed, visual examinations of the assets with use of inspection checklists that are in accordance with the Electric Transmission Preventive Maintenance (ETPM) (TD-1001M) as well as the FMEA. Aerial inspections may be completed either by drone, helicopter, or aerial lift.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase Understanding of Where Risk is Located – Enhanced inspections are prioritized based on risk and consequence. Results from the inspections further help refine this prioritization for future years and provide information on where issues may be developing.

- Develop Better Visibility Into Risk – Enhanced inspections can be trended to provide insight for understanding risk. For example, results from a region may indicate that there are more issues of corrosion in a particular area, on particular asset material types.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Enhanced inspections are used in conjunction with other inspection methods (infrared, below grade foundation inspections, Pole Test

and Treat, etc.) in order to observe conditions that potentially lead to asset failure or safety concerns.

- PSPS – As part of the enhanced inspections, inspectors provide condition codes (on a scale of one to five, where five indicates the most damage) for each component grouping, which directly inform the Operability Assessment (OA) model. This model is used in scoping of transmission lines during PSPS events.

- System Hardening (Underground and Overhead) – Enhanced inspections are a major source of maintenance tags, and completion of asset-health related tags in HFTD and HFRA areas provides the benefit of system hardening. Additionally, inspection results are used in asset health models such as OA and the Wildfire Transmission Risk Model, to help inform other asset strategy work such as life extension programs or asset replacement.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative:

Selection criteria of assets for each inspection cycle is driven by factors such as location, system operating criticality, public safety concerns, and general risk modeling (asset health/probability of failure and consequence of failure). For example, a 500 kV tower providing bulk power transport within HFTD Tier 3 will be inspected more frequently than a 60 kV structure in a non-HFTD area, with low public safety threat.

HFTD and HFRA structures will be inspected more frequently than the 3-year base inspection cycle. These structures will be determined annually based on wildfire risk,[91] wildfire consequence,[92] and other considerations involving data not currently integrated into the wildfire risk and consequence models, for example, inspection trends.

The assets are assigned an initial prioritization for inspection execution based on averaged wildfire risk for each line. Assets are typically grouped by line for execution efficiency. The prioritization may also be coupled with operational field knowledge and constraints, including restricted physical access periods, to develop an annual schedule for completion. HFTD and HFRA inspections are expected to be completed by July 31, 2022, to allow time for any high-priority corrective maintenance notifications to occur prior to peak wildfire season.

Risk Models Used or Other Considerations for Prioritization:

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91 This risk assessment is based on the annualized probability of failure multiplied by the multi-attribute value function (MAVF) wildfire consequence. The MAVF currently is calculated from the results of Technosylva wildfire modeling.

92 Wildfire consequence is considered independently in addition to the risk to account for high consequence, low probability ("black swan") events and to provide additional inspection coverage of higher consequence areas while the probability models continue to mature.

- Operability Assessment Model – Annualized OA Model, with the Wildfire Transmission Risk Model, was utilized for the 2022 inspection workplan. Additionally, this was coupled with the Wildfire Consequence Model in development of the plan.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, 100 percent of overhead transmission structures in HFTD Tier 3 and Zone 1, roughly one third of structures in HFTD Tier 2 and HFRA were subjected to enhanced inspections and some form of aerial assessment. Additionally, there were climbing inspections performed on select structures (e.g., 500 kV).

In 2021, for transmission structures we conducted in HFTD and HFRA areas: (1) 1,385 climbing inspections of 500 kV towers; (2) 26,826 ground inspections; and (3) 26,826 aerial inspections.

Impacts:

- The digital records gathered during enhanced inspections are utilized in asset health modeling (e.g., the OA Model).
- The majority of maintenance tags are found through enhanced inspections. Maintenance tags can then be prioritized and completed (per Sections 7.3.3.12.3 and 7.3.3.15), providing reduction of wildfire risk.

Lessons Learned:

- Continued validation of the Asset Registry is important so that assets are placed on the required inspection frequency.
- Additionally, to aid execution planning of the inspections, we worked to deliver the 2022 workplan earlier in the year.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.02	Detailed Inspection Transmission – Ground	Complete detailed ground inspections on a minimum of 39,000 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target.	7/31/2022	Quantitative
D.03	Detailed Inspection Transmission – Climbing	Complete detailed climbing inspections on a minimum of 1,800 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target.	7/31/2022	Quantitative
D.04	Detailed Inspection Transmission – Aerial	Complete detailed aerial inspections on a minimum of 39,000 transmission structures in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets discovered after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets discovered after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target.	7/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Risk-Based Inspection Scope – Determine risk-based inspection scope each year from a snapshot of the risk (probability and consequence) data. The criteria or thresholds used to define the additional structures also may vary each year as the risk models mature and the overall risk of the transmission system evolves.

Trend Effectiveness – Trend find rates from inspections to determine effectiveness of the inspection method (aerial, ground or climbing). This can help inform changes to the inspection methods or inspection checklist, as well as help inform asset strategy controls and mitigations.

Automate the Validation Process – Automated inspection plan validation process will increase work planning efficiency.

Centralize Risk-Based Data – Use a centralized database to incorporate the system inventory, location based environmental information, and risk and consequence models to streamline inspection planning.

7.3.4.3 Improvement of Inspections

OEIS Initiative Definition: Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk- Equipment – Structures

Secondary Risk: Ignition Risk- Equipment – Conductor

Effective inspections are critical to identify equipment conditions and issues that may result in equipment failure creating a potential wildfire ignition risk. In addition, inspection information provides critical supports for the refinement of our asset investment and operational risk models.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – To drive repeatability in results, inspection tools, methods and guidance are evaluated for improvement opportunities at least annually.
- Develop Better Visibility Into Risk – Repeatability in results also helps inform risk models consistently across all assets.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repairs – Results from inspections include corrective maintenance notifications, which can reduce wildfire risk when completed in HFTD and HFRA areas. Maintenance is described in Sections 7.3.3.12.3, 7.3.3.15, and 7.3.3.12.4.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative – Inspection processes generally cover PG&E's entire service area. In addition, PG&E has implemented protocols and processes for enhanced inspections in HFTD and HFRA, areas because of the greater wildfire risk associated with these areas.

Most inspection improvements do not require region prioritization since the improvement may be valid for the entire system. For example, a revision to the inspection checklists would apply across the system whenever that checklist is used.

Similarly, updates to condition guidance via bulletins, standards or procedures would also typically apply system wide.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, a retrospective assessment of overhead inspection checklists was performed. Revisions were made in the overhead inspection checklist to refine the flow and wording, as well as to address gaps in content from prior cycles.

Revised orientation trainings were also delivered to both incumbent and new inspection personnel in 2021.

System Inspections continues to monitor employee safety. This includes the completion of mandated and compliance trainings necessary for inspectors to perform their jobs safely and efficiently according to federal, state and PG&E regulations, standards, and procedures. Inspection training materials and job aids were updated to align with checklist changes initiated by the checklist/asset owners (e.g., Asset Strategy, Standards).

Impacts:

- Continued revisions to our overhead inspection checklists and ongoing training help improve our inspection processes.

Lessons Learned:

- The shift from plat-map based tactical planning to circuit-segment risk approach has created some execution inefficiencies that will be addressed in 2022.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continuously improve our inspections as discussed in Question 5 below.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Improve Reliability of Results – In addition to the information discussed in Section 7.3.4.14, technology tool investments are in progress to improve field performance of hardware (connectivity, battery life) and usability of the mobile application (integration of additional GIS and SAP data sets, work-flow enhancements) as well as back-office support tools that visualize the annual work plan and progress against execution of inspection. Analytics and trending of conditions found through enhanced inspection will continue to inform future condition -based inspection cycles.

Optimization – PG&E's inspection programs will continue to refine asset data and condition collection needs, modify approaches to support varying risk profiles of assets, and pursue execution efficiencies. PG&E anticipates that asset detail inspection questionnaires will be refined cycle over cycle to focus on collection of data that changes over time and is utilized in various asset health and risk models across the enterprise. The strategy to applying inspection treatment types may also evolve to seek more or less overlap of inspection programs (patrol, detail, infrared (IR), Light Detection and Ranging (LiDAR), Pole Test and Treat (PT&T), etc.), depending on the specific risk profile of the target assets. PG&E will also work to build more cross program execution alignment via process and technology changes to reduce duplicate "touches" of the same asset in a given inspection cycle.

7.3.4.4 Infrared Inspections of Distribution Electric Lines and Equipment

OEIS Initiative Definition: Inspections of overhead electric distribution lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify "hot spots," or conditions that indicate deterioration or potential equipment failures, of electrical equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences – Structures Impacted

Secondary Risk: Ignition Risk – Equipment - Conductor

Although the majority of failure modes can be detected via visual inspections required by existing rules and regulations, there are some that may not be easily detectable (e.g., components experiencing excessive heat condition). Lack of detection can lead to asset failure and associated consequences. For that reason, PG&E has adopted an infrared (IR) inspection program in HFTD areas that goes beyond mandated inspections in order to identify these potential risks and address them before a failure occurs.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – PG&E uses infrared inspections on distribution circuits in HFTD areas to help detect and correct abnormal conditions. Infrared technology provides the opportunity to identify abnormal conditions "hot spots" by utilizing infrared imaging and temperature measuring systems to detect and record heat radiation from a target relative to its surrounding measurements. Based on historical infrared results we expect IR inspections to effectively detect abnormal heat associated with the following assets: Conductors, Jumpers, Splices, Connectors, Transformers, Fuses, Cutouts, Arresters, Switches.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Excessive heat can contribute to component failure. Abnormal conditions attributed to excessive heat in distribution components (e.g., connectors, splices, transformers) are difficult to find during an enhanced ground inspection. Infrared inspections help identify potentially damaged and/or faulty components that are not detectable by visual inspection methods alone.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized.

Prioritization of Work Within Initiative: A 3-year cycle with focus on the HFTD areas began in 2020. In 2021, PG&E leveraged the Technosylva model to take into account wildfire consequence within the HFTD areas in order to prioritize the circuit miles selected. In 2022, it will be the last of a three-year cycle for HFTD areas, therefore it will be the remaining circuit miles in HFTD.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Consequence Model – We are using the Wildfire Consequence Model from Technosylva.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

IR inspections of distribution electric lines and equipment: 10,093 circuit miles were scanned using Infrared technology.

Impacts:

- By scanning the 10,093 circuit miles, we were able to identify potential risks and address them before a failure occurs.

Lessons Learned:

- There needs to be time in project schedule to return to locations that could not be completed upon first attempt due to access issues (customer, terrain, Public Safety Power Shutoff (PSPS) events).

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.05	Infrared Inspections – Distribution	Complete infrared inspections on a minimum of 9,000 distribution circuit miles in PG&E's asset registry as of January 1, 2022, in HFTD areas or HFRA, barring External Factors. Any assets identified after January 1, 2022 with a field installation date on or before 2020 will be inspected within 90 days of when added to the asset registry. Any assets identified after January 1, 2022 with a field installation date in 2021 or 2022 will not be in scope for inspection as part of this 2022 WMP target.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short Term Improvements (2023-2028) – PG&E plans to improve ease of access to circuit miles to scan in order to complete the assigned miles to be scanned. Provide means to reduce the "Cannot Get In" (CGI) by connecting resources to CGI team in order to reduce or eliminate any incomplete scanned circuit miles.

7.3.4.5 Infrared Inspections of Transmission Electric Lines and Equipment

OEIS Initiative Definition: Inspections of overhead electric transmission lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify "hot spots," or conditions that indicate deterioration or potential equipment failures, of electrical equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks – Equipment – Conductor

Secondary Risk: Ignition Risks – Equipment – Structures

IR inspection reduces the potential for component failures and facility damage and facilitates a proactive approach to identifying abnormal components for repair/or replacement. IR inspection effectiveness is dependent on adequate circuit loading and weather conditions, and scheduling IR inspections on specific circuits takes into consideration historic average line loads experienced. For example, a circuit on the coast may have IR performed in the winter, when lines are more heavily loaded, or it may not be possible to obtain adequate results from the IR inspection.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop Better Visibility Into Risk – Infrared technology provides the opportunity to identify "hot spots" by utilizing infrared imaging and temperature measuring systems to detect and record heat radiation from a target relative to its surrounding measurements. Based on our FMEA, we expect IR to effectively detect: Hot/Heating Conductors, Jumpers, Splices, Clamps, Insulators hot end hardware, etc. These conditions may not be something visually assessable.

- Focus Mitigations on Highest Risk Locations – Findings from infrared inspections inform maintenance tags, which use wildfire risk as a prioritization factor.

- Increase Understanding of Where Risk is Located – Understanding where infrared inspections have found issues can help provide feedback to asset health modeling, leading to more informed future predictions of asset probability of failure.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Corona inspections, described in Section 7.3.4.10, are completed simultaneously during infrared inspections.

- System Hardening (Underground and Overhead) – Findings from infrared inspections may result in maintenance tags.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative – PG&E prioritizes infrared inspections on Tier 2 HFTD lines, at a minimum, every three years and on Tier 3 HFTD lines every year. Infrared inspections are deployed in a targeted manner as the effectiveness of the technology is influenced by the level of electric load in the lines being inspected.

Risk Models Used or Other Considerations for Prioritization:

- Currently, risk models are not used to prioritize infrared inspection scope, as cycle times are developed based on HFTD tier. As the conductor modules of the Wildfire Transmission Risk Model develop, it is expected to add a more risk-based approach to the program in future years.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

For 2021, infrared inspections were conducted on 100 percent of transmission circuits in Tier 3 HFTD areas, approximately 33 percent of transmission circuits in Tier 2 HFTD areas, and approximately 20 percent of transmission circuits in non-HFTD areas. Circuits supporting Diablo Canyon Power Plant (DCPP) and Morro Bay Power Plant, and the tie lines for the Western Electric Coordinating Council (WECC) were also inspected. Lines with no electrical loading (e.g., de-energized) were excluded. The 2021 progress of Transmission Infrared Inspections in 2021 was 7,587 miles, of which 4,211 were in HFTD areas.

<u>Impacts:</u>

- Infrared inspection can provide condition information that may be difficult to determine visually. For example, in 2021 infrared inspection detected damage to conductor, jumper, splices, and connectors such as dead-end shoe/ clamps.

<u>Lessons Learned:</u>

- Develop workplan earlier so that winter loading lines can be inspected as soon as possible in 2022.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Trend Effectiveness – Continue to trend and analyze the effectiveness of this technology compared to the other inspection methodologies currently employed.

Evaluation of Infrared Technology vs. Other Inspection Techniques – Currently the value of infrared technology has not been fully evaluated against other inspection technologies that may provide a better understanding or a better value for the investment.

Transition to a More Risk-Based Prioritization – Utilize the Wildfire Transmission Risk Model in conjunction with the Wildfire Consequence Model to inform inspection frequency for HFTD lines, above a baseline inspection cadence.

Inspection Bundling – Evaluate opportunities to combine the infrared sensor technology with other aerial visual data capture on the same flight to drive improved cost efficiencies where possible.

7.3.4.6 Intrusive Pole Inspections

OEIS Initiative Definition: In accordance with GO 165, intrusive inspections involve movement of soil, taking samples for analysis, and/or using more sophisticated diagnostic tools beyond visual inspections or instrument reading.

For this initiative, PG&E has two sub-initiatives including:

- 7.3.4.6.1 – Intrusive Pole Inspections – Distribution.
- 7.3.4.6.2 – Intrusive Pole Inspections – Transmission.

7.3.4.6.1 Intrusive Pole Inspections – Distribution

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

Intrusive pole inspections, also called Pole Test and Treat (PT&T), are a way to evaluate in-service wood poles and are conducted on an approximate 10-year cycle for early detection of deterioration. These inspections can be effective in identifying wood poles that need to be replaced before a pole failure, which may result in an ignition event.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop Better Visibility Into Risk – When intrusively inspecting wood poles, PG&E gains understanding of what the internal and external condition of the pole is at and below groundline. PG&E also gains the understanding of what decay and degradation mechanisms the poles are experiencing, which increase the probability of premature pole failures. This understanding helps to quantify the overall system risk of potential pole failures due to decay and degradation, which helps to build risk profiles. In addition, understanding the internal and external pole condition and subsequent decay and degradation mechanisms helps to indicate where PG&E has risk, to enable development of mitigation plans.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PT&T prolongs the service life of wood poles through reapplication of preservative and/or restoration of structural strength through reinforcement. PT&T identifies poles that are nearing the end of their service life and recommends these poles for replacement or reinforcement prior to failure. PG&E's PT&T program has existed since 1994 and is fully implemented across transmission and distribution wood pole structures. Intrusive wood pole inspection involves the direct measurement of shell thickness, examination of below grade degradation, and application of preservatives. Intrusive wood pole inspection is a control against premature or unintended failure of wood pole structure due to shell degradation.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative: Selection criteria of assets for each inspection cycle is driven by the date of wood pole installation into service. GO 165 requires a maximum 20-year cycle through the life of the wood pole, and PG&E prescribes an initial interval of 1five years, with a recurrence of inspection approximately 10 years thereafter. The fact that a pole is in an HFTD area location is not a factor in the selection of wood poles for intrusive testing, however enhanced detailed inspections may trigger the need for off-cycle intrusive testing based upon initial visual examination.

Risk Models Used or Other Considerations for Prioritization:

- PG&E is prioritizing intrusive inspection of wood poles based on the time since the previous intrusive inspection. PG&E intrusively inspects wood poles on an approximate 10-year cycle, inspecting roughly 10 percent of the population annually.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- Upgrade PT&T Program Field Hardware and Software – In 2021, PG&E upgraded the PT&T program's existing field hardware and software tools to enhance recordkeeping and data system integration. The transition enhanced the capability of PT&T to report asset registry discrepancies, and to collect photographic data to supplement test report results, and aid in the asset registry enhancement efforts. PG&E's Engage and Inspect team worked on the hardware and software upgrade and developed the new application based on the defined business requirements. The team built integration pathways to both GIS and SAP. Lastly, the team has prepared change management for rolling out the new application and training the inspectors. The new application is on-track for deployment in 2022.

Impacts:

- The new hardware and software will enable the PT&T program to be continually supported by Information Technology (IT).

- The enhanced platform enables PG&E to ensure accurate and comprehensive intrusive inspections that are attached to the correct asset in the systems of record, thereby ensuring adequate compliance with recordkeeping.

- PG&E's Engage and Inspect application is already being used by other inspection programs, so bringing the PT&T program onto the same platform enables consistency of recordkeeping, reporting and inspection requirements.

Lessons Learned:

- The enhanced platform enables PT&T to update the asset registry through automated processes, instead of manual efforts.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to perform intrusive pole inspections utilizing new field hardware and software and the revised refreshed technology solution and collect photographs of the poles inspected. We will employ the revised utility procedure (TD-2325P-01, R3) and enhanced testing method to drill at least one new bore hole when intrusively inspecting wood poles.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Based upon the Wildfire Distribution Risk Model (WDRM) and results of PT&T, long-term recurrence intervals may be tailored, such that the inspections are deployed on an as-needed basis, rather than the current approximate 10-year cadence. This enhancement requires extensive analysis, including risk models, cost benefit and inspection rejection criteria. Based on the results of the extensive analysis, program changes could be implemented or rejected.

7.3.4.6.2 Intrusive Pole Inspections – Transmission

OEIS Initiative Definition:

Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment -Structures

Secondary Risk: Ignition Risk – Equipment -Conductor

Intrusive pole inspections (i.e., PT&T) are a way to evaluate wood poles and are conducted on an approximate 10-year cycle for early detection of deterioration. These inspections can be effective in identifying wood poles that need to be replaced before a pole failure, which may result in an ignition event.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase Understanding of Where Risk is Located – Completed inspections can be utilized in asset risk modeling to predict wood pole decay over time.
- Develop Better Visibility Into Risk – When intrusively inspecting wood poles, PG&E gains an understanding of the internal and external condition of the pole, at and below groundline. This understanding results in corrective notifications as needed for poles requiring mitigation. Even for those poles not requiring correction, data from inspections is also useful to begin building an understanding of decay rates for poles, which may also be influenced by environmental location and other attributes of the pole.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – PT&T prolongs the service life of wood poles through reapplication of preservative and/or restoration of structural strength through reinforcement. PT&T identifies poles that are nearing the end of their service life and recommends these poles for replacement or reinforcement prior to failure.
- System Hardening (Underground and Overhead) – Results from inspections may result in transmission maintenance notifications, such as pole replacement or reinforcement. Completed repairs or replacements within HFTD areas have the effect of hardening on the transmission system.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative: Selection criteria of assets for each inspection cycle is driven by the date of wood pole installation into service. PG&E prescribes an initial interval of 1five years, with a recurrence of inspection approximately 10 years thereafter. Additionally, initial results from the Wildfire Transmission Risk Model may add additional poles to the inspection plan above the 10-year base cycle.

Risk Models Used or Other Considerations for Prioritization:

- Initial results from the Wildfire Transmission Risk Model to determine a small population of predicted higher probability of failure assets to be intrusively inspected above their base cycle time. This model is still under development and expected to have enhancements made throughout the year that may warrant refinement of the workplan.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, 11,895 transmission poles (of which approximately 4,054 were in HFTD regions) had intrusive pole inspections.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue to schedule intrusive pole inspections on HFTD areas.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Based upon the Wildfire Transmission Risk Model and results of PT&T, long-term recurrence intervals may be tailored, such that the inspections are deployed on an as-needed basis in addition to the current approximate 10-year cadence. A more risk-based approach to inspection planning can allow for more frequent inspections on assets more likely to fail or with higher consequence.

Integration of Results – Currently, intrusive inspection results completed by a vendor are stored in their database and are not fully integrated with other PG&E inspections whose records reside in SAP. Integration of inspection results will aid in use of the data for risk modeling and asset strategy.

7.3.4.7 LiDAR Inspections of Distribution Electric Lines and Equipment

OEIS Initiative Definition: Inspections of overhead electric distribution lines, equipment, and right-of-way using LiDAR, (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Consequences – Structures Impacted

Inspections, including inspections using LiDAR, can help identify and treat pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure." LiDAR and imagery can improve PG&E's effort to digitize our inventory and update our data sets for our mobile equipped workforce and improve our knowledge about distribution asset condition.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – LiDAR can: (1) provide accurate measurements to improve pole loading; (2) provide an accurate location for distribution inspection and (3) improve mapping.

- Increase Understanding of Where Risk is Located – LiDAR allows for operational decision making from a desktop and minimizes field visits which improves efficiency and safety.

- Focus Mitigations on Highest Risk Locations – Imagery is being used by desktop reviews to determine highest risk factors on poles for prioritization and strategy.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – LiDAR technology can provide information for work planning and operational workflows. Aerial LiDAR collection includes use of helicopters with mounted LiDAR sensors and photogrammetry equipment operated by an onboard technician. Large three-dimensional point clouds and hi-resolution imagery datasets collected during the flight missions are then processed to register data to real world coordinates. The data is used to measure relative distances between classified objects (for example the height of a pole). The LiDAR collection using vehicles includes a 360-degree area collection system mounted on top of the car that can create point cloud data and imagery to be used to identify specific features. This data is used by the operational teams for more efficient decision making and repair.

- System Hardening (Underground and Overhead) – This is a known use case of LiDAR, imagery, and derived vector data.

- Vegetation Management – This is a known use case of LiDAR, imagery, and derived vector data.

- Asset Inspection and Repair – Desktop analysis and corrections to update structural 3D digital twin of overhead assets.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: This initiative was first targeted at HFTD areas. However, the data and operational knowledge gained from its inception is expected to be leveraged and utilized for additional portions of PG&E's service area.

Risk Models Used or Other Considerations for Prioritization:

- The results of imagery from LiDAR can be used to inform risk models.

- Exceptions to the prioritization depends on the needs and urgency of the various use cases such as incident investigation and substations who may need imagery from time to time to address legal and other important needs. Data is used to implement new infrastructure and for GO 95 structure compliance.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

A Program Management Office (PMO) was created to coordinate imagery gathering effort across various lines of business. The PMO oversees the strategy for LiDAR collection, ensures consistency of LiDAR use, and coordinates provision of data for the various use cases identified by the PMO. The PMO works to avoid duplicative efforts/spend across the lines of business that leverage LiDAR.

The PMO helped coordinate a consistent and standardized process across all lines of business, covering annual planning, sourcing and contracting, and collection execution. The PMO managed the acquisition of 5,893 miles of fixed wing and mobile (vehicle) data.

The PMO worked with Land Survey to define and implement data collections standards which apply across the Lines of Business (LOB) and vendors. These standards support the successful adoption/use/reuse of data from Remote Sensing Data platform.

We also created a "One PG&E" view tool that provided visibility to all planned collections across all LOBs, to anyone at PG&E who needs access. Schedules are visible graphically on a map, with ability to see underlying information about each collection in tabular format.

The PMO is working closely to provide business requirements and User Acceptance Test for the central repository IT GIS is developing. The purpose of this centralized repository is to ingest, store and provide access to all Remote Sensing data.

Over 16 use cases were defined, and a matrix was created to identify the best type of LiDAR imagery for each use case. For example, fixed wing is the most appropriate for the data conflation use case, helicopter obliques are mostly used by the Field Estimating and Design and Incident investigation use cases, and so forth.

Impacts:

- Established a centralized team for coordinating remote sensing collections to reduce duplication of efforts and standardizing contracts, processes, and storing of data.
- Ability to remotely identify and prioritize the highest risk overhead poles.
- Supports use cases such as pole loading assessments described in Section 7.3.4.13.

Lessons Learned:

- Understanding the detailed needs and requirements for all lines of business is key to building a complete plan for what's needed in future collections.
- The PMO ensures data quality, consistency, and cost efficiency.
- Images on their own have limitations. The focus is gathering LiDAR point cloud data and extracting three-dimensional imagery from the data.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue LiDAR data acquisition for distribution electric lines and equipment in HFTD and HFRA areas.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028)

One PG&E View – Continue updates on the "One PG&E" view for our yearly Remote Sensing Acquisition plans. This will provide data acquisition cost reduction and efficiency.

Complete ED Asset Digital Twin – This will increase throughput and cost reduction and increase safety by reduction of field visits.

Centralization of Data Platform – This will give all PG&E lines of business the ability to quickly find and access data. It will also provide cost savings in terms of storage, data reuse and visualization of data.

Generate Cadence for Refreshing Digital Twin Catalog of All ED Assets – This will ensure the best asset registry.

Leverage AI to Further Identify Risk Factors and Automate Manual Processes – This will improve risk results and analysis. This will provide cost savings in personnel and increase reliability.

Data Will Support GIS System Updates – This will allow PG&E to automate use cases such as hardening, conflation, modeling, and mapping.

7.3.4.8 LiDAR Inspections of Transmission Electric Lines and Equipment

OEIS Initiative Definition: Inspections of overhead electric transmission lines, equipment, and right-of- way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

Transmission LiDAR for equipment and line inspection typically aims to leverage the same LiDAR data capture from Vegetation Management, which captures data for transmission annually, system wide.

The primary use for transmission LiDAR is through PLS-CADD (Power Line Systems – Computer Aided Drafting and Design) model development. PLS-CADD is the industry standard overhead power line design software. The modeling includes terrain, structures, and wires and uses the Finite Element Analysis feature to combine a system of structures as a single model, which accounts for load between adjacent structures.

PLS-CADD data is used to adjust the strength ratio of assets in the OA Model. Without PLS-CADD data, the OA model computes an estimate of each asset's fragility based on the assets observed condition, its age, its environment, and the historical performance of the associated circuit. Inherent in this fragility is the assumption that the asset has been designed to resist minimum design wind load requirements for transmission structures for a specific site. However, this estimate may not be the case for a given structure for a variety of reasons; for example, an asset may be "over-designed" with respect to minimum design wind load requirements because another load case results in higher member forces, or an asset may be "under-designed" with respect to minimum design wind load requirements because of the addition of loads to the asset over time.

PLS-CADD results are used to adjust the new asset fragility curve to reflect the degree to which an asset is over- or under-designed with respect to the minimum design wind load requirements. This provides a more accurate "digital twin" of the asset in the OA model, which then goes on to inform PSPS and Asset Strategy decision.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – The PLS-CADD models have the ability to identify deficiencies. These modeling efforts could inform corrections to reduce ignitions.

- Reduce Number of Customers Impacted – By having the digital twin of the system, more accurate probabilities of failure can be calculated in the OA Model in place of more conservative assumptions. When using the OA Model to scope transmission lines in PSPS events, a more accurate model will result in less potential lines (customers) de-energized during PSPS events.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Vegetation and Transmission LiDAR use cases (e.g., the Strike Tree Model and the PLS-CADD models) may be using the same base LiDAR data.

- PSPS – PLS-CADD data is an input into the OA Model, which is used directly in PSPS transmission line scoping decision.

- Asset Inspection and Repair – As PLS-CADD data is used to create a digital twin of the transmission system, certain findings may warrant mitigation – such as overloaded or leaning poles or towers.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The order in which LiDAR is collected to model the transmission lines in PLS-CADD is informed by the lines' PSPS likelihood. The rationale being that a line more prone to being involved in PSPS events would have the most benefit of more accurate, digital twin modeling through PLS-CADD. The remaining transmission assets to model will be determined based on the 10-year lookback study, using 2021 PSPS scoping guidance.

Risk Models Used or Other Considerations for Prioritization:

- PSPS 10-year Lookback – The 10-year lookback was used to prioritize the development of the PLS-CADD models. The results of LiDAR analysis are also fed into risk models, such as Operability Assessment.

- Timing of LiDAR capture (e.g., if LiDAR is captured in Quarter 1 (Q1), but the particular line burns down and is rebuilt in Q3, then LiDAR data would need to be re-captured), quality of LiDAR capture, funding resources.

- Exceptions to the prioritization depends on the needs and urgency of the various use cases such as incident investigation and substations who may need imagery from time to time to address legal and other important needs. Data is used to implement new infrastructure and for GO 95 structure compliance.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2020 and 2021, 16,185 structures were modeled and passed QA review for transmission lines through PLS-CADD in the Tier 2 and 3 HFTD areas.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans on completing LiDAR data acquisition for 269 HFTD/HFRA circuit miles.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Conductor Blowout Analysis – PLS-CADD models, along with vegetation LiDAR can be used to simulate conductor span blow out (displacement) conditions on the line. This can be helpful to understand the probability of contact with vegetation or other objects in the event of high winds on the conductors.

Tower Lean Assessment of Burn Scar Areas – Towers that are leaning or are showing signs of change in position over time, may be threatened by instability or other asset deficiencies that need to be mitigated. Using LiDAR data to identify such locations will help focus mitigations at the areas with the highest probabilities of failure.

Support Transmission Conflation – Update the Electric Transmission Geographic Information System (ETGIS) positionally, improve the tower structure locations in ETGIS.

Safety Factor Assessment – Use of LiDAR data can help inform pole loading calculations or other design safety factor analysis for assets.

Centralization of Data Platform – Ability for all PG&E lines of business to quickly find and access data. Cost savings in terms of storage, data reuse and visualization of data.

Complete ET Asset Digital Twin – Increased throughput and cost reduction, Increased safety by reduction of field visits.

3D Data and Imagery Enablement – Complete the PLS-CADD modeling, which creates a digital twin of the transmission system. Provides more accuracy of what is in the field for improved risk modeling and more accurate predictions, better work plan prioritization and intuitive visualization. Includes the need for processes to keep the models up to date.

Support of System Inspections – To help future enhanced prioritization and efficiency of system inspections (e.g., using year over year LiDAR to measure and track displacement of assets). This may include use of AI to further identify geospatial risk factors and automate manual processes.

Generate Cadence for Refreshing Digital Twin Catalog of All ET Assets – Ensures best asset registry.

Data Will Support GIS System Updates – Automate use cases such as hardening, conflation, modeling, and mapping.

7.3.4.9 Other Discretionary Inspection of Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

OEIS Initiative Definition: Inspections of overhead electric distribution lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

Secondary Risk: Ignition Risk – Equipment – Conductor

PG&E has established TD-2302P-05, that governs Electric Distribution Maintenance Requirements for Miscellaneous Overhead and Underground Equipment outside of GO-165. This utility procedure classifies maintenance tasks for miscellaneous electric overhead (OH) and underground (UG) equipment, including capacitor banks, fault indicators, interrupters, reclosers, voltage regulators, Supervisory Control and Data Acquisition (SCADA) and Primary Distribution Alarm and Control (PDAC) controls, and sectionalizers. It requires that preventive maintenance activities be conducted in accordance with applicable PG&E, manufacturer, and engineering requirements.

Key components of these equipment inspections and tests include but are not limited to:

- Testing and ensuring capacitors are fully functional prior to summer hot weather season.
- Testing and ensuring all line reclosers (LR) and automatic switches have fully charged batteries and are fully functional.
- Testing and ensuring all SCADA devices are fully communicating and operable.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition events – When equipment such as capacitors, regulators, and line reclosers are fully functional this equipment can react to faults and changing line conditions that could potentially cause an ignition event.
- Reduce Number of Customers Impacted – In the case of line reclosers, these inspections ensure that they are fully functional and can react to faults and reduce outage times and enable remote switching to limit customers impacted. For capacitors and regulators, these inspections ensure that they are fully functional and prevent sagging or excessive voltages for customers.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – GO 165 inspections are mandated for electric facilities. These equipment inspections are in addition to GO 165 inspections. These additional inspections are primarily utilized to make sure such equipment as capacitors, regulators, and line reclosers are fully functional.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: These inspections are prioritized by utilizing the WDRM and focusing on HFTD areas.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model (WDRM).
- The work is dispatched and prioritized by headquarters based on available resources in each headquarter to execute the work in addition to risk models.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

All electric distribution miscellaneous overhead and underground equipment were inspected and maintained per TD-2302P-05.

Impacts

- All electric distribution miscellaneous overhead and underground equipment were inspected and maintained per TD-2302P-05. Over 95 percent of equipment was functioning properly as of February 1, 2022. For any units not working, Critical Operating Equipment tags have been generated to repair or replace the equipment.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan on inspecting and maintaining all electric distribution miscellaneous overhead and underground equipment per TD-2302P-05.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Develop Formal QA for All Field Automation System (FAS) Inspection-Test Records – Ensure consistency of completed inspection-test records, make sure all data is correct and ultimately that all equipment is available and functioning properly.

7.3.4.10 Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

OEIS Initiative Definition: Inspections of overhead transmission lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Ignition Risk – Equipment – Structures

Although the majority of ignition-potential failure modes can be detected via visual inspections required by existing rules and regulations, there are some conditions that may not be easily detectable (e.g., conductor degradation, conductor strength, corrosion, wear, annealing, pitting, or below grade foundation condition). Lack of detection can lead to asset failure and associated consequences. For that reason, PG&E has initiated several additional inspection programs to further improve the inspection program. Many of these programs are in the pilot phase.

Conductor Measurement/Inspections – This program aims to assess the condition of steel core conductors via the measurement of the remaining cross-sectional area of steel core wires and detection of local flaws such as deep pits or broken strands (by measurement of magnetic flux leakage).

Below Grade Foundation Inspections – This program aims to assess the condition of the steel structure foundations below the ground line. The inspection includes a measure of soil resistivity, pH, Redox and Half Cell Measurement, as well as a visual assessment with photographic evidence of each excavated foundation leg. Cathodic Protection will also be installed concurrently with the inspections.

Corona Inspections – This program aims to assess non-visible conditions, particularly of insulator and insulator hardware, via the detection of corona (free electrons that fragment stable oxygen molecules (O2) combining with others to create ozone (O3) gases) concentration.

Ultrasonic Pole Inspection – This pilot program involves a non-destructive test that uses high frequency sound waves to measure the thickness of the metal poles. Measurements will be taken ~4 feet from the base of the pole as a baseline, and then again at the ground line to determine any shell thickness loss. Additionally, it is potentially capable of also measuring the thickness of any protective coating applied to the steel poles, which can be helpful to understand the effective period for life extending coatings.

Corrosion Climbing Assessment – This pilot program involves climbing towers and lattice steel poles to look for evidence of corrosion. This assessment involves scraping/cleaning of existing corrosion control products to get visibility to the base metal, assessment of any crevice corrosion, assessment of stub interfaces – removing

thick mastic and blisters in paint to fully assess steel, etc. Detailed photos will be captured, including from inside the tower.

Sampling and Testing – This program involves taking equipment samples and performing various tests to understand remaining strength. Testing may involve visual examination (e.g., internal/external corrosion and electrical damage), electrical testing (resistance measurement), and mechanical testing (e.g., measure breaking strength).

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop Better Visibility Into Risk – These inspections can provide information regarding asset condition, including in some non-visual methods. This information can help inform decay rates and the asset health models such as the Wildfire Transmission Risk Model.

- Focus Mitigations on Highest Risk Locations – Prioritizing where these inspections occur first, can help focus any needed mitigations (e.g., Electric Corrective (EC) tags) as a result.

- Increase Understanding of Where Risk is Located – Understanding and trending where issues may be occurring based on results of these inspections and subsequent risk modeling can help inform future asset work, inspections, and designs in particular geographic areas.

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead) – Findings from inspections may result in EC tags or other program work (Section 7.3.3.12.3 and Section 7.3.3.15).

- Asset Inspection and Repair – Results of these inspections may trigger additional enhanced inspections (Section 7.3.4.2) (for example, corona findings may have a follow-up aerial inspection performed to confirm conditions).

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- The Below Grade Foundation Inspections prioritization is informed by 2021 pilot results, with an emphasis is on direct buried towers, excluding towers in which work is already expected to be performed or the asset is to be removed. Specifically, areas of the worst measured thinning (section loss measured during the pilot) and environmentally susceptible underground corrosion helped define prioritization.

- Corona Inspections were and will be included on all lines planned for infrared inspection in 2022. Infrared inspections (Section 7.3.4.5) are prioritized primarily based on HFTD tier.

- Prioritization of the Conductor Measurement/Inspections, Testing/Sampling, Ultrasonic pole measurement, Corrosion climbing assessment are informed by the Wildfire Transmission Risk Model and other performance considerations.

Risk Models Used or Other Considerations for Prioritization:

- Several of the inspection methods (ultrasonic pole testing, corrosion climbing, and conductor measurement) have 2022 scopes that are informed by the Wildfire Transmission Risk Model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Below Grade Foundation Inspection – In 2021, we piloted inspections on 933 structures.

Impacts:

- Results from the 2021 below grade inspection pilot helped to inform the 2022 below grade inspection plan.

Lessons Learned:

- Data capture should be integrated into PG&E systems to assist in analysis of results.

Corona Inspections – In 2021, 7,587 circuit miles (of which 4,211 miles are in HFTD areas) had Corona Inspections performed in conjunction with infrared inspections.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Conductor Measurement/Inspections – In 2021, targeted spans from five transmission lines were inspected. Three of the lines are still undergoing analysis of the inspection results.

Impacts:

- The conductor inspection results provided details on the remaining tensile strength of steel core wires, which helps provide information on the condition of conductors.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans on piloting the Ultrasonic Steel Pole and the Corrosion Climbing Assessment inspection methods. We plan on performing Component Sampling and Testing, and also plan to continue our Conductor Measurement (Linevue) and Below Grade Inspections of HFTD/HFRA structures.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

For all of these pilots, success of the methodology must be determined, based on cost to benefit (number of quality findings), usability/calibration of the data (is the data provided from the inspections useful for asset health modeling) and benchmarking with others in the industry. For remaining failure modes that are not easily detectable with current pilot or enhanced inspection methods, additional research into potential design or inspection method changes will be considered based on consequence of failure.

Upon success of the pilot methodology as described above, we will then develop associated guidance documentation and mature the inspection method beyond a pilot stage. This could include more widespread usage, regular inspection cycles, or targeted deployment as-triggered.

For below-grade inspections, integration of inspection results into SAP will aid in analysis of the results and potential use within the Wildfire Transmission Risk Model.

7.3.4.11 Patrol Inspections of Distribution Electric Lines and Equipment

OEIS Initiative Definition: In accordance with GO 165, simple visual inspections of overhead electric distribution lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Patrol inspections of distribution electric lines and equipment are routinely undertaken for assets not scheduled for a detailed inspection within the calendar year. Patrol inspections are maintenance activities that include a simple, visual examination of applicable overhead and underground facilities to identify obvious structural problems and hazards. Patrol inspections are visual reviews of the asset condition to proactively detect imminent or existing safety or reliability hazards in alignment with GO 165. Distribution overhead patrols may be executed on foot, by vehicle, or by aerial means as appropriate to the terrain.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Patrol inspections reduce the risk of unforeseen equipment failure that could result in a wildfire ignition by ensuring that assets not scheduled for a detailed inspection are patrolled within the calendar year.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Overhead asset patrols seek to proactively identify and treat actual or pending failures of asset components which could create fire ignition if left unresolved.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Prior practice of completing patrols solely on a time driven cadence did not adequately address the increased risk from overhead asset or component failure in HFTD areas. As such, the HFTD area assets not selected for enhanced detailed inspection are normally scheduled for patrol. For 2022, PG&E intends to complete patrol inspections of overhead assets by using the same recurrence interval used in 2021: Tier 2 HFTD areas are patrol inspected on years when enhanced detail inspections are not scheduled (e.g., two of every three years). In general, PG&E schedules HFTD area patrol activities earlier in the year to provide time for necessary

repairs prior to peak fire season. Because all HFTD area assets are scheduled for detailed enhanced inspections annually, they are not subjected to patrol inspections on a routine basis.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed a total of 1.3 million units of patrol in other areas not subject to detailed inspections.

Impacts:

- Not Applicable

Lessons Learned:

- A backlog of as-builts and updates to the Asset Registry drove the need to break-in a higher number of inspections than anticipated to meet regulatory commitments. As a result, various data improvement opportunities were identified.

- Patrol inspections are performed using paper maps. This approach is different than the digital-based enhanced inspections which can hamper resource optimization efforts.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue inspection patrol in HFTD Tier 2 and other areas not subject to detailed inspection.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – The patrol Inspections strategy needs to be migrated from paper-based to digital form. This transition will be informed by lessons learned from the transition of Enhanced Inspections to digital form and from evaluation of corrective maintenance tags. The transition to digital form will make possible the prioritization of patrols based on risk models, asset risk profiles, alignment with other maintenance work such as hot line tags, and evaluation of outstanding corrective work.

The transition to digital form will also make resource optimization planning more feasible and improve the quality of patrols. Digitized record keeping of patrol inspections will make future predictive modeling possible.

7.3.4.12 Patrol Inspections of Transmission Electric Lines and Equipment

OEIS Initiative Definition: Simple visual inspections of overhead electric transmission lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Ignition Risk – Equipment – Structures

Patrols of transmission electric lines and associated equipment are routinely undertaken for assets not scheduled for an enhanced inspection within the calendar year. Patrol inspections are defined within the Electric Transmission Preventive Maintenance Manual (TD-1001M) as a brief, visual inspection of applicable utility facilities (equipment and structures) that is designed to identify obvious structural problems and hazards. Patrols are visual reviews of the asset condition to proactively detect imminent or existing safety or reliability hazards. Transmission overhead patrols may be executed on foot or by vehicle as appropriate to the terrain. Patrol inspections reduce the risk of unforeseen equipment failure that could result in a wildfire ignition by ensuring that assets not scheduled for a detailed inspection are patrolled within the calendar year.

Since patrols are conducted for entire lines, some individual structures which are scheduled for enhanced inspection will also be patrolled if other structures on the same line are not scheduled for enhanced inspection in the given year.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus Mitigations on Highest Risk Locations – Overhead asset patrols seek to proactively identify actual or pending failures of asset components. Non-routine patrols, for PSPS or outage response, focus on high- risk lines that have either already been de-energized or have already failed.

- Reduce Frequency of All Types of Ignition Events – Identification of issues during patrols can help target assets needed for mitigation, and in cases of PSPS, check that the line is safe before re-energizing.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Findings from completed patrols may result in mitigation actions such as maintenance tags. Non-routine patrols may also be conducted after outage events, which provides mitigation to emergent situations, as well as information regarding failure mode which can help inform near-and-long term strategy around similar assets and situations.

- PSPS – Patrols are conducted after each PSPS event on affected lines, prior to re-energizing the line, to check that the line is safe to energize.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work Within Initiative: For 2022, PG&E intends to continue completing patrol inspections of overhead transmission assets that are not in the enhanced inspection scope. Patrols are completed on a line basis, with the focus to complete patrols within HFTD prior to wildfire season. Certain lines, such as those supporting DCPP and Morro Bay Power Plant, may be subject to quarterly patrols provided they do not have an enhanced inspection scheduled in the given quarter.

Risk Models Used or Other Considerations for Prioritization:

- No direct model used for prioritization of patrols.
- Patrols are completed on a circuit basis. There can be some overall change in total structure count if the overall structure count for each circuit changes throughout the year. Non-routine patrols may also be added throughout the year in response to outages, or before or after PSPS events.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

For annual patrol inspections of transmission electric lines and equipment a total of 64,554 structures were patrolled in HFTD and Zone 1 with 64,013, of these structures patrolled by air and 541 structures patrolled by ground due to flight access issues.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue to perform patrol inspections of electric transmission structures in HFTD and HFRA areas.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Trend Patrol Results – Continue to trend issue find rates from routine patrols to enhance effectiveness.

7.3.4.13 Pole Loading Assessment Program to Determine Safety Factor

OEIS Initiative Definition: Calculations to determine whether a pole meets pole loading safety factor requirements of GO 95, including planning and information collection needed to support said calculations. Calculations must consider many factors including the size, location, and type of pole; types of attachments; length of conductors attached; and number and design of supporting guys, per D.15-11-021.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Secondary Risk: Ignition Risk – Equipment – Conductor

Determining whether an electric pole is overloaded is an important element of preventing pole failure and the associated potential wildfire ignition risk. PG&E started our pole loading program to reduce the risk of potential fire ignitions resulting from pole failures by evaluating whether a pole meets GO 95, Rule 44 strength requirements throughout its service life, both when initially installed and while in-service despite changing conditions, impacts from maintenance activities, attachment additions, and potential wood strength degradation.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase Understanding of Where Risk is Located – When performing pole loading calculations, PG&E gains understanding of when poles are overloaded, which increases the probability of failure of the poles. PG&E also gains the understanding of where the overloaded poles are located and can compare that to the wildfire ignition consequence profiles. This increased understanding helps PG&E prioritize the mitigation efforts.

- Develop Better Visibility Into Risk – When performing pole loading calculations, PG&E gains understanding of when poles are overloaded and hence have a higher probability of failure. This understanding helps to quantify the overall system risk of potential pole failures due to overloading, enabling the development of system risk profiles and associated mitigation plans.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – During a pole's service life, pole loading calculations are performed when load is added to a pole, or if a suspected overload condition is observed during inspection. Pole loading calculations are performed in O-Calc software during design phase to ensure poles are sized correctly to satisfy GO 95 requirements. PG&E created a centralized database to retain pole loading calculation record information, in accordance with Decision (D.) 09-08-029.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The program has focused on assessments of poles in the Tier 2 and 3 HFTD areas with the goal to be fully implemented (100 percent poles analyzed) in these areas by 2024. Poles located in non-HFTD areas will follow, with the long-term goal to be fully implemented (100 percent poles analyzed) by 2030.

Risk Models Used or Other Considerations for Prioritization:

- When performing the pole loading calculations, PG&E utilizes Light Detection and Ranging (LiDAR) data and field collected imagery from the recent system inspections to update the baseline models. PG&E is prioritizing analysis of the poles in the HFTD areas and building the annual plans based on the previous year's LiDAR and system inspection data captures.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The pole loading assessment program is related to the pole loading hardening and replacement program described in Section 7.3.3.13.

In 2021, PG&E completed pole loading analysis of 61,723 poles, all of which are considered the highest risk poles, either due to the pole characteristics or location, being in an HFTD area.

PG&E switched vendors for this work in 2021. Contracts took longer than expected and the new vendor had to complete an extensive pilot to establish a solid foundation based on high quality pole loading calculations. In addition, the vendor had to continually on-board new personnel, which required training on the engineering requirements. Despite these setbacks, the vendor was able to ramp up production levels, while continuing to focus on quality. The initiative ended in a delayed status and will require the missed units to be made up in future years (2022 to 2024), to ensure the program remains on-track for timely completion of analyzing all HFTD poles by the end of 2024.

Impacts:

- In 2021, PG&E switched vendors for this work.
- The extensive pilot focus on quality and building a strong foundation for the program with the new vendor delayed the overall production.

Lessons Learned:

- This year was extremely important for PG&E in building a strong foundation for the performance of quality pole loading analysis.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue to perform pole loading calculations.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E is working with the pole loading calculation software vendor to enable analysis of multiple pole models together, enabling span linking to structural connectivity. This enhancement allows for linking pole loading calculation models, so that when one model is updated, it automatically updates the surrounding pole models. The benefit of this enhancement enables more accurate pole loading calculation models, so that PG&E can comprehensively understand the pole loading conditions of all poles system wide.

In addition, PG&E is working with the vendor to increase support and personnel to increase the volume of poles assessed annually.

7.3.4.14 Quality Assurance/Quality Control of Inspections

OEIS Initiative Definition: Establishment and function of audit process to manage and confirm work completed by employees or contractors, including packaging Quality Assurance/Quality Control (QA/QC) information for input to decision making and related integrated workforce management processes.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Structures

Reducing ignition potential is implemented at a tactical level by major initiatives that include vegetation management, inspections and repairs of electric facilities, a system hardening program that upgrades transmission and distribution assets, and a system automation program that enhances visibility into and control of the system. Preventive maintenance tasks such as enhanced inspections of overhead assets are a key means for PG&E to proactively identify potential failure modes that could lead to ignition if not resolved timely. QA/QC are important tools for providing consistent and reliable inspection results for PG&E's equipment and facilities, which ultimately can reduce wildfire risk. PG&E has implemented a number of programs, processes, tools, and other control points to review and manage the quality and accuracy of inspection work performed by our employees and contractors.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Asset Inspections seek to increase our ability to identify asset problems before they result in failure by gaining a deeper insight into asset condition through advanced technologies, data management, and analytical capabilities. Specifically, QA/QC of inspection programs identify anomalies in inspection and patrol results, address any gaps, determine the root cause of any gaps, and implement improvements.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Inspection programs are evaluated at the close of each annual cycle by a cross-functional team from the inspection execution team as well as asset strategy and standards to identify opportunities to improve efficiency and effectiveness of the programs.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

The QC process checks for adherence of inspections to the guidance provided in the Electric Distribution Maintenance Manual (TD-2305M) and the Electric Transmission Preventive Maintenance Manual (TD-1001M). Desktop QC activities are conducted as part of routine inspection quality verification and are also initiated for any ad hoc quality performance issues observed in the SI environment. We currently use three selection methods:

- Random Selection – Determine the inspectors to evaluate using a simple random process methodology.
- Targeted – Picking confirmed "Outlier" inspectors for review based on Quality KPI tracking data.
- Probable Cause – If a vendor or inspector's performance is deemed "suspect" or unsatisfactory through other System Inspection (SI) processes or channels, additional desktop QC inspection will be conducted to verify work quality.

Due to the large volume of detailed inspections conducted, the Desktop QC process only reviews a sample from the overall completed inspection population. Statistically valid sampling plans are established which utilize key system risk information available during the inspection period to select appropriate confidence level and compliance error rates. Once the total sample size is generated, QC calculates the number of records for each inspector proportionate to the total volume of inspections conducted by the inspector. Once the counts are generated for each inspector, records are randomly picked.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model.
- Once the Wildfire Consequence Scores are applied to the population of data (by asset location), the entire population is prioritized by Wildfire Consequence Score, from highest to lowest. The population is then separated into equal deciles, decile 10 being the highest scores and decile one being the lowest scores. The sample is then randomly pulled from the population deciles using the following weighting: 18 percent from decile 10, 16 percent from decile 9, 14 percent from decile 8, 12 percent from decile 7, 10 percent from decile 6, 10 percent from decile 5, 8 percent from decile 4, 6 percent from decile 3, 4 percent from decile 2, and 2 percent from decile 1.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

QC Feedback and Corrective Actions – In Q1 2021, we implemented the Inspection desktop QC process to focus on the sampling of OH inspection results and photos completed via the Inspect application. This included a review of checklist results and associated photos to ensure compliance with program/guidance documents and overall quality of inspections. In Q2 2021, we implemented dashboards for reporting the results of the desktop QC Reviews. Additionally, we established a monthly report-out and the QC Review findings for the System Inspection teams. At the end of Q2, Transmission was at 50 percent attainment to plan and Distribution was at 77 percent attainment to plan. In Q3 2021, Transmission and Distribution Desktop QC achieved 100 percent attainment to plan, and reviews are completed within 7-14 days after completed inspection date. In Q3 we also launched a project to expand the SI QC Program. Objectives are to integrate all SI QC data to perform Continuous Improvement activities as part of the Plan-Do-Check-Act cycle. This will enhance the continuous monitoring of performance trends, provide better analysis for systemic issues, and provide for a more robust oversight and governance of low performing contractors. The initial phase of this enhancement will be focused on the real-time validation and correction of Failed Non-Conformance issues and will include capability for immediate escalation of non-adherence to processes and procedures to address Compliance and Business impacts of Non-Conformances. The initial phase will also include an investigation capability for systemic issues, investigation and validation of root causes of poor performance, identification and implementation of corrective actions and monitoring of corrective actions for effectiveness.

In July 2021, a special QC audit was launched to re-evaluate C-hook wear per Federal Monitor's feedback using the new "combined wear of assembly" criteria which is inclusive of both the C-hook and hangar plate. A total of 179 AIR+ (Helicopter and Drone) Transmission Maintenance Notifications were reviewed using the new criteria. 28 notifications were recommended for a priority upgrade of which four were emergency A priority tags. These 28 C-hooks were dispositioned to be removed from the field and detailed quantitative assessment performed for wear. The audit confirmed the subjectivity that exists within the aerial photographic method of inspection. This is due to the lack of clear and explicit guidance for assessing wear, as well as the limitation on the angles at which photographs can be captured via the current aerial technology being utilized. In Q4 2021, the QC team implemented a process for all Failed Non-Conformance records to be sent to the inspector's immediate PG&E supervisor.

Table PG&E-7.3.4-1 below provides the failure rate for QC reviews of completed inspections. The data is broken down by quarter, as well as by inspection type.

TABLE PG&E-7.3.4-1:
QC DESKTOP REVIEW QUARTERLY FAIL RATE OF INSPECTIONS BY TYPE

	Distribution Overhead Inspection	Transmission Overhead Inspection
2021-Q1	10%	22%
2021-Q2	11%	35%
2021-Q3	14%	32%
2021-Q4	14%	28%

Impacts:

- Provide real time validation and correction of Failed Non-Conformance issues that are generated via the Desktop QC Process. Immediate escalation to address Compliance and Business impact of Non-Conformance issues.

Lessons Learned:

- Once immediate corrections are taken, each issue will be added to QC monitoring. Systemic issues from trending will undergo further investigation for root cause and corrective actions. Urgent, high risk local issues will also undergo the corrective action process

QC Team Field Audit – In Q2 2021, we began the development of a "Blind" Field QC Review process for Transmission and Distribution to be launched in Q3 2021. In Q3-Q4 2021, we piloted the "Blind" Field QC Review process for Transmission and Distribution and implemented reporting dashboards.

Impacts:

- This additional analysis will allow the SI organization to better differentiate root cause drivers of adverse performance that are attributable to process complexity versus human performance and will better inform/validate corrective actions and continuous improvements.

Lessons Learned:

- The results of the pilot validated our approach and confirmed that we can efficiently and effectively enhance System Inspection QC with the implementation of the QC Field Review program to supplement the current QC Desktop Review program.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.09	Asset Inspections – Quality Assurance	Perform Transmission and Distribution system inspection quality audits prioritizing HFTD/HFRA areas. Statistically valid methodology parameters, such as a confidence level of 95 percent, will be utilized.	12/31/2022	Qualitative

We currently plan to implement the QA/QC program for Substation. We also plan to assess the effectiveness of the current Pole Test and Treat program and develop a long-term plan for it. We also plan to publish a System Inspection Quality Control Review Procedure.

Finally, in Q1 2022, we will implement the new process. This is a modified version of the existing post-inspection Desktop QC Review that is already established. The Field QC Review will utilize the same systems, resources, and processes as the previously outlined desk-top audit with three modifications. The first modification is that the QC review is performed in the field, at the location of the asset. The second modification is that the Field QC Review will not use the photos from the completed inspection, which is the subject of the QC review. The Field QC Review will produce new photos, in adherence to the inspection process as documented in ELEC-0341, PSOS-0451, and PSOS-0452 (Inspector Training). The third modification will be the timing of the QC review. The timing of the field review will be within one week of the date of the original inspection, which is the subject of the QC review.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We are in the process of reviewing our QA/QC processes and will implement identified improvements to the program.

7.3.4.15 Substation Inspections

OEIS Initiative Definition: In accordance with GO 174, inspection of substations performed by qualified persons and according to the frequency established by the utility, including record-keeping.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Equipment – Conductor

Secondary Risk: Ignition Consequences - Acres Burned

The substation supplemental (i.e., enhanced) inspection program is a comprehensive inspection of all the assets located inside substations located within HFTD and HFRA areas. These inspections are designed to identify equipment issues and damages that may adversely impact reliable operations and/or pose a wildfire ignition risk. Supplemental inspections are performed in addition to the routine inspections (GO 174) that are part of the maintenance practices described in PG&E's existing Utility Standards.

The supplemental inspection program includes three methods: Drone-based aerial inspection, Ground-based visual inspection, and Infrared inspection.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Supplemental inspections are intended to identify equipment conditions for repairs or replacements prior to equipment failure and ignition risk. FMEA was performed on all substation equipment to identify fire related risks. Supplemental inspections are guided by digital checklists that align to the FMEA for substation structures, associated equipment and components. Both objective criteria and Subject Matter Experts (SME) knowledge are used to evaluate the condition of the assets and identify corrective actions. The improved information gathered from supplemental inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

- Reduce Number of Customers Impacted – The supplemental inspection will also proactively identify issues with equipment that may lead to system reliability and unplanned outage impacts. When issues are identified proactively, repairs can be scheduled and executed prior to equipment failure.

- In general, PG&E schedules patrol and supplemental inspection activities in HFTD areas earlier in the year to provide time for necessary repairs prior to peak fire season.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Findings and issues identified through supplemental inspections within this initiative are corrected and tracked in by the Initiatives described in Sections 7.3.3.12.1 and 7.3.3.12.2.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: For 2022, supplemental substation inspections are planned on a 3-year baseline cycle for all stations located within HFTD and HFRA areas. A portion of the substations will be pulled into the in-year plan based on annual review of defensible space status to determine probability risks, Technosylva consequence scores, and terrain/suppression risk review by Public Safety Specialists (PSS). The same methods will be used to prioritize substations included in the in-year supplemental inspection program. 90 percent of the highest risk and 90 percent of the highest consequence stations will be moved into the in-year inspection plan.

Risk Models Used or Other Considerations for Prioritization:

- Probability risks are based on defensible space completion status for each substation. Top 90 percent included in the in-year plan.
- Wildfire Consequence Model scores modeled for each station to determine additional prioritization. Top 90 percent included in the in-year plan.
- Terrain/suppression risks are evaluated by PSS to identify remaining stations that may have additional terrain and suppression risks that may move them into the in-year plan.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Distribution Substation Supplemental Inspections Completed in 2021 – In 2021, PG&E planned and completed supplemental ground and aerial inspections on 71 distribution substations.

Impacts:

- Supplemental inspections are intended to identify degraded equipment and components so that repairs can be made prior to equipment failure that may result in an ignition event.

Lessons Learned:

- The improved information gathered from supplemental inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

Transmission Substation Supplemental Inspections Completed in 2021 – In 2021, PG&E planned and completed supplemental ground and aerial inspections on 33 transmission substations.

Impacts:

- Supplemental inspections are intended to identify degraded equipment and components so that repairs can be made prior to equipment failure that may result in an ignition event.

Lessons Learned:

- The improved information gathered from supplemental inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.06	Supplemental Inspections – Substation Distribution	Complete supplemental inspections on 86 distribution substations in HFTD areas or HFRA, barring External Factors.	7/31/2022	Quantitative
D.07	Supplemental Inspections – Substation Transmission	Complete supplemental inspections on 43 transmission substations within HFTD areas or HFRA, barring External Factors.	7/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Continue to develop and refine risk and consequence models – Continual improvement and refinement of probability risk, consequence and PSS review of terrain and suppression risk will better inform the inclusion and prioritization of substations targeted within the supplemental inspection program and will focus inspection efforts on stations with the highest risk and or those located within areas of higher consequence.

Routine and supplemental Inspection Efficiencies – For 2023 and beyond, supplemental inspections for substation in HFTD areas are expected to continue. PG&E will evaluate efficiency opportunities between supplemental and routine inspections (GO 174).

7.3.4.16 Other – Substation Inspections Hydro Generation

OEIS Initiative Definition: Not Applicable – This is a PG&E-defined initiative that supports the response for those hydro generation substation inspections performed outside of GO 174 by qualified persons and according to the frequency established by the utility, including record-keeping.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks – Equipment – Conductor

Secondary Risk: Ignition Consequences – Acres Burned

The substation supplemental (i.e., enhanced) inspection program is a comprehensive inspection of all the assets located inside substations located within HFTD and HFRA areas. These inspections are designed to identify equipment issues and damages that may adversely impact reliable operations and/or pose a wildfire ignition risk.

The supplemental inspection program includes three methods: (1) drone-based aerial inspection; (2) ground-based visual inspection; and (3) infrared inspection. These supplemental inspections are performed in addition to the routine inspections that are part of the maintenance practices described in PG&E's existing utility standards.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce Frequency of All Types of Ignition Events – Supplemental inspections are intended to identify equipment conditions for repairs or replacements prior to equipment failure and ignition risk. FMEA was performed on all substation equipment to identify fire related risks. Supplemental detailed inspections are guided by digital checklists that align to the FMEA for substation structures, associated equipment, and components. Both objective criteria and SMEs knowledge are used to evaluate the condition of the assets and identify corrective actions. The improved information gathered from supplemental inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

- Reduce Number of Customers Impacted – The inspection will also proactively identify issues with equipment that may lead to system reliability and unplanned outage impacts. When issues are identified proactively, repairs can be scheduled and executed prior to equipment failure.

Relation to and Impact on Other Initiatives:

- Asset Inspection and Repair – Section 7.3.3.12.5 is intended to capture and report out on the number of corrective work tags identified, as part of the supplemental (enhanced) Inspection Process.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: For 2022, supplemental substation inspections are planned on a 3-year baseline cycle for all stations located within HFTD and HFRA areas. Additionally, a portion of the substations will be pulled into the in-year plan based on risk and consequence assessment. An annual review of Technosylva consequence scores, defensible space risk, and terrain/suppression risk review by PSS will be used as the prioritization method to identify the substations to be added to the supplemental inspection program. Power Generation follows the requirements specified for supplemental Inspections and provides the list of hydro generation sites to be included in the risk model described above to determine priority.

Risk Models Used or Other Considerations for Prioritization:

- Risk and consequence models are based on Wildfire Consequence Model scores, defensible space risk data and terrain/suppression risks. The tools are used to inform of risk and consequences and are used as a method to prioritize the population of substations within the three-year plan that will be added in the in-year supplemental inspection program.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Hydro Substation Supplemental Inspections – In 2021, PG&E planned and completed supplemental ground and aerial inspections on 38 hydro substations and performed 40 missed inspections from 2020.

Impacts:

- Supplemental inspections are intended to identify degraded equipment and components so that repairs can be made prior to equipment failure that may result in an ignition event.

Lessons Learned:

- The improved information gathered from supplemental inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
D.08	Supplemental Inspections – Hydroelectric Substations and Powerhouses	Complete supplemental inspections on 52 Hydroelectric Generation Substations and Powerhouses within HFTD areas or HFRA, barring External Factors. Co located Hydroelectric substations and Transmission & Distribution substations are counted separately as two distinct units.	7/31/2022	Quantitative

- PG&E will complete inspections of all hydro facilities by July 31, 2022, barring exceptions where components are located inside powerhouse facilities with metal clad doors or inspection safety issues without forcing out the generation facility. In those instances, the Power Generation Fire Controls Program Manager will inspect and document indoor Powerhouse facility for fire loading considerations

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Power Generation Asset Registry Continuous Improvement – Refine and update the Asset Registry to align with Electric Operations (EO). The intended benefit is to build out a complete list of equipment to be inspected, that aligns to the EO FMEA and increases efficiencies in the inspection process by identifying components using unique equipment IDs.

7.3.5 Vegetation Management and Inspections

7.3.5.1 Additional Efforts to Manage Community and Environmental Impacts

OEIS Initiative Definition: Plan an execution strategy to mitigate negative impacts from utility vegetation management in local communities and the environment, such as coordination with communities, local governments, and agencies to plan and execute vegetation management work.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable.

Our vegetation management (VM) activities can face legal challenges, such as land rights issues, local permit requirements, environmental requirements, and other state and federal requirements as well as landowner concerns. We understand these issues and concerns and are committed to working with communities, customers, landowners, and local and tribal governments to address them as much as possible. This initiative focuses on working with communities to reduce the impact of VM work where possible and to more closely coordinate this work to mitigate VM work impacts and reduce the potential for legal challenges.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Improve coordination with customers: In our effort to address and resolve customer and community concerns, Pacific Gas and Electric Company (PG&E) works to inform customers, landowners, and communities about the VM work taking place and our role in increasing public safety as well as reducing fire risk.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Many of our VM initiatives may be impacted by landowner refusals, non-contacts, and/or permitting delays/restrictions of the area where work has been identified. In 2021, we improved our approach to addressing these types of constraints by standing up the Constraints Resolution Team. This team focuses on working with local governments, agencies, and landowners to address permitting or access to property constraints that temporarily prevented or delayed enhanced vegetation management (EVM) work from being performed. Our team gathers additional information regarding constraints, reviews data, and works with other internal teams to resolve permitting or property access issues.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Communication efforts to mitigate community and environmental impacts are performed within all PG&E regions by various PG&E lines of business (LOB), such as VM, Governmental Relations, External Communications and Local Customer Experience. The various forms of communication used include letters, postcards, door hangers, fact sheets, brochures, presentation materials, Interactive Voice Response outbound calling, website, social media, email letters, texting, and work plan portals.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E has finished the development of our new process to standardize and enhance customer and community engagement for electric VM work. This new process incorporates a broader proactive outreach to partner with customers more effectively and was implemented in targeted areas in late 2021, with broader rollout planned in 2022. In addition, we initiated our Constraints Resolution Team which focuses on working with local governments, agencies, and landowners to address permitting or access to property constraints that temporarily prevented or delayed EVM work from being performed. Our team gathers additional information regarding constraints, reviews data, and works with other internal teams to resolve permitting or property access issues.

PG&E also continues to utilize a web--based file transfer program known as "ProjectWise"- to share monthly look-ahead workplans and system -hardening reports associated with VM programs with opted-in counties in our service territory. In February 2021, these communications were extended to the Regional Water Quality Control Board Representatives.

<u>Impacts</u>:

- Increased awareness for customers and property owners of PG&E VM activities (e.g., pre-inspections, tree work, post tree work) on their properties or in their communities.

- Reductions in external constraints and/or reducing the delays associated with constraints, resulting in more timely work completion.

- Improved safety of PG&E and contractor crews in the field due to outreach around their presence in the community ahead of onsite activities.

Lessons Learned:

- In order to execute outreach in a timely and effective manner, information regarding the location and timeframe for pre-inspection, tree work, and post-tree work is critical. Without this information, the quality of the outreach is reduced because the outreach does not align with actual field-based activities.

- In Q4 2021, the EVM pre-inspection and tree work schedules allowed customer outreach to occur shortly ahead of PG&E and contractor crews being on or near properties, creating increased awareness for customers and property owners, likely reducing access and escalation constraints, and improving safety for in-field personnel.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to continue customer outreach across EVM and Routine programs through multiple touchpoints and continued advance notifications including prior to inspections, during tree work, and after post tree work. PG&E expects to extend our planning and customer outreach approach across all VM programs, where applicable. PG&E currently plans to leverage our P6 database, that was developed in 2021, to provide alignment and visibility into outreach and work plans across various teams.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023--2028) – PG&E plans to track customer outreach touchpoints across all VM programs and will use this data to get a better understanding of multiple impacts to customers and opportunities to improve the overall customer experience with VM.

7.3.5.2 Detailed Inspections and Management Practices for Vegetation Clearances Around Distribution Electrical Lines and Equipment

OEIS Initiative Definition: Careful visual inspections and maintenance of vegetation around the right-of-way, where individual trees are carefully examined, visually, and the condition of each rated and recorded. Describe the frequency of inspection and maintenance programs.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

Secondary Risk: Reliability Impacts - PSPS

Vegetation located close to electrical equipment can cause a fire by contacting the equipment, either catching fire or dropping a spark that could cause other vegetation to ignite. Vegetation trimming and hazard tree removal reduces the availability of fuel that could start or spread a fire, whatever the cause. PG&E's VM program inspects approximately 80,000 miles of overhead distribution electric facilities on a recurring cycle.

PG&E's distribution VM program includes several different types of inspections and patrols designed to maintain compliance with state and federal laws and regulations including General Order (GO) 95, Rule 35 and California Public Resources Code (PRC) Sections 4292 and 4293, and in some cases, such as EVM, go beyond these regulatory and statutory requirements. Through these inspections, PG&E can identify the following issues for maintenance to be completed consistent with legal and regulatory requirements:

- Dead, dying and declining trees, or dead portions of trees including dead overhangs that can contact PG&E facilities if they fail
- Green trees observed within the Minimum Distance Requirement (MDR) or with the potential to encroach within the MDR before the next patrol cycle
- Trees causing strain or abrasion on secondary lines
- Abnormal field conditions

PG&E has implemented a Quality Control (QC) group and a Senior Vegetation Management Inspectors (SVMI) group which allows us to monitor safety and compliance within the VM project scope, identify deficiencies, and improve upon our protocols and procedures. Additional information on these inspection and evaluation groups is provided in Section 7.3.5.6.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The Distribution VM program is designed to maintain compliance with state and federal laws and regulations including GO 95, Rule 35 and PRC Sections 4292 and 4293. Specifically, these statutes and rules require:
  - GO 95 Rule 35 requires a year-round clearance below power lines of a minimum 18 inches. New fire safety regulations require a minimum clearance of 4 feet (ft) year-round for high-voltage power lines in the CPUC-designated HFTD areas. Rule 35 also requires the removal of dead, diseased, defective, and dying trees that could fall into the lines.
  - PRC 4292 is administered by the California Department of Forestry and Fire Protection (CAL FIRE). It requires that PG&E maintain a firebreak of at least 10 ft in radius of a utility pole, with vegetation within the 10 ft radius of the pole being removed up to 8 ft above ground. From 8 ft to conductor height requires removal of dead, diseased, or dying limbs and foliage. This applies in the State Responsibility Area (SRA) during the designated fire season.
  - PRC 4293 is also administered by CAL FIRE. It requires that PG&E maintain a 4 ft minimum clearance for power lines between 2,400 and 72,000 volts (V), and a 10 ft clearance for conductors 115,000 V and above. PRC 4293 states that dead, old, or rotten trees; trees weakened by decay or disease; and trees or portions thereof that are leaning toward the line which may contact the line from the side or may fall on the line shall be felled, cut, or trimmed so as to remove such hazard. This applies to the SRA during the designated fire season.

Relation to and Impact on Other Initiatives:

- EPSS – EPSS is utilized to shut off power quickly to our lines in HFTD areas to mitigate the chance of ignition which could result in catastrophic wildfires. The inspection and maintenance of vegetation around the distribution lines will allow us to identify work to be completed, and in doing so, lessen the chance of vegetation triggering the EPSS system. Please see Section 7.3.6.8 for additional information on EPSS.
- PSPS – Inspection and maintenance can also help in mitigating the number and/or scope of PSPS events in the future.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: VM inspects and identifies maintenance on all distribution circuit miles in PG&E's service territory on a recurring cycle using a combination of different patrol types:

- Routine Patrol – The VM routine program performs scheduled inspections on all overhead primary and secondary distribution facilities to maintain radial clearance between vegetation and conductors by identifying trees that will encroach within the MDRs as required by law and/or PG&E procedures. In addition, dead, dying and declining trees expected to fail and strike conductors are identified and mitigated.

- Tree Mortality Patrol – The VM Tree Mortality Patrol program performs scheduled Tree Mortality patrols approximately six months before or after the routine patrol on overhead primary and secondary distribution facilities, primarily within HFTD and SRAs/Federal Responsibility Areas (FRA) to maintain radial clearance between vegetation and conductors by identifying trees that will encroach within the MDRs required by law and/or PG&E procedures and by identifying dead, dying and declining trees that are expected to fail and strike conductors. PG&E has implemented a Tree Mortality maintenance plan that commits to completing the identified work within 180 days for HFTD areas and within 365 days for non-HFTD areas.

- EVM Patrol – The EVM program is designed to go above and beyond compliance requirements and includes three main components: (1) expanded radial clearance beyond minimum requirements; (2) overhang clearance; and (3) evaluation of the condition of any tree tall enough to strike electrical lines or equipment (referred to as trees with "strike potential"), documentation of this inventory of trees, and removal of trees that did not pass assessment using the Tree Assessment Tool (TAT). The TAT is a tool that that evaluates an individual tree's likelihood of failing and indicates whether to abate the tree. TAT incorporates historical data on tree failures, regional species risk, and local wind gust data and assesses different components of an individual tree's health to determine the risk of falling into PG&E lines or equipment.

- Vegetation Control (Pole Clearing) – PG&E performs removal of vegetation around select T&D poles and towers, in accordance with PRC Section 4292, to maintain a firebreak of at least 10 ft in radius (out from the pole) up to 8 ft up from the ground. These requirements apply in the SRA during designated fire season and such designation is a priority in performing this defensible space activity. Section 4292, which applies to SRA and United States Forest Service lands, determines the pole clearing requirements.

- In order to perform VM inspection work, permits may at times be required. In these circumstances, we will work with the appropriate governmental entity or jurisdictional agency to obtain necessary permits or enter into programmatic agreements. For example, PG&E has been involved in discussions with the

California Coastal Commission regarding programmatic agreements to allow for inspections in areas subject to Coastal Commission jurisdiction.

Risk Models Used or Other Considerations for Prioritization:

- The EVM Tree Weighted Prioritization was used in 2021 and is currently being used in 2022 to create a risk-ranked EVM Scope of Work.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

As of December 31, 2021, PG&E's internal resources and contractor partners had worked approximately 1,486,330 trees in our Routine VM program and 34,189 trees in our Tree Mortality program. In addition, we completed 1,983 miles of EVM work.[93]

Tree Mortality Patrols – In 2021, PG&E began to implement metrics to track Tree Mortality patrols within every circuit to ensure that they were completed within the required time frame. We will be utilizing the metrics to ensure that patrols are completed approximately 6 months before or after Routine VM patrols, as well as track the percentage of Tree Mortality patrols performed. Once work has been identified by execution during a Tree Mortality patrol, we have implemented a plan that targets completing the identified work within 180 days for HFTD areas and 365 days for non-HFTD areas.

Impacts:

- Continuation of consistent Tree Mortality patrols has a positive impact on reduction of potential tree failures and increased identification of strike trees, resulting in greater mitigation of wildfire risks

Maintenance of EVM Work – In September 2021, we began to transition the maintenance of EVM work that has already been performed to Routine VM patrols. We established routine maintenance requirements for electric distribution circuits where EVM scope clearances have been performed (in HFTD designated areas) and passed by work verification. The requirements have been documented in Utility Bulletin TD-7102P-01-B026 (EVM Transition to Distribution Routine Patrol).

Impacts:

- The maintenance of previous EVM work through Routine VM patrols will allow PG&E to preserve the efforts achieved through EVM clearances.

93 These numbers may change slightly as we complete the work verification and contractor invoicing process for end of year work.

Lessons Learned:

- Routine VM of EVM clearances will preserve the efforts achieved over the course of 2019 and 2020, and for EVM work performed in the future.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.01	Enhanced Vegetation Management	Complete EVM work on 1,800 risk ranked distribution circuit miles, barring External Factors.	12/31/2022	Quantitative
E.02	Pole Clearing Program	Complete work on at least 9,000 poles identified as needing work during pre-inspection in PG&E's Vegetation Management Database as of October 1, 2021, in HFTD areas or HFRA, not required by PRC 4292 and barring External Factors. Any assets discovered after October 1, 2021 will be inspected and cleared within 45 days of when added to the Vegetation Management Database.	4/30/2022	Quantitative

PG&E may be constrained by environmental delays, customer refusals or noncontacts, permitting delays/restrictions or operational holds, weather conditions, active wildfire, and accessibility of the area where distribution system inspections have been identified.

The following additional activities have been identified for this initiative which are not Initiative Targets:

- PG&E expects to implement better tracking metrics through the Structured Learning Path (SLP) in order to ensure proper development of personnel within all VM programs. Please refer to Section 7.3.5.14 regarding additional progress on this initiative.

- PG&E also plans to continue to perform VM program inspections on approximately 80,000 miles of distribution circuits on an annual inspection cycle. PG&E will complete inspections of the entire distribution system by December 31st of each year (inspection periods start on November 15th of the year prior). However, PG&E may be constrained by environmental delays, landowner refusals or non-contacts, permitting delays/restrictions or operational holds, weather conditions, active wildfire, or accessibility of the area where distribution system inspections have been identified.

- Through 2022, PG&E is continuing a pilot program to include an enhanced process to perform visual assessment of all sides of potential strike trees on routine vegetation management patrols in HFTD areas. The pilot program will inform an implementation of this enhanced process of routine vegetation management patrols in HFTDs.

- We are continuing to evaluate our EVM program given evolving and rapidly changing climate risks including implementation of PG&E's additional wildfire mitigations, such as EPSS, with an anticipated update to be included in our 2023 WMP.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Given the rapid change the VM program is undergoing, we have begun the long-term effort of updating over 40 procedural documents, and sub-documents, related to patrol inspections.

7.3.5.3 Detailed Inspections and Management Practices for Vegetation Clearances Around Transmission Electrical Lines and Equipment.

OEIS Initiative Definition: Careful visual inspections and maintenance of vegetation around the right-of-way, where individual trees are carefully examined, visually, and the condition of each rated and recorded. Describe the frequency of inspection and maintenance programs.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

Secondary Risk: Reliability Impacts - PSPS

Trees or other vegetation that make contact or cross within flash-over distance of high voltage transmission lines can cause phase to phase or phase to ground electrical arcing, fire ignition or local, regional or cascading, grid-level service interruption. Dense vegetation growing within the right-of-way (ROW) can act as a fuel bed for wildfire ignition. Vegetation growing close to any pole or structure can impede inspection of the structure base and in some cases can damage the structure.

PG&E's transmission VM program consists of several different inspections (*i.e.*, Patrols). The following programs help us safely and reliably operate primary transmission circuits and secondary transmission lines, while complying with the state laws and regulations.

- Routine North American Electric Reliability Corporation (NERC)
- Routine Non-NERC
- Integrated Vegetation Management (IVM)

These programs are described in more detail below.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency and impact of all types of ignition events – This initiative is being implemented to reduce wildfire risk year-round by removing vegetation that is approaching mandated clearance distances, removing hazard trees that could reach the facilities, reducing dense vegetation in ROWs, widening ROWs where possible, and removing danger trees outside the ROWs.
- Compliance with legal and regulatory requirements – The Transmission VM program is designed to monitor compliance with state and federal laws and regulations including GO 95 Rule 35 and PRC Sections 4292 and 4293, and NERC Standard FAC-003-04:

- GO 95 Rule 35 requires a year-round clearance below power lines of a minimum 18 inches. New fire safety regulations require a minimum clearance of 4 ft year-round for high-voltage power lines in the CPUC-designated HFTD areas. Rule 35 also requires the removal of dead, diseased, defective, and dying trees that could fall into the lines.

- PRC 4292 is administered by the CAL FIRE. It requires that PG&E maintain a firebreak of at least 10 ft in radius of a utility pole, with tree limbs within the 10 ft radius of the pole being removed up to eight ft above ground. From 8 ft to conductor height requires removal of dead, diseased or dying limbs and foliage. This applies in the SRA during the designated fire season.

- PRC 4293 is also administered by CAL FIRE. It requires that PG&E maintain a 4 ft minimum clearance for power lines between 2,400 and 72,000 volts (V), and a 10 ft clearance for conductors 115,000 V and above. PRC 4293 states that dead trees, old, or rotten trees; trees weakened by decay or disease; and trees or portions thereof that are leaning toward the line which may contact the line from the side or may fall on the line shall be felled, cut, or trimmed so as to remove such hazard. This applies to the SRA during the designated fire season.

- FAC-003-04 requires maintaining a reliable electric transmission system by using a defense-in-depth strategy to manage vegetation located on transmission ROWs and minimize encroachments from vegetation located adjacent to the ROW, thus preventing the risk of those vegetation related outages that could lead to cascading.

- Reduce Frequency and Duration of PSPS Events – Removal of vegetation to reduce risk and reduce the scope and frequency of PSPS events.

- Reduce Impact and Duration of Outages on Our Customers and Improve the Reliability of Our Systems – Removal of identified high risk trees which may allow more lines to remain energized during PSPS events and increase reliability of our systems year-round.

Relation to and Impact on Other Initiatives:

- PSPS – Inspection and maintenance of vegetation around transmission lines and equipment will allow us to identify work to be completed. Inspection and maintenance can also help in mitigating the number and/or scope of PSPS events in the future.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E operates our lines in electric transmission (ET) corridors that are home to vast amounts of vegetation. This vegetation ranges from sparse to extremely dense. Our transmission lines also pass through urban, agricultural, and forested settings. The corridor environment is dynamic

and requires focused attention to ensure vegetation stays clear of energized conductors and other equipment.

Vegetation inspection is a required operational step in an overall VM Program. Accordingly, PG&E has developed an annual inspection cycle program as part of our overall Transmission VM Program to respond to the diverse and dynamic environment of our service territory. The Routine NERC and Routine Non-NERC Programs are annually recurring. The IVM Program recurs every three to five years. The frequency and prioritization for each of these programs is described in more detail below.

- Routine NERC – The Routine NERC Program includes LiDAR inspection, visual verification of findings, and mitigation of vegetation encroachments as well as other vegetation conditions on approximately 6,800 miles of NERC Critical lines. 100 percent inspection and work plan completion are required by NERC Standard FAC-003-4. Work is prioritized based on aerial LiDAR detection. This program recurs annually.

- Routine Non-NERC – The Non-Routine NERC Program includes LiDAR inspection, visual verification of findings, and mitigation of vegetation encroachments as well as other vegetation conditions on approximately 11,400 miles of transmission lines not designated as critical by NERC. Work is prioritized based on aerial LiDAR detection. This program recurs annually.

- Integrated Vegetation Management (IVM) – The IVM Program is an ongoing maintenance program designed to maintain cleared rights-of-way in a sustainable and compatible condition by eliminating tall-growing and fire-prone vegetation and promoting low-growing, compatible vegetation. Prioritization is based on aging of work cycles and evaluation of vegetation re-growth. After initial work is performed, the rights-of-ways are reassessed every two to five years.

Risk Models Used or Other Considerations for Prioritization:

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In Table PG&E-7.3.5-1 below, we provide a summary of the Transmission VM Program work performed in 2021. This includes the Transmission ROW Expansion Program which was a part of our 2021 WMP. The Transmission ROW Expansion Program is not continuing in 2022.[94]

[94] PG&E does have an ongoing Transmission ROW Expansion program that is focused on reliability that was initiated in 2017. That program will continue in 2022, but is not directly related to wildfire mitigation. However, to the extent ROWs are being expanded, there will be incremental wildfire mitigation benefits resulting from decreased vegetation around our transmission lines.

TABLE PG&E-7.3.5-1:
TRANSMISSION VEGETATION MANAGEMENT PROGRAM PROGRESS IN 2021

2021 Initiative Activity	Actual Progress 2021
Routine NERC Program	6,564.7 miles
Routine Non-NERC Program	11,193.1 miles
Transmission Row Expansion Program	217.9 miles
IVM Program	10,138 acres

Below we describe the impacts and lessons learned from the three transmission VM programs that will continue in 2022.

Routine NERC Program

Impacts:

- The Routine NERC Program allows PG&E to identify and perform mitigation of hazards to transmission structures.

Lessons Learned:

- LiDAR data collected during Routine NERC patrols allows PG&E to reassess the LiDAR Risk Score Model annually.

Routine Non-NERC Program

Impacts:

- The Routine Non-NERC Program allows PG&E to identify and perform mitigation of hazards to transmission structures.

Lessons Learned:

- LiDAR data collected during Routine Non-NERC patrols allow PG&E to reassess the LiDAR Risk Score Model annually.

IVM Program

Impacts:

- Eliminating -tall growing, -fire prone vegetation and promoting -low growing, compatible vegetation has decreased the impact of vegetation on transmission structures, as well as mitigated wildfire risks.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E currently plans to perform the Routine NERC program on approximately 6,000 miles, the Routine Non-NERC program on approximately 11,000 miles, and the IVM program on approximately 9,000 acres.[95]

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Our short-term plan is to continue the Routine NERC, Routine Non-NERC, and IVM Programs to maintain clearances around our transmission facilities and reduce wildfire risk.

95 The mileage and acreage numbers are approximate and may be impacted by environmental delays, landowner refusals or non-contacts, permitting delays/restrictions or operational holds, weather conditions, active wildfire, and accessibility of the area where transmission system inspections have been identified.

7.3.5.4 Emergency Response Vegetation Management Due to Red Flag Warning or Other Urgent Weather Conditions

OEIS Initiative Definition: Plan and execution of vegetation management activities, such as trimming or removal, executed based upon and in advance of forecast weather conditions that indicate high fire threat in terms of ignition probability and wildfire consequence.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

All trees identified for work by pre-inspectors are evaluated for the priority of the required tree work. If vegetation is determined to be an immediate risk to PG&E facilities, described as a Priority 1 Condition in the VM Priority Tag Procedure (TD-7102P-17), the condition will be mitigated within 24 hours of identification as long as conditions are safe for the tree crew to proceed with work. Vegetation identified as pending Priority 2 work within the Red Flag Warning (RFW) area will be reviewed and re-prioritized if determined necessary by the local PG&E VM Point of Contact. Vegetation identified for follow-up work that shows no near-term risk factors, as outlined in the VM Priority Tag Procedure, is scheduled following the standard mitigation process.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Execution of identified high priority vegetation work in the impacted areas can reduce the potential for ignitions in RFW and urgent weather situations.
- Reduce duration of events (PSPS/EPSS) – Reduction in number and severity of damage to facilities to identify and repair in advance of restoration.

Relation to and Impact on Other Initiatives:

- PSPS – Reduction in number and severity of damage to facilities to identify and repair in advance of restoration.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Identified vegetation work within geographic RFW areas is prioritized in accordance with Procedure TD-7102P-17.

Risk Models Used or Other Considerations for Prioritization:

- Areas identified as subject to RFW conditions are based on the National Weather System's Meteorological Models. Work is performed on Priority Trees in these areas in accordance with Procedure TD-7102P-17.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, we continued to implement Procedure TD-7102P-17 during RFWs and other elevated fire weather events.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E plans to continue to implement Procedure TD-7102P-17 during RFWs and other elevated fire weather events.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We do not currently have any short-term improvements planned. We will continue to implement our procedures during RFWs and other elevated fire weather events.

7.3.5.5 Fuel Management and Management of All Wood and "Slash" From Vegetation Management Activities

OEIS Initiative Definition: Plan and execution of fuel management activities in proximity to potential sources of ignition. This includes pole clearing per PRC 4292 and reduction or adjustment of live fuel (based on species or otherwise) and of dead fuel, including "all downed wood and "slash""" generated from vegetation management activities.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences - Acres Burned

Secondary Risk: Ignition Consequences – Structures Impacted

Pole Clearing – Please refer to Sections 7.3.5.2 and 7.3.5.3 for more information on electric distribution and transmission pole clearing, respectively.

Debris – Woody debris less than 4" in diameter generated during pruning and removal work are chipped or logged and scattered on the property when possible and in accordance with forest best management practices. Debris is left on site or removed based on owner preferences. When chipping is not possible, further processing and disbursement of fuels is required to minimize impacts and accumulation. Debris accumulation from tree pruning or removal activities can result near overhead assets if not processed or removed from work sites, increasing potential wildfire risks.

Wood Management – Wood Management removes larger diameter wood (greater than 4" in diameter) produced through pruning and removal activities when the landowner or individual or entity controlling the property prefers. Wood removal is also offered to landowners affected by wildfires in 2020-2021.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – Processing, proper disbursement or removal of debris generated by pruning and removal activities reduces ladder fuel development. This is particularly beneficial at locations where annual grasses or other flashy fuels develop, dry and can be conductive to surrounding live and dead fuels.

- Improve coordination with customers – Customers are made aware of activities and initial treatments where fuel risks can also be reduced through their separate actions and maintenance of defensible space on their properties.

Relation to and Impact on Other Initiatives:

- PG&E's Utility Defensible Space (UDS) program has expanded in HFTD areas. UDS has annual model driven and local management request prioritization to help target problematic areas and fuel conditions. Fee parcel management applies to annual maintenance of fee parcels for compliance with local weed abatement ordinances. Please see Section 7.3.5.20 for more information on the UDS program.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Prioritization is ongoing and associated with all VM program activities. Wood management actions follow work activities in HFTD areas. The pre-inspector (PI) must perform the following tasks to evaluate whether the potential work meets the qualifications required for the wood management program:

1. Determine whether potential wood management work will require specialized equipment. The following wood management work types require specialized equipment:
    - Remove
    - Relocate/Move
    - Chip on site/Broadcast
2. Consider the capability of the equipment used and the site conditions (slope, obstacles, riparian area, etc.) and evaluate whether the wood is accessible.
3. If the PI is unsure whether the wood is accessible, the PI will then consult with the wood management contractors (WMC) to make the determination based on issues including, but not limited to the following examples:
    - Bridge weight limits
    - Slope restrictions
    - Watercourse and Lake Protection Zones (WLPZ) boundaries
4. If not accessible to equipment, then only two options are available:
    - Cut (wood cut to dimensions specified by the customer)
    - Leave wood as found
5. If accessible to equipment, discuss the applicable work type options with the property owner.
6. Use this information to fill out the Vegetation Management Request for Wood Management and Removal Form (RWMF).

Risk Models Used or Other Considerations for Prioritization:

- The programs in this section are indirectly prioritized by risk models. To the extent that VM work is informed by a risk model and that work requires debris or wood management, this work would be indirectly informed by the risk model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E began our effort to mitigate wood debris following wildfires.

Impacts:

- We received a positive response from customers regarding the wood debris removal effort.

Lessons Learned:

- The importance of communications with customers regarding how we will handle wood debris and of expanding our Wood Management program to all customers who opt-in.

Current Year Activities (2022):

While we have not set specific targets for this initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to complete work on opted-in parcels related to the 2020 wildfires and expects to begin WM work on opted-in parcels related to 2021 wildfires.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We do not currently have any short-term improvements planned. We will continue to implement Wood Management procedures in collaboration with the CPUC, Energy Safety and other stakeholders.

7.3.5.6 Improvement of Inspections

OEIS Initiative Definition: Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

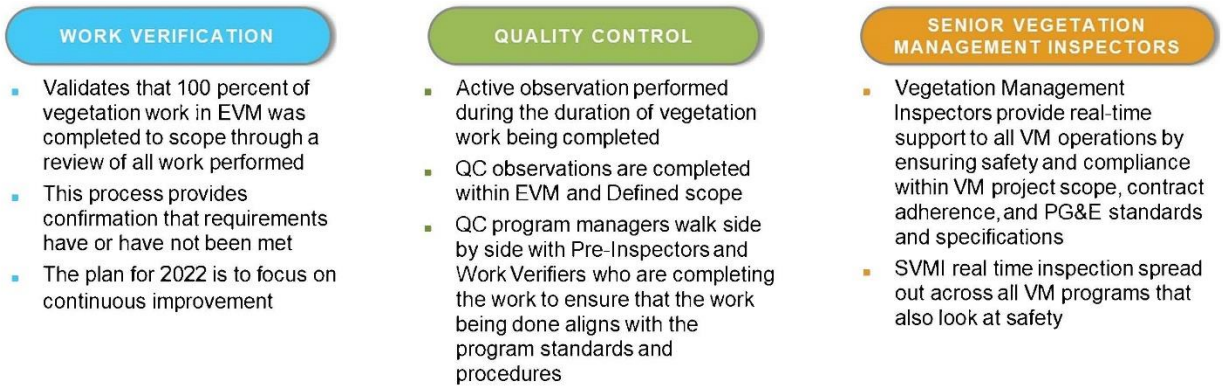
Identifying and mitigating hazards related to vegetation is an effort that requires a series of different protocols to properly manage. Training courses and inspection protocols must be continuously monitored and revised to ensure proper management of potential and unforeseen risk in the field while conducting work.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – The evaluation of the work performed by PG&E personnel and contractors is critical to the effectiveness of our VM program. PG&E has implemented Work Verification (WV), Quality Control (QC), and SVMI programs to monitor and evaluate our VM projects, as indicated below in Figure PG&E-7.3.5-1.

FIGURE PG&E-7.3.5-1:
VM INSPECTION GROUPS



WV, QC, and SVMI personnel must complete required training courses to ensure that inspection programs are being performed to meet all project related protocols, policies, and procedures. Evaluation of WV, QC, and SVMIs is important to ensure personnel stay up to date with the required training and education needed to perform their roles. Inspection protocols, training and evaluation of inspectors are critical to effective vegetation management inspections.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Please refer to Sections 7.3.5.2 and 7.3.5.3 regarding distribution and transmission VM programs, respectively, that are inspected by Work Verification, Quality Control, and SVMI groups. These programs are impacted by inspection protocols and the training and evaluation of inspectors.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E's current training processes include:

Work Verification (WV)

- WV are required to complete trainings in the Structured Learning Path that cover a series of topics such as Fire Mitigation, Safety Procedures, Reporting Procedures, EVM and Defined Scope programs, Transmission programs, Priority Tag Procedures, and Environmental.

Quality Control (QC)

- All QC Program Managers must successfully complete the introduction to Pre-Inspection courses in the SLP. In addition to the introduction to Pre-Inspection courses, the QC Program Managers are required to complete EVM and Defined Scope courses on the SLP. QC Program Managers are also expected to complete a group of Web Based Trainings (WBT) focused on Environmental topics, as well as fulfill supplemental requirements, such as Rural Driving Safety, Fire Precaution, and SafetyNet Training.

- Outside of the tracked SLP and MyLearning training courses, QC Program Managers must complete the SVMI SLP trainings, which consist of approximately 40 courses focused on the process, protocols, and procedures for the SVMI role. During these courses, the QC Program Managers will be given knowledge checks by their supervisors, which serves as an evaluation and confirmation that the QC Program Manager is understanding and retaining all knowledge of the material being taught.

Senior Vegetation Management Inspectors (SVMI)

- All SVMI will have to successfully complete the introduction to Pre-Inspection courses in the SLP. While progressing through the PI track in the SLP, the SVMI will have scheduled check-ins with a supervisor to ensure they have fully absorbed the material that is being taught. The SVMI is also expected to complete trainings around record and information management, and Security and Privacy Awareness. There will be a series of four audits at the 1 month, 3 month, 6 month, and 1 year mark to evaluate the work that is being completed by the SVMI once they finish all their courses.

- SVMI must also complete the SVMI SLP trainings, which consist of approximately 40 courses focused on the process, protocols, and procedures. During these courses, the SVMI will be given knowledge checks by their supervisors, which serves as an evaluation and confirmation of understanding and retention of the material being taught. The supervisor will also discuss how the SVMI trainings relate to the job, and its impact and expectations on program operations. The supervisor has a hard copy check list that they utilize to keep track of the progress being made by the SVMI as they complete the SVMI courses.

- OSHA 30 training and Certified Tree Safety Professional training must be completed within 6 months of hire.

Please see Sections 7.3.5.2 and 7.3.5.3 for additional information regarding region prioritization where inspectors perform their work.

Risk Models Used or Other Considerations for Prioritization:

- Risk models are not used to inform inspection protocols or inspector training and evaluation.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Standardized EVM Methods: In an effort to improve upon EVM practices in 2021, PG&E standardized the method for measuring and identifying strike trees for pre-inspection and work verification teams. The goal of this process improvement was to create alignment between the pre-inspection and Work Verification teams for defining EVM scope.

Impacts:

- Improved training material for employees to better solidify approach to completing inspection tasks

Lessons Learned:

- This alignment is initially showing a reduction in re-work and re-inspection

- Increased workforce to support WV efforts including internal and contract resources

QC Field Observations: The QC group under the Quality Management program was created in 2021. The QC group began a pilot program in July 2021 that focused on active field observation of Pre-Inspectors.

Impacts:

- The QC group allows us to focus on improving the quality of work, as well as improving the knowledge of the people performing the work.

Lessons Learned:

- The QC group can provide active observation as VM inspection work is being performed, resulting in alignment with program standards and procedures.

Increase in SVMI Personnel – At the beginning of 2021, we had 35 SVMI. As of December 2021, we have 100 SVMI, which includes internal resources and contract partners. We have one SVMI manager and one Senior Manager.

Impacts:

- The increase in SVMIs provides the ability to improve oversight of job sites and allows PG&E to increase the number of SVMI to tree crews/PIs. This results in additional real-time support to all VM operations by ensuring safety, compliance, contract adherence, and PG&E standards and specifications within VM project scope.

Lessons Learned:

- Increase in SVMI workforce allows PG&E to better support VM by ensuring all contracts, standards, and specifications are being adhered to with respect to the project in question.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to implement better tracking metrics through the Structured Learning Path (SLP) in order to ensure proper development of personnel within all VM programs. Please refer to Section 7.3.5.14 (Recruiting and Training of VM Personnel) regarding additional progress on this initiative.

QC plans to expand active observations into other VM programs. This will help support adherence to standards, protocols, and procedures as they relate to the VM project that is being worked.

PG&E expects to establish a pilot program to utilize the observer tool to evaluate SVMI in the field will support the SVMI program in ensuring their personnel are following all policies, protocols, and procedures related to the VM project being monitored. The pilot program will allow data to be gathered to determine the appropriate intervals of evaluations.

PG&E plans to offer external training opportunities, which will allow SVMI personnel to continue their education and training in areas such as personal safety, climbing techniques, cutting procedures, etc. If at any time PG&E deems the use of external training to not be beneficial to our employees, we will stop these efforts.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We do not currently have any short-term improvements planned. Instead, in the short-term we will continue to work on effectively implementing the improvements described above for 2021 and 2022.

7.3.5.7 Remote Sensing Inspections of Vegetation Around Distribution Electric Lines and Equipment

OEIS Initiative Definition: Inspections of right-of-way using remote sensing methods such as LiDAR, satellite imagery, and UAV.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

PG&E uses LiDAR to perform right-of-way vegetation radial encroachment inspections on roadside-available distribution line ROWs in selected HFTD areas.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – LiDAR data can take measurements of the current state of the electric distribution system and be leveraged to verify radial clearance and compliance on distribution lines.

Relation to and Impact on Other Initiatives:

- Distribution Inspections – The use of LiDAR is one of the components of the patrols performed on distribution lines described in Section 7.3.5.2 above.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: LiDAR data is targeted toward distribution lines in Tier 2 and Tier 3 HFTD areas. Data will also be collected on selected projects in Routine VM based on road-access that will be determined through a map comparison.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, we continued to expand the utilization of ground-based LiDAR datasets in Routine VM for distribution lines in HFTD areas. VM has been working on a Ground Based LiDAR program to collect potential 4-foot radial compliance data on an operational schedule. In May 2021, we performed a single LiDAR scan in an HFTD

area. Lessons learned led to a pause in scanning until October 2021, when scanning was resumed. To scale this effort to regions with HFTD lines, VM Technology has mapped out the locations of Routine Inspections (VM Projects) and developed a data pipeline to deliver the LiDAR Detections to VM Operations approximately 30 days following collections, which are scheduled to occur approximately four months after routine inspections are complete.

Impacts:

- LiDAR scans on distribution lines HFTD areas can help confirm radial clearance compliance and be used to direct inspections to locations with potential encroachments.

Lessons Learned:

- The lesson learned from the -first-year implementation of this project was that data delivery requires a geographical map to communicate findings to VM personnel. After the initial Ground Based LiDAR scans in May 2021, we were able to take the opportunity to create the necessary tool required to pass on the results to VM personnel.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.03	LiDAR Ground Inspections – Distribution	Complete at least 2,000 circuit miles of Mobile LiDAR capture on HFTD road access electric distribution lines, barring External Factors. If at any point PG&E determines this technology does not effectively support efforts to reduce wildfire risk when compared to other viable approaches or technology, PG&E will pause or discontinue Ground Based LiDAR efforts.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

Our current plans for Ground Based LiDAR Program Mileage for distribution lines are included in Table PG&E-7.3.5-2 below:

TABLE PG&E-7.3.5-2:
GROUND BASED LIDAR PLANNED MILEAGE 2022-2025

Year	Planned GBL Mileage
2022	2,000
2023	4,000
2024	6,000
2025	6,000

All Ground Based LiDAR scans of Electric Distribution assets will be performed along roadside-available ROWs in HFTD areas. LiDAR scans on HFTD areas will be able to confirm radial clearance compliance and be used to direct inspections to locations with potential encroachments.

If at any point we determine this technology does not effectively support efforts to reduce wildfire risk when compared to other viable approaches or technology, we will pause or discontinue Ground Based LiDAR efforts.

7.3.5.8 Remote Sensing Inspections of Vegetation Around Transmission Electric Lines and Equipment

OEIS Initiative Definition: Inspections of right-of-way using remote sensing methods such as LiDAR, satellite imagery, and UAV.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

Vegetation encroachment upon high voltage Transmission Lines presents a serious risk to public safety due to the risk of wildfire, electrical injury, or electrocution. Vegetation encroachment can cause electric service interruptions capable of disrupting the electric grid. Vegetation encroachment can also result in violations of both State and Federal regulations. Encroachment can occur as a result of tree growth, movement of the conductors, or trees failing from within or outside of the ROW.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – In addition to identifying vegetation in immediate proximity to the lines, LiDAR captures attribute data for trees on and adjacent to the ROW that can strike the lines. LiDAR provides a high level of accuracy in these measurements and helps to minimize possible human error.

- Increase understanding of where risk is located – Aerial LiDAR inspections produce vegetation to conductor measurements with approximately less than nine -centimeter accuracy and support modeling movement of the conductor caused by conductor sag (due to ambient temperature and electrical loading) and conductor sway (due to wind). In addition to identifying vegetation in immediate proximity to the lines, LiDAR captures tree data for trees on and adjacent to the ROW that can strike the lines. LiDAR provides a high level of accuracy in these measurements and helps to minimize possible human error. Our transmission system traverses substantially more rugged and inaccessible terrain as a percentage of the system than does Distribution. This presents numerous safety exposures to ground inspectors and significantly increases the time it takes to complete inspections. Thus, for electric transmission facilities, PG&E uses aerial LiDAR because it is a safer, more efficient, more effective, and more accurate means of conducting transmission vegetation inspections.

- Focus mitigations on highest risk locations – PG&E conducts a second, "mid-cycle" aerial LiDAR inspection in the HFTD areas of our system at the height of the vegetation growing season which coincides with the beginning of historically the most active part of the California fire season. This patrol allows PG&E to conduct a

supplemental assessment of potential tree growth following seasonal rain through high fire threat areas to reduce the potential of ignitions.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Section 7.3.5.3 focuses on detailed inspections and management practices for vegetation clearances around transmission electrical lines and equipment in which the use of aerial LiDAR is one of the components of the patrols performed to ensure that our transmission system remains in compliance with state and federal laws and regulations.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The PG&E Transmission VM Program conducts LiDAR inspections on 100 percent of PG&E's transmission system (lines carrying 60 kV and above) as an integral first step of our routine program. PG&E conducts a second, LiDAR mid-cycle inspection in the HFTD areas of our transmission system. This program was started in 2020 to provide a snapshot of vegetation growing conditions and conductor clearances at the height of the growing season and immediately prior to the height of the fire season and is now part of the routine work and recurs annually.

Risk Models Used or Other Considerations for Prioritization:

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Our 2021 progress for transmission lines is provided in Table PG&E-7.3.5-3 below:

TABLE PG&E-7.3.5-3:
LIDAR INSPECTIONS – TRANSMISSION LINES

2021 Initiative Activity	Actual Progress 2021
LiDAR Routine	17,757.8 miles[(a)]
LiDAR Mid-Cycle (Rapid Reporting)	6,290 miles[(b)]
LiDAR Mid-Cycle (Routine)	1,333.4 miles[(c)]

(a) Mileage based on ETGIS; however, LiDAR survey miles differ by 122.
(b) Mid-cycle completed miles includes circuits assessed for UCDs where none were found and circuits where one or more UCDs were delivered.
(c) Mid-cycle routine mileage refers to routine deliverables processed via the LiDAR data collected in June 2021.

LiDAR Routine

Impacts:

- LiDAR helps to identify vegetation in immediate proximity to transmission lines and captures tree data for trees on and adjacent to the ROW that can strike the lines. LiDAR provides a high level of accuracy in these measurements and helps to minimize possible human error.

Lessons Learned:

- Aerial LiDAR is a safer, more efficient, more effective, and more accurate means of conducting transmission vegetation inspections.

LiDAR Mid-Cycle (rapid reporting)

Impacts:

- This patrol allows PG&E to conduct a supplemental assessment of potential tree growth following seasonal rain through high fire threat areas to reduce the potential of ignitions.

Lessons Learned:

- Aerial LiDAR is a safer, more efficient, more effective, and more accurate means of conducting transmission vegetation inspections.

LiDAR Mid-Cycle (routine)

Impacts:

- This patrol allows PG&E to conduct a supplemental assessment of potential tree growth following seasonal rain through high fire threat areas to reduce the potential of ignitions.

Lessons Learned:

- Aerial LiDAR is a safer, more efficient, more effective, and more accurate means of conducting transmission vegetation inspections.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.04	LiDAR Routine Inspections – Transmission	Complete LiDAR inspection of a minimum of 18,000 circuit miles of transmission lines, barring External Factors.	6/30/2022	Quantitative

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety. PG&E expects to do approximately 6,229 miles of LiDAR Mid-Cycle patrols over the course of 2022.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – In 2022, PG&E's target for this initiative is 100 percent of LiDAR inspections of our transmission system. We currently plan for this target to continue in 2023 and beyond. However, this target may be refined based on results from the LiDAR Risk Score Model as well as subject matter expert input to make determinations on scoping or descoping of transmission lines prior to PSPS events.

7.3.5.9 Other Discretionary Inspection of Vegetation Around Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

OEIS Initiative Definition: Inspections of ROWs and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

Secondary Risk: Reliability Impacts - PSPS

Please refer to Section 7.3.5.20 for a description of PG&E's additional vegetation management practices around distribution lines beyond regulatory requirements.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Not Applicable

Relation to and Impact on Other Initiatives:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- Not Applicable

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please refer to Section 7.3.5.20 for a description of PG&E's additional vegetation management practices around distribution lines beyond regulatory requirements.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Not Applicable

7.3.5.10 Other Discretionary Inspection of Vegetation Around Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

OEIS Initiative Definition: Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

Please refer to Section 7.3.5.3 for a description of PG&E's additional vegetation management practices around transmission lines beyond regulatory requirements.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Not Applicable

Relation to and Impact on Other Initiatives:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- Not Applicable

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please refer to Section 7.3.5.3 for a description of PG&E's additional vegetation management practices around transmission lines beyond regulatory requirements.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Not Applicable

7.3.5.11 Patrol Inspections of Vegetation Around Distribution Electric Lines and Equipment

OEIS Initiative Definition: Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Risk – Equipment – Structures

Please see Section 7.3.5.2 above for a discussion of PG&E's vegetation inspection programs for distribution facilities. There is no specific program to perform patrols around distribution lines unique from the inspections described in that section.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Not Applicable

Relation to and Impact on Other Initiatives:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- Not Applicable

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please see Section 7.3.5.2 above for a discussion of PG&E's vegetation inspection programs for distribution facilities. There is no specific program to perform patrols around distribution lines unique from the inspections described in that section.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Not Applicable

7.3.5.12 Patrol Inspections of Vegetation Around Transmission Electric Lines and Equipment

OEIS Initiative Definition: Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk - Vegetation Contact

Secondary Risk: Reliability Impacts - PSPS

Please see Section 7.3.5.3 above for a discussion of PG&E's vegetation inspection programs for distribution facilities. There is no specific program to perform patrols around distribution lines unique from the inspections described in that section.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Not Applicable

Relation to and Impact on Other Initiative:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- Not Applicable

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please see Section 7.3.5.3 above for a discussion of PG&E's vegetation inspection programs for distribution facilities. There is no specific program to perform patrols around distribution lines unique from the inspections described in that section.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Not Applicable

7.3.5.13 Quality Assurance/Quality Control of Vegetation Management

OEIS Initiative Definition: Establishment and function of audit process to manage and oversee the work completed by employees or contractors, including packaging QA/QC information for input to decision-making and related integrated workforce management processes. This includes identification of the percentage of vegetation inspections that are audited annually, as a program target in Table 5.3-1.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Acres Burned

Our Quality Assurance Vegetation Management (QAVM) program audits the compliance of vegetation line clearance activities along overhead electric distribution lines and transmission lines with distribution under-build for FAC-003-4, GO 95 Rule 35, and PRC Sections 4292 and 4293 using a statistically valid sampling methodology.

Our Quality Verification Vegetation Management (QVVM) group, which is separate from QAVM, reviews completed inspections and tree work using a statistically valid sampling methodology to confirm adherence to PG&E standards and procedures and overall quality of work performed by contractors to prevent and/or mitigate hazards (e.g., GO 95, Rule 35, PRC Sections 4292 and 4293).

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Increase understanding of where risk is located – QAVM identifies gaps in regulatory and/or internal procedure conformance and provides guidance to Vegetation Management Operations for continuous improvements.
- Increase understanding of where risk is located – QVVM reviews contractor quality on recently completed inspection and tree work to identify issues, address areas of concern and promote improvement in contractor performance.

Relation to and Impact on Other Initiatives:

- Vegetation Management – QAVM and QVVM both impact other programs within VM by providing audits, reviews and feedback.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: QAVM focuses its planned audit work on a higher percentage of HFTD miles. The majority of QAVM audits are Distribution Audits which are comprised of All Circuits audits and HFTD-only audits. The All Circuits audits look at both HFTD and non-HFTD mileage in the bundle. The HFTD only audits look at 100% HFTD mileage.

QVVM prioritizes work based on recently completed inspection and tree work using a statistically valid sampling methodology, in order of the highest profile of work starting with the EVM Work Verification, Distribution/Transmission Pre-Inspection, Distribution/Transmission Tree Trim, Tree Mortality (2nd Patrol), Mid Cycles (were changed in 2021 to focus on High Fire Threat Districts), and Vegetation Control Pole Clearing.

Risk Models Used or Other Considerations for Prioritization: The highest risk areas for VM are in HFTDs and QAVM focuses their planned audit work on a higher percentage of HFTD mileage. QVVM work is planned based on recently completed inspection and tree trim work.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

QAVM – Distribution Audits – QAVM completed 56 of 65 distribution audits in 2021 (86%) with the remaining 9 of 65 distribution audits cancelled (14%) due to resource constraints, low risk areas already receiving a passing audit, and two audits that were combined into a single audit. Through this process we were able to identify gaps in Facility Protect Tree (FPT) identification and provided information to correct issues.

QAVM – Vegetation Pole Clearing Audit – QAVM completed 1 of 1 (100%) Vegetation Pole Clearing Audit in 2021.

QAVM – Transmission Audits – QAVM completed 2 of 2 (100%) Transmission Audits in 2021.

QAVM – Procedure Audits – QAVM completed 4 of 9 (44%) Procedure Audits with 1 of 9 (11%) Procedure Audits in progress which will be completed by the end of January 2022. 2 of 9 (22%) Procedure Audits were cancelled due to resource constraints and 2 of 9 (22%) were postponed due to resource constraints. Through this process, we were able to identify the need for better communication and consistent work plans for EVM. On the circuit and line verification procedure we learned that VM may need to update their approach to ensure that all line mileage is accounted for in their plan. We also had the following lessons learned:

- VM's response to EVM lessons learned in 2021 led to increased communication between VM teams as well as with our contract partners. This increased

communication includes DORs, a Weekly Operating Review (WOR), a weekly safety all hands call, monthly vendor check-ins, and a monthly VM all hands call.

- To establish consistent workplans, VM implemented a change control process, the Vegetation Management Change Control Board, which reviews any potential changes to the EVM Scope of Work. Any approved recommended changes are reviewed by the Wildfire Risk Governance Steering Committee (WRGSC) for final approval.

- To ensure that all miles are accounted for in the EVM plan, PG&E's Internal Audit (IA) has helped in the review and verification of the EVM 2021 Scope of Work.

QVVM – Distribution – Progress by QVVM in 2021 included 1,539 of 1,930 reviews completed (80%). This process had the following impacts and lessons learned:

- A defined scope was implemented by VM for 2021, increasing the 18-19 Districts to 32 bundles, with the locations reviewed remaining at approximately 40 per district, now bundles. This was an increase from prior years.

- Increase workload for reviews on EVM Work Verification that consist of 600+ line segments to review each month (approximately 3,865 YTD).

- Low staffing for California Forestry Vegetation Management (CFVM) to reach its projected goal of 50 field techs to complete the planned work for 2021, has been impacted by turnovers, and loss of talent to PG&E and other contractors who have unionized.

- In 2021, there were four North Coast bundles that no longer performed 'pre-inspection' work, they send a tree crew first and then use the inspector to perform a 'post-inspection' to capture work completed by the tree crew. This change modified the quantity of reviews for PI, as there were no pre-inspection samples in this area.

- A low generation of Tree Mortality reviews has been identified, as not every bundle completes a Tree Mortality PI and Tree Mortality TT each month.

- There was a significant change in the sampling criteria from circuit-based reviews to reviews based on the location in a larger geographic area. This resulted in more locations reviewed per review.

QVVM – Vegetation Pole Clearing – Progress by QVVM in 2021 included 332 of 475 reviews completed (70%). This process had the following impacts and lessons learned:

- In fall of 2020, the 2021 plan was submitted to review 2% of the subject pole population. After consulting with the QVVM contractor, the decision was later made on April 12, 2021 to adjust the plan to review 1.5% of the pole population and there was an oversight in re-submitting the plan at 1.5%. QVVM reviewed a total of 3,516 subject poles in 2021, or 1.8% of the total pole population.

QVVM – Transmission – QVVM completed 281 reviews in 2021 versus a plan of 262 reviews (107%).

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.05	Vegetation Management – Quality Assurance	Perform vegetation management program quality audits prioritizing HFTD/HFRA areas. Statistically valid methodology parameters, such as a confidence level of 95 percent, will be utilized.	12/31/2022	Qualitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – There are no immediate plans to update any of the existing strategies mentioned above for Quality Assurance or Quality Verification. We will continue to track and review our progress and make changes as necessary.

7.3.5.14 Recruiting and Training of Vegetation Management Personnel

OEIS Initiative Definition: Programs to ensure that the utility can identify and hire qualified vegetation management personnel and to ensure that both employees and contractors tasked with vegetation management responsibilities are adequately trained to perform vegetation management work, according to the utility's wildfire mitigation plan, in addition to rules and regulations for safety. Include discussion of continuous improvement of training programs and personnel qualifications.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

VM work is dependent on having fully staffed PI and Tree Crew resources and there is an increased risk of a vegetation related outage or wildfire ignition event if this work is not completed in a timely manner with the necessary resources. Logging and tree felling are one of the most hazardous industries in the nation, and Northern California forests pose a very different challenge than in most parts of the country, due to the dry conditions, tall trees and high-risk species. Safely removing a 200+ ft tall tree in proximity of a high voltage distribution line must be done by a qualified professional. Therefore, hiring and training workers from outside of California requires additional training in the unique vegetation conditions in California, and Northern California in particular. There is a limited pool of qualified personnel, which causes constraints when responding to emergency events (Snow, Wind, Wildfire) each year. Additional contractor resources are also pulled away from PG&E during large natural disaster events in other parts of the county, as individual contracts are paid premium rates during emergency events.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Without a qualified workforce, PG&E would be unable to complete VM work that has been identified. To address this issue, PG&E is exploring approaches to increase the population of qualified tree workers to perform this work. We use our Pre-Inspector basics SLP to provide specific, well-defined training related to the work being performed. To bolster recruitment and the pipeline of qualified personnel, we have partnered with the IBEW and educational institutions, such as the California Community College system, to establish a training program designed to provide the skills and knowledge necessary to perform tree crew work safely and competently.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Having a qualified workforce impacts other VM initiatives.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: VM works with Contract Management to engage with contract vendors to recruit appropriate personnel to support VM programs across our service territory. Prior to identifying the most effective contract vendors we ensure the vendor is appropriate to perform the scope of work identified and we validate the vendors' safety presence in the industry. The VM Department regularly sources qualified talent for internal positions from current contract staff, who usually have extensive experience working in the industry and for PG&E. PG&E's efforts to recruit and train VM personnel will support VM across PG&E's service territory and, in particular, HFTD areas.

Certification is currently not a requirement for pre-inspectors. For pre-inspectors to become certified, they require a certain level of experience and on-the-job training. PG&E has developed Tree Crew and Inspector Training programs to support a steady pipeline of qualified personnel who may later join our contract or internal VM workforce. PG&E's PI basics SLP and related training courses provide personnel with an opportunity to earn continuing education credit that can be used towards obtaining certification. Our educational partnerships allow us to provide employees and contractors with a direct path of obtaining certification.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Community College Training Programs – PG&E completed and implemented a 5-week tree worker training program at seven California Community colleges that is focused on developing and supporting individuals who are looking to make a transition to the utility tree worker industry. PG&E has also completed digitization of this tree training course. PG&E developed and rolled out our 2-week Utility Line Clearance Pre-Inspection course in October 2021.

Impacts:

- The implementation of the Tree Training Program in conjunction with the California Community College group has led to more widespread visibility within the industry. We can interact and engage with individuals who may have been interested in the industry but were not sure how to become involved in the industry itself.

- Another benefit of the Tree Training program is that graduates of the course are beginning to directly impact the work that we do at PG&E as many of them are being picked up by contract vendors that perform work for PG&E.

Pre-Inspector Knowledge Assessment Courses – In August 2021, PG&E began implementation of knowledge assessments on specific Pre-Inspector courses. With the implementation of the knowledge assessments on VEGM-0110, VEGM-0410, VEGM-0411, and VEGM-0450, it will establish an enforcement of 3 attempts to pass the required PG&E training courses. After 3 failed attempts, the PI employee or contractor will be placed in a cooling off period before being allowed to retake the training course.

Impacts:

- The implementation of the knowledge assessment ensures that all of our PI employees and contractors are up to date around the procedures and policies.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E plans to continue the training, recruitment, and knowledge assessment program implemented in 2021 and described above. PG&E expects that our EVM VMI personnel will be field evaluated in course VEGM-0450. EVM VMI will be required to pass the field evaluation in order to keep their system access. PG&E plans to add 2-3 more colleges for the Tree Training Program, but will be dependent on interest from community colleges. PG&E continues to be a financial sponsor of these courses and will continue to support and provide input as the community college system continues to build out the program throughout California. PG&E plans to roll out a 1-Week Instructor Led training (ILT) that will build on the California Community College 2-week Pre-Inspection Program. The 1-week course will focus on PG&E vegetation policies and expectations. PG&E will also begin developing a scope for a refresher curriculum for specific VM courses.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We plan to continue to refine our tree crew training as needed on PG&E procedures not related to safety or core contracted jobs and our training for all tree crew field personnel. We will also continue to evaluate recruitment and retention of qualified workers for our VM programs.

7.3.5.15 Identification and Remediation of "At-Risk Species"

OEIS Initiative Definition: Specific actions, not otherwise described in other WMP initiatives, taken to reduce the ignition probability and wildfire consequence attributable to "at-risk-species," such as trimming, removal, and replacement.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Accurately identifying and mitigating trees at elevated risk of failure can reduce the risk of wildfire ignitions associated with vegetation contact with electric facilities due to tree failure.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – The results of our Targeted Tree Species study in conjunction with improving the Tree Assessment Tool (TAT) will allow PG&E to more accurately identify and mitigate trees at elevated risk of failure, providing better visibility into risk. TAT incorporates historical data on tree failures, regional species risk, and local wind gust data and assesses different components of an individual tree's health to direct abatement of the risk associated with tree falling into our facilities.

- Reduce frequency of all types of ignition events – The work of this initiative focuses on improving the identification of trees with an elevated risk of failure and striking PG&E facilities.

Relation to and Impact on Other Initiatives:

- This initiative directly relates to the Targeted Tree Species study discussed in Section 4.4. The purpose of the Targeted Tree Species study is to reduce potential wildfire ignitions by identifying species that pose an elevated risk of failure near PG&E facilities. The results of this study will be used to evaluate and inform improvements to the species risk rating component of PG&E's TAT.

- The TAT incorporates historical data on tree failures, regional species risk, and local wind gust data and assesses different components of an individual tree's health to direct abatement of the risk associated with tree falling into PG&E facilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Please see Sections 4.4 and 7.3.5.2 for more information regarding the Targeted Tree Species study and the TAT, respectively.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please see Sections 4.4 and 7.3.5.2 for more information regarding the Targeted Tree Species study and the TAT, respectively.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Please see Sections 4.4 and 7.3.5.2 for more information regarding the Targeted Tree Species study and the TAT, respectively.

7.3.5.16 Removal and Remediation of Trees with Strike Potential to Electric Lines and Equipment

OEIS Initiative Definition: Actions taken to identify, remove, or otherwise remediate trees that pose a high risk of failure or fracture that could potentially strike electrical equipment.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

Actions taken to remove or otherwise remediate trees that could potentially strike electrical equipment if adverse events such as failure at the ground-level of the tree or branch breakout within the canopy of the tree occur are discussed in Sections 7.3.5.2 and 7.3.5.3. PG&E does not perform a separate effort to identify, remove and remediate trees with strike potential. Instead, this is one of the risks that our inspectors assess and take action to resolve as part of our other vegetation management activities. Therefore, please refer to Sections 7.3.5.2 and 7.3.5.3.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Please see Sections 7.3.5.2 and 7.3.5.3.

Relation to and Impact on Other Initiatives:

- Please see Sections 7.3.5.2 and 7.3.5.3.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Please see Sections 7.3.5.2 and 7.3.5.3.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Please see Sections 7.3.5.2 and 7.3.5.3.

Impacts:

- Not Applicable

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Please see Sections 7.3.5.2 and 7.3.5.3.

7.3.5.17 Substation Inspections

OEIS Initiative Definition: Inspection of vegetation surrounding substations, performed by qualified persons and according to the frequency established by the Utility, including record-keeping.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.5.17.1 – Substation Inspections, Distribution;
- 7.3.5.17.2 – Substation Inspections, Transmission; and
- 7.3.5.17.3 – Substation Inspections, Hydro Generation substation.

7.3.5.17.1 Substation Inspections, Distribution

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Management

Secondary Risk: Ignition Consequences – Structures Impacted

PG&E assesses the areas around Electric Distribution Substations in HFTD and HFRA areas to identify potential flammable fuels and vegetation for removal in order to minimize the potential for ignition spread outside of facilities and to provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure. This program is referred to as utility defensible space or "UDS."

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire. PG&E acknowledges in addition to outward fire spread mitigation, achieving utility defensible space also provides mitigation associated with minimizing substation infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Section 7.3.5.18.1 is a related initiative used to capture the vegetation related maintenance and mitigation work associated with this section.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: In 2022, distribution substation defensible space inspections will be prioritized and executed using Wildfire Consequence Model (WFC Model) scores, defensible space risk, and terrain/suppression risk to determine the prioritization of distribution substations included in the 2022 defensible space inspection program.

Risk Models Used or Other Considerations for Prioritization:

- Defensible Space is defined by two primary zones of clearance. The first 30' surrounding energized equipment and structure is called the "Clean Zone" and 1st priority in assessment and mitigation. Any vegetation in this zone should be bare ground, but maintained herbaceous grasses and weeds reaching a height of no more than 4" is permitted. No woody vegetation is permitted (*i.e.* known tree and brush species). The second and larger zone of clearance is the "Reduced Fuel Zone" where vegetation is permitted, provided that it is reduced or thinned from 30' to 100' and maintained regularly. This would include removal of dead, dying or diseased vegetation where permitted. Remaining vegetation is mowed, pruned and trimmed to reduce ladder or flash fuels. Inspection will prescribe vegetation mitigation activities in both zones with emphasis on the 30' clean zone.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed 170 distribution substation defensible space inspections.

Impacts:

- The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.06	Defensible Space Inspections – Distribution Substation	Complete defensible space inspections in alignment with the guidelines set forth in PRC 4291 at 132 distribution substations within HFTD areas or HFRA, barring External Factors.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028): In 2022 and subsequent years, PG&E will continue to utilize updated and available data to help prioritize defensible space inspections.

7.3.5.17.2 Substation Inspections, Transmission

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences - Structures Impacted

PG&E assesses the area around Electric Transmission Substations in HFTD and HFRA areas to identify potential flammable fuels and vegetation for removal in order to minimize the potential for ignition spread outside of facilities and to provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire. PG&E acknowledges in addition to outward fire spread mitigation, achieving utility defensible space also provides mitigation associated with minimizing substation infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Section 7.3.5.18.2 is a related initiative used to capture the vegetation related maintenance and mitigation work associated with this section.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: In 2022, transmission substation defensible space inspections will be prioritized and executed using WFC
Model scores, defensible space risk, and terrain/suppression risk to determine the prioritization of transmission substations included in the 2022 defensible space inspection program.

Risk Models Used or Other Considerations for Prioritization:

- Defensible Space is defined by two primary zones of clearance. The first 30' surrounding energized equipment and structure is called the "Clean Zone" and 1st priority in assessment and mitigation. Any vegetation in this zone should be bare ground, but maintained herbaceous grasses and weeds reaching a height of no more than 4" is permitted. No woody vegetation is permitted (*i.e.*, known tree and brush species). The second and larger zone of clearance is the "Reduced Fuel Zone" where vegetation is permitted, provided that it is reduced or thinned from 30' to 100' and maintained regularly. This would include removal of dead, dying or diseased vegetation where permitted. Remaining vegetation is mowed, pruned and trimmed to reduce ladder or flash fuels. Inspection will prescribe vegetation mitigation activities in both zones with emphasis on the 30' clean zone.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed 79 transmission substation defensible space inspections.

Impacts:

- The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.07	Defensible Space Inspections – Transmission Substation	Complete defensible space inspections in alignment with the guidelines set forth in PRC 4291 at 55 transmission substations within HFTD areas or HFRA, barring External Factors.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Process Improvements (2023-2028) – In 2022 and subsequent years, PG&E will continue to utilize updated and available data to help prioritize defensible space inspections.

7.3.5.17.3 Substation Inspections, Hydro Generation

OEIS Initiative Definition: Not Applicable - This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Structures Impacted

In accordance with our Procedure LAND-5201P-01, PG&E assesses the area around Hydro Generation Substations and Powerhouses in HFTD and HFRA areas to identify potential flammable fuels and vegetation for removal to minimize the potential for ignition spread outside of facilities and to provide improved structure defense capability for firefighting purposes and to reduce risk of potential loss.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by Procedure LAND-5201P-01 reduces fire spread potential from an internal ignition event spreading outside the Hydro Generation substation or Powerhouse as well as minimizing infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Section 7.3.5.18.3 is a related initiative used to capture the vegetation related maintenance and mitigation work associated with the inspections resulting from this Initiative.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Power Generation Hydro Substations and Powerhouses located in HFTD and HFRA areas are inspected. Inspections are prioritized based on elevation and annual fuel growth in which lower elevations are inspected first as they have a higher rate of growth and dry out earlier in the season whereas higher elevations grow slower and later into the year.

Risk Models Used or Other Considerations for Prioritization:

- Defensible Space is defined by two primary zones of clearance. The first 30' surrounding energized equipment and structure is called the "Clean Zone" and 1st priority in assessment and mitigation. Limited vegetation in this zone can remain which includes isolated pruned trees, shrubs and/or herbaceous grasses and weeds reaching a height of no more than 4". Only certain woody vegetation is permitted. The second and larger zone of clearance is the "Reduced Fuel Zone" where additional vegetation is permitted, provided that it is reduced or thinned from 30' to 100' and maintained regularly. This would include removal of dead, dying or diseased vegetation where permitted. Remaining vegetation is mowed, pruned and trimmed to reduce ladder or flash fuels. Inspection will prescribe vegetation mitigation activities in both zones with emphasis on the 30' clean zone.

- Power Generation has developed an evaluation process, which evaluates the risk associated with unique situations at hydro generation sites, that inhibit the ability to achieve full defensible space as described. Included in the evaluation process are SIPT team members, Power Generation and substation fire marshals and Natural Resource Management (NRM) team members which evaluate the risk and make recommendations if further mitigations are required.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E completed 63 hydro substation and powerhouse defensible space inspections.

Impacts:

- The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the hydro substation and powerhouse as well as minimizing infrastructure impacts from an incoming fire.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.08	Defensible Space Inspections – Hydroelectric Substations and Powerhouses	Complete defensible space inspections at 61 Hydroelectric Generation Substations and Powerhouses within HFTD areas or HFRA, barring External Factors. Co located hydroelectric substations and Transmission & Distribution substations are counted separately as two distinct units.	12/31/2022	Quantitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Process Improvements (2023-2028) – In 2022 and subsequent years, PG&E will continue to utilize updated and available data to help prioritize defensible space inspections.

7.3.5.18 Substation Vegetation Management

OEIS Initiative Definition: Based on location and risk to substation equipment only, actions taken to reduce the ignition probability and wildfire consequence attributable to contact from vegetation to substation equipment.

For this initiative, PG&E has several sub-initiatives including:

- 7.3.5.18.1 – Substation Vegetation Management, Distribution;
- 7.3.5.18.2 – Substation Vegetation Management, Transmission; and
- 7.3.5.18.3 – Substation Vegetation Management, Hydro Generation.

7.3.5.18.1 Substation Vegetation Management, Distribution

OEIS Initiative Definition: Not Applicable - This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Structures Impacted

PG&E removes flammable fuels and remove or trim vegetation in and around Electric Distribution Substations in HFTD and HFRA areas to minimize the potential for ignition spread outside of facilities and provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure. Issues identified during the UDS inspections are turned into work orders and are executed in order to mitigate any defensible space issues that could pose a vegetation related ignition risk.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire. PG&E acknowledges in addition to outward fire spread mitigation, achieving utility defensible space also provides mitigation associated with minimizing substation infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Substation defensible space inspections described in Section 7.3.5.17.1 are conducted to identify and determine the level of additional vegetation mitigation work needed around the inspected facilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Vegetation management work performed includes mechanical weed abatement, tree trimming, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for utility defensible space. Utility defensible space mitigation activities are prioritized based on findings of inspections.

Risk Models Used or Other Considerations for Prioritization:

- Vegetation management work performed includes mechanical weed abatement, tree trimming, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for utility defensible space. Utility defensible space mitigation activities are prioritized based on findings of inspections.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E identified and completed 166 corrective maintenance tags identified through UDS inspection findings.

Impacts:

- The identification and mitigation of vegetation and available fuels within or near substations located in HFTD and HFRA areas decreases the likelihood of an ignition event spreading into a wildfire.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

Distribution vegetation management and maintenance activities will be identified through inspections discussed in Section 7.3.5.17.1.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will improve the defensible space program with herbicide treatment plans within defensible space zones for improved long-term control and abatement of noxious weeds and reoccurring/regenerating brush species, where permitted.

7.3.5.18.2 Substation Vegetation Management, Transmission

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Structures Impacted

PG&E removes flammable fuels and remove or trim vegetation in and around Electric Transmission Substations in HFTD and HFRA areas to minimize the potential for ignition spread outside of facilities and provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure. Issues identified during the UDS inspections are turned into work orders and are executed in order to mitigate any defensible space issues that could pose a vegetation related ignition risk.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized.

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by PRC Section 4291 reduces fire spread potential from an internal ignition event spreading outside the substation as well as minimizing substation infrastructure impacts from an incoming fire. PG&E acknowledges in addition to outward fire spread mitigation, achieving utility defensible space also provides mitigation associated with minimizing substation infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Substation defensible space inspections described in Section 7.3.5.17.2 are conducted to identify and determine the level of additional vegetation mitigation work needed around the inspected facilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized.

Prioritization of Work within Initiative: Vegetation management work performed includes mechanical weed abatement, tree trimming, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for utility defensible space. Utility defensible space mitigation activities are prioritized based on findings during inspections.

Risk Models Used or Other Considerations for Prioritization:

- Vegetation management work performed includes mechanical weed abatement, tree trimming, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for utility defensible space. Utility defensible space mitigation activities are prioritized based on findings during inspections.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year.

Actual Progress (2021):

In 2021, PG&E identified and completed corrective maintenance tags at 79 transmission substation and hydro substation facilities identified through utility defensible space inspection findings.

Impacts:

- The identification and mitigation of vegetation and available fuels within or near substations located in HFTD and HFRA areas decreases the likelihood of an ignition event spreading into a wildfire.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

Transmission vegetation management and maintenance activities will be identified through inspections discussed in Section 7.3.5.17.2.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will improve the defensible space program with herbicide treatment plans within defensible space zones for improved long-term control and abatement of noxious weeds and reoccurring/regenerating brush species, where permitted.

7.3.5.18.3 Substation Vegetation Management, Hydro Generation

OEIS Initiative Definition: Not Applicable - This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Structures Impacted

In accordance with Procedure LAND-5201P-01, PG&E removes flammable fuels and removes or trims vegetation in and around Hydro Generation Substations and Powerhouses in HFTD and HFRA areas to minimize the potential for ignition spread outside of facilities and provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure. Issues identified during the utility defensible space inspections are turned into work orders and are executed in order to mitigate any defensible space issues that could pose a vegetation related ignition risk.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The identification and removal of vegetative fuels and achieving defensible space as described by Procedure LAND-5201P-01, reduces fire spread potential from an internal ignition event spreading outside the Hydro Generation substation or Powerhouse as well as minimizing infrastructure impacts from an incoming fire.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Substation defensible space inspections described in Section 7.3.5.17.3 are conducted to identify and determine the level of additional vegetation mitigation work needed around the inspected facilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized.

Prioritization of Work within Initiative: Vegetation management work performed includes mechanical weed abatement, tree trimming, newly identified hazard trees, and brush and debris removal in accordance with Procedure LAND-5201P-01 recommendations for utility defensible space. Inspection and mitigation activities are prioritized based on elevation and annual fuel growth in which lower elevations are inspected first as they have a higher rate of growth and dry out earlier in the season whereas higher elevations grow slower and later into the year.

Risk Models Used or Other Considerations for Prioritization:

- Power Generation has developed an evaluation process, which evaluates the risk associated with unique situations at hydro generation sites, that inhibit the ability to achieve full defensible space as described. Included in the evaluation process are SIPT team members, Power Generation, substation fire marshal and NRM team members which evaluate the risk and make recommendations if further mitigations are required.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year.

Actual Progress (2021):

In 2021, PG&E identified and completed vegetation mitigations at 64 sites as identified through utility defensible space inspections as detailed in Section 7.3.5.17.3.

Impacts:

- The identification and mitigation of vegetation and available fuels within or near substations located in HFTD and HFRA areas decreases the likelihood of an ignition event spreading into a wildfire as well as minimizing the impact of incoming wildfires.

Lessons Learned:

- Not Applicable

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, we plan to inspect 61 Hydro Generations sites as detailed in Section 7.3.5.17.3, and appropriate mitigations will be implemented. Vegetation management activities will continue to be tracked and identified in order of risk priority with work to be completed.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will improve the defensible space program with herbicide treatment plans within defensible space zones for improved long-term control and abatement of noxious weeds and reoccurring/regenerating brush species, where permitted.

7.3.5.19 Vegetation Management Enterprise System

OEIS Initiative Definition: Inputs, operation, and support for a centralized vegetation management enterprise system updated based upon inspection results and management activities such as trimming and removal of vegetation.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Reliability Impacts – PSPS

PG&E's VM Department currently uses multiple centrally managed systems via various platforms, databases, and collection devices based on programmatic requirements to document planned and completed tree work. By using multiple centralized systems, there is a decrease in visibility regarding work being performed at different times and in different locations. The solution to this issue is to build or identify a tool that is flexible and accessible enough to manage our various program requirements and to support our work processes.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – By using multiple centralized systems, there is a decrease in visibility regarding work being performed at different times and in different locations. The solution to this issue is to build or identify a tool that is flexible and accessible enough to manage our various program requirements and to support our work processes.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Having effective data management systems can significantly impact other VM initiatives.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized.

Prioritization of Work within Initiative: The One VM Tool build is being prioritized and implemented system wide on core VM Programs. Work within the tool will be prioritized based on program guidelines.

Risk Models Used or Other Considerations for Prioritization:

- Not applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year.

Actual Progress (2021):

Six of six development "sprints" on the One VM Tool were completed, and demonstrations of user functionality were provided to operations subject matter experts. A Change Team was onboarded to review functionality as the One VM Tool is developed to provide the project team with feedback and operational expertise. This team was comprised of PG&E team members as well as contractor pre-inspectors and tree crew teams from all regions. In January 2022, the One VM Tool was deployed to pilot Routine Maintenance (Distribution) and Tree Mortality.

Impacts:

- By using multiple centralized systems, there is a decrease in visibility regarding work being performed at different times and in different locations. The solution to this issue is to build or identify a tool that is flexible and accessible enough to manage our various program requirements and to support our work processes.

Lessons Learned:

- IT developments may lead to shifts within the release schedule.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to roll out our One VM Tool to the following teams:

- Routine Maintenance (Distribution)
- Tree Mortality

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

The One VM Tool will be rolled out to the following:

- EVM;
- Work Verification;
- Wood Management;
- LiDAR;

- Vegetation Control (Pole Clearing);
- Wildfire Response;
- Utility Defensible Space;
- Routine Maintenance (Transmission);
- Transmission Programs (Orchards, IVM, ROWX);
- System Hardening VM Work/Estimating Arborist (EA); and
- Vegetation Management Inspections (VMI).

Please note, however, that the timing of IT development may require schedule changes. The One VM Tool will continue to increase visibility of what work is being performed at what times to reduce the risk of overlapping programs, reduce potential disruption of services to our customers, and enable better risk-informed planning and decision-making.

Continued improvement of the One VM Tool. Visibility across all VM Programs will be increased as well as alignment with IT enterprise roadmap which will further increase our ability to be seen by other LOB in order to access their information to improve VM work.

7.3.5.20 Vegetation Management to Achieve Clearances Around Electric Lines and Equipment

OEIS Initiative Definition: Identifying and discussing additional vegetation management actions (e.g., trimming and removal of vegetation) taken beyond the minimum regulatory requirements and recommendations, for example, enhanced vegetation management.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Acres Burned

The Overhead Asset UDS program addresses fuels underneath and adjacent to overhead distribution primary voltage power lines in HFTDs areas. Overhead Asset UDS focuses on the following:

- Model driven prioritization of annual work with specific scope developed to break up the vertical and horizontal continuity of fuels in proximity to distribution assets.
- Regionally identified projects with variable scope ranging from right of way clearing to targeted removal of accumulated fuels as identified by local operations. Project areas are identified by local teams and reviewed for prioritization by operation and risk management teams.
- Additional coordination of fuel management resources to support execution or overall risk reduction of other wildfire mitigation programs such EVM.
- Maintenance of historically completed segments.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The goal of the fuel reduction work is to mitigate the spread of an ignition if one were to occur under or adjacent to PG&E powerlines while enhancing defensible space for communities, properties, and buildings. The program supports consequence reduction of utility ignitions but also protects assets from all fires regardless of cause.
- Improve access to assets for inspection and maintenance – Modification of fuels in proximity to utility assets improves the ability to safely access for inspections and maintenance.

Relation to and Impact on Other Initiatives:

- Vegetation Management – UDS can also be related to the ongoing vegetation management programs described in Sections 7.3.5.2 and 7.3.5.3.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: To help address the wide range of fuel conditions within HFTD areas, the UDS program is evolving to utilize model outputs in combination with localized expertise or observations. In 2021, Overhead Asset UDS projects were prioritized using PG&E's Vegetation Risk Model. These outputs were refined and prioritized into tranches through reviews conducted by risk management and regional Public Safety Specialists. In addition to the model driven mitigations, the maintenance of previously completed projects was initiated. Additionally, a limited amount of regionally identified projects were prioritized and completed.

As the prioritization of Overhead Asset UDS evolves, it will continue targeting risk reduction using the WDRM as a primary tool to identify new work in HFTD areas. However, it will also focus on supplemental fuel mitigation on distribution assets across the territory outside of this model to promote collaborative risk reduction working with regional input to prioritize additional work and maintenance.

Risk Models Used or Other Considerations for Prioritization:

- Wildfire Distribution Risk Model (WDRM) – UDS scope targets sanitation and fuel reduction in proximity to equipment baring overhead assets. PG&E will continue to utilize local project requests to complement work prioritized by WDRM and expert review. These local projects can identify areas in the HFTD areas where fuel conditions warrant mitigation otherwise undetected by the model.

- Fuel mitigations will at times have limitations imposed by terrain, customer, and environmental impact considerations.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Of the 4,117 poles identified for this initiative, 3,565 were available to work based on customer approvals and were completed as of December 31, 2021. In addition, 4.17 lines miles of variable scope local/regional projects were completed as of December 31, 2021.

Impacts:

- Coordination and scheduling with other programs and workforces will be an increased focus in 2022 and beyond.

Lessons Learned:

- Need for alignment with other VM projects to help with scheduling, timing of communications, and coordination with customers.

In 2021, 8,551 line miles of previously completed fuel reduction work was retreated for fuel management and new growth.

Impacts:

- 2021 work will need to be reviewed for maintenance cycle.

Lessons Learned:

- Not Applicable.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
E.09	Utility Defensible Space – Distribution	Complete utility defensible space work on a minimum of 7,000 poles in the HFTD, barring External Factors.	12/31/2022	Quantitative

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety. PG&E plans to also do locally identified and approved fuel mitigation projects.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E will continue to modify vegetation at prioritized locations over the next five years, working with our risk modeling team to create a model more specific to Overhead Asset UDS and overall benefit or treatments. This will allow more effective, targeted work where other maintenance activities outside PG&E's programs are not effectively mitigating risks.

7.3.5.21 Additional Vegetation Management Practices Beyond Regulatory Requirements and Recommendations

OEIS Initiative Definition: Vegetation management (VM) activities during post-fire service restoration including, but not limited to: activities or protocols that differentiate post-fire VM from programs described in other WMP initiatives; supporting documentation for the tool and/or standard the utility uses to assesses the risk presented by vegetation post-fire; and how the utility includes fire-specific damage attributes into its assessment tool/standard.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impact

Secondary Risk: Ignition Risk – Vegetation Contact

When a wildfire event impacts PG&E's electric overhead assets there are different phases of the response based on the size of the fire, intensity of burn, and damage to PG&E assets. Restoration is the first phase and is where vegetation management activities are focused on providing public safety by mitigating vegetation that is an imminent threat to PG&E assets and supporting electric crews with removing vegetation to provide access to restore service to customers. The second phase of vegetation management activities are focused on reliability by mitigating hazard trees that have potential to fail into PG&E assets. PG&E performs a hazard tree assessment of the burned area to determine whether trees pose a threat to electric assets and if they should be abated.

This initiative is to develop a standard for assessment criteria to be used when evaluating trees within a wildfire impacted area. The standard will contain objective assessment criteria to identify hazard trees for mitigation and reduce the risk of a tree failing into PG&E facilities within a wildfire impacted area.

Based on the intensity and duration of a wildfire event and residual fuels based on fire behavior, this initiative also has the opportunity to reduce fuel by mitigating appropriate trees and applying mitigation measures that reduce the buildup of fuel within wildfire impacted areas.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Mitigating Risk in Wildfire Areas – The standard for post-wildfire VM work will create consistency across the entire PG&E system, where possible, allowing for geographical or other conditions that may require adjustments. This standard will be used for how trees and residual vegetation within a wildfire impacted area are to be assessed and criteria used for determining when to abate.

- Focus mitigations on highest risk locations – When wildfires occur and damage overhead electric assets, they generally are in high-risk areas. The VM work that is performed to protect the facilities is typically significant in scope to provide compliance and public safety within the high fire risk area that the fire occurred.

Relation to and Impact on Other Initiatives:

- Vegetation Management – Section 7.3.5.5 is related in that it addresses fuel management and reduction of slash from VM activities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: This Initiative establishes the standard for assessment criteria to be used in post wildfire VM inspections. The standard applies to any wildfire area that impacts the PG&E overhead electric system. The timing of when the outcome of the initiative is applied is dependent on the fire behavior, size of the fire event, timing of when crews can access the wildfire impacted area, and the available resources.

Risk Models Used or Other Considerations for Prioritization:

- Post wildfire, the regrowth that occurs from resprouting species can often grow back thicker than pre-wildfire conditions. In some locations herbicide is not allowed because of customer or agency concerns. There are environmental impacts that occur from performing the vegetation management work such as road damage and erosion from equipment. Challenges exist when working with customers or agencies to allow post wildfire VM work to take place on their land and in their communities.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, we created a draft document for VM Wildfire Inspection Guidelines.

Impacts:

- Not Applicable

Lessons Learned:

- The 2019 Wildfire Response Guidance document was used by the vegetation management department for response to the 2021 wildfires. Opportunities for improvement were identified in the year and a draft VM Wildfire Inspection Guidelines was developed that contains objective hazard tree assessment criteria.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E plans to finalize the draft of the VM Wildfire Inspection Guidelines that were created in 2021.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We intend to update the standard on the basis of field feedback and develop additional tools as needed.

7.3.6 Grid Operations and Protocols

7.3.6.1 Automatic Recloser Operations

OEIS Initiative Definition: Designing and executing protocols to deactivate automatic reclosers based on local conditions for ignition probability and wildfire consequence.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks

Secondary Risk: Reliability Impacts

Reclosing devices, such as circuit breakers and line reclosers, are used to quickly and safely de-energize lines when a problem is detected. Reclosing devices by design re-energize lines to restore service on momentary fault conditions, and de-energize lines for sustained outages; however, the action of reclosing, poses risk of fire ignition during elevated fire conditions.

Supervisory Control and Data Acquisition (SCADA) devices can remotely de-energize a line for a hazard condition like a tree contacting a line, a car hitting a pole where the pole is broken and the wires are still energized, live wires down on the ground, or broken wires hanging from the pole without contacting a grounded surface. These types of situations can create public safety hazards as well as wildfire risk from a potential ignition.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Reclosing is disabled on all automatic devices within the Tier 2 and Tier 3 High Fire Threat District (HFTD) areas during fire season to avoid reclosing into faulted conditions that could potentially cause ignition.

Relation to and Impact on Other Initiatives:

- Other – Pacific Gas and Electric Company's (PG&E) Utility Procedure TD-1464P-01, Fire Index Patrol and Non-Reclose Procedure, establishes precautions for wildfire risks associated with recloser protection functions. Using analyses provided by fire officials and our Meteorology team regarding each year's fire season timeline and exposure, PG&E makes an informed decision on when to disable automatic reclosing/testing during elevated fire conditions in protection zones that intersect Tier 2 or Tier 3 HFTD areas. Timing for disabling/enabling is based on the condition of fuels and a recommendation made by the Hazards Awareness and Warning Center and Meteorology. Once the decision to disable has been approved, all reclosing devices for transmission 115 kilovolts (kV) and below

and distribution lines will be disabled during the determined utility fire risk season for protection zones that intersect Tier 2 or Tier 3 HFTD areas.

There are approximately 3,100 distribution reclosing devices on PG&E distribution lines serving Tier 2 and Tier 3 HFTD areas. The devices with reclosing functionality include substation circuit breakers, line reclosers and FuseSavers (single phase reclosers utilized for tap-lines that can have SCADA-capability). Most of the reclosing devices serving Tier 2 and Tier 3 HFTD areas have SCADA capability. For the non-SCADA distribution reclosing devices serving Tier 2 and Tier 3 HFTD areas, PG&E will manually disable automatic reclosing/testing during the determined utility fire risk season.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Reclosing is disabled on all automatic devices for transmission 115 kV and below and distribution lines within the Tier 2 and Tier 3 HFTD areas prior to fire season.

Risk Models Used or Other Considerations for Prioritization:

- Fire Potential Index (FPI) Model – The FPI Model is one the tools used to determine when reclosing should be disabled for the fire season.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In May 2021, PG&E disabled automatic reclosing within the Tier 2 and Tier 3 HFTD areas prior to fire season. Automatic reclosing remained disabled for the entire fire season.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We will continue to follow the utility procedure for automatic recloser disabling prior to fire season and re enabling after fire season. Reclosing is disabled on all automatic devices within the Tier 2 and Tier 3 HFTD areas during fire season to avoid reclosing into faulted conditions that could potentially cause ignition.

7.3.6.2 Crew Accompanying Ignition Prevention and Suppression Resources and Services

OEIS Initiative Definition: Those staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, and water) that are deployed with construction crews and other electric workers to provide site--specific fire prevention and ignition mitigation during on-site work.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment - Conductor)

Secondary Risk: Ignition Consequences (Acres Burned)

PG&E's Safety and Infrastructure Protection Team (SIPT) consists of 40 two-person International Brotherhood of Electrical Workers (IBEW) crews who are trained and certified in safety and infrastructure protection. SIPTs are highly trained in fire suppression and prevention and can provide detailed insights to reduce fire hazards at work sites. During elevated fire risk conditions and based on priority and availability, SIPTs accompany PG&E personnel during high-risk work activities and perform critical fuel reduction work around PG&E assets to prevent damage from wildfires. SIPTs also coach and educate field employees on the requirements of Utility Standard TD-1464S, Preventing and Mitigating Fires While Performing PG&E Work.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – The presence of a SIPT crew at a work site decreases the potential for a PG&E caused ignition to develop until a consequential fire.

- Increase understanding of where risk is located – SIPT crews are highly trained in fire prevention and can provide detailed insights into fire hazard reduction at work sites.

Relation to and Impact on Other Initiatives:

- PSPS – The presence of a SIPT crew at field location during a Public Safety Power Shutoff (PSPS) event can decrease the potential for a PG&E caused ignition to develop into a consequential wildfire.

- Other – The presence of a SIPT crew at a work site decreases the potential for a PG&E caused ignition to develop into a consequential wildfire. SIPT crews are also highly trained in fire prevention and can provide detailed insights to reduce fire hazards at work sites.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Prioritization of Work within Initiative: Crew support decisions are based on an assessment of the FPI rating, type of work being performed, project location, and SIPT availability.

Risk Models Used or Other Considerations for Prioritization:

- A risk model has not been developed for this work.
- SIPT crew availability impacts prioritization. If crews are not available to due injury, illness, or emergency activity, adjustments are required for any prioritization process.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

SIPT maintained staffing levels to support fire prevention and mitigation activities (40 crews and 40 engines and associated equipment). SIPT personnel continued to perform defensible space inspections for Power Generation facilities, weather station installations, and provided Utility Standard TD-1464S training to the tower recoating group.

Impacts:

- SIPT was able to support these activities by prioritizing work efforts across the service territory.
- The SIPT activities reduced fire hazards and improved employee awareness regarding wildfire prevention.

Lessons Learned:

- Additional SIPT crews can provide more program capacity to support this initiative.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

SIPT will continue to support fire prevention and mitigation activities and when possible perform defensible space inspections for PG&E facilities as needed.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – PG&E is considering adding a dedicated facility for a base of SIPT operations. The intended benefit is to provide necessary logistical support for SIPT organization. PG&E is also planning to determine upgrades to existing equipment (engines) and enhancements to the overall program. The intended benefit is to develop a risk-informed business case to determine if increases to staffing and or equipment is recommended.

7.3.6.3 Personnel Work Procedures and Training in Conditions of Elevated Fire Risk

OEIS Initiative Definition: Work activity guidelines that designate what type of work can be performed during operating conditions of different levels of wildfire risk. Training for personnel on these guidelines and the procedures they prescribe, from normal operating procedures to increased mitigation measures to constraints on work performed.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risks (Equipment - Structures)

Secondary Risk: Ignition Consequences (Acres Burned)

Utility-caused ignitions pose a risk to the environment, the utility system, work personnel, and the public. Utility Standard TD-1464S, Preventing and Mitigating Fires While Performing PG&E Work, establishes directives that are essential to mitigating fire danger. The content of the standard is intended to minimize the frequency of potential ignitions and establish fire prevention standards to minimize the consequences of an accidental ignition. The standard establishes work activity guidelines that designate the type of work that can be performed during different levels of wildfire risk. The standard also ensures compliance with existing legal statutes regarding fire prevention requirements. Training for personnel on these guidelines and the procedures they prescribe are included in this initiative.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – By adjusting work activities based on the FPI Model, compliance with Utility Standard TD-1464S can reduce the frequency of PG&E-caused ignitions. In addition, proactive fire mitigation activities will reduce the frequency of PG&E-caused ignitions.

- Reduce consequence of potential ignitions – Compliance with Utility Standard TD-1464S ensures that PG&E employees and contractors are equipped with required fire prevention and suppression tools to minimize the consequences of any PG&E- caused ignitions.

- Focus mitigations on highest risk locations – Compliance with Utility Standard TD-1464S ensures that PG&E employees and contractors are following all legal statutes regarding fire prevention on forest, grass, and brush covered lands. Additional mitigation requirements are expected during higher risk R4 and R5 conditions. During R5+ (PSPS), routine work is not allowed in specific areas of the service territory.

Relation to and Impact on Other Initiatives:

- Utility Standard TD-1464S provides fire prevention guidance for all field personnel engaged in the following initiatives:
  - Asset Inspection and Repair;
  - Vegetation Management; and
  - PSPS.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that outcomes of risk model are being prioritized

Prioritization of Work within Initiative: Utility Standard TD-1464S establishes requirements that apply to all PG&E employees and contractors when travelling over, performing work in, or operating on any forest, brush, or grass covered lands.

Risk Models Used or Other Considerations for Prioritization:

Not Applicable.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E finalized learnings from the 2020 quality control program pilot and adjusted the program based on our findings. We initially began implementation of a pilot with SIPT leads. SIPT availability to perform the quality observations was limited during fire season due to fire response activities. After discussion with Field Safety Leadership, it was decided that the quality observations would be performed by the Field Safety Specialist organization. The Field Safety Specialists were already deployed to the field performing Safety observations and adding the Wildfire Mitigation observations to their responsibilities was a smooth transition.

Impacts:

- The Field Safety Specialist Team completed 2,651 observations. The findings will help identify points to emphasize in the standard revisions and as part of training programs.

Lessons Learned:

- The Field Safety Specialist Team are well suited to coach our field employees and confirm adherence to Utility Standard TD-1464S requirements.

Utility Standard TD-1464S was revised in December 2021. Key revisions were made to further clarify the standard and incorporate feedback from impacted Lines of Business.

Web-based training (WBT) SAFE-1503 will be updated in 2022 to incorporate key aspects of the revisions.

Impacts:

- Revisions will provide greater clarity for field personnel.

Lessons Learned:

- Elements of Utility Standard TD-1464S need to be clarified for field personnel on a periodic basis.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

As mentioned above, WBT SAFE-1503 will be updated in 2022 to incorporate key aspects of the revisions made to Utility Standard TD-1464S.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – PG&E will continue an annual review of Utility Standard TD-1464S to incorporate field feedback and any changes in applicable statutes. The intended benefit is to ensure the guidelines are relevant and compliant with established statutes.

7.3.6.4 Protocols for PSPS re-energization

OEIS Initiative Definition: Designing and executing procedures that accelerate the restoration of electric service in areas that are de-energized, while maintaining safety and reliability standards.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – PSPS

Prior to re-energization during PSPS events, PG&E conducts patrols, looking for damages or hazards on the de-energized circuits. Damages are conditions that occurred during the PSPS event, which are likely wind related and necessitate repair or replacement of PG&E's assets, such as downed wires or a fallen pole. Hazards are conditions that might have caused damages or posed an electrical arcing risk had PSPS not been executed (e.g., a tree limb found suspended in electrical wires). In each case, PG&E repairs or replaces damaged equipment or clears the hazard before re-energizing the line.

PG&E's PSPS re-energization objective is to provide a safe and efficient restoration of our electric facilities (i.e., transmission lines, substations, and distribution circuits). To ensure for a safe re-energization requires extensive coordination amongst numerous groups and large numbers of personnel (i.e., system operators and patrollers). Only by close coordination can we be certain that overhead assets are safe to be energized by mitigating ignition risks. Due to the number of personnel and assets involved, to mitigate the ignition risks we utilize the Incident Command System as a base response framework, in which each circuit is assigned a taskforce consisting of supervisors, crews, troublemen and patrollers. This structure allows us to patrol (mitigate ignition risks) and perform step restoration (faster customer restoration) in alignment with the centralized control centers.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – PG&E reduces the potential of ignition both during and following a PSPS weather event by patrolling Transmission and Distribution overhead assets that were previously de-energized by being identified as "event specific assets at risk" for a given event.

- Reduce duration of events (PSPS/Enhanced Powerline Safety Settings (EPSS) – PG&E reduces the duration of PSPS events by utilizing consistent processes by all groups involved with the PSPS restoration efforts. We continue to utilize and expand the PG&E network of weather stations and high-definition wildfire cameras, which has improved our ability to forecast and identify safe weather and declare the weather "all clear" in more granular areas.

Relation to and Impact on Other Initiatives:

- Ignition Components – PG&E executes PSPS on both Transmission and Distribution assets defined as at-risk during weather events meeting the PSPS criteria for de-energization. These assets are identified and provided to all involved groups via the De-energization Playbook[96] which is a listing of circuit elements that have been defined as at risk from an ignition component perspective noted above. In addition, PG&E has added a Customer Owned Lines initiative to isolate customer owned facilities (transmission and distribution) following de-energization when identified as being at risk. This in turn requires customers to ensure and communicate to PG&E that their facilities are both safe and ready to be energized following being provided the weather "all clear." This process will be fully developed following field asset assessments and formalized in the 2022 PSPS-1000P-01 update.

- PSPS – The PG&E Emergency Operations Center (EOC) Officer-in-Charge makes the decision to initiate PSPS patrols and re-energization by approving the re-energization of impacted assets within the event footprint as recommended by the PSPS event meteorologist in charge. This approval is termed the weather "all clear", indicating that a return to weather conditions supporting the commencement of restoration (both the patrol and re-energizing activities) activities in given area(s). Re-energizing activities then commence in the event footprint including conducting patrols and removing and repairing hazards. The protocol for re-energization (when both transmission and distribution assets, including substations, are involved) typically includes re-energizing both transmission and distribution assets simultaneously. The transmission element may be prioritized first to ensure system stability and may be electrically necessary to provide sources for substations and their associated distribution circuits that may have been impacted during the PSPS event.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that outcomes of risk model are being prioritized

Prioritization of Work within Initiative: The transmission line patrol prioritization strategy is driven by electrical system stability (i.e., ensuring adequate transmission facilities are in service to support the overall grid and accompanying local loads along with ensuring that the system protection component is addressed) followed by the customer impacts associated with each line impacted in the event. Distribution circuit "segmenting" is also used to better align both field and control center personnel. In supporting and performing distribution circuit-based isolation (segmentation), PG&E uses a circuit-based patrol personnel hierarchy structure. The segmenting process can commence immediately following the impacted distribution assets being de-energized. The process is usually done in a de-energized state (while the weather event is ongoing) and typically consists of using previously created distribution circuit segment

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96 The De-energization Playbook is a list of transmission lines and distribution circuits planned to be de-energized as part of the PSPS event.

guides on impacted circuits to open pre identified distribution field devices downstream of the open-source device (used to de-energize given portion(s) of a distribution circuit). This allows for setting up “step restoration” once the weather “all clear” is received.

All impacted transmission and distribution overhead lines that are identified as “event specific assets at risk” in High Fire Risk Areas (HFRA), as directed by the EOC, must be patrolled (via aerial or ground) in their entirety, and all trouble found must be isolated or cleared prior to energizing. For transmission, patrols occur on the de-energized sections of all lines with identified “event specific assets at risk” as directed by the EOC. For distribution, patrols occur on all impacted primary (and secondary that extends beyond primary) overhead lines identified as “event specific assets at risk” as directed by the EOC. Secondary does not include service drops.

Risk Models Used or Other Considerations for Prioritization:

- Ignition Probability Weather (IPW) Model – PSPS restoration activities are based upon the risk models that evolve during the execution of a specific PSPS event. This model is one of the tools utilized used to determine the “all clear” for various areas by the meteorology team to allow for restoration efforts to commence.

- During PSPS events, numerous challenges are encountered with some meeting the exception category. Most challenges can be adequately mitigated by proper planning and process, while others may be outside of those controls (those being the exceptions). For instance, safety of the public and our coworkers is paramount, and with that it is sometimes necessary to cease restoration activities until exceptions are mitigated. Some examples of these exceptions are police activity and access issues due to road/area closures by public agencies, weather/visibility (cannot perform aerial patrols), damages encountered requiring repair and communication issues due to the large geographic and remote areas encountered during these events.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E improved the “all clear” process by releasing impacted assets in a more granular fashion by the implementation of:

- “All clear zones” which more readily translate to impacted Transmission and Distribution assets during PSPS events;

- The Restoration Playbook “F” format, which utilizes the “all clear zones” to identify specific assets that have been approved for restoration; and,

- A restoration forecast element to allow for more effective staging of resources to support the overall goal of reducing outage duration

The Customer Owned Lines initiative process (both transmission and distribution) was implemented in August 2021 after the release of the PSPS-1000P-01 update. As noted

previously in this section, the process will be fully developed following field asset assessments and formalized in 2022 based on those assessments and lessons learned.

Impacts:

- The “all clear” improvements were incorporated into PG&E’s PSPS guidance procedure PSPS-1000P-01, which allowed for the development of training for field personnel.

- The Customer Owned Line process provided for a reduction in wildfire ignition risk during the restoration phase of PSPS events.

Lessons Learned:

- Develop and communicate change management activities incrementally as process improvements are identified

- Ensure change management communications includes all level of coworkers involved with PSPS restoration activities

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – We currently intend the following short-term improvements:

- Electronic Maps to field – Provide field groups with enhanced situational awareness of the event footprint via visualization. This will facilitate PG&E’s ability to develop, update, and provide more real-time oriented maps electronically rather than the current paper maps. It will also support field validation efforts and could include delineation of patrol boundaries along with addition of other layers deemed necessary (i.e., aerial/access hazards, critical infrastructure, active fires, etc.).

- Segment Guide Automation – Provide for a more event specific footprint device and segment identification guide along with incorporating any new field devices. This will support reduction of real time modification requirements required on current segment guides while providing for improved accuracy of event specifics details being provided to field groups.

- Advanced Distribution Management System automated switching solution for PSPS activities – Consolidate PSPS activities onto a single platform for dissemination to distribution control center and field personnel. This will provide for common and consistent data exchange between distribution control center and field personnel.

7.3.6.5 PSPS Events and Mitigation of PSPS Impacts

OEIS Initiative Definition: Designing, executing, and improving upon protocols to conduct PSPS events, including development of advanced methodologies to determine when to use PSPS, and to mitigate the impact of PSPS events on affected customers and local residents.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Risk – Equipment

Our PSPS Program proactively de-energizes a portion of the electric system in the interest of public safety when weather forecasts predict conditions of an extreme fire threat. The principal object of de-energization is to prevent PG&E equipment from causing a catastrophic wildfire that could harm customers' lives and property. Public safety risks of a PSPS de-energization mean that impacted communities may spend an extended period without electricity. PG&E considers the public safety impacts of de-energizing by looking at the total count of affected customers and the impact of potential de-energization upon medical baseline customers, critical facilities, and backup generation capabilities of critical facilities that pose societal impact risks if de-energized (e.g., critical infrastructure). Inasmuch as PG&E uses PSPS as a tool of last resort for wildfire mitigation, we review any alternatives and mitigations available before deciding to de-energize.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – De-energization is necessary to protect public safety when PG&E believes there is significant risk of strong winds impacting PG&E assets, which may potentially result in catastrophic wildfires should ignition occur. PSPS is used as a measure of last resort and is only deployed when other measures are not adequate alternatives.

- Reduce number of customers impacted – A key objective of the PSPS Program is to capture unmitigated wildfire risk while implementing measures that reduce customer impacts of PSPS events without compromising safety.

- Reduce duration of events (PSPS/EPSS) – PG&E's PSPS Program also aims to minimize the duration of PSPS events as described in Section 8.1.

Relation to and Impact on Other Initiatives:

- Situational Awareness and Forecasting – PSPS Scoping is directly dependent on weather forecasting and meteorology models.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that outcomes of risk model are being prioritized

Prioritization of Work within Initiative: PSPS de-energization is dependent on the impacted location within PG&E's service territory. PSPS primarily occurs in HFRA areas, but de-energization will occur anywhere in PG&E's service territory that has been affected by a PSPS event.

Risk Models Used or Other Considerations for Prioritization:

- IPW Model – We evaluate both the minimum fire conditions and the fire potential index to ensure PSPS is only executed during wind events when the atmospheric conditions and fuels (live and dead) surpass our PSPS thresholds. If all the minimum fire conditions are met, PG&E conducts an in-depth review of fire risk using three separate measures: Catastrophic Fire Probability, Catastrophic Fire Behavior, and Vegetation and Electric Asset Considerations. If the criteria for any of these measures are met, PG&E may need to turn off power for safety.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E had five PSPS events in 2021 which resulted in approximately 80,400 customer de-energizations.

Impacts:

- PG&E has improved during the last two PSPS seasons and intends to continue our efforts on scoping process and tools, external communications and customer notification processes, data management and restoration processes based on lessons learned and internal and external feedback. For more details about the PSPS initiative please refer to Section 8.1.2.

Lessons Learned:

- Please refer to Section 8.1.3

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We will continue to review and revise, as needed, our PSPS Protocols in order to reduce the impact of PSPS events on our customers while at that the time using PSPS under the appropriate circumstances to mitigate potential wildfire ignitions.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – PG&E will continue to utilize lessons learned during the PSPS season to reduce the impact on customers without compromising safety. PG&E expects to see further impact reductions as we continue to increase the maturity of our PSPS Program and tools. We will also evaluate adoption of newer technologies currently only in pilot phases such as Rapid Earth Fault Current Limiter and Distribution Transmission Substation: Fire Action Schemes and Technologies (DTS FAST). These efforts may enable some lines to remain energized during high wind conditions, contributing to event size reductions. For more details, please see Section 8.1.

7.3.6.6 Stationed and On-Call Ignition Prevention and Suppression Resources and Services

OEIS Initiative Definition: Firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, firefighting foam, chemical extinguishing agent, and water) stationed at utility facilities and/or standing by to respond to calls for fire suppression assistance.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Consequences (Acres burned)

Secondary Risk: Ignition Consequences (Structures Impacted)

PG&E's SIPT consists of 40 two-person IBEW crews who are trained and certified in safety and infrastructure protection. All personnel have previous firefighting experience and certification. SIPT crews operate Type 6 fire engines equipped with firefighting tools and equipment necessary to protect PG&E infrastructure from damage during wildfires. While SIPT engines are not considered "initial attack" fire resources, they can protect PG&E assets during active wildfires after obtaining permission from the Authority Having Jurisdiction (AHJ). SIPT crews are also available to support requests for assistance from an AHJ. SIPT crews reduce the consequences of ignitions by:

- Pre-treating and protecting PG&E assets to prevent wildfire loss and reduce risks from pole failures during wildfires
- Supporting AHJs' fire mitigation and suppression requests when available

There are 40 SIPT crews available for response Monday through Friday during normal work hours. During the summer preparedness period, eight SIPT crews remain on call, with availability to respond for emergency needs on weekends and holidays. When necessary, additional SIPTs can be mobilized to support response. During periods of elevated fire risk, SIPT leadership may identify additional standby SIPT personnel to support response.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – Pre-treating and protecting PG&E assets prevents wildfire loss and reduces risks from pole failures during wildfires. SIPT crews are available to support fire mitigation and suppression requests from an AHJ.

Relation to and Impact on Other Initiatives:

- PSPS – SIPT employees are performing observations prior to de-energization and all clear decisions. They are also available to respond to ignitions.

- EPSS – SIPT employees are an available resource to Electric Dispatch to support assessment and fire mitigation response.

- Ignition Components – SIPT employees are an available resource to Electric Dispatch to support assessment and fire mitigation response.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that outcomes of risk model are being prioritized

Prioritization of Work within Initiative: Pre-treatment and asset protection efforts during wildfires are prioritized by the number of assets at risk, type of assets at risk, potential fire behavior, agency access and personnel safety. Examples of pre-treatment and asset protection work include IT communications towers and infrastructure, hydro generation assets, electric substations, electric transmission and distribution pole and tower assets, and gas compressor and regulating stations.

Risk Models Used or Other Considerations for Prioritization:

- A risk model has not been developed for this work.

- SIPT crew availability impacts prioritization. If crews are not available due to injury, illness, or emergency activity, adjustments are required for any prioritization process.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

SIPT maintained staffing levels to support fire prevention and mitigation activities (40 crews and 40 engines and associated equipment). SIPT provided/maintained 8 crews on "on call" status during the summer preparedness period.

Impacts:

- SIPT prioritized standby and response throughout the year to ensure adequate coverage.

Lessons Learned:

- Additional SIPT crews can provide more program capacity to support this initiative.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

Our SIPT crews will continue to support fire prevention and mitigation activities and maintain an “on call” status during the summer preparedness period.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4):

Short-Term Improvements (2023-2028) – PG&E will consider adding a dedicated facility for a base of SIPT operations. The intended benefit would be to provide necessary logistical support for SIPT organization. PG&E is planning to determine upgrades to existing equipment (engines) and enhancements to the overall program. The intended benefit would be to develop a risk-informed business case to determine if increases to staffing and or equipment is recommended.

7.3.6.7 Other – Aviation Support

OEIS Initiative Definition: Not Applicable – This is not an OEIS-defined initiative. This is an initiative that PG&E is adding to the 2022 WMP to describe Aviation Services.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risk (Equipment – Conductor)

Secondary Risk: Ignition Consequences (Other – Suppression Capability/Difficulty)

The Aviation Services team manages all enterprise flight operations (Fixed-wing, Helicopter Operations and Unmanned Aerial Vehicles, (UAV/Drones)), vendors, and aviation assets. Aviation Services provides scheduling and dispatching for passenger transport, aerial inspection and construction with our internal and third-party assets providing vendor governance, contract management and oversight for all enterprise aviation operations.

The following wildfire-related programs utilize one or more aviation assets:

- Vegetation Inspection/Patrol;
- System Hardening;
- Wildfire Restoration/Rebuild;
- SIPT; and
- Pre-PSPS Inspections/PSPS Inspections.

PG&E's Aviation fleet consists of:

- Four heavy-lift helicopters purchased in 2018/19 to enhance wildfire safety and support utility infrastructure projects. The helicopters guarantee heavy-lift resource availability for PG&E facility restoration and construction support during fire season. The helicopters are fitted with fire suppression equipment such as a Bambi Buckets. If needed and requested, they are available to aid in wildfire suppression efforts under the direction of the agency leading the response (e.g., California Department of Forestry and Fire Protection).
- Two Cessna fixed-wing assets for operational practices – These assets perform electric system inspection operations in a manner that reduces the possibility of wildfire ignition in times of elevated fire danger conditions and reduces fire spread in the use of PSPS.
- 30 Unmanned Aircraft Systems (UAS) to enhance wildfire safety and support utility infrastructure projects.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce duration of events (PSPS/EPSS) – One of the primary benefits of aviation services is the ability to aerially inspect assets for conditions that could potentially lead to ignitions in HFTD areas. In support of PSPS customer restoration, aircraft are dispatched to ensure our electric facilities are clear for re-energization.

- Reduce lag in information from hazard events – Aviation allows parties to quickly and efficiently inspect and patrol leading to faster results in information.

- Increase understanding of where risk is located – Aviation allows parties to quickly and efficiently inspect and patrol leading to faster results in information.

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead) – The increased demand for additional aircraft is caused by System Hardening, PSPS, and Vegetation Management programs. System Hardening requires aerial construction support.

- PSPS – The increased demand for additional aircraft is caused by System Hardening, PSPS, and Vegetation Management programs. PSPS requires aerial patrols for faster customer restoration.

- Vegetation Management – The increased demand for additional aircraft is caused by System Hardening, PSPS, and Vegetation Management Programs. Vegetation Management requires aerial tree saws, Light Detection and Ranging, and inspection/survey for compliance and other initiatives.

- Aerial resources are currently managed by each aviation services department (in different locations) based on the asset type.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Emergency aerial requests have priority and will take priority over other work. If there is an emergency, the fleet is dispatched to support the emergent need. The Regional Emergency Center and EOC request and prioritize where to send aircraft. The Flight Coordinators Supervisor supports managing the aerial request(s) and set priority.

Risk Models Used or Other Considerations for Prioritization:

- There are no risk models supporting the type of asset to utilize for supporting wildfire efforts. Work prioritization and aircraft selection is completed on a first

come first serve basis giving priority to all emergent work. If the entire queue of requested aerial work is identified as emergent, then operations will lean on the line of business for prioritization of work.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E identified all user groups of the contracted Fixed-Wing program. The Cessna 206 fleet was grounded for further use to develop the Caravan program. Maximum asset utilization and capacity of current staffing and fleet was identified, and PG&E completed benchmarking with aviation industry peers on a general operational framework.

Impacts:

- Reduction of contractor activity
- Flexibility of survey ability
- Expanded role in Wildfire Mitigation

Lessons Learned:

- The increase of fixed wing flight hours increased the potential for human factor errors; therefore, starting in 2021, as a precautionary measure, all mission-driven flights are required to have a co-pilot to support the industry standard of safety redundancies.

Aviation Services has continued to develop and implement further deployments of drones as a tool to support electric system operations and/or wildfire risk reduction. PG&E benchmarked with other utilities to further develop drone use within our service territory. Through these benchmarking engagements, PG&E has continued to source ideas to increase safety margins for our field employees, improve repair, restoration efficiency and reduce costs through the development and incorporation into PG&E's wildfire safety efforts and, potentially, future WMPs.

Working with the Edison Electric Institute (EEI), the Federal Aviation Administration (FAA) and other partner utilities, PG&E is engaged in the development of Beyond Visual Line of Sight (BVLOS), which will allow PG&E to further manage asset usage and reduce the reliance of helicopters and fixed wing for some inspections. BVLOS will require a centralized control room to coordinate and manage drone flights concurrent to other aerial operations.

PG&E will continue to leverage the BVLOS development and EEI forums and the relationships developed to share our learnings to date and cast a broad net for best practices, lessons learned, tools, technologies and ideas that can help PG&E and California reduce wildfire risk.

In 2021, the UAS Operations Group supported Electric Operations in WMP flights for data capture efforts. In addition to WMP flights for Electric Operations, Aviation Services Drone Operations has expanded across all lines of businesses. However, the UAS Operations Group continues to support Electric Operations as its main customer in data capturing efforts through aerial surveys. Additionally, Drone Operations has:

- Engaged Applied Technical Services (ATS) for procedural Drone Safety mitigation initiatives:
  - Conductor strike mitigation
  - Electro-Magnetic Interference testing
  - Adverse effects on drone batteries
  - Hand protection for use of hand catch method
- BVLOS efforts:
  - The FAA has granted a Special Governmental Interest (SGI) Waiver to Part 107 regulations to allow PG&E to perform BVLOS operations during an emergency.
  - Drones are now available for PSPS efforts through the SGI waiver process, as follows:
    - Pre de-energization
    - Patrols of transmission, substation, and distribution assets with focus on scoping extent of impending PSPS
    - Post de-energization
    - Patrols of transmission, substation, and distribution assets with a focus on finding any potential damage caused by recent wind events
    - Inspection of specific assets that may have been damaged during the event.
    - Ability to operate UAS at night
    - Ability to receive/review asset integrity data in near-real time
- Updated Standard TD-1464S to expand UAS capability to support flights during R4/R5/R5+ and red flag warning conditions.
- Five vendors and internal PG&E qualified pilots have been selected to respond to 2022 SGI waiver events.
- EPIC 3.41 efforts for BVLOS (Distribution Alert and T-line inspection use cases and longline inspection waiver process) is underway for 2022 to expand BVLOS efforts.

- Published UAS General Operations Manual, including a Job Hazard Analysis guidance that focuses on job tasks to identify hazards before they occur for all UAS flights. Drone Operations is in process of developing a Web-Based Training to socialize the UAS General Operations Manual for all vendors and internal pilots for increased safety and compliance.

- UAS vendors are required to participate in Vendor Safety Audit and must include proof of participation in SMS, and integration was completed by the end of 2021.

- Updated and confirmed the 2019 Process Hazard Analysis for UAS Operations for a comprehensive re-evaluation of internal and vendor operations with employee/contractor safety to be appropriately risk categorized for contracting/ISNetworld.

Impacts:

- Reduction of contractor activity and risk exposure to manned aerial activity

- Flexibility of survey ability

- Expanded role in Wildfire Mitigation

Lessons Learned:

- In Q2 of 2021, a supplier drone operator performed a landing procedure called “hand catching.” The method to capture the drone resulted in minor lacerations to the operator’s hand. After actions of the incident resulted in the removal of the work method and modification to the UAS Manual and Supplier training.

- Due to the increase in supplier drone conductor strikes, a gap analysis was issued by the Aviation Safety team to confirm the low risk on drone asset strikes. In an effort to close the gap, Aviation employed the ATS group to conduct drone line/conductor strike testing. The results indicated that a drone cannot cut through conductor. The ATS team applied various testing methods (a large drone vs. smaller weighted conductor—trying to identify the most impact), and no test resulted in the segregation of the conductor.

- In efforts to expand drone services from just servicing Electric Operations, in Q3, the Gas Operations team paired with Aviation Services was successful in a new use case for methane testing.

- In efforts to expand drone services, a new method of flight BVLOS efforts were deployed after the Federal Aviation Administration granted an SGI waiver to conduct BVLOS. PG&E learned what equipment is needed to perform such operations, what distance(s) may be successfully operated and the level of operator oversight needed.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, Aviation Services will continue to provide support for wildfire mitigation programs as described above and evaluate the best use of our existing assets and to evaluate new technologies.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4).

Short-term Improvements (2023-2028) – PG&E's Aviation Services is looking into consolidating operations to Vacaville in 2023. This would remove the current decentralized operations from physically managing and conducting operations from three locations (Concord Fixed-wing/UAS Drone, Vacaville Helicopter, Red Bluff Helicopter) to a centralized model.

Aviation Services' long-term work is highly dependent on the Line of Business needs and requirements. All strategic planning is driven by the organizations that utilize aerial assets. As noted, PG&E has participated in benchmarking discussions with other utilities to understand their use of helicopters and operational management. The insourcing of helicopters will reduce the contracting cost inspections and construction, while increasing safety margins through complete mission and operational control.

7.3.6.8 Protective Equipment and Device Settings

OEIS Initiative Definition: The utility's procedures for adjusting the sensitivity of grid elements to reduce wildfire risk, other than automatic reclosers (such as circuit breakers, switches, etc.). For example, PG&E's Fast Trip Settings.

1) Risk to be mitigated/problem to be addressed:

Primary Risk: Ignition Risk

Secondary Risk: Ignition Consequences

This section of our 2022 WMP addresses the Enhanced Powerline Safety Settings (EPSS) Program that we implemented in July 2021.

In 2020 and 2021, California had its 5th and 2nd driest water years, respectively, in the last century.[97] PG&E's entire service area experienced extreme and severe drought conditions before the rainstorms that occurred in the latter part of the year.

Prior to 2021, most of the total acreage impacted by large wildfires[98] in our service area resulting from electric facilities occurred as a result of ignitions that started during RFW weather conditions. In 2021, however, the acreage burned by large wildfires occurred as a result of ignitions that started on non-RFW days. Table PG&E-7.3.6-1 below highlights this significant change.

TABLE PG&E-7.3.6-1:
ACREAGE IMPACTED IN PG&E'S SERVICE AREA FROM LARGE WILDFIRES CAUSED BY ELECTRIC FACILITIES

Year	Red Flag Warning Ignition Acres Impacted	Non-Red Flag Warning Ignition Acres Impacted	Ratio of Non-RFW to RFW
2017	228,112	32,063	0.14
2018	243,624	0	0.00
2019	77,758	0	0.00
2020	56,338	696	0.01
2021	0	981,695	N/A

97 Water years run from October 1 to September 30. See Water Year 2021: An Extreme Year (ca.gov).

98 The California Department of Forestry and Fire Prevention defines a large wildfire as 300 acres or more.

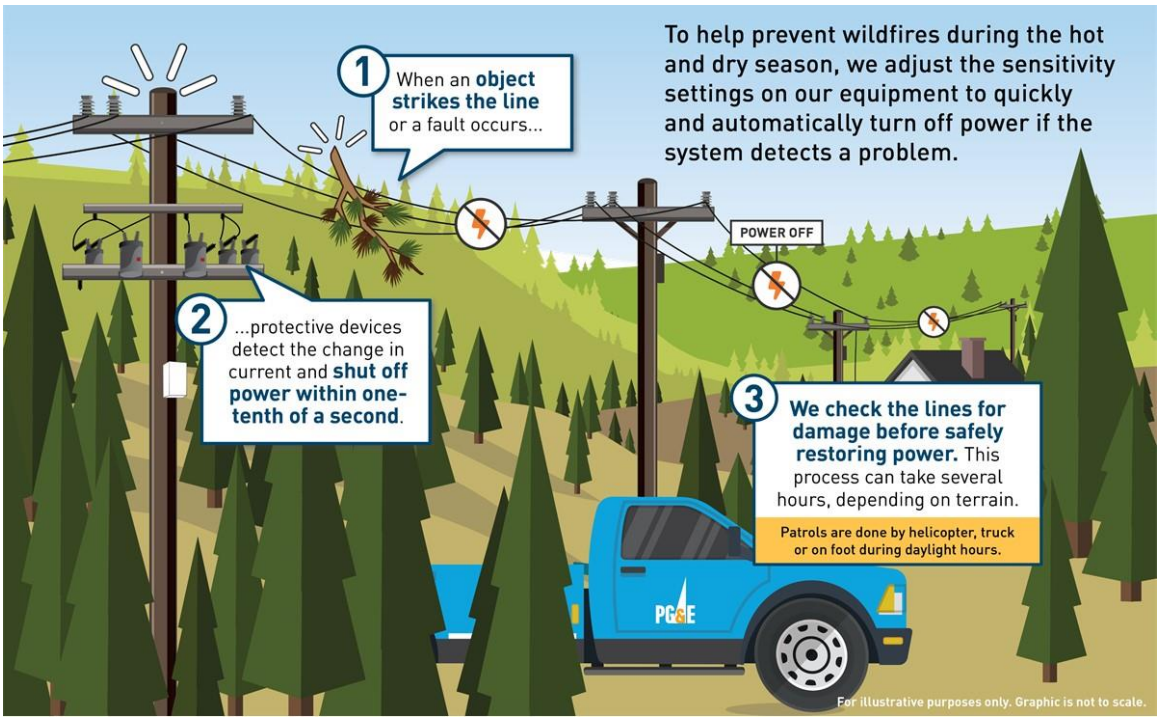
The risk of an ignition event occurs every time there is a fault of any magnitude (fault current),[99] including failures that could emit sparks from overhead assets. Utilities have devices on their system to prevent prolonged fault current by de-energizing the relevant distribution line, much like a household fuse in an electric panel will de-energize for safety. The longer duration that a fault current event occurs, the more wildfire risk is present.

In July 2021, to address this dynamic climate challenge, we implemented the EPSS program on approximately 11,500 miles of distribution circuits, or 45 percent of the circuits in HFTD areas. With EPSS, we engineered changes to our electrical equipment settings so that if an object such as vegetation contacts a distribution line, power is automatically shut off within 1/10th of a second, reducing the potential for an ignition. EPSS-enabled settings provide a layer of protection on days when the wind speeds are low. EPSS is especially important during hot-dry summer days, when there are low winds but continued low relative humidity, low fuel moistures levels, and where the volume of dry vegetation, in close proximity to the distribution lines, increases the risk of an ignition becoming a large wildfire.

Figure PG&E-7.3.6-1 below demonstrates how EPSS works.

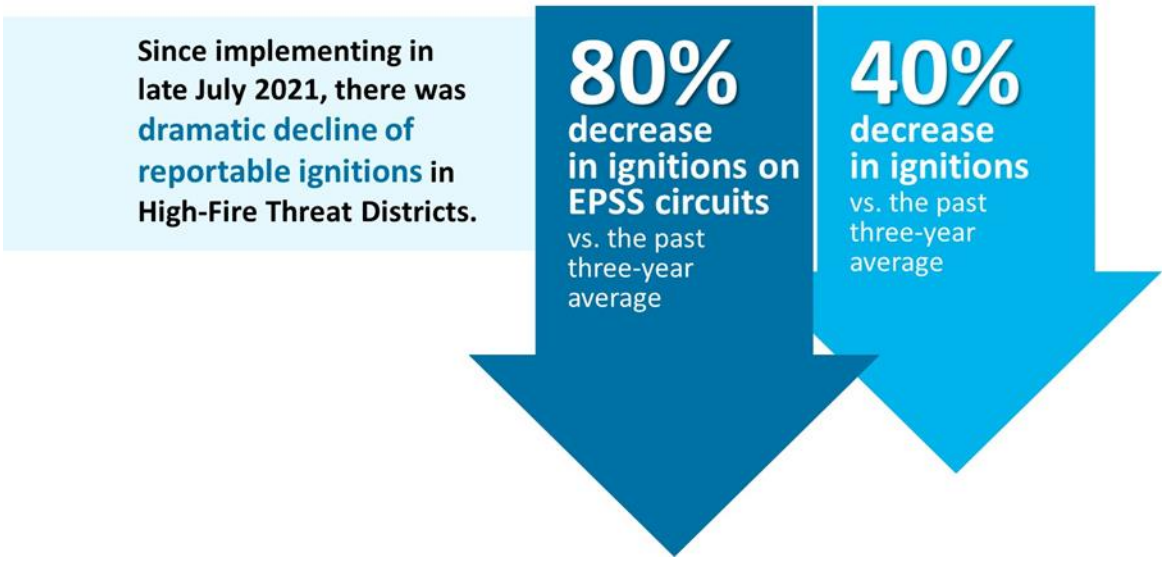
[99] Fault current is described as abnormal electric current, and usually occurs when electric lines contact external objects or other unintended electric equipment. For example, these incidents can occur when vegetation contacts distribution lines and/or structures; when animals and birds touch or traverse the lines and/or structures; or when, due to other reasons, a component or piece of equipment fails on the circuit.

FIGURE PG&E-7.3.6-1:
EPSS OVERVIEW



Our Public Safety Specialist (PSS) team, who have extensive public safety and fire-fighting experience, evaluated circuits which might have presented a potential catastrophic wildfire risk from an ignition with overhead assets; in collaboration with Division Superintendents, local District Storm room personnel, Electric Operations Maintenance & Construction, Restoration, Compliance, Meteorology staff and Vegetation Management personnel, with considerations of historical fire and weather data, terrain, potential ignition fuel, and ingress and egress factors. Once implemented, the results of our EPSS program were significant, leading to a dramatic reduction in CPUC-reportable ignitions as indicated in Figure PG&E-7.3.6-2 below:

FIGURE PG&E-7.3.6-2:
CPUC-REPORTABLE IGNITION REDUCTION ON EPSS ENABLED CIRCUITS AND OVERALL DECREASES IN HFTD AREA IGNITIONS AFTER EPSS ENABLED



Note: The reduction in CPUC-reportable ignitions occurred between July 28, 2021 and October 20, 2021.

We are planning to expand the EPSS program in 2022 to all distribution circuits in HFTD and HFRA areas in our service territory, as well select non-HFTD areas. As explained above, in 2021, EPSS was able to reduce CPUC-reportable ignitions by 80% on EPSS-enabled circuits. The 2022 EPSS program will be expanded to all distribution lines in HFTD and HFRA areas as well as select non-HFTD areas which will significantly increase the ignition risk reduction we can achieve.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events during periods of elevated wildfire risk – Since July 2021, on EPSS-enabled lines, there was an 80 percent reduction in CPUC-Reportable Ignitions on EPSS enabled circuits as compared to the 3-year average.

Relation to and Impact on Other Initiatives:

- PSPS – In some PSPS events in 2021, circuits that did not meet PG&E's PSPS planned de-energization criteria thresholds but were located in areas under Red Flag Warning and elevated fire risk were temporarily EPSS-enabled. These EPSS-enabled circuits provided an added layer of protection against wildfire risk under Red Flag Warning conditions. Although PSPS and EPSS are—both effective

wildfire mitigation tools, they are un-related operationally in how they are executed. PSPS is a planned de-energization of circuits within a geographic area that is based on forecasted meteorological conditions and thresholds as set forth in our PSPS protocols. In contrast, outages that occur when EPSS setting are enabled on protection devices are un-planned and only occur when an external event occurs on the distribution line causing a fault on the circuit.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: In 2022, we will be expanding the EPSS scope to all HFTD and HFRA areas in our service territory, as well as select non-HFTD areas. Specifically, approximately 25,500 miles of distribution circuit in HFTD and HFRA areas, as well as a limited number of circuits within non-tiered areas that are immediately adjacent to HFTD or HFRA areas have been risk ranked based on the overall wildfire consequence of an ignition occurring on that circuit. There is a 1-n list of the 988 circuits that are planned to be programmed with EPSS settings in 2022. Our engineering team works through these 988 circuits and each protection device is individually programmed with the appropriate EPSS settings. Programming of EPSS settings into the protection devices along the circuits will be prioritized based on HFTD and HFRA exposure and forecasted Fire Potential Index (FPI) conditions. Once the devices are programmed, they will be capable of being enabled into EPSS mode. Enablement (activation) of EPSS settings will be determined based on FPI ratings throughout the service territory. Given the expansion of EPSS in 2022, PG&E is taking proactive action to reduce outage impacts, including additional patrol and restoration resources to shorten the duration of EPSS related outages, as well as providing community and customer support.

Risk Models Used or Other Considerations for Prioritization:

- In addition to the 1-N risk ranking of 988 circuits noted above, we utilized additional criteria (not yet explicitly in the risk model) to further prioritize our engineering efforts to complete EPSS programming.
  - Circuits in HFRA areas not included in HFTD areas
  - Terrain may be difficult for first responders to access
  - Areas where concern exists for fuel or topography-driven fire on a blue-sky day
  - Immediate hazards posed during active fires and/or PSPS events
  - FPI Model results indicate potential catastrophic fire spread
  - Known high-priority asset and/or vegetation risks

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

The initial roll out of the EPSS program occurred after the 2021 WMP filing and was a new and piloted program in 2021, as described above in the response to Question 1.

The goal with the protective device settings is to trip quickly enough to minimize ignition risk, while also allowing a very short time buffer for multiple devices to act in coordination. The device coordination is helpful in that it can limit the scope of an EPSS caused outage. This provides benefits in terms of situational awareness and response with a smaller geographic area to patrol as well as reducing the scope of an outage. After implementation in July 2021, we made significant progress in tuning these settings to balance trip time responsiveness and device coordination. Further details follow below.

Starting in early September 2021, PG&E began further refining and optimizing our engineered settings for the protective devices on both line reclosers and substation circuit breakers as part of the EPSS program. This allowed for improved coordination amongst the protective devices with the intent of maintaining the wildfire mitigation benefit of turning off power faster (e.g., tripping in 0.1 seconds) but still allow some margin for inter-device coordination between reclosers and circuit breakers. We refer to these settings adjustments as Fast Trip Settings or FTS. The timing chosen of 0.1 seconds allows 2-3 line reclosers or circuit breakers to remain in coordination with each other while still keeping tripping speeds to the fastest extent possible. These timing values seek to optimize the tradeoff between risk and reliability. As the ignition risk is both a function of tripping time as well as the magnitude of the fault it is acknowledged that this risk profile may vary throughout the circuit based on grid topology and wildfire risk.

Many of the line reclosers and circuit breakers on the system can detect and operate within 3 cycles (or 0.05 seconds). With equipment operating capabilities defined it is possible to optimize the timing between devices. For example, an overall tripping time maximum goal of 0.1 seconds would allow for 2 devices in series to remain coordinated with a full 3 cycles coordination margin in between those devices. This further optimization allows for flexibility in maximizing ignition reduction while still providing for coordination amongst devices to minimize the extent of an outage by limiting the scope to the protection zone. By limiting the scope of the protection zone, PG&E is able to respond to outages faster and therefore improve restoration time resulting in shorter outages.

In addition to the high-end overall tripping time, there is an upper limit to this value in order to optimize the second main fundamental aspect of EPSS which is to reduce fuse single phase operation by detecting faults beyond fuses to clear across all three-phases. This objective is to minimize the likelihood of a high impedance fault created by back feeding through the primary coil of a line-to-line service transformer. In order to overreach the fuse and trip the line recloser or circuit breaker before the fuse link melts, there is an upstream trip time requirement based upon the current magnitude that is required to achieve this benefit.

We will continue to refine the device sensitivity settings in 2022 and beyond; some of the optimization opportunities being considered include the following:

- Refinement of inter-device coordination delay based upon protective device make and model variations

- Ongoing laboratory testing to better understand and quantify protective device clearing time vs. ignition risk

Impacts:

- July – October 2021: 80 percent reduction in CPUC Reportable Ignitions on EPSS-enabled circuits as compared to 3-year average.

- EPSS Pre-Optimization (July 28 through September 2021) – Allowed for devices to be quickly enabled, leading to reduced fault energy and reduced potential for catastrophic wildfire. However, these settings allowed for the potential for multiple devices within a circuit to detect the same fault, resulting in larger and more frequent outages for some customers.

- EPSS Post-Optimization (early September through October 2021) – Allowed for devices to reduce fault energy and reduce the potential for catastrophic wildfires. The optimized settings also reduced outage sizes and the time required to restore service. However, the time required to program individual circuits to operate in an optimized manner increases the overall implementation timeline.

- In addition to notifying all customers served from EPSS enabled circuits, via direct mail and email, Medical Baseline (MBL) customers received additional outreach to help ensure they are aware of the potential for outages and the resources available to them.

- In late November 2021, a mailing was sent to MBL customers who had been impacted by an outage on an EPSS enabled circuit. The mailing focused on backup power options these customers may be eligible for such as the Generator and Battery Rebate Program or the Self-Generation Incentive Program.

- We have been reporting EPSS outages on a monthly basis to the CPUC's Safety and Enforcement Division (SED) and plan to continue to do so in 2022. Because EPSS is separate from PSPS, EPSS outages are not reported in PG&E's PSPS post-event reports.

Lessons Learned:

- Initial EPSS enablement in July 2021 resulted in more frequent and longer outages for some customers including:

  - ~22 percent increase in Customer Average Interruption Duration Index

  - Increase in outage frequency for some customers on some circuits, with 64% of EPSS circuits experiencing 3 or less outages; ~13% of EPSS-enabled circuits

experiencing 4 outages; and ~23% of EPSS circuits experiencing 5 or more outages

- With the adjusted, Post Optimization settings, we were able to adjust the patrol strategy to only focus on the impacted Circuit Protection Zone vs. needing to patrol the full circuit. Following an analysis of historic reliability performance and the results of enhanced reliability patrols, we were able to further reduce negative reliability impacts by implementing various "spot reliability" improvements such as animal guards and targeted, supplementary vegetation management. In 2022, based on forecasted outages and resource availability, we will take steps to ensure that we have the appropriate ground and aerial resources to perform timely patrol and restoration of outage locations. We also plan to enhance our outage investigation process with the goal of increasing our ability to identify outage causes and corrective actions. Lastly, we will perform additional reliability analysis on all circuits within the EPSS scope in order to identify areas where we can perform additional vegetation management work and prioritize repair or replacement of equipment.

- We plan to build on our customer engagement and outreach developed in August and September of 2021 to inform customers about EPSS and the various resources and support services available to them before and during EPSS enablement

- Additional communication and outreach are needed to Medical Baseline Customers and customers with access and functional needs. Many customers were unaware of the emergency preparedness planning and resiliency offerings available to Medical Baseline and Self-Identified Vulnerable customers.

- Leveraging existing communication channels and solutions for hospitals, enhancing existing communication channels and coordination with telecommunications customers, and targeting additional support solutions for K-12 schools forecasted to be highly impacted.

- Some of the stakeholder cooperation and community engagement efforts for PSPS may be leveraged for EPSS pre-enablement and in-season outreach. PSPS Regional Working Groups, Wildfire Safety Working Sessions, the Key Customer Association Collaborative, the Energy Communications Providers Coordination Group, Wildfire Safety Town Halls and Webinars, and Advisory Councils as described in Sections 7.3.9.2 and 7.3.10.1, are opportunities to combine engagement and outreach for EPSS and PSPS.

- In addition, PG&E plans to conduct pre-season direct to customer outreach through multiple channels. Automated outage alert phone calls will be used to keep impacted customers informed during outages on EPSS-enabled circuits.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
F.01	EPSS – Settings Design and Test	Conduct laboratory testing to refine the circuit device design parameters for 2022 EPSS implementation.	4/1/2022	Qualitative
F.02	EPSS – Install Settings on Distribution Line devices	Load the engineered settings on protection line devices (line reclosers and fuse savers) on the identified 988 circuits (based on WRGSC approval as of 1/26/2022) on the following schedule, barring External Factors: (1) line devices on 80 percent of identified circuits by 5/1/22 and, (2) line devices on the remaining 20 percent by 8/1/22.	8/1/2022	Quantitative
F.03	EPSS – Develop Enablement Standards and Procedures	Develop the procedure to govern the enablement of EPSS settings in 2022.	5/1/2022	Qualitative
F.04	EPSS – Reliability Improvements	Initiate reliability mitigations on 50 EPSS capable circuits in the HFTD areas, HFRA and non HFTD buffer zones based on highest projected Customer Experiencing Sustained Outage (CESO).	8/1/2022	Quantitative

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety. Activities we will perform in 2022 include refining our outreach programs to provide more tailored information to various customer groups. We are also taking action to provide better support to these key customers and stakeholders to provide timely and useful information and minimize the impact of these outages. Our customer resiliency programs were originally designed for PSPS and targeted to customers who either reside within the HFTDs or have experienced two or more PSPS outages. Most of the EPSS-impacted customers meet those criteria. PG&E will explore expanding resiliency program eligibility in 2022 to include EPSS-impacted customers who reside outside of HFTD areas and have not experienced two or more PSPS outages. Program support in 2022 to help prepare customers for EPSS outages will include:

- Partnering with our Community Based Organizations on customer outreach and education efforts focused on emergency preparedness. Customers on PG&E's Medical Baseline Program and customers with access and functional needs are key audiences for this outreach. This will include training customers on making a plan in case of a prolonged power outage and educating them on the variety of resources and services available to support them.

- Continuing our partnership with 211, a free, confidential calling and texting service available to support PG&E customers 24/7. 211 is available to connect individuals with local social services specific to their community.

- Encouraging customers living in high fire-risk area who are reliant on power for medical or independent living needs to contact their local DDARC or disabilitydisasteraccess.org for assistance with emergency planning and resources. Note that due to the shorter duration of EPSS outages, these program services are designed to prepare customers ahead of time for outages and will not be providing support during the outage.

To help improve our communications, both before and during outages to all potentially impacted customers, our efforts include:

- Improving the notifications that we provide to customers during outages, with more accurate information about when they can expect power to be restored.

- Increasing our outreach and communications to impacted customers, including via email and direct mail.

- Increasing our social media and local media outreach efforts to grow awareness, including posts on social media sites, Nextdoor and Facebook.

- Utilizing paid advertising on local radio and social feeds.

- Refining our EPSS-dedicated web page with additional information and resources. (pge.com/epss)

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – The EPSS program is still in an evolving state. In 2022, we will look to further optimize the device settings to improve customer reliability. We will also apply the best practices for Customer, Agency, and External Communications and Engaging Vulnerable Communities learned through our implementation of PSPS events to our EPSS strategy. Data gathered during three months of operation in 2021 and enablement throughout a full wildfire season in 2022 will allow us to further mature the program for the development of future plans and new strategies. We will continue our benchmarking efforts with other utilities, particularly our CA peers, to inform how we operationalize the program in future years. Additionally, the need for and scope of EPSS in subsequent years will be interdependent with other wildfire mitigation initiatives and as EPSS matures in parallel with other initiatives, we will be able to better define future plans and new strategies in the next five years.

7.3.7 Data Governance

7.3.7.1 Centralized Repository for Data

OEIS Initiative Definition: Designing, maintaining, hosting, and upgrading a platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

This section provides an overview and update to Pacific Gas and Electric Company's (PG&E) efforts to operationalize a data analytics environment that integrates data from disparate sources into a single environment, enabling data-driven approaches to wildfire risk mitigation.

A practical data integration approach that utilizes data pipelines from source data systems to integrate data in a central platform is necessary to enable access to timely, trusted, and consistent information, that can be used for advanced data analytics, thereby enabling more effective data-driven decisions.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative: PG&E's data environment has evolved organically over decades with the development and deployment of large, built-for-purpose data source systems (e.g., SAP, Geographic Information Database (GIS)). PG&E has historically integrated data between individual systems on a case-by-case basis through data interfaces. This has led to a many-to-many relationship between data systems, with no centrally integrated environment that facilitates effective development of analytic and situational awareness tools. In order to more effectively mitigate wildfire risks, PG&E must be able to access, integrate, and analyze data across disparate systems.

As part of our strategy to mature our wildfire risk management practices, we are developing a central data repository and implementing data management practices to support this repository. These efforts are responsive to the following drivers of improvements to risk management practices: (i) increasing need for data availability, data quality and trusted analytics; (ii) increasing demand for advanced analytics, business intelligence (BI), visualizations, dashboards, and data sharing; and (iii) increasing need for data security and privacy.

The goal of the initiative is to provide access to governed and trusted data necessary to facilitate data-driven decisions regarding wildfire risk management. This repository is capable of bringing together physical, operational, lifecycle, and environmental data elements from disparate built-for-purpose data systems into a single environment to

better enable access to data in support of risk management. Within this repository, data objects are curated, data attributes are defined, data sources are documented, data pipelines are governed, and key connections between disparate data sets are established. PG&E is also developing and hosting BI dashboards, analytics, and data science models in this environment.

Access to trusted, traceable and governed data through the central data platform can help to achieve the benefits listed below:

- Focus mitigations on highest risk locations – Centralized access to critical data through the Foundry platform enables PG&E to perform analysis on a constantly changing set of parameters provides insight to improve work planning capabilities designed to target the highest priority risk mitigation work.

- Reduce frequency of all types of ignition events – Centralized access to critical data through the Foundry platform also enhances PG&E's insight into potential causes of ignition events, which is informed by analysis of historical data from multiple sources. Furthermore, developing analytical models to understand the risk and likelihood of ignition events based on current asset state, environmental conditions and other factors requires access to data of sufficient quality and completeness. Centralized access to this data also enables model development and enhances the transparency and quality of the modeling.

- Develop better visibility into risk – Access to critical data in the Foundry platform and the ability to develop analytic tools within the platform enable PG&E to develop analytical models to understand the risk and likelihood of ignition events based on current asset state, environmental conditions, and other factors.

- Information sharing with partners – The data centralization and data management capabilities of the Foundry platform provide a consistent and trusted source for sharing key data (e.g., Public Safety Power Shutoff (PSPS) and ignition events) with partners, including the California Public Utilities Commission (CPUC or Commission), California Department of Forestry and Fire Protection (CAL FIRE), local governments and tribes.

Relation to and Impact on Other Initiatives:

- Ignition Components – Ignition component processes are dependent on access to comprehensive and trusted asset data and other data that informs risk analysis and prioritization of work.

- Asset Inspection and Repair – Asset inspection, maintenance, and repair processes are dependent on access to comprehensive and trusted Asset Registry and other data that informs current state as well as risk-based prioritization of work.

- System Hardening (Underground and Overhead) – System hardening planning, execution, and management is dependent on access to trusted data to support scoping and decision making.

- Enhanced Vegetation Management (EVM) – The location of assets relative to trees and other vegetation are key data sets to support scoping and decision making.

- PSPS – The PSPS Situational Intelligence Platform (PSIP) is built on the Foundry platform and will continue to evolve and improve capabilities related to PSPS event planning and execution, including insights necessary to reduce customer impact while managing wildfire risk.

The alternative to the development and implementation of a centralized data platform would be to continue producing analytics using historically siloed data systems that were purpose-built and not designed for more efficient integration. This could result in ineffective decision-making based on incomplete data, missed opportunities to improve wildfire risk management decisions by scaling data analytics, under-utilization of our analytic and engineering human resources, and an inability to more effectively share data with external partners (e.g., Safety Enforcement Division, Office of Energy Infrastructure Safety (Energy Safety), CAL FIRE, or local government agencies).

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The prioritization and rationalization of the activities contributing to the integration of data into a central Foundry data platform are summarized as follows:

- Central Data Platform – In November 2020, PG&E procured a central data and analytics platform, Palantir Foundry, based on results from operational use-cases implemented in the platform in 2020. In 2021, PG&E continued to make foundational investments in developing our capability to manage, govern and develop data and analytic products in this platform to advance our ability to make data-driven decisions.

- Identification and Integration of Additional Data Sources – PG&E will build on the data foundation created in 2021 and continue to identify and integrate additional data sources in support of high-value data products on a risk-prioritized basis using a combination of asset risk scoring and evaluation of the potential impact on critical processes/programs to manage wildfire risk.

- Development of Ontology Objects – One of the key values of the Foundry platform is support for developing a data integration and semantic layer that effectively translates raw data from multiple sources into consistent, recognizable, reusable data objects (Ontology objects), with associated and governed properties and relationships. By presenting all underlying data in a form that business users can readily understand, the ontology allows analysis and decision making to occur in a more accessible and intuitive environment.

- Data Management – PG&E continues to establish and mature data management and governance capabilities for the Foundry platform governance with a focus on maintenance of the data architecture, data quality, and data security. Data management efforts are foundational to ensuring effective use of data for wildfire mitigation.

Risk Models Used or Other Considerations for Prioritization:

- Analytic and situational awareness tools constructed in the Foundry data platform need to be continually adjusted to reflect the effect of mitigation efforts, changing environmental conditions and new risk mitigation strategies. As new data and analytic needs emerge, the areas of focus for the data platform initiative will evolve.

- PG&E prioritizes the integration of foundational, reusable data (ontology objects) into Foundry based on the Enterprise Risk Model for Wildfire Risk (see Section 4.5.1 for more details), along with the risk bow ties for each asset family. This prioritization is supplemented by qualitative assessment of the impact that data will have on critical processes/programs to manage wildfire risk.

- Data completeness and quality gaps exist that are difficult to address (e.g., missing installation dates for equipment). Gaps can be identified and closed if records exist. However, in cases where records do not exist data gaps may persist until alternative approaches to closing the gaps are designed and implemented.

- Execution of critical data management functions at-scale (e.g., metadata management, data quality management, or coherent data schema) is dependent on technology enablement beyond the scope of this initiative and the Foundry data platform. If required technology elements are not in place, progress on these fronts will be limited.

4) Progress on initiative since the last Wildfire Mitigation Plan (WMP) submission and plans, targets, and/or goals for the current year

In 2020, PG&E contracted with Palantir to implement the Foundry enterprise data platform, to centralize, curate, and transform data into business insights through creation of various data products. Throughout 2021, PG&E continued to build capacity to manage the data platform, developed new and impactful data products, and integrate critical data sets into the platform, as described in more detail below. In this section, PG&E aligns our description of progress on initiative activities with “Capability 33: Data collection and curation” from the Utility Wildfire Maturity Model Survey and the related questions and capabilities.

Actual Progress (2021):

Centralized Repository of Situational, Operational, and Risk Data (Utility Survey Question G.I.a):

By end of year 2021, PG&E connected over 50 data source systems to Foundry, creating pipelines to deliver critical data sets to the platform. The Foundry ontology was expanded to include 436 data objects by integrating product-specific data sets and centrally developed ontology objects. In the second half of 2021, PG&E defined and implemented a structured process, governing data flow from source system to ontology to continuously improve accountability, maturity, and quality for all ontology components. PG&E also created and staffed an information technology (IT) team to develop foundational, reusable Electric ontology data objects. This increased product development team capacity by 50 percent adding seven new developers in Q3/Q4

2021. Finally, PG&E established the Platform Operations team to support platform stability and growth.

Impacts:

- PG&E increased our connected data source systems and data objects available for use in Foundry in direct support of the prioritized data products to identify and manage wildfire risks and reduce the customer impact of PSPS events.

- PG&E increased our capacity to deliver new, high quality, reusable data objects into the Foundry platform accelerating delivered value of data products and providing consistent data sources for risk mitigation across key business processes.

- PG&E instituted governance and controls to improve data quality and manage access to data in Foundry, providing trusted data to enable critical business decisions.

Lessons Learned:

- Governance and a standard operating model are needed to introduce data objects (ontology objects) into Foundry platform in a high-quality manner that ensures fidelity with the source system and makes the data reusable across business applications.

- Governance is required to ensure sanctioned access to data objects and establish controlled permissions for operating in the platform.

- Data and development work performed through individual use cases can provide valuable inputs that can be leveraged to mature ontology development. For example, in 2021, PG&E initiated implementation of a use case that aims to connect and automate data outputs required to meet the OEIS GIS Data Standard (Spatial Quarterly Data Report (QDR)), which requires quarterly submissions of a vast set of wildfire mitigation related data in a complex schema format. The schema for this report has been reviewed and considered for alignment with select ontology developments. In addition, the 24 datasets developed through the OEIS GIS Data Standard use case and associated transformation logic are available through Foundry, providing an initial framework that can be further refined through Ontology developments. Lessons learned from this use case have been shared with the Ontology development team, including data development processes and the benefits that have resulted from facilitation of cross-functional workshops between data stewards and technical experts to understand data and associated requirements (e.g., definitions, schematics, transformation logic) prior to implementation of development work. Collaboration between teams contributing to ontology and the OEIS GIS Data Standard will continue in 2022 as schematics evolve and further datasets are developed.

Develop advanced analytics on Centralized Repository of situational, operational, and risk data to make short-term and long-term operational and investment decisions (Utility Survey Question G.I.b):

In 2021, PG&E developed the below wildfire-related analytic and situational intelligence products in the Foundry platform that are designed to target the integration of critical, foundational datasets from disparate data systems and enhance wildfire risk management capabilities. These data product suites include the following items identified below.

Impacts:

- PSPS Situational Intelligence Platform – PG&E continues to develop this product, which was initiated in 2020 to inform PSPS decision-making, reporting and event communication. In 2021, PG&E improved the effectiveness of our PSPS event management capability by (1) reducing the time and complexity between scoping; (2) improving the accuracy of event impact assessments; (3) facilitating improved communication of event scope; and (4) sharing more timely and accurate PSPS event information with California Governor's Office of Emergency Services (Cal OES) via API.

  The product delivery team developed new functionality including Distribution Asset Health Scoping dashboard, which identifies incremental scope, due to high-risk trees and electric compliance tags that feed back into scoping process. Furthermore, the team enhanced coverage of notifications to vulnerable and microgrid customers. PG&E also streamlined the PSPS scoping process by enriching De-energization and Restoration playbooks in Foundry eliminating previously manual efforts and time spent from data hand-offs. Finally, the team integrated data sources to support delivery of consistent and accurate information throughout a PSPS event.

- Grid Data Analytics Tool (GDAT) – In 2021, PG&E continued developing this analytic tool which leverages data from distribution system sensors (including SmartMeters, line reclosers and Supervisory Control and Data Acquisition (SCADA)-enabled reclosers) to more efficiently and rapidly identify and resolve the source of unknown cause outages and to identify and resolve incipient grid conditions before they result in catastrophic failure.

  The GDAT product development team enabled the capability to produce significantly smaller, targeted patrol zone maps for unknown cause outage investigations, and began piloting the use of this tool with San Luis Obispo office Distribution Engineers. This tool is being assessed for use in narrowing patrol zones for real time outages.

  Additionally, PG&E developed and deployed (see Electric Program Investment Charge (EPIC) Project 3.20 in Section 7.1.E), the capability to assess transformer performance and identify and proactively mitigate incipient transformer failure.

- Wildfire Distribution Risk Model (WDRM) – In 2021, PG&E leveraged the Foundry platform to further develop our WDRM. The 2022 WDRM v3 provides predictions of the where, why, and how much wildfire risk occurs during a typical wildfire season

(defined as June 1st through November 30th). The 2022 WDRM v3 differentiates risk by location and/or individual assets, providing information on where the likelihood of ignitions and the consequences of ignitions are elevated (and by how much), so that PG&E can prioritize higher-risk areas for applying potential mitigation efforts. Through modeled relationships between risk and a wide array of environmental (i.e., wind, temperature, fuels) and asset characteristics, it also helps PG&E understand the factors contributing to risk. Finally, the model estimates whether specific mitigations (*i.e.,* EVM, System Hardening, pole replacement, and transformer replacement) may be most effective for which asset types in which locations by estimating the wildfire risk reduction achieved by performing a given mitigation at a given location or on a given asset. The risk modeling results contained in Foundry were integrated into another Foundry-based tool designed to enable more effective planning of System Hardening work.

- Asset Failure Analysis (AFA) – In 2021, PG&E developed a Wires Down Investigation Workflow that enables Asset Engineers to validate wire down outages and prioritize risk-mitigation projects. PG&E also developed an Overloaded Transformer Analysis Tool to enable Asset Engineers to more quickly review ~4000 high-risk transformers and proactively determine replacements.

- Transmission Operability Assessment (OA) Model – In 2021, PG&E leveraged the Foundry platform to develop our transmission wildfire risk models. The Electric Transmission (ET) OA model was updated with enhanced Power Line Systems – Computer Aided Design and Drafting and advanced atmospheric corrosion data inputs to increase predictive accuracy of ET asset fragility. Also, work planning was bolstered with addition of annualized wind hazard and use of Technosylva data through the Wildfire Consequence (WFC) Model. The team developed dashboards showing standardized risks per ET asset and allow for ranking and analysis of reasons why assets are at risk. Finally, the team began leveraging Foundry to address the Federal Monitor requirement for new asset information being used in useful life modeling and 2022 inspection work plans

- Hazard Awareness and Wildfire Center (HAWC)/Electric Incident Investigation (EII) -- In 2021, PG&E created a Foundry-based application that allows users to quickly gather information related to ignitions/fires and establish foundational situational intelligence. The tool also provides a platform to allow for deeper investigation into fires/ignitions to determine if cause was related to PG&E assets. Finally, the datasets integrated into this product allow PG&E to better understand timeline of grid conditions/events that happened concurrent to an ignition.

- Wildfire Risk Command Center (WRCC) – In 2021, PG&E leveraged to Foundry data platform to create several tools supporting the central management of wildfire risk through the WRCC. These tools enable central tracking for WMP Commitments, and development of a Common Operating Picture for all WMP Activities. The WRCC team also produced tools to support new wildfire mitigation programs including a tool to plan and execute fire retardant plans in both Private and State-Owned land and a tool to assist in providing a central location for reporting reliability, customer impact, and effectiveness metrics related to Enhanced Powerline Safety Settings.

- Asset Maintenance and Compliance Platform (AMCP) – In 2021, PG&E developed a Foundry-based application providing a comprehensive view of distribution support structures reflecting assets and critical attributes from core systems (i.e., GIS and SAP) to improve insight into distribution pole inspection planning and compliance with GO165 and WMP Commitments. The team is currently developing features to enable planning of annual inspections consistent with GO165 and WMP commitments using compliance-based logic.

- Data Quality Dashboard – In 2021, PG&E developed a data quality monitoring dashboard with capability to identify synchronization issues between core support structure records in GIS and SAP. PG&E also developed prototype of data quality dashboard to assess completeness of data sets.

- By integrating critical data into Foundry and developing platform-based analytics and workflows, PG&E has significantly advanced our capabilities to understand and manage our wildfire risk. The impact of the centralized Foundry data platform extends broadly across domains of wildfire risk management from risk analytics, to system inspections, to new mitigation program support and PSPS event management.

- Using a centralized platform to access data and build data products has significantly accelerated PG&E's development and improved the quality of data products by leveraging data pipelines, shareable logic structures and reusable data objects.

Lessons Learned:

- Use of a central data platform with appropriately governed data can allow new data products to be quickly developed from data sets that were integrated for other purposes or as part of a central ontology development.

- Controls on data integration are necessary to prevent the proliferation of multiple, product-specific versions of similar data objects (e.g., support structures) within the platform, which could create confusion and data quality errors.

Ingest and share data using real-time API protocols with a wide variety of stakeholders (Utility Survey Question G.I.d):

PG&E has not committed to supporting the ingestion or delivery of real-time data via API or other protocols within the timeframe of the Utility Survey commitments (by Q1 2023). In general, technologies and infrastructure required to support true real-time data ingest or delivery are substantially different than more generalized data integrations and storage and are generally less mature. Further, use cases that would require real-time data ingest have not been identified for 2022 prioritization.

In many cases, near real-time capabilities can be supported by micro-batching data ingest at a higher frequency. As part of the HAWC product, micro-batching and incremental processing has been implemented to achieve 15-minute latency for fire related data sources. As part of the implementation of the SmartMeter Sensor IQ program, PG&E is exploring the Foundry Streaming Data Service in order to evaluate platform capabilities to integrate and provide near real-time alerting from key SmartMeter data and events (e.g., voltage sags). PG&E will continue to evaluate

emerging use cases and the potential value of ingest and processing of data at real-time rates.

Impacts:

- Refer to Sections 7.1.E and 7.3.2.2.4 for specific details on the capabilities planned.

Lessons Learned:

- Using Foundry micro-batching and incremental processing it is possible to achieve 15-minute latency for key data sources. Sensor IQ data is currently being ingested with a 30 to 60 minute latency which supports current use cases. PG&E will continue to investigate Foundry Streaming Data Services on a case-by-case basis.

Identify highest priority additional data sources to improve decision making and incorporate these into centralized repository of situational, operational, and risk data (Utility Survey Question G.I.e):

PG&E integrates new critical data sets into Foundry through two separate processes. First, PG&E integrates data that directly supports the development of new, high-impact data and analytic products that enable enhanced wildfire risk management capabilities.

Second, through our ontology development team, PG&E separately ingests into the platform data that contributes to a foundational, reusable ontology data layer that can be made available across Foundry platform users.

To prioritize the ingestion and curation of these critical data sets, Electric Operations (EO) has developed a risk-based prioritization framework that incorporates risks for physical assets that are determined from the event-based risk models developed for each asset family along with the aggregated Wildfire ignition risk model that encompasses risk drivers from all EO assets. Consistent with PG&E's risk-based approach, these risk models describe and quantify the risk's drivers, outcomes, and consequences, and may inform prioritization of initiatives by assessing the impact of existing control and mitigation programs. The event-based risk assessment is supplemented by an assessment of data risks for data used by asset managers in processes critical to managing their assets (e.g., asset inspections, risk analysis, AFA). This framework is being used to support the prioritization of developing additional high quality, reusable ontology data objects on the Foundry platform, resulting in a dynamic development roadmap for data objects. Identified and prioritized data sources may already be integrated with Foundry or may be new, including sources external to PG&E.

Foundry ontology development is the mechanism for incorporating the prioritized data sources and content into the platform and includes identifying the required data quality and update frequency needed to support all identified business use cases.

Impacts:

- PG&E has connected 50 critical data source systems to Foundry, creating pipelines to deliver critical data sets to the platform. The Foundry ontology layer was expanded to include 436 data objects through integration of product-specific data sets and centralized ontology development efforts.

- Through application of the risk-based prioritization framework PG&E can consistently and systematically prioritize new data sets for ingestion into the Foundry ontology. Introduction of these data sets into ontology enables access to the data across a broad set of data users.

Lessons Learned:

- When developing new, reusable data objects in Foundry it is important to consider all possible use cases to ensure requirements for data elements, data sources for each element, data latency and other factors are well understood and accounted for in the design of the object.

- Data duplication can occur if multiple product development teams require the same data object but separately develop those data objects to meet their own needs. This can create technical debt and confusion among data users as to which data object to use for their needs.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
G.01	Data Governance – Identify and Centralize High Priority Data	1. Document and implement a process to identify data gaps in Foundry for critical risk drivers	12/31/2022	Qualitative

Additional activities have been identified for this initiative which are not Initiative Targets and will not be included in quarterly reporting to Energy Safety.

Centralized Repository (Survey Question G.I.A)

PG&E will continue to maintain and develop the Foundry platform and provide operational support to enable our effective use. PG&E will also continue to mature our governance and data quality initiatives and tools with a focus on delivery of high quality, reusable data objects in support of high priority use cases.

Product Development (Survey Question G.I.B)

PG&E will continue to evolve and improve existing Foundry data products as well as develop new products in support of high priority use cases for wildfire mitigation and operational improvement. This includes continued development and feature delivery for Foundry data products requiring further development and moving completed products into Operations and Maintenance modes. PG&E will also continue to identify, risk-prioritize and initiate development of additional high value data products to support wildfire risk management.

As part of our data product development PG&E will continue to expand the capability to use Foundry to assess the quality of source data that is integrated, and to identify key areas of focus for data quality improvement.

Integration of real-Time Data (Survey Question G.I.D)

PG&E has not committed to supporting the ingestion or delivery of real-time data via Application Programming Interface (API) or other protocols in the near-term. However, PG&E will continue to explore Foundry's real-time data integration for potential use cases (e.g., ingestion of SensorIQ data providing SmartMeter event data).

5) ***Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)***

Short-Term Improvements (2023-2028) – PG&E will continue to build out our foundational ontology within the centralized Foundry data platform to support a broader array of critical wildfire management processes and wildfire risk drivers.

We will also consolidate and develop high value data products on the Foundry platform. Consolidating data and data products onto the Foundry platform will support improved access to critical information with lower latency and higher overall efficiency.

7.3.7.2 Collaborative Research on Utility Ignition and/or Wildfire

OEIS Initiative Definition: Developing and executing research work on utility ignition and/or wildfire topics in collaboration with other non-utility partners, such as academic institutions and research groups, to include data-sharing and funding as applicable.

This section addresses projects in which PG&E collaborates with one more academic institutions or research groups where, in addition to bidirectional data sharing, there is funding from both PG&E and the other organization(s). There are other research projects in the 2022 WMP in Section 4.4 and Section 4.5.1 that include research with an academic institution or research group, though those research projects do not meet the collaborative definition in this section. In addition, this section focuses on research ongoing in 2022.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – PSPS

The EPIC 3.11: Multi-Use Microgrid project develops and tests the technology, processes, and business models needed to deploy and operate multi-customer microgrids that are integrating third party-owned renewable energy generation assets to power the microgrid on a section of PG&E's distribution system. This includes the design and development of control specifications and SCADA integrations to maintain visibility and operational control of the microgrid in grid-connected and islanded modes. This project supports the PG&E strategy of reducing or eliminating the impact to customers from PSPS events.

This EPIC 3.11: Multi-Use Microgrid project is conducted in collaboration with the two primary California Energy Commission (CEC) EPIC grant recipients: Schatz Energy Center and the Redwood Coast Energy Authority (a Community Choice Aggregator); these two entities are building the renewable generation and energy storage that will support the microgrid, known as the Redwood Coast Airport Microgrid (RCAM), including designing the control system for the microgrid. PG&E is designing the SCADA interface from the microgrid to the PG&E distribution grid, protection schemes, all associated controls and logic, as well as the required operational control software within PG&E's grid management systems.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- This project will demonstrate that energy resilience can be provided to critical facilities located within the microgrid via elimination or reduction of the duration of the impact of a PSPS event and other grid outage conditions for the customers served through the microgrid.

Relation to and Impact on Other Initiatives:

- PSPS – This project is targeted at reducing the customer impacts from PSPS events.

- The RCAM project serves as the model for other microgrid programs including PG&E's Community Microgrid Enablement Program[100] and the Statewide Community Microgrid Incentive Program. Work on this project led the development of the approved Community Microgrid Enablement Tariff[101] which is now available to other communities seeking to develop microgrids of this kind.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Since the ownership and placement of these microgrids is by third parties, PG&E cannot prioritize the work. We note though that these types of microgrids are particularly of benefit in High Fire Threat Districts (HFTD) to mitigate the effect of PSPS events though the formalized, streamlined process can be applied anywhere where a third-party chooses to install one and interconnect it with the grid.

Risk Models Used or Other Considerations for Prioritization:

- A risk model is not applicable as it is the third party that chooses where to build the microgrids.

- This collaboration on the RCAM aims to provide the necessary learnings that will enable PG&E to formalize and document a repeatable operational process that will enable a streamlined design, construction, and interconnection of third-party multi-use microgrids. These types of microgrids are particularly of benefit in HFTDs to mitigate the effect of PSPS events though the formalized, streamlined process can be applied anywhere where a third party chooses to install one and interconnect it with the grid.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- Functional design specification for the microgrid controller and the end-to-end integration network architecture and security approach have been finalized. Operational decisions for the microgrid including for communication and hardware fail-safes were evaluated in order to prepare the microgrid for integration at the Distribution Control Center. This specification along with the completed Concept of

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100 See Community Microgrid Enablement Program (CMEP) (pge.com).

101 See ELEC_SCHEDS_E-CMET.pdf (pge.com).

Operations documentation is now being used to complete PG&E's advanced microgrid testbed. This collaborative project is progressing towards broader adoption, including creating standards and tariffs that would be needed to enable PG&E to partner with third parties (such as communities) and deploy these types of microgrids. The RCAM is approaching commercial readiness with full permission to operate expected to be granted in early 2022. The associated PG&E EPIC 3.11: Multi-Use Microgrid project is expected to be completed in 2022.

Impacts:

- The EPIC 3.11: Multi-Use Microgrid project will develop formalized, streamlined frameworks, standards, and processes for community microgrid enablement that can be applied anywhere on the grid to improve reliability, and mitigate customer power loss from outages, particularly from PSPS events.

Lessons Learned:

- Circuits should be designed to allow microgrid mode transitions to be seamless if possible.
- Verify prior to system design that preferred resilient communication systems, such as the Field Area Network, are available at the microgrid location.
- Ensure clear designation and separation of stakeholder responsibilities, particularly between the utility and the microgrid generation owner/operator.
- Defining if microgrid will be allowed to operate under certain fail-safe conditions requires strong operator buy-in and participatory planning. The process used for this project can serve as a useful guide for future microgrid deployment.
- Because each microgrid configuration is unique it may not be possible to fully standardize and streamline processes and technology to be applicable for all microgrids. Future frameworks will need to be flexible to accommodate unique project needs.
- Future project economics will likely differ significantly from the CEC and PG&E EPIC--funded RCAM project and could be a major barrier to future scalability of multi-customer microgrids.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue to perform the activities related to this Initiative and aim to close out the project referenced above.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Additional flexibility in a future integration and operation framework to accommodate unique project needs. Because each multi-use microgrid configuration is unique it may not be possible to fully standardize and streamline processes and technology to be applicable for all multi-use microgrids though future additional flexibility may be able to be achieved. The result will be more design and implementation options for third-party multi-use microgrids.

7.3.7.3 Documentation and Disclosure of Wildfire-Related Data and Algorithms

OEIS Initiative Definition: Design and execution of processes to document and disclose wildfire-related data and algorithms to accord with rules and regulations, including use of scenarios for forecasting and stress testing.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Secondary Risk: Ignition Consequences

Data and algorithm development provide foundations for asset management and emergency operations decision-making, including but not limited to initiatives to reduce ignition risk and ignition consequence. Design and execution of processes to document and disclose data and algorithms contribute to their overall maturity and enhance understanding of wildfire risk and mitigation activities.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – Design and execution of processes to document and disclose data and algorithms allows traceability and transparency in data and algorithm development. Traceability provides a foundation for standardized approaches for data and algorithm development and application of lessons learned across a broad spectrum of data or algorithm related initiatives. Transparency enables integration of industry best practices and vendor or regulator engagement on data or algorithm related initiatives. This contributes to the overall maturity of these programs, enhancing our understanding of wildfire risk drivers, and effectiveness of risk management activities.

- As insights from risk models are used to develop workplans often there a need to understand how data was used by the model or what version of data was used in the model development to better interpret the model output. Having a traceable documentation of the model development aides in more readily understanding the model. In addition, it also enables teams to collaborate on future model development from a common understanding of the model structure and code.

Relation to and Impact on Other Initiatives:

- PSPS – Design and execution of processes to document and disclose data and algorithms contribute to their overall maturity and enhance understanding of wildfire risk and mitigation activities, including enhancements to PSPS decision-making. For instance, during the preparation and execution of a PSPS event accurate records on scoped circuit segments allow PG&E to communicate potential event scope and estimated restoration times to state agencies, such as Cal OES, and impacted counties.

- Risk-Based Asset Management – Design and execution of processes to document and disclose data and algorithms contribute to their overall maturity and enhance understanding of wildfire risk and mitigation activities, including risk-based asset management. For instance, understanding the version of a data set used in model development (e.g., enablement of risk-based prioritization or wildfire mitigation related work).

- Wildfire-Related Risk Analytics – Design and execution of processes to document and disclose data and algorithms contribute to their overall maturity and enhance understanding of wildfire risk and mitigation activities, including wildfire-related risk analytics. The 2021 WDRM v2, 2022 WDRM v3, WFC Model, and the Wildfire Transmission Risk Model (WTRM) benefit from ingesting data from the Palantir Foundry Ontology. The advantages of managing data in this environment include repeatability and clarity on source data. For example, a clear and common understanding of the data set used in model development enables coworkers to collaborate on future model development and improvements more readily.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative:

- Data Processes and Documentation – Design and execution of data and algorithm processes and documentation are guided by regulatory requirements, regulatory commitments, data governance objectives and record retention policies.

- Data Disclosure – PG&E leverages several programs and processes to support the sharing of wildfire-related data with regulatory agencies, local and state agencies, customers, and other stakeholders. Prioritization of the documentation and disclosure of wildfire related data is informed through a variety of inputs, including but not limited to: (i) regulatory requirements; (ii) relevance to customer wants or needs; (iii) public safety impacts; (iv) stakeholder requests. PG&E restricts sharing of confidential or otherwise sensitive data to help ensure the security of our customers and the electric system. Data security is also informed through PG&E's Data Management Framework, which guides protective measures to prevent unauthorized access to data.

- Wildfire Risk Algorithms – Model algorithms are developed for each portion of the wildfire risk models. As described in Section 4.5.1(b), wildfire risk is calculated as the probability of an outage x the probability of that outage becoming an ignition and the consequence of that ignition as a fire or wildfire. The documentation and disclosure of these algorithms is detailed in the 2021 WDRM Overview document provided as an appendix in PG&E's June 2021 WMP Revision filing as Attachment 2021 WMP_Revision_PGE_02_Atch02.

Risk Models Used or Other Considerations for Prioritization:

- PG&E leverages a number of wildfire risk models to inform planning and operations, including: WDRM, WTRM, and the WFC Model.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

GIS Data Standard (SPATIAL QDR)

In 2021, we implemented process improvements around the collection, curation, and organization of data inputs – including identification of data stewards, technical resources, and other stakeholders who contribute to reporting inputs.

We also adopted revised requirements from the Energy Safety, as introduced in GIS Data Standard V2 and V2.1 and addressed majority of the Energy Safety evaluation findings, as detailed in the Appendix (Table 1) of PG&E's Q3 2021 submission cover letter. We also added metadata to report submissions.

We provided comment on GIS Data Standard V2.1 and V2.2 and participated in Energy Safety's Technical Workshop on October 21, 2021, highlighting: (i) elements of the data schema that are subject to technical limitations; (ii) field requirements that are subject to interpretation and require clarification or are out of alignment with other Energy Safety direction; and (iii) proposed methods to improve consistent implementation of the GIS Data Standard across electrical corporations, including the potential benefits of a formalized working group.[102]

We also leveraged PG&E's enterprise data platform (Foundry) to drive connectivity between select source systems and data sets, enabling reporting of formerly distinct data. As part of the Energy Safety GIS Data Standard submission (Spatial QDR), 24 wildfire critical data sets were brought into Foundry, making them available in the central data platform to other users.

Developed a Domain Quality Checker Tool via Foundry. This tool automates the comparison of PG&E's data outputs (file geodatabase (FGDB) domain structures) with the domain structures established by Energy Safety. Issues identified are flagged for manual review, enabling PG&E to enhance the quality of our FGDB submission.

Impact:

- Increased transparency around wildfire mitigation activities by providing data in requested geospatial format to Energy Safety on quarterly basis.
- Increased quantity and enhanced quality of data submission, leveraging automations and scripting techniques where technically feasible to enable sustainable reporting for select datasets.

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102 PG&E Response to ES Geographic Information Systems Data Standard, Version 2.1. Filed August 27,2021. ES Docket #2021-GIS-DRS, REF # 10296. Available at: https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=51711&shareable=true.

Lessons Learned

- PG&E's existing data and system architecture were developed over decades to address specific operational uses and lack integration capability and a cohesive data schema. This presents significant challenges to accessing and aligning data to meet Energy Safety's GIS Data Standard.

- Manually deriving datasets on a quarterly basis is not feasible. Sustainable reporting of datasets requires automation/scripting through Foundry, PG&E's enterprise data platform. Utilizing this platform, PG&E has connected, curated, and transformed 24 formerly dispersed datasets for the Energy Safety GIS Data Standard submission. Performing this work through Foundry allows accessibility to other users, providing both reporting and operational value. Where technically possible, automations of datasets for this report require inputs from cross-functional teams to: (i) define the data; (ii) map PG&E's source systems to the GIS Data Standard schema; (iii) apply transformation logic to derive data outputs; and (iv) perform engineering work to automate data outputs.

- The interconnected aspect of feature class data and geospatial representation of the data create complexities in identifying the confidentiality of individual records and introduces additional risk for error. For example, the Transmission Outages ID (TOutageID) field is directly applied to five feature classes and can be indirectly linked back to an additional feature class – Risk Event Photo Log (Wires Down includes a TOutageID – that can be traced to the Risk Event Photo Log). TOutageID is confidential when linked to transmission lines over 115 kilovolt (kV). While transmission lines under 115Kv may not be considered confidential at the individual asset level, there is additional information in all six referenced datasets that would need to be carefully assessed at the record level for other confidential data, such as locational data on substation or other equipment connectivity, customer related data, critical facility, SCADA connectivity, etc. that could impact the entire records' confidentiality designation.[103,104]

Quarterly Data Report

We successfully submitted Q1-Q3 2021 QDR reports and revised data as needed within the 12 data tables.

Impact:

- Status updates across the various dataset set by Energy Safety displaying PG&E's progress over time.

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103 Physical facility, cyber-security sensitive, or critical energy infrastructure data protected from disclosure. (See 18 C.F.R. § 388.113, see also Govt. Code § 6254(k), (ab); 6 U.S.C. § 131; 6 CFR § 29.2.).

104 Customer-specific data, which may include demand, loads, names, addresses, and billing data (Protected under PUC § 8380; Civ. Code §§ 1798 et seq.; Govt. Code § 6254; Public Util. Code § 8380; Decisions (D.) 14-05-016, 04-08-055, 06-12-029).

Lessons Learned:

- Encountered questions each quarter on the process and who to obtain the dataset from. With the turnover of subject matter experts, the teams are looking to document the quarterly data request process for future submissions.

- Checking for data inconsistency between the various quarterly submission, Quarterly Initiative Update (QIU), Spatial QDR & etc., to ensure data is reflected correctly.

Quarterly Initiative Update

We successfully submitted Q1-Q3 2021 QIU reports. In Q1, inserted under category "Protocols on Public Safety Power Shutoff" the WMP Initiative Activities on the "Initiative Mapping" tab, to include:

- Section 8.2.4 for K.01 Customer, Agency, and External Communications commitment.

- Section 8.2.5 for K.02 commitment Protocols for Mitigating Public Safety Impacts of PSPS.

We included all initiatives from the 2021 WMP in the QIU working file by adding all "Other" sections for Q2 report.

In Q3, added four "Addressing Extreme Drought Conditions" initiatives under Category "Protocols on Public Safety Power Shutoff" and Initiative Activity "Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions."

Quantitative initiatives have quantitative targets that involve work being performed on assets (i.e., inspections, repairs, replacements, new installations), as shown in Table 5.3-1 "List and Description of Program Targets." Overall, there are 33 quantitative commitments/initiatives.

Finally, we implemented a pilot program in Foundry to build QIU reporting functionality in this data application. Planning to implement all progress updates, approval process and uploading of supporting file within Foundry for Q4 reporting.

Impact:

- Provides status updates across all WMP initiatives including requested supporting documentation to validate the quarterly progress reports of all unitized initiatives. Provides update on all 2021 WMP initiatives.

Lessons Learned:

- We encountered work process issues in utilizing one multi-user based Excel file for all data input. While building and testing the Q3 Foundry based pilot, we implemented six separate working files separated by WMP Initiative Category and will implement the Foundry based process in Q4.

Documentation and Disclosure of Ignition Events

We adopted the schema provided in the OEIS GIS Data Standard Submission (Spatial QDR), including development of processes to support submission of photos and executed several audits of PG&E's historic ignition record. We were able to successfully identify and address gaps in PG&E's ignition records.

We also revised and republished PG&E's Fire Incident Data Collection Plan and Reporting Standard (Utility Standard RISK-6306S). This document is reflective of recent ignition documentation and disclosure process changes.

We instituted a new ignition investigation process for CPUC reportable ignitions in HFTD to better identify failure modes and trends related to ignitions and process controls to improve the accuracy and completeness of PG&E's ignition record.

Impact:

- Automation of data reporting for select datasets to help ensure to meet reporting timeline requirements as established through regulatory proceedings.
- More complete and accurate disclosure of PG&E's historical ignition record than prior years.
- Increased insight on ignitions of consequence.

Lessons Learned:

- Design of PG&E's first-responder field-based applications contributed to past gaps in ignition identification.
- PG&E's processes, roles, and tools related to ignition documentation and disclosure continue to evolve and the Fire Incident Data Collection Plan and Reporting Standard (Utility Standard RISK-6306S) requires regular review and revision.

Documentation and Disclosure of PSPS Events (PSPS 10-DAY REPORT)

PG&E, SDG&E, and SCE met with the Commission's Safety and Enforcement Division (SED) on May 21, 2021 to propose and review a standardized 10-day post-event reporting template.

Adoption and adherence to SED's PSPS Post-Event Reports and Lessons Learned template was issued on October 18, 2021, pursuant to CPUC Resolution ESRB-8, Decision (D.) 19-05-042, D.20-05-051, D.21-06-014, and D.21-06-034.

Impact:

- We provided a detailed explanation of PG&E's decision to execute a PSPS; all factors considered in the decision to shut off power, including wind speed, temperature, humidity, and fuel moisture in the vicinity of the de-energized circuits; the time, place, and duration of the shut-off event; number of customers impacted, any wind related damage/hazards to circuits shut off; and description of the notice to customers and any other mitigation provided by PG&E.

Lessons Learned:

- PG&E holds an after-action review session after the submission of each post PSPS de-energization event report to identify lessons learned and opportunities for improvement from the subject matter experts.

- Action items identified in these sessions were proactively acted upon and resulted in a more efficient, effective, and robust reporting process. Some notable improvements included prioritization of key data gathering and analysis steps, standardized communications, improved alignment across internal teams and enhanced data reporting automation.

- Third party responses to the 10-day report were reviewed, and improvements were incorporated and addressed where applicable.

Wildfire Risk Model Algorithms

Our wildfire risk modeling capabilities advanced significantly in 2021 due to the introduction of the Composite model framework. This common framework for model development was introduced to both the WDRM and the WTRM. The Composite model framework enables the results of models to be composited or combined to represent the total risk at a location on the grid. For example, a model representing the risk of structure failure is developed following a consistent methodology as another model representing the risk of animal contact. Due to the implementation of this consistent framework these risks can be added to represent the combined risk at a given location on the grid.

Impacts:

- From a composited risk value presented by the WDRM or WTRM, a model user can drill down to understand which risk has the greater contribution to the overall risk. Based on insights from this investigation mitigation, options can be assigned to address more prominent risks at each location along the grid.

Lessons Learned:

- Model development needs to be very disciplined in aligning what risks are being modeled to avoid double counting or over-representing risk.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

- GIS Data Standard (Spatial QDR) – PG&E plans successfully submit our GIS Data Standard reports (Spatial QDR) to Energy Safety.

- Quarterly Data Report – PG&E plans successfully submit our QDRs to Energy Safety.

- Quarterly Initiative Update – PG&E plans to successfully submit our QIU reports to Energy Safety.

- Documentation and Disclosure of Ignition Events – PG&E plans to review and revise PG&E's Fire Incident Data Collection Plan and Reporting Standard (Utility Standard RISK-6306S), where applicable.

- Documentation and Disclosure of Ignition Events – PG&E plans to submit notifications and reports per Rules 29300 and 29001 in Energy Safety's Emergency Rulemaking Compliance Protocols. Timelines vary upon condition but are outlined in Rules 29300 and 29001.

- Documentation and Disclosure of Ignition Events – PG&E plans to complete the Preliminary Ignition Investigation Reports for Q1-Q3 CPUC Reportable ignitions in HFTD prior to year-end.

- Documentation and Disclosure of Ignition Events – PG&E plans to continue the revision and republishing of PG&E's Fire Incident Data Collection Plan and Reporting Procedure (Utility Standard RISK-6306P).

- Wildfire Risk Algorithms – PG&E will continue to add risk models representing additional risk drivers to the composite risk model framework for both the WDRM and WTRM according to the schedule outlined in Section 4.5.1(c).

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

- Ontology Data Object Development – A key enabler for documentation and disclosure of wildfire related data includes the availability of high fidelity data that follow a standardized structure/schema. As discussed in Section 7.3.7.1, PG&E is continuing to build out data objects (Ontology objects) via our enterprise data management platform, Foundry. Prior to the development of a data object, PG&E assesses desired data structure/schema, factoring a variety of considerations, including operational needs. Over time, as data objects are integrated into Foundry, they will take on an organized data schema, enabling greater access to structured data.

- GIS Data Standard (Spatial QDR) – PG&E has continued to improve our quarterly submissions quantitatively and qualitatively and will continue to seek ways to enhance future submissions. Enhancement opportunities will largely require more involved operational and technological changes, including a significant level of resources required to collect, curate, and organize the Data Standard submissions on a recurring basis, while simultaneously advancing our data maturity. PG&E looks forward to continued conversation and collaboration with the Energy Safety and other stakeholders on the GIS Data Standard.

- Documentation and Disclosure of Ignition Events – Redesign the field-based applications available to PG&E first-responders related to ignition event identification: More-comprehensive ignition data from PG&E field employees immediately upon learning of an ignition event. Pictures available at event identification.

- Wildfire Related Algorithms – Models representing additional risk drivers will continue to be added to the composite risk model framework for both the WDRM and WTRM over the next two to three years.

7.3.7.4 Tracking and Analysis of Risk Event Data

OEIS Initiative Definition: Tools and procedures to monitor, record, and conduct analysis of data on risk event data (near miss events).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risks

Gathering data on "near miss events", which have been redefined by Energy Safety as "risk events" in the Glossary provided for the 2022 WMP, can be helpful in analyzing and evaluating events which have a probability of the ignition of a wildfire.

Energy Safety defined a risk event as: An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition.

The following risk events all qualify as risk events:

- Ignitions;
- Outages not caused by vegetation;
- Vegetation-caused outages;
- Wire-down events
- Faults; and
- Other risk events with potential to cause ignitions (Resolution WSD-011 Attachment 2.2, page 12).

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Develop better visibility into risk – Capturing data concerning risk events to better understand the conditions that lead to potential wildfire ignitions is critical for PG&E. With this data, PG&E can further improve and develop models and procedures to avoid scenarios of increased ignition risk from occurring in the future. The goal is to continue learning the "behavior" of ignitions, or for this purpose, the "behavior" of events that could lead to an ignition. Understanding that behavior will allow us to better inform tool developers, operations, and mitigation initiatives. PG&E also provides similar risk event data to the CPUC as part of our ongoing reporting obligations. PG&E provided our initial report of "near hit" data in September 2020. The next report is scheduled to be provided on February 4, 2022. In addition, we provide information in Tables 2, 7.1, and 7.2 (Attachment 2022-02-25_PGE_2022_WMP-Update_R0_Section_7.3.a_Atch01) of the 2022 WMP involving risk event data.

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead), EVM and Asset Repair and Replacement – Including near miss data in the WDRM allows PG&E to enhance the model's ability to identify high risk areas and prioritize locations for wildfire mitigations such as system hardening, EVM, and asset inspection and repair. Specifically, outages are a key part of the data used as training and test sets for the development of the probability of failure modules that are part of the WDRM.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E tracks risk event data in all areas of our service territory.

Risk Models Used or Other Considerations for Prioritization:

- PG&E tracks near miss risk event data in all areas of our service territory.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, PG&E made improvements in five critical areas to increase the accuracy and comprehensiveness of data captured for "risk events":

- Ignition incident data – The EII team conducted audit of multiple work tracking databases to identify ignitions that had been missed in the past, increasing PG&E's reportable ignition record by 23 percent. This led to a more-comprehensive ignition review process, several corrective actions, and revision/publishing of PG&E's Fire Incident Data Collection Plan standard (RISK-6306S). Additionally, a cross-functional Enhanced Ignition Investigation analysis team was established in collaboration with AFA, Vegetation Management (VM), Advanced Technology Services and EII to conduct deep dive analysis into CPUC reportable ignition incidents. The enhanced investigation team allowed PG&E to significantly increase the ability to identify more granular failure modes and drive targeted corrective actions to mitigate emerging risks. The Enhanced Ignition Investigation Team started collecting equipment involved with ignition events for failure analysis. In 2021, EII increased the structured data points captured by each ignition event by 10 percent and published a data dictionary/review guide for all collected data points.

- Equipment failure-caused wire down data collection – The AFA team developed a semi-automated Foundry tool to capture critical attributes related to failed conductors (e.g., location, age, material type, wind condition). The new process will be operationalized in 2022 to increase the accuracy of information collected, while also increasing the efficiency in engineering hours required for analysis.

- Equipment failure-caused outage data – The AFA team developed and piloted a dynamic asset failure data collection form that allows trouble-persons to capture key attributes of the failed equipment in less than five minutes. This form also provides an opportunity for Trouble-persons to provide pictures and additional feedback (using open text field) to help Engineers understand the cause of failure. In 2022, PG&E will be rolling out this process system-wide and will collaborate with the Field Operations team to increase adoption of the form.

- Vegetation failure-caused outage data – In 2021 the Vegetation Asset Strategy and Analytics (VASA) team was stood up and began a deeper analysis of ignition investigations and vegetation caused outages. VASA/VM implemented an Extent of Condition patrol on vegetation caused ignitions 5 spans in all directions from the subject tree in order to assess the immediate area to prioritize any additional trees which may require risk mitigation work in the area.

- Near miss data was leveraged to enhance the WDRM – As described in the 2021 WMP, the 2021 WDRM was trained on ignition data. With the expansion of the WDRM to include risk drivers will lower ignition counts, the model format was expanded to calculate risk as the probability of failure multiplied by the probability of an ignition given and failure multiplied by the wildfire consequence of an ignition. The near miss data was part of the failure data set used to train and test the 2022 WDRM v3.

Impacts:

- The EII team increased the structured data points captured for each ignition incident by 10 percent.

- The EII team audit of past ignition data increased PG&E's reportable CPUC ignitions by 23 percent, leading to a more complete reportable ignition dataset and identify new previously unidentified failure modes.

- Equipment failure analysis process has produced insight on equipment failure modes and ensured a more-accurate identification of ignition cause in PG&E's ignition dataset.

- In 2021 the continued collection and analysis of near miss data enabled an updated set of data from which to train and test the WDRM v3.

Lessons Learned:

- Improved near miss data quality and collection provided an improved data set from which to train and test the 2022 WDRM v3.

- Well established data governance process is critical to ensure that the tools developed in Foundry are producing accurate results.

- Close collaboration with field operations SMEs in developing the asset failure data collection form helped us refine the process to take less than five minute per incident for the trouble-person to complete the data collection process.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

PG&E aims to Update the 2022 WDRM v3 with near miss data from 2021, to roll out training to all Troublepersons to fill out the questionnaire for all equipment failure outage incidents, and transition wires down data analysis process to the Foundry tool.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – There are no specific plans beyond continuing to refine and improve PG&E's analytics and data collection, including:

- The Ignitions Investigations Team is working on a field-based application to improve the identification and data collection process related to documenting ignition events in the field. Application starts development in 2022 for deployment in 2023.

7.3.7.5 Other, IT Projects to Support Wildfire Mitigation work

OEIS Initiative Definition: Not Applicable – This is a "PGE-defined sub-initiative" that supports the response for the (parent) OEIS-defined Initiative.

This section describes the IT programs and initiatives to support PG&E's Wildfire mitigation efforts.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

IT is a critical aspect of PG&E's business operations and enables many of the capabilities required for wildfire mitigation. This section describes a high-level overview of the IT projects that are underway or planned for 2022 that are needed to deliver PG&E's overall WMP.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- The primary benefit of this initiative is the tracking of all technology projects needed to enable the other initiatives in the WMP.

Relation to and Impact on Other Initiatives:

- This initiative is used to describe the IT technologies and projects needed to enable other initiatives throughout the WMP. This includes but is not limited to technologies that enable areas such as PSPS, wildfire risk modeling, aerial inspections, remote sensing and asset data analytics. Question 4 will provide details of the projects.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The primary governance driver for project prioritization involves a detailed ranking based on four categories: Business Value, Time Criticality, Risk Reduction and External Relationship impact. This ranking (or scoring) is derived from the datapoints given from each project for the categories and the project's relative value compared to other projects in the portfolio. The category scores are then added up to give us the final score which is used to determine the relative ranking/priority of the projects.

After initial scoring projects were divided into related groupings to allow sponsors to discuss and develop prioritization recommendations. These recommendations were

then presented to the Community Wildfire Safety Program Governance Committee for evaluation and approval.

Risk Models Used or Other Considerations for Prioritization:

- No specific risk model was used as we are focusing on the projects that support other initiatives in the WMP.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

- Wildfire Safety Division/Wildfire Mitigation Plan (WSD/WMP) Automated Reporting – This project built a wildfire data foundation and developed a connected architecture between key assets and wildfire initiatives—made possible data access for risk/analytics use cases more efficient. This project enabled the ingestion and transformation of wildfire critical data to create a single, accessible, trusted set of data to accelerate EO wildfire mitigation efforts. PG&E intends further development of this project in 2022.

- Foundry Ontology – The Foundry Ontology project is realizing the core value proposition of developing a high-quality, reusable data foundation that can accelerate development of data-driven insights that improve business outcomes. The current Foundry strategy prioritizes product delivery and produces ontology specific to the needs of each use-case to accelerate benefits realization; resultingly, ontology objects may not be useable across EO wildfire efforts. This project coordinated and accelerated wildfire prevention leveraging key shared wildfire ignition and spread data. The project accelerated product delivery for existing wildfire-related use cases. PG&E intends further development of this project in 2022.

- Hazard Awareness and Warning Center/Early Ignition Investigation Awareness & Investigation Tool (HAWC/EII) – This project created a tool where data across source systems and associated work are consolidated into a single user-friendly view focused on fire awareness and investigation. This project enabled the Hazard Awareness and Warning Center (HAWC), formerly the Wildfire Safety Operations Center (WSOC), and Early Ignition Investigations to quickly gather basic information about ignitions and provide rapid alerting of fire ignitions that may be attributable to PG&E electrical facilities.

- Safety and Infrastructure Protection Team (SIPT) Scheduling – This project created a web form to allow lines of business the ability to request a Safety and Infrastructure Protection Team (SIPT) Crew to support daily fire prevention and/or mitigation work. This project enabled SIPT and Public Safety Specialists to seamlessly integrate into the CAL FIRE Incident Command Structure on incidents where PG&E infrastructure may have been threatened or damaged.

- Wildfire Safety Operations Center (WSOC) Incident Viewer – This project created a solution that allows for the tracking of active wildfire incidents; assessment of their impact on PG&E infrastructure, employees, and customers; and the dissemination

of the intelligence within PG&E to support safety of employees and the public. Additionally, the solution aids in decision-making for PSPS events. This project enhanced situational awareness intelligence and decision support. PG&E intends further development of this project in 2022.

- Itron Sensor Implementation for High Resolution Meter Data – This project implemented the Itron Sensor IQ solution to 500K SmartMeters™ in High Fire Threat Districts and customized data reads with other use-cases considered based on wildfire risk reduction and/or business value. This project enabled users to proactively manage safety issues such as transformers at risk, vegetation contact and improve asset failure prediction accuracy, and perform near real-time analytics and alerting.

- Partial Voltage Detection (Enhanced Wires Down) Phase 2 – This project extended the partial voltage functionality to the entire meter fleet to provide alerts and locational information of potential asset failures, thus enabling earlier detection of "Wires Down" events. This enhanced situational awareness helps detect and locate downed distribution lines more quickly to enable faster response.

- Grid Data Analytics Suite (GDAT) – This project developed a toolset with the goal of identifying, locating, and rectifying potential fire ignition risks using grid sensor data. The platform also managed investigation workflows and results to maintain a continuous feedback loop further enhancing outcome accuracy driving a long-term goal to build the ability of auto-detection and auto-field dispatch. This enabled increased operational capability by empowering Distribution Engineering teams to investigate outages and create better-targeted patrols and improved performance. PG&E intends further development of this project in 2022.

- Inspect: Electric Compliance – This project designed and implemented an integrated and risk-informed inspection and maintenance program across Transmission and Distribution, with a phased implementation. This project enabled changes to the inspection checklist, data readiness and validation to support 2021 and 2022 inspections and developed a field safety reassessment workflow feature that allows users to provide updated corrective tag information on a single application.

- Aerial Inspection-Sherlock Tool – Following the catastrophic wildfires in November 2018, PG&E captured more than two million images of our field equipment in high-fire risk areas. To handle this magnitude of images that need to be inspected individually, PG&E developed a visualization tool and back-end system to enable the receipt of images and provided an intuitive interface to allow inspectors to review images and identify any possible irregularities. In 2021, PG&E continued to enhance the Sherlock tool by adding two new profiles to assist with the pre- and post-inspection review process to encompass more of the aerial inspection process within Sherlock. This allows inspectors the ability to complete inspection checklists directly in Sherlock and the system will manage the creation of inspection checklists in the SAP system of record. PG&E intends further development of this project in 2022.

- Electric Asset Registry-Trusted Data (Sync dashboard) – The project has created custom data quality dashboards (specifically GIS/SAP synchronization and GIS asset data priority ranking dashboards) for EO to surface data quality issues and monitor the progress of resolving these issues. The dashboard results assisted EO in defining scope to resolve asset registry issues in support of wildfire inspections. PG&E intends further development of this project in 2022.

- Emergency Web Remediation – This project increased the stability of the web platform used during emergencies and improves customer user experience with new and enhanced functional capabilities and content. This project enabled the creation of new PSPS content, integrated 7-day forecasts, improved publishing process, publishing speeds, and map enhancements for usability. PG&E intends further development of this project in 2022.

- Wind Loading Assessment – The first phase of this project reduced risk through providing asset intelligence to identify locations that need corrective actions and a determination of pole safety factors or limitations for wind speeds. Additionally, this project developed a common repository for pole loading calculation for Distribution Operations. The second phase continues the need to clear vegetation and re-inspect and address all facility issues within HFTD Tiers 2 and 3 and Zone 1 areas. Phase 2 made further enhancements to O-Calc 6.0, SAP, and Geographic Information Database (GIS). O-Calc is a structural analysis software package for utility poles and is used to perform pole structural loading calculations. Phase 2 enabled the update of Geographic Information Database (GIS)/SAP systems with wind loading data and enhanced workflows to align with new data sets. PG&E intends further development of this project in 2022.

- Microgrid Order Instituting Rulemaking (OIR) Portal – This project created separate, access-restricted portals for local and tribal governments to access utility data to help identify microgrid development opportunities. The project consolidated with other portals to use the same architecture as the Public Safety Power Shutoff (PSPS) portal that makes it easier for the users of the portals to have a single point of entry to PG&E's data. This project added several GIS layers to provide detail on items such as representation of High Fire Threat Districts and utility planned work and grid investments in both tabular and GIS format.

- Remote Sensing Data Platform – This project created a framework for implementing a centralized, spatial analysis compatible platform that will act as a centralized coordinator of the various data sets, allowing for greater access and minimizing duplication of remote sensing data captured. This project introduced organization-wide remote sensing standards that allow for more effective planning, sourcing, contracting, and the collection of internal and vendor provided data.

- Transmission Support Structures 2 – This project defined a greater understanding of failure modes, established of a common repository of data gathered, and updated workflows and key asset systems to align with the new data strategies. The project integrated Pole Test and Treat reports into Grid Search removing the manual e-mail process for requests, provided a central location to store site specific tower models, and automated the Federal Aviation Administration Marker Ball checks. PG&E intends further development of this project in 2022.

- Asset Failure Data Collection – This project enabled the collection of data required for identifying equipment failures and potential causes. PG&E intends further development of this project in 2022.

- Asset Failure Analysis Data Product – This project links multiple backend databases, compiles key metrics to provide asset overviews, incorporates risk-analysis and trending processes, and creates workflows for asset owners to manage their assets. This project developed a centralized replacement for the Wire Down Database. PG&E intends further development of this project in 2022.

- Electric Transmission Operability Assessment – This project focused on making enhancements to the OA model developed which identified "at-risk" transmission assets and informed ET line PSPS scope. A key milestone was accurate ET line asset data being used in inspection work planning and was presented to the Federal monitor. PG&E intends further development of this project in 2022.

- PSPS Field Communication – This project provides a safe and reliable form of radio communications to individuals supporting PSPS events to leverage in the absence of consistent cellular coverage and/or when communications traffic needs to be separated by role. A key milestone for this project was an upgrade of 30 radio sites to very high frequency (VHF) radio cross band which allows helicopters to use their legacy VHF aircraft radios to communicate with Tait / Ultra High Frequency (UHF) radios.

- ET Overhead Asset Information Collection – This project provided additional precautionary measures intended to further reduce wildfire risk. This project developed a catalogue of attributes on transmission towers in High Fire Thread Districts where this information was available, and a methodology for determining this information when not available. The catalogue consolidated information collected regarding the age, mechanical integrity, location and identity regarding each component of each transmission line into a single source. PG&E intends further development of this project in 2022.

- Weather Station Installation – This project improved real-time environment monitoring on the grid through the implementation of weather stations across PG&E's service territory. The Weather station team installed 308 Weather Stations in 2021 and 1,318 weather stations in total.

- Fire Spread & Consequence Model Updates – This project continues the implementation of Technosylva fire spread technology to enable wildfire risk reduction. The goal was to build the operational data pipelines needed to process millions of fire spread simulations performed daily and evaluate how fire spread models could integrate into PSPS decision making. This project enabled the ability for fire spread simulations to be an input in PSPS decision making.

- Wildfire Visualization Map (Wildfire Data Viewer) – This project developed a way of providing internal and external stakeholders a consistent, map-based visual depiction of wildfire risk reduction and resiliency workstreams, whether planned, underway, or completed.

- PSPS Field Patrol – This project developed a PSPS Field Inspection and Patrol mobility tool that supports the identification of damage, hazards, and risk events. This project accelerated time to restorations and replaced some paper-based process and records. PG&E intends to further development of this project in 2022.

- Enhanced Vegetation Management – This project enhanced the tools used to help reduce wildfire risks by reducing vegetation above and adjacent to overhead primary voltage powerlines in High Fire Threat Districts. This project provided support to field workers and updated the platform. PG&E intends further development of this project in 2022.

- One Vegetation Management – This project designed and implemented a mobility product that allows for work management, digital work packages, digital work tracking, and integration into other work management systems all for more efficient, effective, and traceable VM operations. PG&E intends further development of this project in 2022.

- Wildfire Distribution Risk Model (WDRM) – This project developed a Distribution Asset Risk Model, tuned for Wildfire Risk. This project enabled situational awareness of the current wildfire risk on the distribution system, enhanced risk-informed decision-making in the budget planning process, and improved risk reduction reporting capabilities. PG&E intends further development of this project in 2022.

- Wildfire Transmission Risk Model (WTRM) – This project combines the sub-models that have been developed for ET. This model utilizes these sub-models as inputs to join models to further predict the probability of an outage being caused by the specific thread for a discrete portion of the system. This project has enabled the Transmission Asset Strategy team to refine and update their Inspection, Repair, and Replacement workplans. PG&E intends further development of this project in 2022.

- Outage Management Tool/Distribution Management System Enhancements (OMT/DMS) – This project enhanced the Outage Management Tool (OMT), the Distribution Management System (DMS), and the Integrated Logging Information System (ILIS) to support data quality, Estimated Time of Restoration management efficiency, hazard tracking and overall workflow. This project enabled stabilization of workflows and operational efficiencies in High Fire Threat Districts. PG&E intends further development of this project in 2022.

- PSPS Viewer Enhancements – This project enhances PG&E's ability to scope the electric distribution impact of a PSPS event and passes data to downstream systems, such as the PSPS Portal and PSPS Situational Intelligence Platform, to allow for situational awareness, notifications and data sharing. Work completed enabled integrations and automation of scoping to reduce error and manual data transfers. PG&E intends further development of this project in 2022.

- Sharing Wildfire & PSPS Data Externally – This project enhances the PSPS portal to display outage area data and customer impact in real-time with external public safety partners. The project extended process automation for data updates and file sharing. PG&E intends further development of this project in 2022.

- PSPS Situational Intelligence Platform (PSIP) – This project provides integrated situational awareness for the Incident Commander and Officer-in-Charge to improve decision making and response activities during a PSPS event. This project incorporated vegetation and tags into distribution scoping and increased accuracy for customer notifications. PG&E intends further development of this project in 2022.

- High Fire Threat District (HFTD) Response in 60 minutes – This project was designed to fulfill the desire to respond to all outages in HFTDs within 60 minutes. The project enabled the ability to have full visibility of all outages in HFTDs Tier 2 and Tier 3, allow customer care teams to create outage tags, and provide timely information to dispatchers for event response.

- System Inspection Wildfire Mitigation Program – The Systems Inspections organization has an annual workplan that requires a technology suite of applications to appropriately document the detailed overhead inspection of Electric Transmission and Distribution Structures. These applications provide an end-to-end digital process to accomplish the work to support the completion of the WMP inspection program. In 2021, enhancements were made to incorporate new documentation requirements, application performance improvements, new features to drive data accuracy and worker efficiency, and to respond to feedback from end-users, external observers, regulators, and System Inspection leadership. PG&E intends further development of this project in 2022.

- Wildfire Risk Command Center – This Wildfire Risk Command Center (WRCC) aims to enhance the process efficiency and traceability of aggregated daily WMP operating information. The WRCC provides visibility to the prioritized efforts to achieve wildfire mitigation initiatives. PG&E intends further development of this project in 2022.

- Maps + Asset Registry/Map Correction – This project completed discovery and created the product design and technical framework for a digital, easy-to-use means for field-based personnel to electronically submit map correction requests that are identified during their daily work. This will reduce risks related to asset registry inaccuracies and missing attributes, establish a streamlined and consistent process to collect data sets and enable triage and prioritization of all map corrections for all input sources. PG&E intends further development of this project in 2022.

Overall Lessons Learned:

- PG&E has sponsored IT projects to improve our ability to provide critical data and information to our customers and other stakeholders. During PSPS events, PG&E has improved our ability to provide outage information and customer impact data to our Public Safety Partners. Additionally, we have implemented new methods for sharing weather modeling, fire penetration shape files, and aerial videos with our external stakeholders to improve community responses to wildfires.

Overall Impacts:

- PG&E has evaluated, implemented, and enhanced technologies as part of our efforts to mitigate wildfire risks across our service area. PG&E now collects

significant amounts of weather and environmental data for use in weather modeling, fire spread and consequence modeling and PSPS scoping criteria. To take full advantage of new technologies and information, PG&E has developed platforms to manage the significant amounts of data being collected, integrated with PG&E's legacy systems, and performed analysis to support risk informed decisions. For example, new and developing technologies like remote sensing leverage data to better manage risk and predict events before they might happen. PG&E is also sponsoring projects to improve our ability to provide critical data and information to our customers and other stakeholders. During PSPS events, PG&E continues to improve our ability to provide outage information and customer impact data to our Public Safety Partners. PG&E will also develop new ways to better share weather modeling, fire penetration shape files, and aerial videos with our external stakeholders in order to improve community responses to wildfire.

Current Year Activities (2022):

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Annual Project Evaluation: With the data in Question 4 we set forth our 2022 plans for each IT project that directly enables wildfire mitigation work. Throughout the course of each year, PG&E evaluates the progress of every project to determine whether each one continues to be feasible and if it continues to support our goals of wildfire risk mitigation and improved customer and community awareness.

7.3.8 Resource Allocation Methodology

7.3.8.1 Allocation Methodology Development and Application

OEIS Initiative Definition: Development of prioritization methodology for human and financial resources, including application of said methodology to utility decision making.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

Activities under this initiative prioritize work broadly across all categories of risk. In any work prioritization effort, Pacific Gas and Electric Company (PG&E) puts safety first in the development of work plans that also need to consider financial constraints to keep costs reasonable for our customers. In general, the highest risk work on our system is prioritized as determined by our Enterprise and Operational Risk Management Organization (please see Section 7.1 for PG&E's discussion of Enterprise Risks). Currently, wildfire risk is our highest enterprise risk. However, PG&E's total portfolio of work includes funding mitigation of other risks and for response to emergencies and customer restoration from outages, new customer requests for service, electric asset maintenance, compliance with regulatory requirements, and investment to ensure safe and reliable system operations. Risks considered when funding these various needs include wildfire, asset related safety and reliability risks (e.g., overhead, underground, or substation), and environmental risk impacts.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative: The main benefits of successfully implementing this initiative are:

- A portfolio of work that drives toward reducing risk and improving the experience for PG&E's customers across multiple benefit or value categories and across multiple asset and work types within a variety of constraints.
- Provides visibility to how PG&E is allocating our human and financial resources across multiple programs/initiatives.
- Allows for continuous improvement as individual risk models evolve – whether they be at the circuit level, asset level or program level.
- Provide a basis for various regulatory and other external reporting requirements.

Relation to and Impact on Other Initiatives:

PG&E's investment planning process aims to continuously improve safe and reliable operations in compliance with legal and regulatory requirements while maintaining reasonable customer costs. PG&E's total portfolio of work includes funding for

response to emergencies and customer outages, new customer requests for service, electric asset maintenance, compliance with regulatory requirements, and system operations. Risks considered when funding these various needs include wildfire, asset-failure safety and reliability risks (overhead, underground, substation and other asset failure), and environmental risk impacts.

To allocate the human and financial resources in a way that provides customers with the highest value, PG&E's prioritization methodologies have continued to evolve. Currently, PG&E is using a methodology called the "Loading Order," which aligns work in the portfolio with our primary risk or value driver. The Loading Order categories are:

1. Work that prevents wildfire ignition;

2. Overhead Assets (with strong Safety link);

3. Emergency Preparedness;

4. Underground/Network (with strong Safety link);

5. Compliance/Commitments (with strong Safety link) (Mitigates System Wide failure risk);

6. New Business and work at the request of others;

7. General Rate Case (GRC) Commitments;

8. Compliance/commitments (low Safety risk); and

9. Reliability (low Safety risk).

PG&E is piloting a value framework methodology with the goal of improving safety and reliability while controlling costs. A value framework incorporates a variety of inputs across multiple asset and work types to develop analysis for scenarios to allocate workforce and financial resources within a variety of constraints and across multiple benefit or value categories. This methodology will aid in driving decisions on how to best allocate resources.

As risk modelling for specific asset and program types continues to evolve and improve, PG&E will integrate those model outputs into the value framework to provide analysis on how to prioritize and optimize our total electric capital and expense portfolio.

The financial planning process also leverages affordability initiatives that find cost efficiencies with the goal of maximizing as much risk-mitigating work as possible without increasing demand on financial resources.

Resource allocation occurs for major working groups, particularly the construction, engineering, and estimating resource groups within Electric Operations' Transmission Operations, Distribution Operations and Major Projects & Programs organizations. These are the primary resources that execute work for, and on, electric assets. PG&E aligns our financial plan and workforce plans we move the plans from a prioritized list of

work to the in-field execution of work. This is critical for PG&E to put forward an affordable, executable plan.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E's portfolio prioritization and resource allocation methodologies take into account risks related to regions or geography by utilizing the outputs of the various program/circuit/asset specific models. PG&E emphasizes wildfire risk mitigation work in our prioritization and planning processes. This work mostly occurs in the HFTD Tier 2 and Tier 3 areas. After high-level portfolio financial allocation occurs, resource allocation is aligned at a systemwide level as well, before more detailed regional resource allocation and execution plans are developed.

Risk Models Used or Other Considerations for Prioritization:

- Investment Planning Seeks input from applicable PG&E Risk Models such as the Wildfire Distribution Risk Model (WDRM).

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, our risk teams expanded Risk Spend Efficiency (RSE) Scores from 54 risk mitigation and control programs to 286 (see Section 7.3.8.3). Additionally, Electric Operations completed the first phase pilot of the value framework pilot for our Transmission Capital portfolio. The Investment Planning team continues to expand development of the value framework on a program-by-program basis from Q4 2021 into 2022 on Distribution and Transmission Capital with the potential to utilize the value framework in 2022 for 2023 workplan prioritization analysis.

Lessons Learned:

- The Transmission Capital Pilot suggests that PG&E continues to develop program specific value framework methodologies and also use Loading Order as primary cross-program prioritization and allocation methodology.

- The balance of prioritization frameworks across multiple objectives needs further testing with more portfolios for consideration and will be re-visited in 2022 as part of an integrated planning approach.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We do currently plan to continue to develop value framework methodologies for each program in the Electric Portfolio, as well defining an integrated process that evaluates all risks across the electric system.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term improvements (2023-2028) – Expand the programs for which the investment planning team can utilize tools such as the value frameworks for the entire Electric Portfolio with potential to expand beyond electric portfolio: In the next two to three years, we will expand implementation to include electric's expense portfolio with the intent to move away from the Loading Order methodology. Beyond the two to three year timeframe, we may expand use of value framework beyond the electric portfolio to include gas, generation and other areas of PG&E.

Continue to incorporate program-specific risk-modelling outputs into value framework to enhance the accuracy of cross-program budget allocation analysis. As program-specific risk models evolve continue to update the to align the value framework inputs for broader portfolio-wide financial and human resource allocation.

Incorporate circuit-based and asset-based risk methodologies into prioritization methodology. This would allow for more efficient use of financial and human resource supply to identify more opportunities for mitigating multiple risks by aligning work geographically, on circuits across multiple programs and asset types.

Evolve the electric planning and strategy process, with the goal to address multiple needs facing the electric system. Consideration of current and future needs will deliver the greatest value in risk reduction and other customer benefits for every customer dollar invested.

7.3.8.2 Risk Reduction Scenario Development and Analysis

OEIS Initiative Definition: Development of modeling capabilities for different risk reduction scenarios based on wildfire mitigation Initiative implementation; analysis and application to utility decision making.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

Risk models, such as the 2021 WDRM v2 and 2022 WDRM v3, allow PG&E to understand current risk scores, as well as potential mitigated risk scores, if wildfire mitigation programs were undertaken at a locational level. For example, if an estimate of risk exists for certain equipment, it is possible to estimate how much risk reduction will occur if the equipment is replaced. The 2022 WDRM v3 has the ability to model risk reduction based upon scenarios of equipment replacement. Apart from the 2022 WDRM v3, other models are developing this capability, and in the meantime, standalone analysis that incorporates data and subject matter experts is undertaken to estimate risk level changes if initiatives are undertaken. These analyses, which then lead to the calculation of RSEs, are used to inform workplans and facilitate decision making by quantifying risk at the equipment, circuit segment, and circuit level. Risk models also provide the risk reduction potential provided by mitigation alternatives to aid in identifying the most effective mitigation for locations along the electric transmission and distribution system.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Focus mitigations on highest risk locations – Wildfire mitigation workplans will be able to improve quantification of the risk reduction provided by each mitigation by type.

Relation to and Impact on Other Initiatives:

- System Hardening (Underground and Overhead) – Risk mitigation values for system hardening can be identified along the distribution system in order to identify locations where system hardening is most effective in reducing wildfire risk.

- Vegetation Management – Risk mitigation values for Enhanced Vegetation Management (EVM) and other vegetation mitigations can be identified along the distribution system in order to identify locations where vegetation work is most effective in reducing wildfire risk.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: This initiative enables improved prioritization of mitigation workplans to the highest risk or consequence areas. Because the output of the 2022 WDRM v3 and the Wildfire Transmission Risk Model (WTRM) are geospatial, there is flexibility in how work is prioritized. The prioritization can occur at the HFTD area level, all the way down to the size of the geospatial grid output, which is 100m x 100m.

Risk Models Used or Other Considerations for Prioritization:

- WDRM – For System Hardening, subject matter expert (SME) input from Public Safety Specialists (PSS) and Distribution Engineering teams could modify mitigation selection or prioritization as a result of known conditions not assessed by the WDRM (e.g., depth to bedrock for UG, or local conditions including topography, ingress/egress, etc.). For EVM, Vegetation Inspections and Customer Commitments/Permitting could influence prioritization and work bundling.

- While not adversely impacting prioritization of deployment, permitting, customer permissions, and potentially right of way access could impact timing of mitigation deployment.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

New features in the 2022 WDRM v3 are described in Section 4.5.1(b).

Impacts:

- Going forward, relevant workplans will be based on 2022 WDRM v3 and therefore will be based on improved modeling.

Lessons Learned:

- Modeling capabilities will be applied to develop the 2023 workplans.

Current Year Activities (2022):

While we have not set specific targets for this initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We also plan to update the SME informed mitigation effectiveness factors.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – Continued improvements to modeling will allow PG&E to assess pre and post-mitigation Multi-Attribute Value Function (MAVF) scores, as well as RSE values at the project location level. PG&E will focus on building out the modeling of risk drivers, improving the granularity of the model results, and providing risk reduction values for mitigation alternatives. Over the next three to 10 years, as these focus areas are achieved, the continuous improvement of the wildfire risk models will shift to a steady state improvement approach primarily driven by improvements in input and training data. As we continue to develop and enhance a more formalized long-term perspective, these data improvements will enable model granularity to evaluate the risk down to the span and asset level.

7.3.8.3 Risk Spend Efficiency (RSE) Analysis

OEIS Initiative Definition: Tools, procedures, and expertise to support analysis of wildfire mitigation initiative risk spend efficiency, in terms of MAVF and/ or MARS methodologies.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

The problem to be addressed with this initiative is the ability to compare potential risk-reducing initiatives to each other to better understand the amount of risk reduced for the dollar spent. This is a foundational activity in order to actively monitor and measure wildfire and PSPS risk mitigation and is used to support PG&E's decision-making process.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- An important benefit of performing RSE calculations is the process itself. Creating RSEs gives an opportunity for PG&E to develop a more rigorous approach to how potential activities may help to reduce risk. These processes: stimulate conversation between internal stakeholders, help to develop the necessary data collection to support the efforts, and ensure that financial teams are closely associated to the specifics of the mitigations. In short, the creation of RSEs foster a culture of quantitative analysis for risk-based decision making.

- RSE calculations are produced using PG&E's 2022 Enterprise Risk Model (2022 ERM) and are used to quantify risk reduction versus spend for various initiatives.[105] The quantitative assessment supports the WMP, Risk Assessment and Mitigation Phase (RAMP), and GRC filings. While RSEs are reported in these regulatory filings, continued developments and lessons learned are gained through these processes, fostering next steps in ongoing risk proceedings at the Commission and working groups facilitated by Energy Safety to mature the process of risk spend efficiencies.

- RSEs support the selection of initiatives.

- Although RSEs are useful in decision making, there are other considerations in determining the prioritization of programs and initiatives. PG&E views RSE as one

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105 PG&E used the RSE Lite Tool, a model that uses outputs from the 2022 ERM to calculate RSEs. For a detailed description of the RSE Lite Tool, see PG&E's RSE Lite Tool Documentation and User Guide, available in 2022-02-25_PGE_2022_WMP-Update_R0_Section 4.5.1_Atch01.pdf.

tool to evaluate risk initiatives and uses it as one input into the overall decision-making process.

Relation to and Impact on Other Initiatives:

The calculation of RSEs have a relationship with all other activities that also have RSEs calculated. This relationship allows for activities with RSEs to be compared quantitatively with each other to assist in decision making.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: RSEs are typically calculated at the region level, by using the HFTD areas as tranches. These tranches allow separate analysis of initiatives for each HFTD area. However, the decision to perform an RSE calculation is not based on region.

Risk Models Used or Other Considerations for Prioritization:

- The application of the Enterprise Risk Model is discussed in Section 4.5.1(a).

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

2023 GRC: Additional RSEs covering PG&E's risk control and mitigation programs expanded to 286 in the 2023 GRC Application.

RSE Validation: With RSEs being developed, PG&E is in the process of implementing an additional review of RSEs as part of our verification process to enable governance and benchmark-ability across the industry.

Impacts:

- PG&E has engaged a third-party technical advising group that is performing an assessment of RSE methodologies used in the WMP, as well as provide recommendations for future WMP filings.

Lessons Learned:

- In discussion with other California utilities through working groups or specific initiative benchmarking calls, there is still variability in each utilities' representation of risk scores and effectiveness for RSE calculation.

- PG&E is forming an RSE Governance team that is tasked with developing standards of RSE implementation across the enterprise. These standards will be communicated to SMEs involved in the WMP to ensure a consistent application of RSE-related items. This ensures comparability within PG&E and makes cross-utility comparisons more likely.

Current Year Activities (2022):

See Table PG&E-7.3.8-1 below for current year activities (2022).

TABLE PG&E-7.3.8-1:
2022 RISK SPEND EFFICIENCY TARGETS

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
H.01	Risk Spend Efficiency – Develop and Share Governance Process	Develop and share RSE Governance Process with Energy Safety.	9/30/2022	Qualitative

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – RSE calculations are being reviewed by a third-party technical advising group to challenge the SMEs on any assumptions and how to use potential data to refine effectiveness and scope calculations and to continuously improve our quality.

In addition, we will be actively participating in the RSE working group facilitated by Energy Safety. This development feeds into the overall Enterprise Risk Model used for RSE calculations and will drive improvements as part of the Safety Model and Assessment Proceeding (S-MAP), subsequent filing for RAMP, and the GRC.

7.3.9 Emergency Planning and Preparedness

7.3.9.1 Adequate and Trained Workforce for Service Restoration

OEIS Initiative Definition: Actions taken to identify, hire, retain, and train qualified workforce to conduct service restoration in response to emergencies, including short-term contracting strategy and implementation.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – Public Safety Power Shutoff (PSPS)

The Preparedness and Planning for Service Restoration wildfire risk mitigation strategy focuses on training to support safe and efficient service restoration following emergencies, while providing for and maintaining procedural compliance and adherence. PG&E has a large, geographically distributed workforce that can mobilize throughout the service territory in response to emergency events. To ensure our responders are prepared, PG&E will use a relevant and rapid training approach to build and maintain an internal workforce that is in a state of readiness, with skills and abilities to react and respond to any incident within the service territory.

In addition, mutual assistance can provide additional personnel, equipment and materials to support the restoration efforts during emergencies. Pre-planning for these resources is important to ensure personnel can be deployed quickly, as needed.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce duration of events (PSPS/ Enhanced Powerline Safety Settings (EPSS)) – A primary benefit of having a ready and trained workforce is the capability to respond to emergency restoration events safely and effectively which facilitates a reduced restoration time.

- Reduce duration of events (PSPS) – Mutual assistance is an effective tool used by utilities to provide emergency response assistance in support of one another. During an emergency, mutual assistance allows us access to additional personnel, equipment, and materials to supplement internal resources and increase the speed of restoration. Restorations may be delayed for communities without mutual assistance.

Relation to and Impact on Other Initiatives:

- PSPS – Throughout our service territory, we conduct field exercises preparing utility personnel to restore services after emergencies. In preparation for the exercises, PSPS-0001WBT PSPS Restoration Process and PSPS-0002WBT PSPS Execution for DCC Operators will be completed by personnel in advance to ensure compliance

with PSPS-1000P-01 (Public Safety Power Shutoff for Electric Transmission and Distribution) which provides focused alignment with the overall PSPS efforts.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PSPS and/or other hazard events are geographic emergent activity dependent. While PSPS events would include High Fire Risk Area areas, other wildfire event locations could include additional geographical areas (i.e., system-wide). Training will be developed and provided to impacted and potentially impacted groups system-wide to deploy additional resources as needed.

Mutual assistance is not prioritized based on region, but rather where an emergency event is located and if additional support is needed.

Risk Models Used or Other Considerations for Prioritization:

- Operability Assessment – An exception to prioritization would be if a real-life event occurred in the scheduled geographic area and local personnel were deployed to support the event.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PSPS-0001WBT Restoration Process and PSPS-0002WBT PSPS Execution for DCC Operators training were 100 percent completed in November 2021.

Impacts:

- PSPS Restoration Operational Emergency Centers (OEC) personnel were familiar with the updated procedures and expectations in alignment with PSPS-1000P-01 (Public Safety Power Shutoff for Electric Transmission and Distribution) which facilitated implementing the standards and procedures.

Lessons Learned:

- The lesson learned from a field operations training perspective is that the more we prepare for an operation the better the operation performs.

The G197/IS368 Access and Functional Needs (AFN) training was 100 percent completed by September 1, 2021. The Incident Command System (ICS) 300/400 Q2 EOC cohort was 100 percent completed by November 17, 2021. Phase 1 5 Web-based Standardized Emergency Management System (SEMS)/ICS training was 100 percent completed by December 31, 2021.

Impacts:

- EOC Command and General Staff were familiar with the needs of the AFN community.
- EOC Command and General Staff were familiar with the ICS construct and core principles.

Lessons Learned:

- Lessons learned from an EOC perspective, awareness of AFN supports whole community recovery.
- Lessons learned from an EOC perspective, the use of the ICS framework aligns PG&E with our public partners in a coordinated response. PG&E is required to implement SEMS/ICS in several regulatory commitment including:
  - General Order (GO) 166 Standard 1D was updated in May 2021 to require all investor-owned utilities (IOU) to adopt the SEMS which includes ICS;
  - GO166 Standard 3.C requires PG&E to annually train designated personnel (interpreted as those holding roles in the EOC) to support response to emergencies; and
  - PSPS Ordering Paragraph 15 requires the IOUs to implement SEMS/ICS.[106]
- Due to the duplicative nature of the commitment, Emergency Preparedness and Response (EP&R) will not include a SEMS/ICS training commitment in future WMPs and continue to report compliance in existing regulatory process.

As of December 31, 2021, PG&E hired 41 Linemen and 123 Apprentice Linemen, exceeding our target for staffing for support service restoration by one Lineman and 23 Apprentice Linemen, respectively.

Impacts:

- Our current hiring strategy is performing well and achieving our targets.

Lessons Learned:

- More frontline apprentices and Lineman are needed to continue with steady state work in future years.

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106 The OP at issue requires the IOUs to adopt SEMS/ICS as a framework for our PSPS response. SEMS has four key components: (1) the incident command system; (2) multi/inter-agency coordination; (3) mutual aid; and (4) the operational area concept. PG&E complies with these concepts through the adoption of the four components, all of which are included in the Company Emergency Response Plan (CERP).

In 2021, PG&E continued to maintain mutual assistance agreements through the California Utilities Emergency Association (CUEA), Western Region Mutual Assistance Association (WRMAA), Edison Electric Institute (EEI), and American Gas Association (AGA).[107] We also compiled the profile information for these industry partners to support an efficient regional deployment of resources when needed.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

ICS/SEMS EOC activity arises from and its progress is being tracked and/or reported consistent with a regulatory requirement in annual GO 166 filing to SED as required in GO 166 Standard 11.

We will continue to maintain our mutual assistance agreements in compliance with all our regulatory and statutory requirements.

5) Future improvements to initiative—include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028) – Collect data from After Action Reviews (AAR) post-exercise and post-events to update training: Identify gaps in training and performance to address in training to deliver relevant, just-in-time training to prepare for future events.

Update training in alignment with PSPS-1000P-01 (Public Safety Power Shutoff for Electric Transmission and Distribution): Standardized response and performance from PSPS restoration field operations

Conduct hiring strategy meeting with key stakeholders: Identify new/improved attraction and retention strategies to get more Lineman into the Company.

107 Pursuant to the requirements of Public Utilities Code Section 8386(c)(16) and GO 166.

7.3.9.2 Community Outreach, Public Awareness, and Communications Efforts

OEIS Initiative Definition: Actions to identify and contact key community stakeholders; increase public awareness of emergency planning and preparedness information; and design, translate, distribute, and evaluate effectiveness of communications taken before, during, and after a wildfire, including Access and Functional Needs populations and Limited English Proficiency populations in particular.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Community outreach and public awareness is a key component of emergency planning and preparedness to ensure customers and communities are informed and adequately prepared prior to a wildfire. PG&E strives to deliver effective communications before, during and after a wildfire.

To further explain PG&E's community engagement approach related to emergency planning and preparedness, we have broken up this section into the following categories:

1. Before wildfires;
2. During wildfires; and
3. After wildfires.

1. **Before Wildfires:** General Order 166, Standard 1 requires PG&E to prepare an emergency response plan ("Plan") setting forth anticipated responses to emergencies and major outages, including wildfires. For more information, please see Section 7.3.9.4.

   Please see Sections 7.3.10.1 and 7.3.10.3 for details regarding PG&E's actions to: (a) identify and contact key community stakeholders; (b) increase public awareness of emergency planning and preparedness information; and (c) design, translate, distribute, and evaluate effectiveness of communications taken before wildfires. Our engagement with community stakeholders on our wildfire mitigation activities includes emergency event preparation overall, which includes wildfires.

2. **During Wildfires:** PG&E follows the established emergency communication framework outlined in our CERP,[108] GO 166 standards, and the Electric Emergency Plan. PG&E uses notification systems to alert customers of an electric outage caused by planned or unplanned outages, such as those related to wildfires. PG&E also alerts Public Safety Partners. The notification systems we utilize send automated notifications via calls, text messages, and email to notify recipients of major events affecting their area and at key milestones. Notifications provide incident-related updates if long duration outages are anticipated, which may include the cause of the outage, estimated times of restoration, and notification once power is restored (where possible). Like our PSPS customer notification protocols, PG&E offers customers a choice for these notifications of their preferred communication channel (i.e., Interactive Voice Recording call, email, text). Customers with language preference selected in their PG&E accounts receive in-language notifications. If a customer has set their notification preferences to receive outage related updates, a customer will receive automated notifications with status of the outage. See Section 8.2.5 for additional information related to PSPS event notifications.

   PG&E also provides situational updates to customers and communities via our website, broadcast media (e.g., radio and TV), and social media (e.g., Twitter and Facebook). PG&E personnel are available 24/7 for media interviews when requested during an event. See Section 8.2.5 for additional information related to additional multi-channel outreach and engagement during PSPS events.

- Agencies and Critical Facilities – PG&E recognizes the importance of ensuring that agencies and critical facilities have the necessary information during emergency events in order to prepare their own resources, communication channels, and response to community needs. During emergency events, PG&E follows ICS and National Incident Management System structure and protocols to ensure that public safety partners receive timely and appropriate information during PSPS events and other emergencies.

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108 See Electric Annex to CERP.

Specifically, the Liaison and Customer Strategy Officer Command Staff functions within PG&E's EOC and local OEC prepare and disseminate key information to agencies and critical facilities during events. In addition to automated notifications and information available through online tools, the teams also work directly with these stakeholders to answer questions in real-time and solicit feedback to ensure that localized and ad-hoc requests during emergencies are fulfilled in a timely manner. Please refer to Section 8.2.3 for more information on how PG&E structures the EOC to provide agencies and critical facilities with key information during a PSPS event. This same protocol would be followed for other types of emergencies, with considerations specific to that emergency, under the guidance of the Incident Commander.

PG&E establishes communications with critical facilities such as local water districts, telecommunications infrastructure providers, as well as CBOs, using similar protocols in place for PSPS related communications.

Additionally, PG&E invites County OES and federally recognized tribal leaders to workshops that review PG&E's emergency response plans and solicit feedback. This ensures coordination and alignment during the planning process and through execution of emergency events.

- Red-Tagged Customers – PG&E implements our Emergency Consumer Protection Plan to support eligible customers when the Governor of California or President of the U.S. issues an emergency declaration for a disaster that results in the loss or disruption of the delivery or receipt of utility service and/or results in the degradation of the quality of utility service.[109] In these cases, PG&E partners with fire, emergency services, and county representatives to verify premises that are "impacted" or "red-tagged." PG&E flags "impacted" customers within two miles of the disaster-impacted perimeter area as designated by CAL FIRE or Cal OES or other governmental agencies. An account may carry a "red-tagged" flag because the premise has been deemed dangerous or unfit for human habitation by a government agency, and/or because PG&E's infrastructure was damaged beyond short term restoration capabilities by the disaster, both resulting in the premise being unserviceable.

  These customers will receive a notice from PG&E to help raise awareness of the customer protections that will be available to them (see Section 7.3.9.3 for more details on the consumer protections available to customers). The notice will also include information on how to access in-language support for customers with limited English proficiency. See Section 8.4 for more information on prevalent languages in PG&E's territory.

3. **After Wildfires:** Once a wildfire is fully contained, ongoing communications efforts will continue to ensure key stakeholders and customers have the most up to date information about PG&E's response, rebuild and recovery efforts. Please see

[109] D.19-07-015, OP 2.

Section 7.3.9.3 for details on PG&E rebuild and recovery customer resources and consumer protections for customers impacted by wildfires.

Throughout the year, PG&E collects feedback to evaluate agency and customer awareness, understanding, satisfaction, and experience, regarding wildfire safety preparedness and PSPS. This includes quantitative and qualitative research, such as surveys, fora, and other types of direct customer and agency feedback, and by tracking customer engagement (e.g., web traffic, click-through-rates of advertisements, and conversion rates/actions taken by customers as a result of the outreach). Additionally, we gather customer feedback across multiple channels including web surveys, contact center calls, text, and e-mail notification responses, live chat focus groups, and select social media posts. We will adjust as needed to ensure the effective use of available outreach channels.

PG&E provides more details on our qualitative and quantitative research around CWSP, wildfire safety, and PSPS preparedness in Sections 7.3.10.1 and 4.6 Issue 5.9A.

Relation to and Impact on Other Initiatives:

- PSPS
- Enhanced Powerline Safety Settings (EPSS)

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E conducts outreach to customers, agencies, CBOs, and communities throughout the entire service territory. As mentioned previously, PG&E customizes agency outreach based upon agency need. The level of customization will vary according to multiple factors such as community or agency preference, prior PSPS and EPSS impact prioritization of wildfire mitigation plans, and wildfire impacted jurisdictions. The most impacted agencies will receive the most customization in terms of localized topics covered and type of engagement. These agencies are often located in HFTD areas.

Risk Models Used or Other Considerations for Prioritization:

- No Risk Models are used for the Customer Care/Agency Sections.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Section 7.3.10.1 describes our progress on this initiative since the last WMP submission.

Impacts:

- COVID-19 considerations and other unforeseen factors may also have an impact on PG&E's outreach approach for 2022.

Lessons Learned:

See Section 7.3.10.1 for lessons learned related to actions taken to:

- Identify and contact key community stakeholders;
- Increase public awareness of emergency planning and preparedness information; and
- Design, translate, distribute, and evaluate effectiveness of communications taken before, during, and after a wildfire, including Access and Functional Needs populations and Limited English Proficiency populations

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

Activities we will perform in 2022 are described in detail in Section 7.3.9.3 for all emergencies and Section 7.3.10.1 for wildfire mitigation.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028) – As new information, best practices, and lessons learned are available, PG&E will refine stakeholder outreach and community engagement approach as we have done over the course of three years.

7.3.9.3 Customer Support in Emergencies

OEIS Initiative Definition: Resources dedicated to customer support during emergencies, such as website pages and other digital resources, dedicated phone lines, etc.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

Electric service is a critical resource for customers and when it is disrupted due to an emergency, it is important that PG&E provides information and resources that help customers mitigate the impact to the furthest extent possible.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Waive deposit requirements for affected customers seeking to re-establish service and expedite move in and move out service requests – PG&E waives security deposit requirements to reestablish service for customers whose home(s) or small business(es) were destroyed by the disaster. In addition to offering this protection, PG&E notes that the Commission adopted D.20-06-003 in June 2020, which prohibits PG&E from requiring re-establishment of service deposits from residential customers.[110] PG&E stopped requiring such deposits from customers, consistent with D.20-06-003.

  In accordance with our Emergency Consumer Protection Plan, PG&E also allows customers whose homes or businesses were red tagged- and had been served under a rate that has since been closed to new customers, to reestablish service under their prior rate schedule at their current location or an alternative location, regardless of the current applicability of their prior rate schedule, as long as the rate schedule is still available and has not been retired.[111]

  D.19-07-015 also requires PG&E to expedite move- in- and move-out service requests for affected customers.[112] PG&E expedites these requests based on the date requested by the customer.[113] Consistent with our Emergency Consumer

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[110] D.20-06-003, OP 9.

[111] The Commission approved PG&E's proposal in AL 4014 G/5378 E to revise Electric Rule 12 to allow customer to reestablish service under a prior rate schedule as part of our Emergency Consumer Protection Plan.

[112] D.19 07 015, COL 14.

[113] This does not include any meter sets, including multi-unit meter sets or any other requests that require inspections, and/or criteria as required in the PG&E Electric and Gas Service Requirements Handbook.

Protection Plan, PG&E also waives the cost for temporary power under Electric Rule 13 for affected customers.[114]

- Stop estimated usage for billing attributed to the period when a home/unit was unoccupied due to a disaster – During natural disasters, PG&E identifies general areas that were evacuated and recalibrates our approach for any bills in the area requiring estimation.

- Discontinue billing and prorate minimum delivery charges – PG&E identifies premises of affected customers whose service has been disrupted or degraded and discontinues billing these premises without assessing a disconnection charge. PG&E also prorates any monthly access charge or minimum charges for affected customers.[115]

- Implement payment plan options, including customers with employment impacted by a disaster – Following a disaster, PG&E offers impacted and red tagged customers our most lenient payment arrangement term, which requires a 20 percent down payment and a repayment period of 12 months. Customers are eligible to pay off their arrearage sooner if preferred.

  In addition, customers who indicate that their employment was impacted by the disaster are also eligible for favorable payment plans.[116]

- Suspend disconnections for non-payment, waive deposit and late fee requirements – PG&E suspends disconnections for all red tagged- customers for up to 12 months from the Governor or President's emergency proclamation.[117] PG&E waived deposits as described previously and clarifies that it does not charge late fees.

- Support for low-income customers – PG&E provides support for low income customers, including freezing California Alternate Rates for Energy (CARE) eligibility standards and high usage post enrollment verification requests, increasing the assistance cap for emergency assistance program, and modifying qualification requirements for the Energy Savings Assistance Program by allowing customers to self-certify they meet income qualifications. PG&E leverages our CARE community outreach contractors to inform customers of the protections available to them. Additionally, PG&E coordinates with the program administrator of the Relief for Energy Assistance Through Community Help (REACH), a PG&E and customer funded emergency assistance program, to request increasing the assistance cap

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114 The Commission approved PG&E's proposal in AL 4014-G/5378-E to add waiving fees for temporary service to our Emergency Consumer Protection Plan.

115 D.19-07-015, p. 21.

116 The Commission approved PG&E AL 4145-G/5643-E on October 30, 2019. This AL revised PG&E's Emergency Consumer Protection Plan under Gas and Electric Rule 1 in compliance with D.19-05-037, OP 24.

117 Note that due to the COVID-19 pandemic and pursuant to Res.M-4842, PG&E suspended disconnections for non-payment for all residential and small business customers through September 30, 2021.

amount for red tagged customers. This assistance allows customers who lost their homes to receive additional financial assistance to pay their current utility bill or to set up new service. PG&E informs all REACH agencies of this financial support for customers.

- Offer repair processing and timing assistance and timely access to utility representatives – D.19-07-015 requires PG&E to offer repair processing and timing assistance and timely access to utility customers pursuant to CPUC Section 8386(c)(18).[118] PG&E works with the impacted community to communicate priorities and timelines for repairs and restoration. Specifically, PG&E calls red tagged customers directly to notify them of the protections available and to provide a single point of contact at PG&E for related support. This includes providing information on the process for receiving temporary power. In addition to directly contacting red tagged customers, impacted- customers have access to utility representatives through multiple channels, such as PG&E's call center, public affairs and customer account representatives, and field teams.

- Consumer protections for Net Energy Metering (NEM) customers[119] – In the event a NEM customer is impacted by a natural or man-made disaster, PG&E allows the customer to:

  1) Size their replacement generating system to produce no more than the expected annual usage (kilowatt hours-) of their new premises and remain on their original NEM or NEM2 tariff;[120]

  2) Be exempt from paying interconnection application fee when reapplying to resume service on NEM2 (with some restrictions); and

  3) Identify on the application form that they are disaster impacted customers to benefit from these provisions.

A) Rebuilding After a Wildfire

We are committed to helping our communities throughout the rebuild process. During and after a wildfire, we want to help ensure our customers' and our communities' safety. We prioritize restoring service in wildfire zones as soon as it is safely possible. PG&E has resources and programs in place to help our customers through this difficult process. For example, we have established single points of contact for customers seeking to rebuild after wildfires. Our Building and Renovation Services department works directly with customers impacted by wildfires who need temporary power to rebuild structures or live on their properties, and subsequent permanent electric and

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[118] D.19-07-015, COL 15.

[119] On April 25, 2019, the CPUC approved PG&E AL 5404-E that, through revisions to its tariff provisions in the NEM Tariff and NEM Successor Tariff (NEM2), allows PG&E to offer these additional protections to NEM customers.

[120] The new NEM system is limited to a maximum of 1,000 kilowatts, otherwise it is required to move to the successor tariff (NEM2). The customer must comply with the NEM or NEM2 tariff provisions, as appropriate.

natural gas services. As described above in the discussion on customer protections, PG&E assists customers affected by wildfires by waiving the fee for connecting temporary power. Additionally, PG&E's offers customers a step-by-step guide on how to safely start their rebuilding journey.[121]

In November 2021, the Commission approved the creation of a new statewide program designed to provide incentives and support owners of residential and multi-family properties in rebuilding lower-carbon, all-electric homes post-wildfire and other natural disasters, called Wildfire and Natural Disaster Program PG&E anticipates this program will be available to customers in late 2022.[122]

B) Customer Communications and Coordination

- Webpages and other Digital Resources – In Section 7.3.10.1, PG&E explains how it uses our website and other digital resources to provide customers and communities with information about emergency related outages and wildfire safety—related messages. In addition, PG&E established a dedicated webpage as an ongoing resource to help raise awareness about the protections available to customers, which is available for customers to use anytime.[123] This webpage is available in all 15 prevalent non-English languages.[124] PG&E also has a dedicated webpage to support customers during and after a wildfire.[125] This webpage includes resources on how to safely return to premises after a wildfire, having power restored and other safety and wildfire program -specific information.

- Contact Centers/Dedicated Phone Lines – PG&E's customer service representatives are available to answer any customer questions or concerns regarding the customer protections. PG&E uses a leading translation service provider in the industry, Language Line Services, to provide translation services in over 240 languages (including 10 indigenous languages) in our Contact Centers. See Section 8.4 for more details on PG&E's in-language support.

- Direct Outreach to Red Tagged Customers – PG&E sends letters to all red tagged customers that provide information on the available protections and direct customers to PG&E's customer protections website for more information. In addition, PG&E has a dedicated team to conduct targeted outreach to highly impacted customers who were unable to receive utility service. PG&E's account representatives contact red tagged customers through outbound calls, personalized emails, and sending brochures with information on how PG&E could help them to rebuild and recover. PG&E also offers the Rebuild@pge.com email box dedicated

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121 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/natural-disaster-rebuilding.pdf.

122 D.21-11-002.

123 https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/consumer-protection.page.

124 Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

125 www.pge.com/wildfiresupport.

to customers going through the rebuild process. This email solution allows customers direct access to PG&E's team of rebuild experts and resources.

- Coordination with Local Government Staff and Elected Officials – During a natural disaster such as a wildfire, PG&E coordinates with local governments on a regular basis by e-mail and phone to provide updates on outage impacts and estimated time of restoration. In addition to these regular updates, PG&E provides additional updates in response to requests from county and city leaders, including elected officials. In addition, PG&E's Division Leadership Team and Government Relations team provides outreach materials with information on available assistance to local governments to share with impacted communities.

  After a wildfire, PG&E coordinates with local cities, counties, and elected officials to support the community's rebuild efforts, as needed and required. Through our Government Relations team, PG&E supports local governments in their rebuild process. For example, PG&E will participate in Town Hall events to provide community members information on PG&E's rebuild process such as customer connections and service planning process, and hazard tree removal policies. Additionally, PG&E proactively obtains the status of city owned electric infrastructure progress to understand and communicate local government implications to the rebuild (e.g., streetlights, lot clearance, permits, street closure, traffic management, water management).

- News Releases – Typically, after a wildfire or other natural disaster, PG&E issues news releases that outline the customer protections. The news releases are circulated to all media outlets in the impacted counties for the best possible reach to applicable customers.

- Coordination with CCAs – PG&E coordinates with CCAs during disasters to share information on customers who are affected and taking service from respective CCAs.[126] Per D.19-07-015 PG&E offers CCAs an automated solution via Electronic Data Interchange (EDI) that allows CCAs to have timely access to a list of impacted and red-tagged customers who they serve. This data is updated daily. CCAs have assigned PG&E Relations Managers who provide proactive, timely updates and communications to CCAs during disasters. These assigned PG&E representatives can be reached by the CCAs at their convenience via phone or email. PG&E uses this process to coordinate with CCAs during disasters.

126 D.19-07-015, COL 18.

Relation to and Impact on Other Initiatives: This initiative can impact PSPS as well as communication during wildfire emergencies.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E offers protections to customers impacted by natural disasters, including wildfires. As such, customers located in those regions (e.g., counties) that have been impacted by the natural disaster are eligible for the protections. PG&E's communications (e.g., webpages) that describe consumer protections are accessible by all customers throughout our territory.

Risk Models Used or Other Considerations for Prioritization:

- No Risk Models for Customer Care Sections
- Emergency Consumer Protections—we are required to provide protections to customers per proceeding R.18-03-011; required to prioritize customers located in regions impacted by natural disasters, including wildfires.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Since establishing our Emergency Consumer Protection Plan in 2019, PG&E has provided customer protections for more than twenty disasters.[127]

Impacts:

- Pursuant to D.19-07-015, PG&E will continue to offer protections for eligible customers impacted by disasters in 2020 for up to 12 months from the date of the emergency proclamation noted above. In addition, PG&E will offer protections for eligible customers impacted by any new disasters in 2021.
- PG&E also filed AL 5744-E on January 24, 2020 to request approval for a pilot program to provide underground electric service pedestals, including installation, to eligible residential customers who request temporary service under Electric Rule 13 for properties impacted by the Camp Fire. The CPUC approved this AL on February 24, 2020.

Lessons Learned:

- Not Applicable

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127 For the full list of proclamations and disasters where PG&E offered protections, see "Emergency Consumer Protection Plan" in PG&E's Electric and Gas Rule 1.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, we will continue to offer consumer protections and rebuild resources, and our communications to support our customers before, during and after a wildfire as outlined above. We will also continue to gather feedback from customers and communities and adjust our approach, as required.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028) – As described in response to questions two and four above, over the next several years, PG&E will continue to evaluate the needs of our customers in order to support them in response to future emergencies and work with the CPUC to seek approval on further emergency protections, as applicable.

7.3.9.4 Disaster and Emergency Preparedness Plan

OEIS Initiative Definition: Development of plan to deploy resources according to prioritization methodology for disaster and emergency preparedness of utility and within utility service territory (such as considerations for critical facilities and infrastructure), including strategy for collaboration with Public Safety Partners and communities.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences – Other – Suppression Capability/Difficulty (in development)

GO 166, Standard 1 requires PG&E to prepare an emergency response plan (Emergency Response Plan) setting forth anticipated responses to emergencies and major outages. The plan will help assure the utility is best able to protect life and property during an emergency or major outage and communicate the scope and expected duration of an outage. The Emergency Response Plan must fulfill requirements set forth in the 14 Standards and sub standards within GO 166, as well as the requirements set out in PUC Section 768.6.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – A well-managed emergency event minimizes potential for additional risks/issues. Incident command system focuses on management by objectives, including efficient emergency incident management.

Relation to and Impact on Other Initiatives:

- PSPS – PSPS Annex is a "response" plan for implementation of PSPS events.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Work is prioritized by Threat and Hazard Identification and Risk Assessment and is prioritized based on highest risks.

Risk Models Used or Other Considerations for Prioritization:

- We use the FEMA-developed risk matrix to prioritize work.
- Our Emergency Response Plan is submitted to the CPUC annually, pursuant to GO 166.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

PG&E's Company Emergency Response Plan (CERP) is created in compliance with PUC Section 768.6 and GO 166, which set out the requirements for utility emergency response plans. In particular, PG&E meets (and exceeds) the biennial outreach requirement of PUC Section 768.6 by interacting directly with county emergency management staff throughout the year, particularly during emergencies. Additionally, all supplemental "Annex" documents[128] are reviewed and updated annually in accordance with GO 166.

In 2021, PG&E updated the CERP and Functional and Hazard specific Annexes in compliance with EMER-2001S. We are also on track with the development of two additional hazard annexes for Tsunami and Extreme Weather.

The FORCE tool (resource calculator) was updated in 2021 to incorporate several key items. These included: patrol calculation was modified to compute based on circuit miles instead of poles, helicopter and ground patrol units patrol speeds were updated based on 2020 actual patrol data and both 2020 and (when available) 2021 pre-flight data, and, in addition, added the patrol method air or ground percentage by circuit. New items incorporated into the FORCE tool included a calculated recommendation on number of helicopters needed for Transmission patrols, based on Transmission Playbook miles impacted, new ability to check for helicopter effectiveness allocation with instructions on how to perform an effectiveness check, added circuit description details to optimize helicopter allocations (and add visibility to ground resource needs without air support).

To support these changes, a FORCE tool usage WBT (web-based training) was created and implemented. These updates and newly incorporated items are intended to allow EOC personnel to use the model to assist in resource allocation decisions and provide feedback on FORCE tool effectiveness for future improvements.

Impacts:

- We added graphics to the CERP and Electric Annex identifying elements that align with GO 166 compliance requirements and Serious Injury *and* Fatality Corrective Actions and this has been valuable for socializing the regulatory and safety aspects of these documents.

Lessons Learned:

- To spread out the annual due dates of the CERP and our Annexes across quarters to ensure adequate time for quality review and aligned due dates for hazard annexes that are seasonal to ensure capture of lessons learned from the specific season.

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128 Supplementary documents to the CERP that cover specific emergency response protocols.

- Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028) – There are no material future improvements planned for this initiative at this time. PG&E will continually improve as new approaches or best practices are identified.

7.3.9.5 Preparedness and Planning for Service Restoration

OEIS Initiative Definition: Development of plans to prepare the utility to restore service after emergencies, such as developing employee and staff trainings, and to conduct inspections and remediation necessary to re-energize lines and restore service to customers.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Secondary Risk: Reliability Impacts – PSPS

PG&E's electric system is a complex set of assets, including transmission lines and distribution circuits, which connect to both internal facilities and external utilities and deliver energy to millions of customers. Qualified and skilled personnel that are properly trained in restoring power after emergencies are essential to eliminate wildfire ignitions, minimize public safety concerns, injuries to employees and damage to public and Company assets.

PG&E provides responding personnel with in-depth training so that electric service is consistently restored to our customers after emergencies in a safe, efficient, and timely manner. This is essential given the size and complexity of our electric system. Responding personnel utilize formal PG&E processes and procedures to ensure that service is restored properly. There are no acceptable alternatives for ensuring procedural compliance while meeting PG&E's key objective of restoring power safely, efficiently, and in a timely manner.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce frequency of all types of ignition events – Reduce potential of ignition following a PSPS weather event by patrolling Transmission and Distribution overhead assets that were identified as "event specific assets at risk" for a given event. See Section 7.3.6.4 for associated protocols.

- Reduce duration of events (PSPS/EPSS) – Reduce duration of PSPS events by utilizing consistent processes for well-trained employees to use for safe and efficient restoration following PSPS events. See Section 7.3.6.4 for associated protocols.

Relation to and Impact on Other Initiatives:

- Ignition Components – Utilize PSPS and associated restoration procedures to mitigate any ignition hazards due to Ignition Probability Weather Model (IPW Model).

- PSPS – Safe and efficient restoration of customers following PSPS events.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The roll out of the policies and procedures to personnel associated with service restoration in conjunction with wildfire mitigation and/or PSPS efforts are completed on a service territory-wide approach, rather than by region or area. This is because over half of the PG&E service territory consists of Tier 2 and Tier 3 HFTD as defined by the CPUC, so all personnel need to be informed and trained concurrently.

Risk Models Used or Other Considerations for Prioritization:

- IPW Model – PSPS Restoration activities are based upon the risk models that led to the execution of a specific PSPS event.
- Challenges and compliance considerations include:
  - Employee safety;
  - Access;
  - Aerial patrols impacted by weather or visibility;
  - Found hazards and damages;
  - Communications coverage during PSPS; and
  - CPUC requirement to restore customers within 24 hours after the "all clear zones" has been provided, as long as it is safe to do so.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

In 2021, both field and control center personnel involved in PSPS events completed training on updated restoration protocols identified in Section 7.3.6.4. In addition, two PSPS Full Scale Exercises were conducted to provide opportunity to utilize the updated restoration protocols. PSPS Segment Guides were also updated to reflect any new remote controlled (Supervisory Control and Data Acquisition) devices that had been installed.

To further reduce wildfire ignition risk during the PSPS restoration process, implemented a new "Customer Owned Line" process that requires customers who own Transmission or Primary voltage level Distribution Overhead facilities impacted during PSPS events to confirm with PG&E that their facilities are both safe and ready to be energized following the weather all clear. The aircraft complement of 65 helicopters as well as two fixed-wing aircraft equipped with MX-15 cameras and capable of night flying were secured for the 2021 season. As with 2020, helicopter assets were made

available for Distribution circuit pre-flights as needed for both training (including familiarization) and to update patrol methodology (i.e., air only, ground only or either) on accompanying PSPS Distribution circuit maps.

Impacts:

Previously provided preparedness and planning activities, combined with the process improvements based upon feedback, lessons learned and event reviews resulted in:

- Field personnel being properly trained to utilize the updated restoration protocols (i.e., “all clear zones”, “all clear forecasts”, etc.) to support restoration activities both safely and more rapidly.
- Applied updated patrol method and mileage to PSPS restoration maps as needed.
- Reduced wildfire ignition risk by requiring customers with customer-owned lines to notify PG&E that their facilities are both safe and ready to be energized following the weather all clear. See Section 7.3.6.4 for full details
- These aircraft were utilized as needed during PSPS events to expedite patrols and restoration activities and supported emergent wildfire events and other activities as they occurred.

Lessons Learned:

- Develop and communicate change management activities incrementally as process improvements are identified; and
- Ensure change management communications includes all level of coworkers involved with PSPS restoration activities.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

We will continue to train employees on the 2022 restoration protocols, conduct field exercises for all impacted divisions, and support pre-flight requests as deemed necessary by field organizations.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028): Electronic PSPS Maps to field: Provide field groups with enhanced situational awareness of the event footprint via visualization. Ability to develop, update and provide more real-time oriented maps electronically rather than the current paper maps. Supports field validation efforts and would include delineation of patrol boundaries along with addition of other layers deemed necessary (i.e., aerial/access hazards, critical infrastructure, active fires, etc.).

Unmanned Aerial Vehicles (UAV) for PSPS patrols: Supplement existing aerial fleet, considerable safety implications by using unmanned aerial vehicles (rather than the helicopters typically utilized currently).

Advanced Distribution Management System (ADMS) automated switching solution for PSPS activities: Consolidate PSPS activities onto a single platform for dissemination to distribution control center and field personnel. Provides for common and consistent data exchange between distribution control center and field personnel. Examples minimally could include providing existing circuit segment guides, switching logs and maps on this single platform rather than using separate programs.

7.3.9.6 Protocols in Place to Learn from Wildfire Events

OEIS Initiative Definition: Tools and procedures to monitor effectiveness of strategy and actions taken to prepare for emergencies and of strategy and actions taken during and after emergencies, including based on an accounting of the outcomes of wildfire events.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences

This initiative helps PG&E to monitor the effectiveness of emergency response to wildfires and other emergencies.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- The AAR process is used by PG&E to summarize observations and key takeaways following an exercise or an actual event that impacts the business and allows the organization to identify strengths as well as gaps in response plans and process that will provide opportunity to continue to improve response for the next emergency event. The result of this initiative will provide external agencies an opportunity to engage in the AAR process to improve coordination with external agencies during a PSPS or Wildfire incident.

- PG&E describes additional evaluation mechanisms employed to assess the effectiveness of PG&E's outreach and communication effectiveness before and after each wildfire season in Sections 4.6 (Additional Issue 5.9.A) and 7.3.10.1.

- The result of this initiative will provide greater visibility from external agencies and utilize the AAR process to identify training gaps, improve processes, and insert areas for improvements into new or current work streams to reduce risk.

Relation to and Impact on Other Initiatives:

- Coordinated response with public agencies supporting whole community recovery.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The completion of AARs is an evaluation of response during exercise or incident/event and a key element of the continuous improvement element of the Preparedness Cycle. GO 166 Standard 3.B requires PG&E to evaluate our response to an exercise or major outage and include the evaluation in the annual GO 166 filing required in Standard 11.

Risk Models Used or Other Considerations for Prioritization:

- The potential impact to the initiative factors on whether the external agencies will choose to participate or not.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

We revised the AAR Standard EMER-2003S, process standard document to modify the process flow using Kaizen effort supported by enterprise line of business subject matter experts. The purpose of the Kaizen activity was to identify and remove obstacles to capture feedback more efficiently. We changed the online automated hot wash form processes and the After-Action Meeting (AAM) to the Corrective Action Meeting (CAM).

Impacts:

- We developed and implemented an AAR procedure resulting in greater alignment with the LOBs and utilizing the AAR process in order to identify training gaps, improve processes, and insert area of improvements into new or current work streams.

Lessons Learned:

- To improve the process, we identified a gap in the current protocol to include external agencies into the AAR process which will be our 2022 Initiative.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, we plan to develop a communications and operations plan that engages external agencies that participate in PG&E exercises and activations for inclusion in after-action reviews.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-term Improvements (2023-2028) – Automation of AAR process: Reduce manual labor of creating the After-Action Report to streamline the process to reduce inefficiency.

7.3.9.7 Other, Mutual Assistance

This PG&E-defined sub-initiative has been removed from the 2022 WMP. For updates on the 2021 progress, please refer to the Q4 2021 Quarterly Initiative Update.

7.3.10 Stakeholder Cooperation and Community Engagement

7.3.10.1 Community Engagement

OEIS Initiative Definition: Strategy and actions taken to identify and contact key community stakeholders; increase public awareness and support of utility wildfire mitigation activity; and design, translate, distribute, and evaluate effectiveness of related communications. Includes specific strategies and actions taken to address concerns and serve needs of Access and Functional Needs (AFN) populations and Limited English Proficiency populations in particular.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Reliability Impacts – Public Safety Power Shutoff (PSPS)

Secondary Risk: Reliability Impacts – Enhanced Public Safety Settings (EPSS)

Working together with agencies and customers is an important part of PG&E's Community Wildfire Safety Program (CWSP). This is to help ensure that communities understand the critical safety work underway in their area and are adequately prepared for wildfire season, and specifically PSPS and EPSS outages.

The goals of our outreach and engagement plan, supported by ongoing evaluation of the effectiveness of our outreach efforts, facilitates the following benefits, among others:

- Identifying and engaging with key stakeholder groups
- Creating alignment between PG&E, customers, agencies, and community needs
- Informing agencies, community-based organizations, and customers of emergency planning and preparedness in their area
- Identifying opportunities to collaborate with key local agencies and community-based organizations in the design and planning of wildfire mitigation work to leverage efficiencies in project execution and/or the pursuit of projects that are closely aligned with community priorities and local emergency planning and preparedness
- Preparing agencies, community-based organizations, and customers for PSPS events and EPSS outages to mitigate the risks associated with those events, especially for our most vulnerable customers
- Aligning the understanding of PG&E's Local Government Affairs Representatives, Public Safety Specialists (PSS), Customer Relationship Managers (CRM), Tribal Relations, and other local engagement teams to efficiently and clearly provide support and timely wildfire mitigation work information to key stakeholders

In addition, PG&E designs, translates, distributes, and evaluates communications before, during, and after a wildfire, including AFN and Limited English Proficiency populations, to help ensure:

- Customers and communities are aware of PG&E's emergency preparedness and resources available before, during, and after a PSPS event or wildfire

- Customers and communities increase their own emergency preparedness based upon effective PG&E communications

There is balanced communication to customer populations, where the most vulnerable populations have more access to information resources before, during, and after a PSPS event or wildfire.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

PG&E develops an outreach and engagement plan for the various stakeholders within our service territory. We recognize that a one-size-fits-all approach to engagement does not necessarily take into account a community's specific priorities, and that localized outreach will better inform and engage stakeholders throughout the territory. Key stakeholders include agencies, including federal, state, local and tribal; critical facilities, such as water agencies, communications providers, and hospitals; community-based organizations; and, customers, including our most vulnerable customers.

While PG&E's engagement for the PSPS program has advanced in maturity, and will remain an area of focus, other key wildfire mitigation programs are driving additional needs for engagement. Throughout the year, we engage with these stakeholders with a focus on emergency planning and preparedness.

To further explain PG&E's community engagement approach for the CWSP, we have broken up this section into the following categories:

A) Strategy and actions taken to identify and contact key community stakeholders;

B) Strategies to increase public awareness and support of utility wildfire mitigation activity;

   1. Agency and Critical Facilities Outreach / Advisory Committees; and

   2. Customer and Community Outreach.

C) Strategy and Actions Taken to Design, Translate, Distribute, and Evaluate Effectiveness of Related Communications; and

D) Strategies and Actions Taken to Address Concerns and Serve Needs of AFN Populations and Customers with Limited English Proficiency.

Please note additional information on outreach conducted during PSPS events is outlined in Section 8.2.5. Customer engagement before, during, and after EPSS

enablement is outlined in Section 7.3.6.8. In addition, emergency planning and preparedness outreach is also described, in part, in Section 7.3.9.2.

A) Strategy and Actions Taken to Identify and Contact Key Community Stakeholders

We understand the importance of identifying and contacting key community stakeholders and aim to work together with stakeholders to inform them of wildfire safety work in their area and address unique, local issues in real time. This is also an opportunity for PG&E to gather feedback and adjust the CWSP to minimize impacts to these groups.

Because public safety partner agencies and other community organizations evolve over time, PG&E must work to keep contact lists updated throughout the year. That is why PG&E has dedicated representatives within our Federal Affairs, State Government Relations, Local Public Affairs (LPA), PSSs, and Tribal Relations departments. These dedicated representatives are solely responsible for identifying and maintaining relationships within federal, state, local, and tribal agencies. These relationships enable PG&E representatives to hear directly from agencies if, and when, there is staff turnover or potentially an additional agency that requires engagement. PG&E representatives make note of these changes throughout the year and embed them in PG&E's internal tracking systems so that new contacts will be automatically included in future outreach engagements and in emergency notifications. There are more than 50 representatives among these groups and those that coordinate closely with local agencies are divided into regions to best serve these stakeholders at a local level. PG&E also has CRMs that coordinate regularly with critical facilities and large businesses and are responsible for identifying and maintaining these contacts.

Our representatives work to build trust with their respective stakeholder groups over time and are equipped to share information and seek feedback on future wildfire mitigation work. While teams engage with agencies and critical facilities on a proactive and as needed basis, there are several established engagement activities that also provide a forum for these stakeholders to learn about our wildfire safety work and provide feedback. This will be addressed further below.

Beyond our existing relationships, PG&E's Customer Care Department has established partnerships with CBOs and AFN entities that assist PG&E in our outreach and engagement efforts. These entities can also assist with identifying stakeholder groups that require additional outreach. PG&E also follows best practice guidelines and seeks input from the other California Investor-Owned Utilities (IOUs) and through our advisory committees to identify additional stakeholders.

For further information on how PG&E identifies and maintains agency and critical facility contact information for PSPS and emergency event notifications, see Section 7.3.9.2.

B) Strategies to Increase Public Awareness and Support of Utility Wildfire Mitigation Activity

Prior to peak wildfire season, PG&E designs and executes a comprehensive wildfire safety and PSPS preparedness community outreach strategy, using lessons learned and feedback received from customers and stakeholders. Further, PG&E conducts

community outreach to educate agencies, customers, and property owners on aspects of our wildfire mitigation practices, such as Enhanced Vegetation Management (EVM), EPSS, community resilience and system hardening, and the role they play in helping to reduce wildfire risks in their communities.

We incorporate multiple platforms and tactics into our engagement approach that enable us to regularly hear and act upon feedback from agencies with an imperative to serve their communities in emergencies, critical facilities, and other key customers, CBOs, and customer associations. We will remain flexible, and we can adjust or customize our approach according to community and customer needs and focus efforts strongly on jurisdictions and geographies most heavily impacted by wildfire mitigation efforts, such as PSPS events and EPSS, while maintaining an inclusive posture for all agencies impacted in prior fire seasons.

Due to the continuing COVID-19 pandemic, PG&E will continue to follow prevailing public health guidelines, including hosting meetings virtually when possible. In years' past, PG&E has been able to collaborate with agencies, critical facilities, and other stakeholders on outreach forums, including designing in-person meetings and community town halls. The COVID-19 pandemic has prevented most in-person engagement efforts for most of 2021 and likely will impact in-person engagements in 2022 as well.

We execute an Emergency Preparedness Safety Awareness campaign to provide education to customers, residents, and communities throughout our service territory. This campaign helps customers and the community prepare for emergency situations and take preparatory measures such as updating contact information to ensure delivery of PG&E notifications and signing up for the Medical Baseline (MBL) program and/or self-certify for Vulnerable Customer status. PG&E takes a collaborative approach to our public awareness initiatives by partnering with local public safety officials and community stakeholders to expand the reach of our activities. PG&E uses the tactics in the sections below to increase public awareness of emergency preparedness.

1. Agency and Critical Facilities Outreach / Advisory Committees – PG&E works closely with agencies and critical facilities to ensure they are informed of PG&E's emergency planning and preparedness resources and actions, and so that PG&E can hear about partners' evolving needs regarding emergency planning and preparedness. PG&E often also relies on these agencies to provide key local guidance and partner with PG&E to gain efficiencies in local wildfire project implementation. For example, a local permit may be needed or PSPS preparedness activities may be required to help minimize customer impacts. That is why PG&E has an extensive outreach plan and dedicated representatives to ensure agencies and critical facilities are informed and have an opportunity to provide feedback. Agencies, critical facilities, and community groups may also directly engage with PG&E customers and communities and can provide additional outreach support to increase awareness and support of utility wildfire mitigation activities.

   Table PG&E-7.3.10-1 below includes the key agency and critical facilities engagements, and the proposed timing of each engagement tactic.

TABLE PG&E-7.3.10-1:
KEY AGENCY, CRITICAL FACILITIES, AND CBO OUTREACH TACTICS AND TIMING

Type	Description	Timing
Ongoing Local Agency Engagement and Coordination	Rather than a one-size-fits-all approach to engagement, PG&E's local teams can provide personalized engagements specific to the local stakeholders' requests on a myriad of topics regarding wildfire mitigation programs. This enables an efficient use of our partner's time and to provide choice in topics and issues that matter most to local communities, at a cadence they prefer.	Ongoing
PSPS Regional Working Groups	Forum for stakeholders to learn key information on the previous wildfire and PSPS season and to share feedback on wildfire safety work, discuss lessons learned and stakeholder concerns, build regional collaboration and incorporate learnings into future wildfire safety and PSPS plans.	Quarterly
Additional CWSP Trainings & Workshops	Ad hoc, or as needed trainings and workshops for agency and public safety partners, based upon agency feedback (e.g., PSPS Portal trainings, deep dive webinars on specific wildfire mitigation topics).	Ongoing and as needed
CWSP Advisory Committee	Select county, city, and tribal governments to provide early feedback and guidance on developments in numerous wildfire mitigation programs, including PSPS and EPSS.	As needed
People with Disabilities and Aging Advisory Council (PWDAAC)	Forum that provides insight into the needs of AFN populations related to emergency preparedness and to facilitate co-creation of solutions and resources to serve the customers reliant on power for medical needs	Quarterly
Other AFN Advisory Councils	Statewide IOU AFN Advisory Council Disadvantaged Communities Advisory Group (DAC-AG) Low Income Advisory Board (LIOB) among others Communities of Color Advisory Group Customer Advisory panels with National Diversity Coalition (NDC) and Communities of Color These are designed to gather customer feedback on our outreach efforts and other important topics impacting low income, disadvantaged, and underserved communities.	Varies
Energy and Communications Providers Coordination Group	Forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate engagement before and during PSPS events	As needed
Key Customer Association Collaboratives	Ongoing engagement, intelligence sharing, consultative support, and contact updating efforts	Ongoing
Ongoing Mitigation Engagement and Coordination	Community based outreach for coordination of wildfire mitigation improvements	Ongoing

- Ongoing Local Agency Engagement and Coordination – PG&E conducts frequent reoccurring engagement with state agencies, counties, cities, tribes, first responders, CCAs, water, wastewater and communication service providers and other local emergency responders and community groups throughout the service area to partner on emergency plans and increase public awareness related to emergency planning and preparedness. This primary engagement method is capable of being more customized to each agency's needs and requests rather than a prescribed approach that does not consider localized issues. This allows for feedback loops where PG&E can continue to engage and update local agencies at a cadence they prefer when progress is made, and new information is available. This ensures that topics covered are relevant and applicable to the agency's needs, and that the timing and cadence of engagements can be well integrated into busy agency schedules. This also draws more engagement and participation from external stakeholders which enable PG&E to have dynamic conversations and find areas of improvement rather than a prescribed agenda and cadence that may not be in the external agencies' best interests.

  These engagements allow for a wide variety of topics to be discussed rather than a set agenda for the entire territory that may not apply to each individual jurisdiction or agency. Examples of some of the topics that PG&E has collaborative engagements with are (but are not limited to):

  - Local resiliency planning
  - EVM line miles planned
  - EPSS program plans
  - Local resources for de-energization, including Community Resource Centers (CRC), CBO assistance, etc.
  - PSPS criteria and strategies for mitigation
  - Undergrounding plans

  To avoid conflicts when agencies may be responding to active emergencies during the wildfire season, PG&E focuses most of our engagement in the months preceding fire season and immediately following the end of fire season. This allows for lines of communication and collaboration when processes are being updated and adapted based on lessons learned from prior fire seasons while getting real-time input from external agencies. The end of season engagements allows for gathering of feedback while fire season events are still fresh in stakeholders' mind and sets up action items for consideration going into the planning phase for the next fire season. This does not preclude PG&E from engaging with external stakeholders when needed during fire season, but this tactic of timing engagements for outside a potentially difficult time to meet for most agencies has led to a more engaged external audience and collaborative solutions. In response to feedback from agency partners on duplicative meetings, PG&E is replacing both of our end-of-season Listening Sessions and our Wildfire Safety Working Sessions from 2021 into these more localized meetings. With respect to Listening Sessions,

agency partners also have the option to provide end-of-season feedback during the Q4 Regional Working Groups.

Part of this outreach includes reviewing the agency's contact information on an annual basis to ensure we are contacting the correct stakeholders during an emergency event. PG&E also conducts annual gas and electric safety training for first responders, including law enforcement, fire departments, and public works and transportation agencies to further align emergency plans with local agencies.

- PSPS Regional Working Groups – As required by Decision (D.) 20-05-051, PG&E hosts quarterly meetings with tribal and local government entities, public safety partners, and representatives of AFN and vulnerable customers[129] grouped into five regions across PG&E's territory. These meetings are structured to enable feedback and information sharing on aspects of PSPS event execution and planning. This includes aspects of PSPS, including CRC planning, communication strategies, information sharing, identification of critical facilities, strategies for supporting AFN communities and contingency plans. PG&E began these Regional Working Groups in Q3 2020 and will continue quarterly meetings in 2022.

  Continuing from our 2021 plan, PG&E has integrated two other agency outreach regulatory requirements with the Regionalized Working Groups: the semiannual meetings required by D.20-06-017 in the Microgrid Order Instituting Rulemaking (OIR) (at p. 46) to discuss electric grid, microgrid projects and the other wildfire safety related topics;[130] and the semi-annual Wildfire Mitigation Meetings requirement by the Investigation (I.) 19-06-015 in the Wildfire Order Instituting Investigation (OII) (at Appendix A, Exhibit C, p. 7) to discuss wildfire mitigation activities and solicit feedback. Every other Regional Working Group will be dedicated to one of the two semi-annual agency engagement meetings described above; this will ensure that each of these meeting types will be held at least twice per year as required.

  The public safety partners included in the Regional Working Groups overlap significantly with the audiences of the Microgrid OIR semiannual meetings and the Wildfire OII semiannual meetings. The Regional Working Groups provide an existing, successful forum to solicit feedback and encourage collaboration on PSPS events, wildfire mitigation activities, and microgrids and other temporary generation that could be leveraged during PSPS.

  Additionally, due to overlapping topics and stakeholders' desires to reduce duplicative meetings, PG&E enabled the Q4 Regional Working Groups to serve as a forum to collect targeted agency feedback on the year's fire season. This provides an open forum at the conclusion on fire season for PG&E to share localized key information on the past season, listen to concerns, gather important

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129 D.20-05-051 at p. 13.

130 See PG&E Advice Letter (AL) 5882-E (at p. 6) filed on July 17, 2020, for more detail on this proposal.

feedback, and identify ways to improve coordination and partnership with local communities going forward.

PG&E uses feedback gained in the Regional Working Groups to guide improvements to our wildfire mitigation activities (i.e., PSPS Portal improvements, PSPS mitigation projects such as sectionalizing and hardening, notifications to customers and agencies, CRC locations and planning, partnerships with CBOs and other topics) and help prioritize key focus areas for the following year.

- PSPS Exercises and Workshops – PG&E's EP&R department hosts PSPS exercises where we test our ability to communicate effectively with our partners during PSPS events, gain efficiencies within roles, and identify possible areas of improvement that PG&E and our partners may undertake in advance of the 2022 fire season. Following the exercises, After Action Reviews are completed to identify adjustments needed to procedures and/or where additional training is required. These PSPS exercises and workshops are a continued best practice in 2022.

- Additional PSPS Trainings and Workshops – PG&E hosts additional CWSP trainings and workshops for public safety partners, as needed. For example, in 2021, PG&E continued regular PSPS Portal trainings in the summer and fall for public safety partners to ensure appropriate users had access and were able to navigate the tool ahead of any PSPS events. PG&E will continue to host PSPS Portal trainings in 2022, outlining improvements made and providing instruction for new users, both before and during wildfire season.

  In designing the scope and content of CWSP trainings and workshops, PG&E prioritizes topics that are most valuable to the jurisdictions most impacted by PSPS and other wildfire mitigation tools, total and unique customers deenergized, impact to critical facilities, and other localized issues that may have caused escalations. In 2021, that led to PG&E creating Deep Dive sessions to provide an in-depth view for stakeholders on topics such as meteorology, updated PSPS criteria including vegetation overstrike, and EPSS.

  In addition, PG&E will host PSPS Portal trainings for Public Safety Partner users and will continue sessions with the PSPS Portal Working Group, comprised of users from each Public Safety Partner category to provide PG&E with ongoing feedback on how the PSPS Portal can be improved. The Portal Working Group will meet on an as-needed basis as it was in 2021.

  PG&E aims to be more customized in our engagement efforts based on the needs of the agency and remain adaptive. PG&E is looking to incorporate additional customized options for agencies, with a focus on those most impacted by PSPS and wildfires, such as:

  - Hosting field tours to view PG&E infrastructure and facilities

  - Co-creating ideas for new tools and processes with agency partners, including enhanced self-serve options for information on wildfire mitigation programs in their areas

- Establishing additional user testing groups to gather real-time feedback as we build new emergency management tools and processes

- Hosting topic specific workshops to provide additional information on PG&E programs, localized drivers of PSPS, wildfire mitigation activities in their communities and other topics of interest

- Partnering with additional external partners organizations to assist with outreach and engagement

- Continuing the practice of enabling external agency representatives to embed in the PG&E EOC during actual PSPS events.

- Advisory Committees – PG&E's advisory groups provide hands on, direct advisory functions related to PG&E's wildfire mitigation strategies such as PSPS and EPSS. This includes helping PG&E develop best practices for PSPS protocols, community preparedness, regional coordination, and the optimal use of existing and emerging technologies.

- CWSP Advisory Committee – PG&E established a PSPS Advisory Committee in 2020, which includes representatives from local and tribal governments. These meetings provide a forum for participants to weigh in on a variety of PSPS program updates such as customer notification scripts, wildfire safety working session content and meeting outlines, and PSPS full-scale exercises, among other topics. The participants in the PSPS Advisory Committee represent the broader local agency community, and they provide PG&E with early feedback on initiatives or resources that are in development. PG&E plans to continue to host these meetings on an as-needed basis in 2022 and will broaden the scope of this advisory committee from PSPS to Community Wildfire Safety, in recognition that PG&E can benefit from Advisory Committee feedback on a variety of wildfire mitigation programs. PSPS will remain in scope of this Advisory Committee.

  In 2022, PG&E will evaluate local and tribal representation on the CWSP advisory committee for diversity of regions and experiences with PG&E's wildfire safety initiatives. PG&E may make adjustments to this committee once that evaluation is complete in early 2022.

- People with Disabilities and Aging Advisory Council (PWDAAC) – PWDAAC consists of members representing a diverse mix of expertise, backgrounds, and perspectives of the AFN population and provides insight into the needs of AFN populations related to emergency preparedness. The Council facilitates cocreation of solutions and resources to serve the customers reliant on power for medical needs before, during and after a PSPS event in PG&E's territory. More details on PWDAAC are included in Section 8.4 and PG&E's 2022 PSPS AFN Plan.

- AFN IOU Leadership Meetings – A continuation of the AFN Panel Discussion included in the California Public Utilities Commission (CPUC or the Commission) Joint IOU PSPS Workshop on March 29, 2021, PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E) together with state and local agency and community AFN leaders established regular meetings. The group discussed how IOUs can better identify and target AFN customers to

ensure unmet needs of AFN customers are addressed during PSPS events. In addition to the IOU Senior Executives, attendees included leaders from State Council on Developmental Disabilities, Disability Rights California, California Foundation for Independent Living Centers, Disability Rights Education and Defense Fund, California Governor's Office of Emergency Services, CPUC, Liberty Utilities, Bear Valley Electric, and Pacific Corp. PG&E will continue to meet with these stakeholders to improve on identification of AFN customers and improve access to resources during PSPS events.

- 2022 AFN Plan Collaborative Planning Team – In Q3 2021, PG&E began the development of our 2022 AFN Plan in accordance with the Federal Emergency Management Agency (FEMA) Comprehensive Preparedness Guide as adopted by the Phase 3 revised guidelines for PSPS.[131] The IOUs have collaborated to align our approach and to enlist a FEMA expert to assist with the development of the structure.

- Statewide IOU AFN Council – PG&E, SCE, and SDG&E established the Joint IOU AFN Advisory Council in 2020 and has continued regular engagement. The Joint Council is a diverse group of recognized CBOs, association and foundation leaders supporting the AFN population, and leaders from various state agencies. It provides insight into the unique needs of the IOUs' most vulnerable customers and stakeholders, offers feedback, makes recommendations, and identifies partnership opportunities to serve the broader AFN population before, during, and after a PSPS and bring consistence statewide. PG&E will continue to meet with these stakeholders and will periodically bring these groups together, along with other stakeholder groups outlined in D.20-05-051, to solicit feedback on the PSPS Program.

- Other AFN Councils – PG&E hosts meetings with the NDC via a quarterly Low-income and Communities of Color Advisory Panel, and an Annual Executive-level meeting. At these forums, PG&E provides safety-related outreach such as wildfire safety, PSPS preparedness and specific safety-related gas or electric projects impacting disadvantaged and underserved communities. The Low-income and Communities of Color Customer Advisory Panels are designed to provide customer feedback on our outreach efforts related to public safety and other important topics impacting low income, disadvantaged, and underserved communities. The Annual Executive Level meeting with the NDC's and PG&E's leadership helps PG&E to better understand NDC members' perspectives and recommendations to improve the effectiveness of PG&E's community outreach and engagement. PG&E also leverages opportunities to share emergency preparedness, and CWSP and PSPS updates at other stakeholder meetings such as the DAC-AG and LIOB among others. Further, we use our network of CBOs to support our AFN stakeholder outreach work, as described in Section 8.4.

- Energy and Communications Providers Coordination Group – PG&E initiated this group in early 2020, to create a forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate

[131] D.21-06-034, Appendix A.

engagement before and during PSPS events. Attendees include, but are not limited to, representatives from AT&T, Verizon Wireless, Comcast, Charter Communications, Frontier Communications, T-Mobile, Consolidated Communications, U.S. Cellular, Sierra Telephone and Cellular Telecommunications and Industry Association. PG&E receives valuable feedback from this group.

- Key Customer Association Collaborative – PG&E regularly meets with key customer stakeholders including large customers, community groups and business associations. PG&E uses these meetings to provide tailored and relevant information about emergency preparedness, local progress on wildfire safety measures, and expanded resources available to prepare for PSPS events.

- Customer and Community Outreach – PG&E continues to engage with customers and communities regarding wildfire safety and with customers who may be directly impacted by a PSPS event and/or EPSS. This effort is to increase public awareness and support of PG&E's wildfire mitigation activity. PG&E prioritizes engagement with those most likely to be impacted by PSPS and/or EPSS, which include those served by electric lines (specifically those served by electric lines 115 kilovolts and below) which traverse Tier 2 and Tier 3 High Fire Threat District (HFTD) areas. PG&E also implements additional touchpoints for MBL customers,[132] those with limited English proficiency, Self-Identified Vulnerable customers, and the AFN community.

  PG&E leverages multiple channels, such as webinars, emails, letters, bill inserts, postcards, radio, and television broadcasting, print media, informational videos, social media, digital engagement (e.g., website), and possibly face--to---face meetings.[133] PG&E will continue direct-to---customer outreach campaigns that are focused on, but are not limited to, building PSPS readiness among customers, gathering updated contact information, and sharing backup power safety tips.

- "Wildfire Safety Town Halls," Webinars and other Community Events – PG&E hosts interactive virtual safety town halls[134] where customers can learn about our work to prevent wildfires, hear about emergency preparedness activities they can take, get answers to their questions, and provide feedback on our wildfire prevention plans and PSPS initiatives. Additionally, PG&E holds webinars for our customers and communities to help them prepare for emergency situations. PG&E provides a target associated with this initiative below. PG&E hosts and/or participates in community events focused on AFN customers, including targeted webinars and participation in meetings hosted by CBOs and state agencies (IHSS/Regional Centers). In 2022, the format and timing of community events will depend on the

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132 MBL customers are PG&E customers who are eligible for MBL tariffs and receive an additional allotment of electricity and/or gas per month. The tariffs are designed to assist residential customers who have extra energy needs due to qualifying medical conditions.

133 As applicable due to the COVID-19 pandemic and safety concerns with large gatherings.

134 Per I.19-06-015, Joint Motion of PG&E the Safety and Enforcement Division of the CPUC, Coalition of California Utility Employees, and the Office of the Safety Advocate for Approval of the Settlement Agreement, pp. 25-26.

public health safety protocols related to COVID-19. When it becomes safe for our customers, communities, and employees to gather, PG&E will review the potential to resume in person- events, based on state and local health guidance.

- Communications for AFN Populations and Limited English Proficiency Populations – PG&E translates "critical information" which includes resources focused on emergency preparedness, wildfire safety, and PSPS preparedness in 15 prevalent non-English languages. PG&E customers with limited English proficiency can contact PG&E any time, whether during an emergency or simply for a bill inquiry and have access to in-language support via our Contact Centers, which are equipped to provide translation support in over 240 languages. Additionally, we have partnerships with CBOs and multicultural media partners to provide in-language outreach spoken by people that occupy significant roles in California's agricultural economy (e.g., Mixteco and Zapoteco). Emergency preparedness materials such as webinar presentations and PSPS notifications are recorded in American Sign Language (ASL) via our collaboration with NorCal Services for Deaf and Hard of Hearing. Our wildfire safety and PSPS customer information and materials are available in alternate formats, including Braille and large print, upon request. Please see Section 8.4 for details on PG&E's communications for AFN populations and limited English proficiency populations.

- Direct to Customer Outreach and Education – PG&E sends direct mail and e-mails to customers throughout the year with information on emergency preparedness resources and reminders to update contact information so PG&E can reach out to customers in advance of a PSPS. PG&E will continue to disseminate educational information through e-mail newsletters or special insert included in customer bills, with an electronic version emailed to paperless customers, if -applicable.

  Figure PG&E 7.3.10-1 includes sample PSPS preparedness brochures, bill inserts, postcards used during PG&E's direct to customer outreach.

FIGURE PG&E-7.3.10-1:
SAMPLE PSPS PREPAREDNESS BROCHURES, BILL INSERTS, AND POSTCARDS

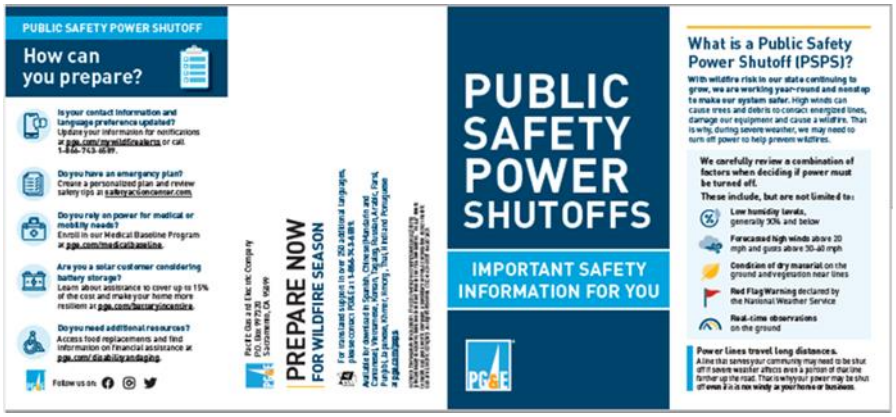


FIGURE PG&E-7.3.10-1:
SAMPLE PSPS PREPAREDNESS BROCHURES, BILL INSERTS, AND POSTCARDS (CONTINUED)

How is PG&E reducing the impact of PSPS events this year?

We know losing power disrupts lives. That is why we are doing even more this year to help customers and communities before, during and after PSPS events. We are:

- **Partnering with community-based organizations** to provide food replacements, portable batteries and hotel stays to qualifying customers and those with medical needs
- **Providing better information** about when power will be turned off and back on, available in 14 languages
- **Offering more options for backup power**, including portable batteries and generator rebates for qualifying customers
- **Preparing additional Community Resource Center sites** to support customers

To learn more about PSPS events, visit pge.com/psps.

SUPPORTING YOU
BEFORE, DURING AND AFTER

BEFORE DURING AFTER

More resources than ever before are available to support customers

- **OUTAGE NOTIFICATIONS** Update your language preference at pge.com/mywildfirealerts
- **LOCAL SUPPORT** Find support and resources from local organizations for access and functional needs at disabilitydisasteraccess.org
- **TRANSPORTATION AND HOTEL ACCOMMODATIONS** Access support provided through local Disability Disaster Access and Resource Centers for those who are power-dependent on medical or assistive technology devices at disabilitydisasteraccess.org
- **REAL-TIME INFORMATION** Stay informed about the event at pge.com/pspsupdates
- **COMMUNITY RESOURCE CENTERS** Find safe locations to go to charge your devices and get basic supplies at pge.com/crc
- **MEAL REPLACEMENTS** Find food for you and your family through local food banks at pge.com/pgeresources
- **RESTORATION UPDATES** Find out when to expect the power back on at pge.com/pspsupdates
- **POST-EVENT FOOD SUPPORT** Find local food banks to access meal replacements up to three days after power is restored at pge.com/pgeresources
- **STAY PREPARED** Restock your supply kit and update your emergency plan at pgeemergencycenter.com

NEW FOR 2021

Self-certify for Vulnerable Customer status | You can now sign up to receive additional PSPS notifications, including an in-person visit if needed, if anyone in your home has a condition that could become life threatening if power is disconnected.

Apply at: pge.com/vcmcases

Address Alerts | Receive notifications about PSPS events for any additional addresses you care about, such as:

- The home of a friend or loved one
- Your child's school or day care
- Your work or business

Enroll at: pge.com/addressalerts

How will you know about a PSPS?

We will share what we know as soon as we can, keeping in mind that weather can be uncertain and change quickly.

You will be notified in advance through automated calls, texts and emails.

Two days before | One day before | Just before | Daily until power is restored

We will also use pge.com, social media, local news and radio outlets to keep you informed and updated.

Make sure your contact information is up to date.
Visit pge.com/mywildfirealerts.

Watch for notifications about potential PSPS events from:

CALLS 1-800-743-5002
TEXTS 976-33
EMAILS PGECustomerService@notifications.pge.com

Save PG&E's number (1-800-743-5002) as a contact in your phone, so you know when we are trying to reach you.

AN IMPORTANT SAFETY MESSAGE

How will you be notified of a Public Safety Power Shutoff?

At Pacific Gas and Electric Company (PG&E), our most important responsibility is the safety of the customers and communities we are proud to serve. That is why we may need to turn off power to prevent wildfires during severe weather. This is known as a **Public Safety Power Shutoff (PSPS)**.

We know how disruptive it is to be without power.

We are listening to our customers and finding ways to reduce the impact of PSPS events, without compromising safety. To learn more, visit pge.com/pspssupport.

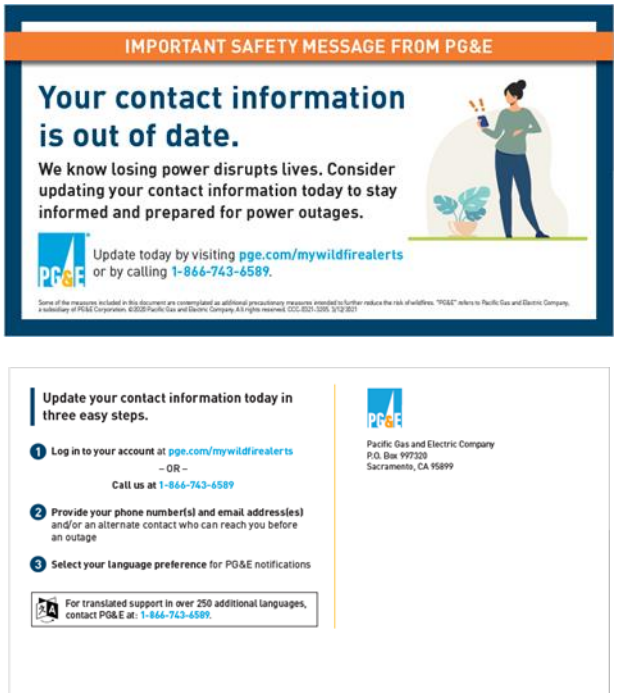
Keep your contact information up to date so you are informed about PSPS events before and during outages.

Visit pge.com/mywildfirealerts or call 1-866-743-6589 to update your information and select your preferred language for PSPS notifications. Notifications will be made through automated calls, texts and emails.

As a PG&E account holder, you will automatically receive notifications for your home and/or business. **If you would like to know about potential PSPS events** at other important addresses, such as work, school or family members' homes, consider signing up for Address Alerts at pge.com/addressalerts.

For translated support in over 200 additional languages, contact PG&E at 1-866-743-6589.

FIGURE PG&E-7.3.10-1:
SAMPLE PSPS PREPAREDNESS BROCHURES, BILL INSERTS, AND POSTCARDS
(CONTINUED)



- Outreach and Engagement with Master-Metered Owners, Property Managers, and Multi-Unit Dwelling Account Holders – PG&E conducts outreach to multi-unit dwelling account holders, property managers, and master-meter owners, whose residents are not direct PG&E-metered customers that includes information about resiliency programs, PSPS event resources, and reinforces the importance of tenants signing up for direct notifications prior to a PSPS event via Address Alerts.

  PG&E recognizes the need to communicate with multi- dwelling account holders, landlords and property managers and in 2022 will continue to work in identifying other opportunities to broaden our message regarding PSPS preparedness. This includes but is not limited to working with CBOs and Non-Government Organizations that serve this segment of the population.

- Wildfire Program Outreach – PG&E conducts community outreach to educate customers/property owners on the details of PG&E's wildfire safety programs and the potential need for their participation to reduce wildfire risks in their communities. PG&E maintains an open channel of communication with customers and communities who proactively reach out to PG&E when identifying safety risks related to these programs.

  To identify and implement efficient and appropriate customer and community communications, PG&E assesses the anticipated program impacts related to planned road closures, property access needs, tree removal, pole inspections, and helicopter operations, among others. To set expectations with customers and with the goal of limiting work refusals or access issues, PG&E uses various

communication methods, such as letters, postcards, text messages, e-mails, and automated calls through Interactive Voice Recordings. PG&E will provide translated outreach in alignment with the language access and translations strategy described in Section 8.4.2.

Outreach includes broad communications about PG&E's wildfire safety related work scope in neighborhoods, cities, and counties, as well as direct communications to customers/property owners who may be impacted by PG&E employees and contractors requiring access to their sites to conduct the necessary safety related wildfire prevention work.

PG&E also responds to issues raised by customers/property owners including general access issues (e.g., locked gate), or sensitive access issues (e.g., medical concerns). In some cases, properties requiring access/work may be occupied by a customer of record that differs from the property owner, in which case PG&E will engage with both. PG&E addresses these issues by contacting the customers/property owners directly to understand their concerns and to develop a mutual solution that allows access to complete the relevant wildfire safety work.

In certain instances, such as in the system inspections program, if PG&E is unable to coordinate access to our facilities with the customer/property owner, PG&E may leverage authorization via Rule 11 to turn off customers' power to complete safety related work to inspect or repair facilities. PG&E will only consider this tactic to ensure safety related work can be completed and will work to limit such instances. Customers will receive multiple advanced communications from PG&E if this action must be implemented.

PG&E works with customers to develop solutions to resolve property owner non-compliance issues (e.g., property access or work refusals) and escalated CPUC complaints by landowners that are impacted by PG&E's CWSP programs, including Electric Vegetation Management, system hardening, and system inspections.

- Digital Engagement – PG&E provides emergency preparedness information and safety resources on pge.com.[135] Our dedicated emergency preparedness webpages have detailed information for customers to help them make a plan so that they are ready for emergency events. PG&E provides customer resources on our website that include details on how to create an emergency supply kit,[136] and instructions on ensuring that customers' properties and homes are prepared for emergencies. For example, PG&E provides information to help customers know

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135 https://www.pge.com/en_US/safety/emergency-preparedness/emergency-preparedness.page.

136 https://www.pge.com/en_US/safety/emergency-preparedness/preparedness-kit/emergency-preparedness-kit.page.

how to turn off electricity[137] and gas at the main switch and valves.[138] We also provide tips on resiliency, how to safely use a generator[139] and preparing solar customers for winter storms.[140] Additionally, PG&E has created a series of materials[141] that will educate children in kindergarten[142] through 6th grade[143] about the importance of emergency preparedness in a fun and reassuring manner. To ensure that our customers have information about emergency related- outages, we encourage customers to sign up for outage alerts via our online platform "Your Account."

- Safety Action Center – PG&E has a dedicated safety webpage (safetyactioncenter.pge.com) featuring helpful information about wildfire risks and what customers can do to keep their home, family, or business safe, including tips on how to create an emergency plan, emergency preparedness guides and videos.

- Informational Videos – PG&E uses informational videos as an engaging way to inform customers about or CWSP and PSPS available at the pge.com/pspsvideos webpage.

- Media Engagement – PG&E works closely with external media outlets, including both paid and earned media, to provide broad awareness to Californians to share tips related to wildfire and PSPS preparedness, socialize available resources, and communicate PSPS event information. This includes PG&E multicultural media engagement that reaches our non-English speaking customers and community members, as described in Section 8.4.

  - Earned Media – To serve non-English speaking customers, PG&E engages with over 150 multicultural media outlets throughout the year in an effort to promote safety initiatives, including PSPS, to monolingual or difficult-to-reach populations that may not have access to mainstream television media and/or read/speak English.

    PG&E shares news releases and coordinates interview opportunities with media outlets to help educate non-English speaking customers on various

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137 https://www.pge.com/en_US/safety/electrical-safety/turning-your-electricity-on-and-off/turning-your-electricity-on-and-off.page.

138 https://www.pge.com/en_US/safety/gas-safety/gas-safety-tips.page.

139 https://www.pge.com/en_US/safety/electrical-safety/electric-generator-safety/electric-generator-safety.page.

140 https://www.pgecurrents.com/2015/12/14/how-rooftop-solar-homeowners-can-prepare-for-el-nino/.

141 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-Activity-Book.pdf.

142 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-K-3-Placemat.pdf.

143 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-4-6-Placemat.pdf.

PG&E programs, including the CWSP, PSPS, emergency preparedness, public safety, consumer protections and income qualified programs, to name a few. PG&E also schedules media visits with these organizations to discuss other partnership opportunities (e.g., Public Service Announcements, advertising, event sponsorships

PG&E also staffs bilingual and multilingual employees to serve in the EOC to support the PIO multimedia engagement function. These employees provide urgent translation support, such as verification and approval of ad hoc written translations during emergencies. These staff assist PG&E with avoiding delays that can occur when engaging outside vendors for translation needs during an active event or wildfire.

- Paid Media and Advertising – To supplement PG&E's outreach efforts during PSPS events, PG&E runs PSPS emergency messages to reach customers via paid media channels, when/where channels are available. PG&E purchases a combination of English and in language radio ads, as well as digital banners in English and multiplate languages based on targeted ZIP Codes.

Figure PG&E 7.3.10-2 includes sample print advertisements used in 2021.

FIGURE PG&E-7.3.10-2:
SAMPLE 2021 ADVERTISEMENTS

- Social Media – PG&E regularly provides customer preparedness resources through our official social media channels, including Twitter, Facebook, Instagram, and Nextdoor. An "advisory" post in 15 languages directs customers to our website so they can access important information in their preferred

language.[144] We also developed a three-minute YouTube video on safety tips for those with medical needs. PG&E holds contracts with 38 multi-cultural media partners and five CBOs to assist with in-language communications and share our social media posts before and during PSPS events.

- CBO Engagement – PG&E is actively engaged with over 280 CBOs.[145] PG&E continues to use CBOs to support the dissemination of emergency preparedness information, including resources on wildfire and PSPS safety, to their networks via their established communication protocols as well as their social media channels and newsletters. Our CBO network plays an instrumental role in our ability to reach our customers with access or functional needs including customers with limited English proficiency. More details on our CBO engagement are included in Section 8.4.

- Community Partnerships – PG&E regularly works with community partners to better prepare for emergencies. For example, PG&E partners with the California Fire Foundation to provide Wildfire Safety and Preparedness grants focused on funding for firefighters and Community/Neighborhood Emergency Response Teams in Northern California, specifically communities identified as extreme or elevated fire risk. PG&E also provides grants to more than 40 CBOs annually to support them in communicating the importance of emergency preparedness to their constituencies. Further, PG&E awards grants to local Fire Safe Councils to fund shovel ready projects to help keep communities safe. The funds help pay for fuel reduction, emergency access and defensible space projects, as well as chipper days in local communities.

- HealthCare Industry and Durable Medical Equipment (DME) Customer Outreach – PG&E established new partnerships with healthcare groups and durable medical equipment companies in PG&E's service territory to cross promote the MBL Program with members/patients. PG&E is leveraging the healthcare and DME patient channels to drive enrollment in the MBL Program and promote the Disability Disaster Access and Resources (DDAR) program. PG&E also conducted both an e-mail campaign and a call campaign to healthcare groups and DME's to promote both programs and establish new partnerships.

For more information, see:

- Section 7.3.9.2 for some additional details on PG&E's outreach related to emergency planning and preparedness;

- Section 8.2.5 for more information on stakeholder cooperation and community engagement during PSPS events; and

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144 www.twitter.com/PGE4Me/status/1438924885728837633.

145 PG&E engages with over 280 CBOs before, during, and after a wildfire and PSPS events. PG&E also engages with over 400 CBOs for efforts outside of wildfire and PSPS events such as our efforts to assist customers access utility bill relief and manage utility debt.

- Section 8.4 for a description of our communication protocols and outreach activities for AFN populations and customers with limited English proficiency. In addition, PG&E includes more details in the 2022 PSPS AFN Plan, filed January 31, 2022.

C) Strategy and Actions Taken to Design, Translate, Distribute, and Evaluate Effectiveness of Related Communications

PG&E engages with agencies, CBO, critical facilities, and customers in multiple fora that foster open and transparent communication and encourage key stakeholders to provide candid feedback. The feedback is then reviewed internally and determined if feasible and appropriate to implement into PG&E's operational and/or engagement plans. Below is a list of evaluation mechanisms that PG&E employs to assess effectiveness of PG&E's outreach and identify improvements as needed:

- After engagement surveys – Periodically provide to agencies, critical facilities, large businesses, and other stakeholders that have participated in engagement efforts to ask for feedback on effectiveness of the engagement and solicit ideas for engagement improvement and future topics for engagements and trainings.

- After engagement internal evaluations – After each type of engagement (e.g., PSPS Regional Working Groups), PG&E evaluates feedback from stakeholders received on the effectiveness of the meeting and determines where improvements can be made before the next engagement effort. In this way, PG&E seeks to continuously improve in terms of the value of engagements to our stakeholder partners.

- Advisory committees and councils – The advisory committees and councils described in the section above (*Strategies and Actions Taken to Identify and Contact Key Community Stakeholders*) are designed to help PG&E improve our actions to help communities prepare for emergencies including PSPS, and to provide input on our wildfire mitigation activities generally. Part of this scope will include committee and council evaluations on effectiveness of communications, covering stakeholder engagement throughout the year, as well as in emergency stakeholder notifications. PG&E will take committee and council feedback into account when designing future engagements and communication plans.

- Feedback from local PG&E representatives – Local PG&E representatives—PSS, LPA, Tribal Relations, and CRMs—seek feedback on communication effectiveness from agencies, community stakeholders and customers throughout the year, both in formal engagements and during informal conversations. These local PG&E representatives share this valuable feedback internally and it is then used to evaluate effectiveness of communications and to identify specific actions that PG&E can take to improve.

The section above (*Strategies and Actions Taken to Identify and Contact Key Community Stakeholders*) also notes the various ways PG&E engages with customers. We understand that every customer is different, and it is important to have various engagement types on to engage frequently. To measure effectiveness, PG&E collects feedback from customers on outreach and identifies barriers and areas for improvement. The feedback is collected both prior to and after wildfire and/or PSPS events.

We evaluate outreach effectiveness around wildfire safety and PSPS preparedness through both quantitative and qualitative research. Quantitative research involves representative surveys of a specific population (customers, CBOs, etc.) that may measure statistically significant progress over time. These include measures of message awareness and recall, message understanding, and reported changes in behavior. Non-survey quantitative measures include web traffic, clickthrough rates of advertisements and conversion rates / actions taken by customers as a result (e.g., attendance of a webinar, updates made to contact information, or adoption of various customer programs).

Qualitative research includes input from small groups of customers. It is traditionally associated with focus groups and in-depth interviews but is also conducted virtually with participants recruited using list samples or from online panels. PG&E conducts a variety of qualitative studies throughout the year to identify solutions and potential program offerings to improve future customer experience and outreach.

- Opinion Surveys – PG&E conducts surveys online or via phone that are representative of specific populations to measure statistically significant changes over time. These include the following:
  - Tri-annual surveys with residential customers (available in 16 languages) that capture awareness and recall, understanding of, and satisfaction with PG&E's customer communications and to measure statistically significant changes over time.
  - Survey of CBO/Partners to assess the effectiveness of outreach targeted to non-English speaking populations and other groups of vulnerable and hard-to-reach customers.
  - Post PSPS event surveys conducted immediately after each PSPS event to agencies and customers to assess PSPS performance during that specific event.
- Transactional Surveys – PG&E hosts website surveys that allow customers to provide direct feedback on the site page and topic. PG&E's e-mail newsletters also provide customers the option to score the value of the content and to provide direct comments.
- Customer Feedback – PG&E regularly reviews customer sentiment received directly by account managers, via the Contact Center, the website, and other social outlets during and after events.

PG&E also quantitatively tracks customer engagement at different periods of time throughout wildfire season to understand customer behavior in the following ways:

- Web Traffic – Traffic to relevant pages on PG&E's website, such as wildfire alerts, updates to contact information, wildfire safety pages, safety action center, statewide

PSPS program. Website traffic is currently measured by assessing number of unique visitors, visits, and page views.[146]

- Click through rates of advertisements – Click through rate of advertisements is an industry accepted standard that measures the number of people visiting a webpage who access a hyperlink to an advertisement (e.g., wildfire safety). To note, advertisement click through rates measure the immediate response to an advertisement but not necessarily the overall response. Customers may see the advertisement, absorb the messaging, and choose to act later.

- Conversion rates / actions taken by customers as a result – Conversion rates of customers are the measurable actions taken by customers based on the outreach (e.g., updating contact information, attending an open house, enrolling in MBL Program).

More information on methods to assess outreach effectiveness and use of quantitative and qualitative research can be found in Section 4.6, Issue 5.9A. PG&E will continue to apply best practices and leverage lessons learned from our 2021 customer outreach experience. Going forward, we support a collaborative, data driven process to define the most effective and appropriate outreach and in language translation requirements.

D) Strategies and Actions Taken to Address Concerns and Serve Needs of AFN Populations and Customers with Limited English Proficiency[147]

PG&E is committed to providing additional services to AFN and medically sensitive customers by partnering with organizations that assist and provide services to the AFN community. PG&E will continue to engage and collaborate with local governments and CBOs that serve AFN groups to encourage awareness and enrollment of the MBL Program, as well as other programs and resources. PG&E is also raising awareness by informing customers who do not qualify for MBL on how they can self-identify as vulnerable.

Please see Section 8.4 that provides more details on our AFN population support strategy before and during PSPS events, including programs that serve these customers, preparedness outreach approaches that are focused on vulnerable populations, and in event customer communications that serve AFN populations. This is also detailed in PG&E's 2022 PSPS AFN Plan, filed January 31, 2022.

- CBO Engagement and Multi-Cultural Media Organizations – PG&E partners with CBOs throughout the year in targeted communities to increase their capacity to serve AFN communities, such as medically sensitive customers, low income, limited English speaking customers. Our focus is on EP&R, disaster resiliency and

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146 Unique visitors are the number of individuals that visit the specific webpage. These unique visitors may make multiple visits to the webpage. Page views account for all webpages served by the website (pge.com) whereby a unique visitor goes to multiple pages on the website.

147 Section 8.4 Engaging Vulnerable Communities includes the definition of AFN populations and prevalent languages in PG&E's territory.

expanded access to 211 referral services. We partner with multicultural media organizations to help translate communications and make our communications more accessible for people with disabilities. Through CBO collaborations, PG&E also seeks to provide additional, customer specific support to AFN community member customers during a PSPS event, such as portable batteries for medical device charging from participating Independent Living Centers, accessible transportation to PG&E CRCs, funds for hotel stays and short-term loans of a portable backup power batteries.

PG&E will continue to outreach and manage ongoing customer support resources such as Disability Disaster Access and Resource program, Portable Battery Program, Generator and Battery Rebate, Self-Generation Incentive Program, CRCs, 211 referral services, MBL, Tribal Engagement, and the Food Bank and Meals on Wheels agreements. More details on these customer support programs can be found in Sections 8.2.1 and 8.4.

- Income Qualified Customers and Disadvantaged Communities – PG&E will engage stakeholders who represent, support, and advocate for our income qualified customers and disadvantaged communities. This includes engaging with Communities of Color, the CPUC's Disadvantaged Communities Advisory Group (DACAG) and the Low Income Oversight Board (LIOB) to provide relevant PSPS Program updates and gain input from participants regarding approaches to support disadvantaged communities. PG&E will also leverage California Alternate Rates for Energy and Energy Savings Assistance contractor networks to help educate customers on wildfire and PSPS preparedness. PG&E will continue to seek other ways and opportunities to engage disadvantaged and underserved communities' stakeholders and customers.

- AFN Populations Feedback and Research – PG&E continually seeks formal and informal feedback to improve our CWSP and PSPS related outreach and education. We do this through consultation with PG&E PWDAAC, Statewide IOU AFN Council, DACAG, LIOB, local government advisory councils and working groups, Communities of Color Advisory Group, as well as research directly with customers.

Please see Section 8.4 for more details on our AFN population support strategy before and during PSPS events, the programs that serve these customers, the preparedness outreach approaches that are focused on vulnerable populations, and the in-event customer communications that serve AFN populations. This is also detailed in PG&E's 2022 PSPS AFN Plan, filed January 31, 2022, as part of Rulemaking (R.) 18-12-005 and in compliance with D.21-06-034.

Relation to and Impact on Other Initiatives:

- PSPS – included in the Benefit Description/Result above

- EPSS – included in the Benefit Description/Result above

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: PG&E conducts outreach to customers, agencies, CBOs, and communities throughout the entire service territory. As mentioned previously, PG&E customizes agency outreach based upon agency need. The level of customization will vary according to multiple factors such as, community or agency preference, prior PSPS and EPSS impact prioritization of Wildfire Mitigation Plans (WMP), and wildfire impacted jurisdictions. The most impacted agencies will receive the most customization in terms of localized topics covered and type of engagement. These agencies are often located in HFTD areas.

Risk Models Used or Other Considerations for Prioritization:

- No Risk Models are used for the Customer Care/Agency Sections
- PG&E will prioritize the rules and regulations applicable to a utility's use of power shutoffs as a mitigation measure to protect the public safety under Pub. Util. Code §§ 451 and 399.2(a) from fires caused by utility infrastructure. The Commission has issued several decisions in proceeding, R.18-12-005, including D.19-05-042, D.20-05-051, D.21-06-034, which set forth guidelines and rules pertaining to when an IOU de-energizes power lines as a last resort measure to mitigate the risk of potential catastrophic wildfire caused by the IOU's infrastructure, a process referred to as PSPS events. In determining priorities, PG&E will consider the guidelines and rules set forth in R.18-12-005.
- On November 13, 2019, the Commission opened I.19-11-013 to review the use of electric power shutoffs as a wildfire mitigation measure by utilities in late 2019. On June 3, 2021, the Commission issued D-21-06-014, which provides several directions to the IOUs pertaining to PSPS events. PG&E will consider these directions set forth in D-21-06-014.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021)

In 2021, PG&E completed and conducted activities as described in question 2. Additional information for 2021 to further emphasize progress towards the initiatives are noted below utilizing the categories outlined in question 2 above.

A) Strategy and Actions Taken to Identify and Contact Key Community Stakeholders

In 2021, PG&E completed the strategy and actions taken to identify and contact key community stakeholders as described in question 2 above.

B) Strategies to Increase Public Awareness and Support of Utility Wildfire Mitigation Activity

- Agency and Critical Facilities Outreach / Advisory Committees – In 2021, PG&E continued to work closely with agencies and critical facilities to ensure they are informed of PG&E's emergency planning and preparedness resources and actions, and so that PG&E can hear about partners' evolving needs regarding emergency planning and preparedness. Some of PG&E's key 2021 engagement and outreach highlights to increase public awareness of emergency planning and preparedness information with agency and critical facilities includes:

  - Hosted over 390 meetings with agencies to share information related to PG&E's CWSP.

  - Held 35 listening sessions with cities, counties, tribes, and customers (e.g., telecom providers) to better understand their 2020 PSPS experiences and identify key areas for improvements.

  - Cohosted 25 Wildfire Safety Working Sessions with County OESs and tribes.

  - Hosted over 9 PSPS Portal trainings with public safety partners.

  - Continued various advisory committees and hosted ongoing meetings with each committee.

  - Hosted 20 Regional Working Groups.

  - Held three PSPS seminars, two PSPS Tabletop exercises, one 5-day full scale and one two-day functional PSPS exercises.

  - Hosted three systemwide virtual open houses and ten safety town halls to provide a localized update on wildfire safety work happening in respective communities and answer customer questions.

  - Hosted 19 webinars on EPSS

In addition, PG&E engaged with the various Advisory Committees described in Question 2 above throughout 2021. Key 2021 highlights are described below:

- 2022 AFN Plan Collaborative Planning Team – In Q3 2021, PG&E began the development of our 2022 AFN Plan in accordance with the FEMA Comprehensive Preparedness Guide as adopted by the Phase 3 revised guidelines for PSPS. On September 2, 2021 at the AFN IOU Leadership Meeting, the IOU Senior Executive team briefed the stakeholders identified in D.21-06-034 to initiate the collaborative planning team discussions and propose a schedule. In addition, to ensure comprehensive representation across various AFN perspectives, on September 24, the IOUs introduced this effort to the broader Joint IOU Statewide AFN Advisory Council plus additional invited organizations such as DeafLink, Hospital Council, American Red Cross, and the California Rural Indian Health Board, to solicit participation in the planning committee. Throughout the remainder of 2021 and through January 2022, PG&E continued to meet with the AFN Plan Collaborative

Planning Team utilizing the six steps outlined by the FEMA Comprehensive Preparedness Guide.

- Statewide IOU AFN Council – PG&E continued to convene the Statewide IOU AFN Council. In 2021, representatives from Pacific Corp and Bear Valley Electric joined the Statewide IOU AFN Council.

- Key Customer Association Collaborative – Throughout 2021, PG&E met with:

  - California Hospital Association (CHA)

  - Hospital Council Board of Directors of Northern and Central California

  - Telecommunications and broadband providers

  - Water and wastewater agencies

  - Industrial and commercial members of California Large Energy Consumers Association, and the Small Business Utility Advocates

In 2021, PG&E conducted meetings with nearly 300 individual stakeholders.

- Customer and Community Outreach – In 2021, PG&E continued to engage with customers and communities regarding wildfire safety and with customers who may be directly impacted by a PSPS event and/or EPSS as described in question 2 above. Key 2021 highlights are described below:

  - Outreach and Engagement with Master-Metered Owners, Property Managers, and Multi-Unit Dwelling Account Holders – In Q3 2021, PG&E conducted outreach to multi-unit dwelling account holders, property managers, and master-meter owners, whose residents are not direct PG&E-metered customers. The outreach included a brochure with details on how tenants can sign up for PSPS notifications through Address Alerts, as well as the resources PG&E offers before, during, and after a PSPS. Additionally, PG&E sent a PSPS "toolkit" to master-meter owners to assist with tenant education that included information about resiliency programs, PSPS event resources, and reinforced the importance of tenants signing up for direct notifications prior to a PSPS event via Address Alerts.

  - Informational Videos – Building off our success in 2020, PG&E updated and created new videos about the CWSP and PSPS events. In 2021, PG&E developed four new short (3 to 5 minutes) videos about EVM, System Hardening, Restoration and Microgrids. These videos allow us to further the reach of our emergency preparedness messaging and reach a broader group of customers and community members.

  - Media Engagement – In 2021, PG&E identified 38 multicultural media outlets to partner with on PSPS and wildfire safety education. During the 2021 PSPS events, PG&E provided event update videos on our social media platforms in

English, ASL, Spanish, and Chinese.[148] Additional media engagement highlights for 2021 include:

- Placing over 220 posts on PG&E social media channels;
- Sending 21 direct mail pieces to customers;
- Sending 5 bill inserts to customers;
- Conducting 40 customer email outreach campaigns; and
- Having an estimated 122 million average monthly advertising impressions in advance of- and during the months with- the highest likelihood of wildfire and PSPS events (July – October)

C) Strategy and Actions Taken to Design, Translate, Distribute, and Evaluate Effectiveness of Related Communications

PG&E engaged with agencies, CBO, critical facilities, and customers in multiple fora that foster open and transparent communication and encouraged key stakeholders to provide candid feedback as described in question 2 above.

D) Strategies and Actions Taken to Address Concerns and Serve Needs of AFN Populations and Customers with Limited English Proficiency

PG&E continued to engage and collaborate with local governments and CBOs that serve AFN groups to encourage awareness and enrollment of the MBL Program, as well as other programs and resources. PG&E also raised awareness by informing customers who do not qualify for MBL on how they can self-identify as vulnerable.

- MBL Program Outreach – PG&E witnessed a significant increase in MBL enrollments as a result of our voluntary and temporary program revisions under the COVID-19 Emergency Customer Protections.[149] These revisions included: temporarily allowing customers to enroll in the program online or with paper application forms without a certification from a qualified medical practitioner, suspending program removals, and suspending the requirement for self-certifications or recertifications for continued MBL eligibility.

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148 www.twitter.com/PGE_Deanna/status/1428122242307686407.

149 On May 1, 2020, PG&E filed in AL 4244-G/5816-E (and supplemented with two additional ALs, AL 4244-G-A/5816-E-A and AL 4244-G-B/5816-E-B) outlining the temporary revisions to our MBL program under the COVID-19 Emergency Customer Protections.

PG&E aligned the expiration of the COVID-19 Emergency Customer Protections with the implementation of significant improvements to the MBL enrollment and unenrollment processes, including but not limited to the following:[150]

1. Launched a new online MBL Application form: This form enables customers to apply for MBL online and receive a unique confirmation code in an email for their medical practitioner certification. The online form is available in 16 languages

2. Launched a new Medical Practitioner Portal: This portal enables qualified medical practitioners to certify their patients' medical needs online by using their patients' unique confirmation codes,

3. Updated the existing paper MBL forms and in-language versions to align with the online application experience and improve screen reader compatibility,

4. Launched new MBL Welcome letters: New MBL enrollees now receive a welcome letter with brief MBL program information and other safety and accessibility resource information,

5. Revised the MBL application "denial" letters: when applicable, customers will receive a direct mail tailored to their application denial reasons along with potential steps to remedy and the option to self-identify as Vulnerable Customer Status,

6. Redesigned the MBL webpage (including in-language versions) with a new layout that has both easier navigation and new content including an enhanced MBL Frequently Asked Questions (FAQ), a MBL factsheet and a FAQ for medical practitioners,

7. Enhanced functionality in Your Account to show customers' MBL enrollment status, and

8. Added an online unenrollment option in PG&E's Your Account online platform for existing MBL customers to unenroll themselves from MBL program if they are no longer eligible.

PG&E also worked with a market research firm to conduct a focus group with medical practitioners aiming to better understand their experience with our MBL program and our new Medical Practitioner Portal in Q4. The results of the focus group will be used to inform future portal and process improvements.

- CBO Engagement and Multi-Cultural Media Organizations – As of December 2021, PG&E has engaged with over 280 CBOs for information sharing and has secured contracts with 76 CBOs to provide additional resources to customers during PSPS events (e.g., portable battery provision, food replacement, and translation

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150 On April 1, 2021, PG&E filed our COVID-19 Emergency Customer Protections Transition plan via AL 4414-G/6142-E. On May 5,2021, PG&E filed AL 4429-G/6181-E (Pacific Gas and Electric Company's Proposed Modifications to MBL Program Self-Certification Request Form (Form 61-0502) and MBL Program Application (Form 62-3481).

services/event communications in indigenous languages). More details on these customer support programs can be found in Sections 8.2.1 and 8.4.

- AFN Populations Feedback and Research: In 2021, PG&E held four Customer Collaboration Co-Labs with two focused on AFN customers who are Deaf or hard of hearing, blind or have low vision, or have an intellectual/developmental disability and live in high fire threat and rural areas, and have been impacted by two or more PSPS events during the past year. PG&E also held two additional Customer Collaboration Workshops for customers frequently impacted by PSPS events in rural areas and renters, non-account holders, and landlords. Please see Section 8.4, which describes how PG&E incorporated feedback from these groups into our programs and services.

Lessons Learned:

- A key finding from our customer research showed that there was low awareness and usage of CRCs. PG&E will continue to refine our CRC strategy working in close collaboration with our county, tribal, and CBO partners. PG&E will also work with customers to find ways to improve CRCs or provide helpful alternatives to ensure customers have the resources they need during PSPS events. In accordance with D.21-06-034, PG&E will file an updated CRC plan (for both fixed facility and mobile locations) within the 2022 Pre-Season Report no later than July 1, 2022.

- In PSPS Post Event Surveys, customers frequently mentioned wanting more timely and accurate notifications in advance of and during the shutoffs. PG&E will refine our communications and notifications to make them as clear and accessible as possible for customers and community members (e.g., Estimated Time of Restoration accuracy).

- We recognized the need to further expand the AFN definition. In 2022, PG&E is adding six additional categories for which vulnerable customers can self-identify and will be executing a dedicated outreach campaign to promote self-identification in the newly added categories.

- We recognize food replacement is a critical need for some individuals with AFN, particularly those who are low income. In 2022, PG&E will continue to look for opportunities to enhance food bank agreements, partner with Meals on Wheels organizations, and grocery delivery services in additional regions of our service area, as well as opportunities to add family resource centers throughout our service area.

- We will drive execution of customer outreach and engagement, enhanced through ongoing customer and stakeholder feedback, to propel improved customer, community, and utility readiness and resiliency in the face of growing wildfire threat.

Current Year Activities (2022):

ID	Initiative Target Name	Initiative Target Description	Activity Due Date	Qualitative or Quantitative Target
J.01	Community Engagement – Meetings	Host 22 customer and community focused virtual meetings (i.e., Safety Town Halls, CWSP Webinars) to further stakeholder and community awareness of PG&E's wildfire mitigation efforts.	12/31/2022	Quantitative

In addition to the customer engagement target identified above, we plan to continue to perform the activities related to this Initiative described in this section. However, those activities will not be included in our quarterly reporting to Energy Safety or in the Annual Report on Compliance.

In 2022, we will continue to perform the following activities:

- Main outreach and engagement objective:
  - Continue territory-wide awareness campaigns established and implemented in 2020, with a focus on customers and stakeholders who have been repeatedly impacted by PSPS events and/or EPSS
  - Listen to customers, community leaders, and CBOs to fully understand and respond to concerns and feedback about communications
  - Support our most vulnerable customers through expanded identification, identifying needs, and developing and providing programs, operations, and services, with a key focus in driving customer resiliency
  - Customize outreach approach, scope and cadence tailored to each community's needs, with a key focus on providing more heavily impacted communities with information and resources
  - Provide timely and accurate information that supports emergency preparedness and localized wildfire mitigation efforts to agencies, CBOs, and customers
  - Solicit feedback from agencies and CBOs at key milestones in wildfire mitigation planning processes to ensure that local projects meet community priorities, and that opportunities for efficiency in collaboration may be identified and acted upon
  - Adapt to shifting agency needs and priorities in emergency preparedness and wildfire mitigation, including a mindfulness of other key local priorities such as responding to the ongoing COVID-19 pandemic
  - Host localized discussions with agency and geography/region specific information to enhance agency knowledge of drivers for PSPS events and other potential emergency events in their areas

- Strengthen relationships between local agencies and external facing PG&E teams so that agencies are aware of their knowledgeable point-of-contact that can address their needs both during an emergency event and throughout the year.

- Critical Facilities and Infrastructure – PG&E will continue the type of coordination described in Question 2 above in 2022. In accordance with D.21-06-034, PG&E will provide a critical facilities and infrastructure plan within the 2022 Pre-Season Report that PG&E will file no later than July 1, 2022.

- Customers – PG&E will continue to leverage a multipronged approach to provide outreach to customers as described in question 2 above in 2022.

- CBOs – PG&E will continue to partner with CBOs as described in Question 2 above and in Section 8.4 in 2022.

- Actions to Increase Public Awareness of Emergency Planning and Preparedness Information – PG&E will continue to follow prevailing public health guidance first and foremost when planning 2022 engagements and will also take into account the preferences of agencies, CBOs, customers, communities, and our own internal staff.

- PSPS Exercise and Workshops – In 2022, PG&E will host one territory-wide PSPS Tabletop exercise and one territory-wide PSPS Full Scale Exercise, where county OES and tribal leaders will be invited to help plan the exercise and participate as players and/or observers.

- Additional CWSP Trainings and Workshops – PG&E will continue to host PSPS Portal trainings in 2022, outlining improvements made and providing instruction for new users, both before and during wildfire season.

- Regional Working Groups – PG&E will host a total of 20 PSPS Regional Working Groups in 2022 to both disseminate PSPS-related updates and to collaborate with local public safety partners and others within each region.

- Advisory Committees – PG&E will continue collaborating with and meeting with advisory committees in 2022.

- Energy Communications Providers Coordination Group – In 2022, PG&E will host, as needed, meetings to discuss collaboration and engagement opportunities before and during PSPS events, and for other wildfire and “all hazards” resiliency and readiness initiatives.

- Key Customer Association Collaborative – PG&E will continue these meetings throughout 2022, maintaining a focus on providing content that is responsive to the unique needs of each stakeholder. This includes maintaining and building on collaborative relationships with the CHA and Hospital Council of Northern and Central California, telecommunications and broadband providers, municipal utilities, water and wastewater agencies, and other groups representing critical customer sectors.

- Ongoing Community Engagement and Coordination – Throughout 2022, PG&E will continue to conduct customer outreach and respond to customer related access issues. As we do with all customer outreach, we will look for ways to improve our programs, focusing on building relationships with property owners where PG&E assets are located.

- Customer and Community Outreach – PG&E will continue customer and community outreach activities as described in question 2 above in 2022.

- Paid Media and Advertising – In 2022, PG&E will run a series of print ads across our service territory highlighting in-language support of over 200 languages via the Call Center.

- Actions to Design, Translate, Distribute, and Evaluate Effectiveness of Communications Taken Before, During, and After a Wildfire – PG&E will continue to implement the actions described in question 2 above in 2022.

5. Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – As new information, best practices, and lessons learned are available, PG&E will refine stakeholder outreach and community engagement approach as we have done over the course of three years.

7.3.10.2 Cooperation and Best Practice Sharing With Agencies Outside CA

OEIS Initiative Definition: Strategy and actions taken to engage with agencies outside of California to exchange best practices both for utility wildfire mitigation and for stakeholder cooperation to mitigate and respond to wildfires.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Equipment – Conductor

Preventing wildfires is a challenge that goes beyond California's borders. We actively participate in various industry groups to benchmark and identify potential alternative solutions from industry leaders around the world.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Benchmarking allows PG&E to be aware of and continuously improve best practices to mitigate and respond to wildfires.

Relation to and Impact on Other Initiatives:

- Not Applicable

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: The benefits of benchmarking are applicable across PG&E's service territory, although certain practices may be prioritized based on wildfire risk, where applicable.

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

International Wildfire Risk Mitigation Consortium (IWRMC) – PG&E is a founding member of the Utility Executive Steering Group for the IWRMC. The consortium is industry-sponsored and provides a forum for members of the global utility community to share wildfire risk mitigation insights and strategies. The group hosts regular technical working group meetings to discuss:

- Asset Management;
- Risk Management;
- Operational Practice;
- Vegetation Management;
- Data Governance (New); and
- Stakeholder Engagement (New).

PG&E's engagements with IWRMC continued in 2021. The efforts are ongoing with adjustments and improvements made as gaps or opportunities are identified.

Lessons Learned:

- Fire Risk Models – Fire risk models was a topic discussed amongst several working groups within the IWRMC. Discussions included operational decision making, circuit disconnection decision making, refresh frequencies, evaluating models using actual ignition and consequence data and incorporation of fire suppression. These and future discussions will help with considerations for future Fire Risk Models.
- Covered Conductor – Due to interest in Covered Conductor amongst membership, the IWRMC dedicated time to discuss with membership, lead webinar presentations and build a repository of industry research. IWRMC also distributed a benchmarking survey with its membership to understand the current state of covered conductor in their system and its usage.
- Engagement with Utilities in Australia – Utilities in Australia have shared their experiences from their wildfire / bushfire challenges. For example, the Rapid Earth Fault Current Limiter (REFCL) technology that PG&E installed in 2020 and is actively testing to assess wildfire risk mitigation benefits (see Section 7.3.3.17.4) was developed in Australia.

Lessons Learned:

- Learned from the Australian utilities who shared their REFCL testing experiences and suggestions along with considerations for REFCL fault sensitivity from deploying REFCL to over 20 substations in Victoria, Australia to date.

Partnering with educational institutions on mitigating wildfire risk: As noted in Section 7.3.10.4, PG&E has been engaged with federal landowners on how to partner on mitigating wildfire risks on those lands. PG&E is also partnering with educational institutions and firms from across the country to explore technologies or tools (like risk models from the nuclear industry) that may contribute to reducing wildfire risk. Examples include the Distribution Fault Anticipation Technology (Section 7.3.2.2.3) and Fault Signature (Section 7.3.2.2.6) technology.

Engagement with other utilities in the US / CA – PG&E is a member of various practices within the North American Transmission Forum and Center for Energy Advancement

through Technological Innovation (CEATI). Through these working groups, PG&E continues to benchmark our operational and wildfire-related practices and identify areas for further review and refinement.

Associations like the Edison Electric Institute (EEI) facilitate a series of engagements regarding "Wildfire Technology" exploration, sharing, and discussion. The California IOUs also meet weekly to discuss topics such as outreach and engagement strategies, CPUC requirements, technology solutions and operational plans.

Similarly, in alignment with the undergrounding work already being performed and our long-term goals to increase this activity, PG&E has been benchmarking construction methods and approaches for UG of electric lines with various other parties.

Lessons Learned:

- Leveraging the North American Transmission, PG&E gained insights about transmission resiliency and current best practices related to emergency management and vegetation management

- Similarly, CEATI shared learnings via member meetings and conferences on various wildfire-related topics such as condition assessment, inspection and maintenance techniques, risk mitigation, etc.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, PG&E will continue to engage in the IWRMC. We will also continue to partner with educational institutions and other utilities (in the US / CA) on mitigating wildfire risk.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028):

- Engage with partners to reduce wildfire risk – PG&E plans to continue growing the number of partnerships and engagements over the long-term through supporting additional industry forums (like IWRMC, as noted above) and reaching out to other entities or groups with insights and learnings. These engagements allow PG&E to identify tools, technologies, or other best practices to reduce wildfire risk and to validate improvements made.

- IWRMC Development – PG&E will continue strengthening of the IWRMC by supporting the inclusion of additional industry players to expand and maximize opportunities for wildfire mitigation solutions. In light of some of the experiences from the 2020/2021 wildfire season, PG&E is also seeing increased interest and engagement from utilities in the Pacific Northwest on wildfire knowledge and best practices.

- Accelerate and standardize how PG&E operationalizes opportunities and best practices – Additionally, PG&E is working to standardize and operationalize our processes for identifying, reviewing, and implementing best practices that can provide wildfire risk mitigation benefits.

7.3.10.3 Cooperation With Suppression Agencies

OEIS Initiative Definition: Coordination with California Department of Forestry and Fire Protection (CAL FIRE), federal fire authorities, county fire authorities, and local fire authorities to support planning and operations, including support of aerial and ground firefighting in real-time, including information-sharing, dispatch of resources, and dedicated staff.

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Consequences - Acres Burned

Secondary Risk: Reliability Impacts - PSPS

Providing ongoing coordination with CAL FIRE, federal fire authorities, county fire authorities and local fire authorities to support planning and operations serves to eliminate gaps between PG&E and these agencies. This helps to promote more effective safety alignment and emergency response operations. It also improves future collaboration and support with these agencies.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- External public safety partner engagement efforts have proven successful in mitigating risks associated with communication gaps, as well as the potential for incongruent mission response activities between PG&E and local emergency responders. Not only is the coordination critical for emergency response and event/incident coordination; it is also important for advanced planning and post event (after action) support.

Relation to and Impact on Other Initiatives:

- External public safety partner engagement – PG&E has a team of 25 PSSs and five Supervisors that are dedicated to maintaining established relationships with agency partners and supporting emergency planning activities and information sharing during emergency events. Every member of the PSS team has an extensive public safety background, including previous law, fire or emergency management experience.

  During active emergency events, PSSs serve as PG&E's Agency Representatives and are responsible for coordinating and integrating PG&E's response with Agencies Having Jurisdiction (AHJ). The Agency Representatives assist with facilitating communication between relevant AHJs, PG&E Incident Management Teams, PG&E first responders, PG&E Operational Emergency Centers, Emergency Operations Center staff, and the Wildfire Safety Operations Center personnel, as well as supporting other internal Lines of Business. The real time intelligence sharing includes, but is not limited to, PG&E's tactical plans and the deployment of

necessary aerial and ground resources to support fire mitigation and asset protection activities.

3) Region prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Presently, the PSS team is organized into five response regions to ensure timely and effective response presence across the PG&E service territory. Each region has an assigned supervisor, and each respective PSS is assigned to one or more counties to support both regulatory compliance needs and emergency response engagement. Within the respective counties, PSS contacts have been pre-identified, and PSS members are responsible for maintaining coordination and engagement with their assigned agency contacts on an ongoing basis.

Risk Models Used or Other Considerations for Prioritization:

- The PSS team is positioned to assist both internal (PG&E) and external public safety stakeholders. While there is no specific "risk model" associated with the PSS team, their operational role and function are aligned to support emerging risks as needed across the service territory.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Throughout 2021, the PSS team supported over 600 external engagement activities including, but not limited to attending and/or hosting:

- PSPS listening sessions
- Wildfire Safety Working Sessions
- Regional Working Group meetings
- Gas/electric safety workshops
- Professional group meetings
- Wildfire safety trainings, and
- Gas safety outreach with external public safety partners

<u>Impacts</u>:

- The efforts of the PSS team solidified the value of strong collaboration with external public safety partners in support of emergency response and preparedness engagement. This was demonstrated through close coordination and operational efficiencies when working with external public safety stakeholders.

Lessons Learned:

- The strong engagement of the PSS team with external public safety partners has demonstrated overall success with developing and maintaining cohesive relationships, which have proven valuable in the context of emergency response and preparedness.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

The PSS team continues to provide ongoing engagement and collaboration with our external public safety (fire) partners. The team will continue to support events in 2022, similar to those which the PSS team engaged during 2021, such as tailored local engagements; Regional Working Group meetings; Gas/electric safety workshops; Professional group meetings; Wildfire safety trainings; and Gas safety outreach with external public safety partners.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – The PSS team will continue to support engagement activities, along with cross training and information sharing opportunities. As the program develops, the PSS team will adjust their outreach and coordination approach to ensure optimal external engagement.

Long-term program adjustments have yet to be identified. As the program develops or the needs of external public safety partners shift, the PSS team will adjust their outreach and coordination approach to ensure optimal support/engagement.

7.3.10.4 Forest Service and Fuel Reduction Cooperation and Joint Roadmap

OEIS Initiative Definition: Strategy and actions taken to engage with local, state, and federal entities responsible for or participating in forest management and fuel reduction activities; and design utility cooperation strategy and joint stakeholder roadmap (plan for coordinating stakeholder efforts for forest management and fuel reduction activities).

1) Risk to be mitigated/problem to be addressed

Primary Risk: Ignition Risk – Vegetation Contact

Secondary Risk: Ignition Consequences – Population Impacted

As a result of severe drought periods and the bark beetle infestation over the past decade in California, the United States Forest Service (USFS) land has more dead and dying trees than ever before. These factors have had a direct impact on forest lands and create additional fuel which in turn increases the likelihood of catastrophic wildfires, placing PG&E facilities and the surrounding communities at risk.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- Reduce consequence of potential ignitions – This initiative reduces fuel loads of surrounding USFS lands outside of our Right-of-Ways (ROW).

Relation to and Impact on Other Initiatives:

- Vegetation Management – This initiative reduces fuel loads on USFS lands outside of our right of ways (ROWs). This reduces chances of fire spreading due to ignition and also reduces chances of fires outside of our ROWs impacting our facilities.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Each year, we request all 11 forests within our service territory to submit proposals for fuel reduction work to occur on their lands. These proposals are for projects that are shovel ready, where most of the work can be completed within 12 months of the funds being awarded. After the proposals are received, an internal committee at PG&E reviews each proposal and ranks them for award funding. Typically, the USFS prioritizes the project areas based on seasonal access, equipment available, and fire risk to nearby communities. In addition, projects funded by the program are assessed, taking into consideration both proximity and risk to PG&E transmission and distribution assets in HFTD.

Risk Models Used or Other Considerations for Prioritization:

- No risk model is used, as this is dependent upon the proposals submitted by USFS.
- The USFS is required to provide us with quarterly check-ins on the success of the project and report on whether they will complete the work outlined in the proposals.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

Fuels Reduction Partnership Program – We awarded $4,307,950 to 5 of 11 forests in USFS jurisdiction for fuel reduction work in 2021.

Impacts:

- This funding will result in fuel load reduction to 6,721 acres of USFS lands outside our ROWs

Lessons Learned:

- This program has been in effect for three years. PG&E continues to get praise from the USFS as they appreciate the much-needed funding to undertake critical forest management work.
- The USFS has announced a 1-year plan that provides additional funding to California forests throughout PG&E's service territory. PG&E will be monitoring the execution of the plan to understand future funding needs.

Current Year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

In 2022, we currently plan to award up to $5 million to USFS for fuels reduction projects in forests within our service territory but outside our ROWs.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – We do not have any short-term plans for this initiative other than what is described above.

7.3.10.5 Project Management Office (PMO) and General Wildfire Support

OEIS Initiative Definition: Other (Definition N/A), PMO and General Wildfire Support

1) Risk to be mitigated/problem to be addressed

Primary Risk: Not Applicable

This is not an Energy Safety-defined initiative. This is an initiative that PG&E is adding to the 2022 WMP to describe the PMO office and general wildfire support.

Wildfire safety work is complex and multi-faceted. It requires a wide range of internal subject matter experts—for operations, support, communications etc.—to assist with developing comprehensive solutions and supporting our customers, communities, and other partners. The CWSP PMO aims to:

- Coordinate with the various operational teams to develop cohesive operational plans that maximize wildfire risk reduction and minimize community and customer impacts;
- Monitor, govern, and support wildfire risk mitigation workstreams in the delivery of activities to meet goals, align with plans, and aggressively reduce wildfire risk;
- Coordinate with various outreach teams to have a coordinated communications plan for engaging with customers, agencies, tribes, critical facilities, and other key stakeholders;
- Have accurate and timely data for internal tracking, governance, and management that can be shared with external stakeholders;
- Lead and facilitate regulatory reporting and filings on wildfire programs, including the WMP process; and
- Provide a feedback loop from external stakeholders to the operational teams.

Given the increase in the volume of work in our Wildfire Mitigation Programs, regulatory reporting requirements, and focus on execution of these mitigations, PG&E has seen growth in the management, oversight, and support needed for wildfire programs. This management support spans across various functions in Electric Operations, providing leadership and oversight to the various wildfire mitigations the Company is undertaking.

2) Initiative selection ("why" engage in initiative) – include reference to and description of a risk informed analysis and/or risk model on empirical (or projected) impact of initiative in comparison to alternatives and demonstrate that outcomes of risk model are being prioritized

Primary Benefits of Initiative:

- The ability to coordinate with the various operational teams to develop cohesive operational plans that maximize wildfire risk reduction and minimize community and customer impacts

- Align operational plans to reduce wildfire risk
- Have a coordinated communications plan for engaging with customers, agencies, tribes, critical facilities, and other key stakeholders
- Provide a feedback loop from external stakeholders to the operational teams.

Relation to and Impact on Other Initiatives:

- Other – The CWSP PMO is designed to touch on all of PG&E's wildfire mitigation activities and reporting requirements.

3) Region Prioritization ("where" to engage initiative) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk") and demonstrate that high-risk areas are being prioritized

Prioritization of Work within Initiative: Not Applicable

Risk Models Used or Other Considerations for Prioritization:

- Not Applicable – The activities of the CWSP PMO and related support functions are applicable across PG&E's service territory, particularly focused on HFTD areas. Regional prioritization is not applicable for this initiative.

4) Progress on initiative since the last WMP submission and plans, targets, and/or goals for the current year

Actual Progress (2021):

CWSP PMO and support functions experienced growth in 2021 to ensure the right level of leadership and support was available to enable the successful execution of our wildfire mitigations.

Impacts:

- In part due to the support of the CWSP PMO, PG&E continues to meet, and in some cases exceed, our operational goals and has improved our outreach to communities and customers. The CWSP PMO will change as the program evolves and as new best practices are identified.

Lessons Learned:

- We will continue to be nimble in communication and coordination with emerging/new wildfire mitigation tactics such as EPSS.

Current year Activities (2022):

While we have not set specific targets for this Initiative and will not provide ongoing reporting each quarter on it, we are still doing the work as part of our overall plan.

5) Future improvements to initiative – include known future plans (beyond the current year) and new/novel strategies the utility may implement in the next five years (e.g., references to and strategies from pilot projects and research detailed in Section 4.4)

Short-Term Improvements (2023-2028) – There are no material future improvements planned for this initiative at this time. PG&E will continually improve, and the CWSP PMO will provide leadership, Governance, and coordination as PG&E's wildfire activities change, and as new approaches or best practices are identified. The PMO also helps facilitate wildfire benchmarking and collaborative activities which can drive improvement opportunities across the wildfire program.

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 8

PUBLIC SAFETY POWER SHUTOFF (PSPS), INCLUDING DIRECTIONAL VISION FOR PSPS

8. Public Safety Power Shutoff (PSPS), Including Directional Vision For PSPS

8.1 Directional Vision for Necessity of Public Safety Power Shutoff

Describe any lessons learned from PSPS since the last Wildfire Mitigation Plan (WMP) submission and describe expectations for how the utility's PSPS program will evolve over the coming 1, 3, and 10 years. Be specific by including a description of the utility's protocols and thresholds for PSPS implementation. Include a quantitative description of the projected evolution over time of the circuits and numbers of customers that the utility expects will be impacted by any necessary PSPS events. The description of protocols must be sufficiently detailed and clear to enable a skilled operator to follow the same protocols.

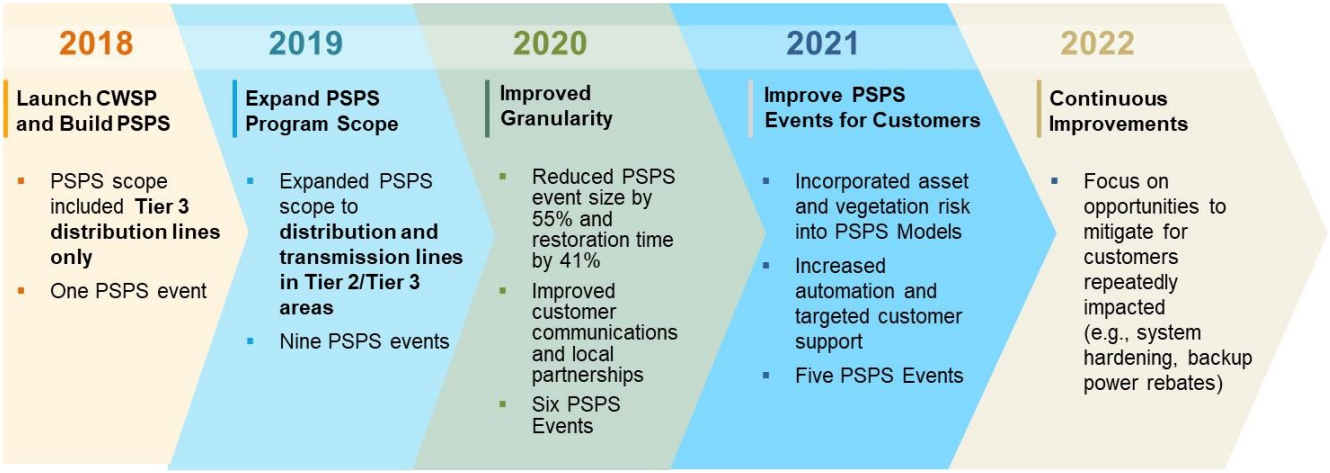
When calculating anticipated PSPS, consider recent weather extremes, including peak weather conditions over the past 10 years, as well as recent weather years and how the utility's current PSPS protocols would have been applied to those years.

Pacific Gas and Electric Company's (PG&E) most important responsibility is protecting the health, welfare, and safety of our customers and the communities we serve. When severe weather or other circumstances threaten the ability to provide electricity safely, PG&E must take the appropriate steps necessary to protect the public. Our PSPS program proactively de-energizes a portion of our electric system, in the interest of public safety, and as a measure of last resort when there is a potential for a catastrophic wildfire should the lines be left energized.

PG&E understands that de-energizing customers causes not only significant disruption but also causes safety risks to those impacted. Therefore, we are actively working to reduce the impact of de-energization on our customers and the communities we serve. PG&E remains committed to executing our PSPS program in a manner that complies with California Public Utilities Commission (CPUC or Commission) guidelines in accordance with Resolution (Res.) ESRB (E)-8, Decision (D.) 19-05-042, D.20-05-051, and D.21-06-034.

In Section 8.1, we describe our progress towards reducing the overall PSPS impact to our customers and communities in 2021 and identify actions and areas for improvement in 2022 and the longer-term. The discussion of PG&E's accomplishments and future goals during 2021 PSPS season is divided into the following four major sections: (1) improvements in 2021; (2) results from 2021; (3) lessons learned; and (4) future plans. Figure PG&E-8.1-1 below provides at a high level the evolution of our PSPS program since 2018.

FIGURE PG&E-8.1-1:
EVOLUTION OF PSPS PROGRAM



8.1.1 Improvements in 2021

In 2021, PG&E continued to make progress to better balance mitigating wildfire risks and reducing customer impact with each PSPS event. This section describes PG&E's 2021 progress in the following areas: (1) Meteorology Models and PSPS Distribution Scoping Guidance Updates, (2) Transmission PSPS Scoping Protocols, (3) Scoping Process, (4) Risk-Benefit Tool, (5) Mitigation Initiatives, and (6) Re-energization Strategy and Protocols. Information about PG&E's results in Community and Customer Awareness, Coordination, and Support is provided in Section 8.1.2.

Meteorology Models and PSPS Distribution Scoping Guidance Updates:

In 2021, we updated our meteorology models and distribution scoping guidance (PSPS protocols) to reflect our latest analysis of catastrophic wildfire risk during severe wind events. The updated PSPS protocols included the enhancement of our Outage Producing Wind (OPW) Model to a new Ignition Probability Weather (IPW) Model, improvements in our Fire Potential Index (FPI) Model, and the integration of Technosylva Fire modeling into our PSPS protocols. The current guidance also incorporates tree overstrike, as well as high risk vegetation and asset tags. More information on these improvements to the meteorological models, scoping guidance and PSPS protocols is provided in Section 8.2.

PG&E's main focus on PSPS is to mitigate the risks associated with a catastrophic wildfire and to prioritize customer safety. As such, the updated Meteorology and scoping guidance has enabled PG&E to incorporate additional risks associated with tree overstrike, vegetation, and asset tags. To demonstrate PG&E's protocols' evolution, Figure PG&E-8.1-2 below shows the customer impact during the 2019-2021 PSPS weather events using the 2019, 2020, and current protocols.[151] While most of past PSPS events would have had smaller scope if the current guidance had been applied, there are some exceptions, and some PSPS events may have been larger in scope under the current protocols. Additionally, some smaller PSPS events (i.e., September 20, 2021 event) would only exist when the current protocols are applied and would not be scoped using either the 2019 or 2020 protocols.

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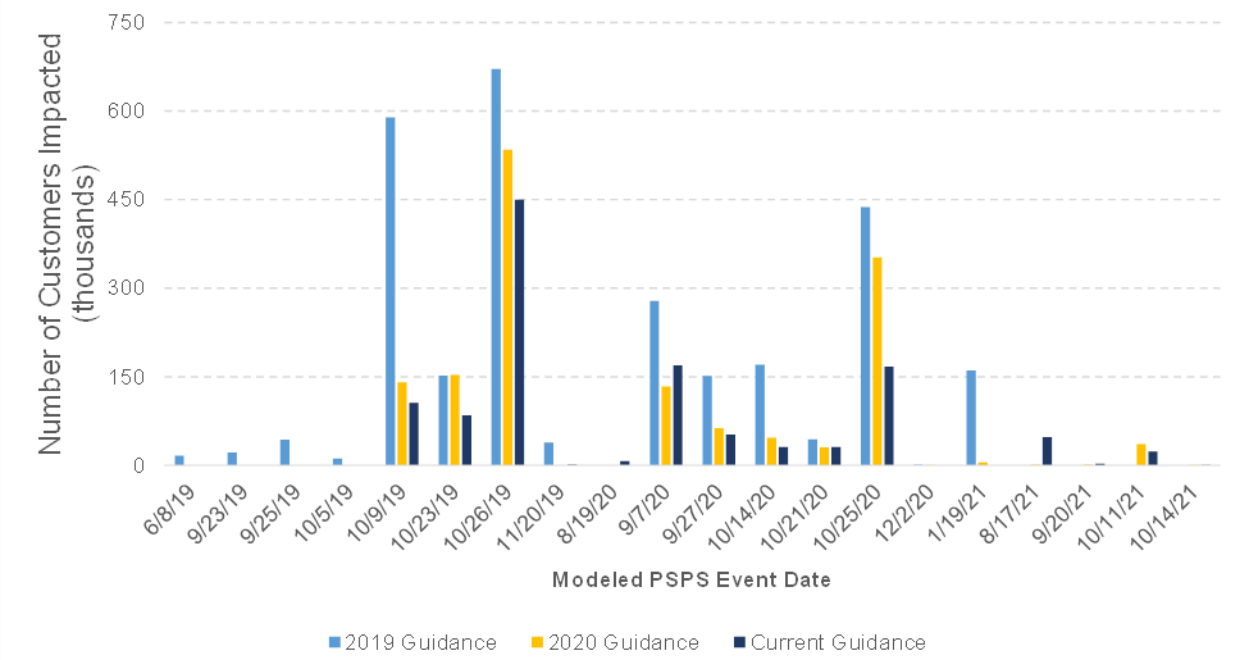
151 Historical weather lookback analyses are computationally and resource intensive. In addition to the PSPS events which were executed with 2019, 2020, and current guidance, the chart on Figure PG&E-8.1-1 uses data from two types of scoping analyses. First, we applied the latest PSPS guidance to weather conditions from previous years to scope hypothetical PSPS events for those past years based on the latest guidance. This analysis was used to generate 2020 PSPS guidance scopes for the year of 2019, and current PSPS guidance scopes for the years of 2019 and 2020. Second, we applied a previous year's PSPS guidance to a current year's PSPS events to determine what customer impact would have resulted from using a previous year's PSPS guidance for each PSPS event in the current year. Unlike the first analysis, this second will only generate hypothetical scopes for the PSPS events which actually occurred in each year and will not show any additional events which would have been executed based on the past PSPS guidance. The second analysis was used to generate matching 2019 guidance scopes for 2020 PSPS events, and matching 2020 scopes for current PSPS events. For both 2019 and 2020, the January 19, 2021 PSPS event is counted as "2020" because the 2020 PSPS guidance was still in use at the time of that PSPS event.

FIGURE PG&E-8.1-2:
COMPARISON OF PSPS LOOKBACKS BY DISTRIBUTION SCOPING GUIDELINES



Note that predicting actual event sizes based on weather lookbacks does not correspond exactly to how PG&E executes PSPS events. In weather lookbacks, event weather polygons are created based on model pixels that exceed guidance levels. During actual PSPS events, PG&E accounts for forecast uncertainty and uses real-time feedback from weather stations and Public Safety Specialists (PSS) in the field in addition to guidance levels. For information about past events and PSPS metrics please see Section 8.5.

PG&E also developed a lookback analysis to evaluate our proposed 2022 WMP initiatives. More information about the lookback analysis will be provided further in Section 8.1.4.

Transmission PSPS Scoping Protocols:

Transmission lines are scoped into PSPS to mitigate against three types of risks: vegetation hazards, asset condition, and wildfire consequence and behavior. In 2021, within each risk category, PG&E further refined our transmission scoping protocols and criteria to better capture each of these risks. These refinements are detailed in PG&E's supplemental testimony 10-year historic lookback 2021 update.[152] More information about the current transmission scoping protocols is available in Section 8.2.3.4.

While refinements to the asset condition and wildfire consequence and behavior categories led to more instances of transmission lines being scoped into events, the refinements to vegetation scoping significantly reduced the transmission line footprint.

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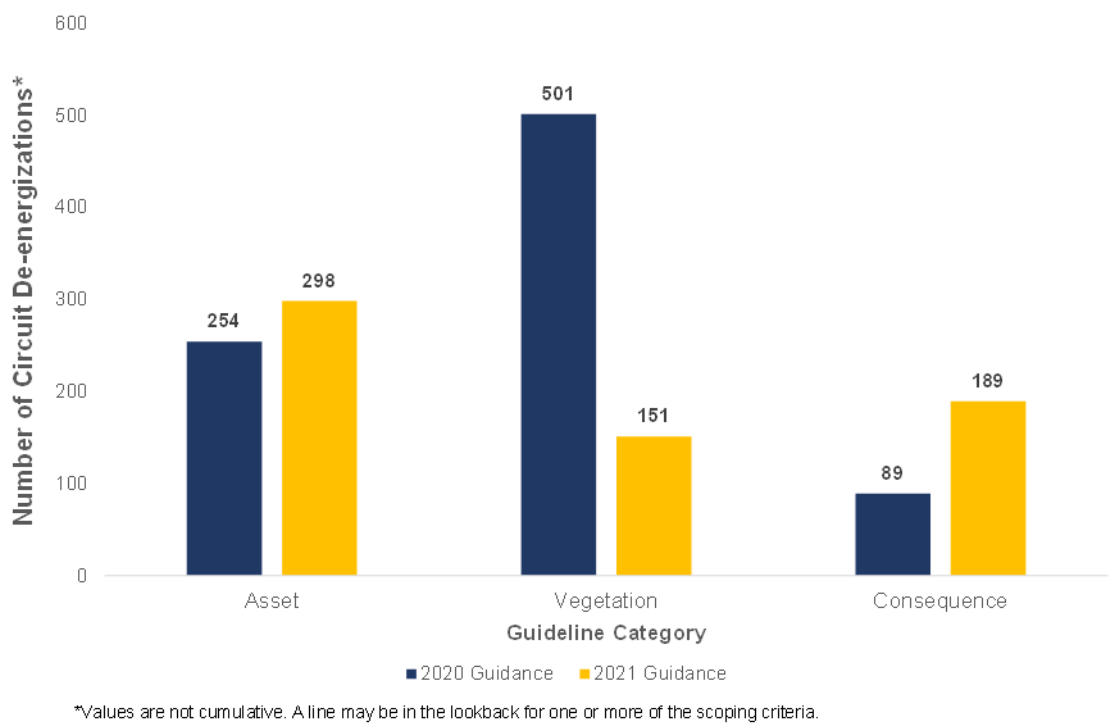
152 Proceeding A.21-06-022 filed on December 17, 2021.

This improvement in targeting vegetation risk can mainly be attributed to the transmission-specific vegetation risk model that PG&E developed in 2021. The vegetation risk model uses aerial Light Detection and Ranging (LiDAR) data to map the location and attributes of trees near transmission lines, enabling the calculation of risk scores at individual tree level and the ability to assess catastrophic wildfire risk at a more granular asset level e.g., structure vs. line. The increase in granularity reduced the frequency of certain lines being included in scope for a PSPS event due to projected vegetation risks. Figure PG&E-8.1-3 below shows PG&E's progress in reducing the number of total times in which transmission lines are brought into scope when comparing the 2020 transmission protocols compared to the current transmission protocols over a 10-year weather lookback horizon.

FIGURE PG&E-8.1-3:
COMPARISON OF PSPS LOOKBACKS BY TRANSMISSION SCOPING GUIDELINES



*Values are not cumulative. A line may be in the lookback for one or more of the scoping criteria.

Scoping Processes:

The PSPS scoping processes improvements that PG&E implemented in 2021 included the following:

- Smaller Time Places (TP) – In 2021, PG&E's meteorology team implemented the use of smaller TPs during the scoping process to ensure that any required de-energizations tracked closely to real time weather conditions. The use of smaller TPs allowed for improved adjustments to scoping and timing of de-energizations due to rapid and unpredicted real time changes in weather. For example, adjustments in TPs due to weather changes can include shifting a de-energization time earlier if the weather threat grows stronger earlier than initially forecasted or

delay de-energization if the severe weather is advancing more slowly than forecasted.

- Scoping Process Enhancements – In 2021, PG&E significantly reduced the time it took to 'scope' or translate the impacts of the weather system onto PG&E's assets. This was accomplished by tool enhancements and automation[153] allowing PG&E to quickly update the PSPS event scope during the events. The reduced timing for scoping permitted more time for timely customer notifications and planning of PSPS mitigation activities such as Community Resource Centers (CRC) and temporary generation.

Risk-Benefit Tool:

During the last four PSPS events in 2021, PG&E introduced our PSPS Potential Risk vs. Benefit Tool to support the evaluation of the potential public safety risk due to a PSPS event against the forecasted potential wildfire risk.[154] For these PSPS events, the benefit of mitigating catastrophic wildfire risk far exceeded the impact (public harm) of the PSPS event. For a detailed discussion about PG&E's PSPS Potential Risk vs. Benefit Tool, please see Section 8.2.3.7.

Mitigation Initiatives:

The key PSPS mitigation initiatives that PG&E implemented in 2021 to minimize the size and impact of PSPS events included the following:

- Transmission Line Sectionalizing – PG&E installed 29 switches on transmission lines before September 1, 2021 to minimize the number of customers impacted by PSPS outages. More information is provided in Section 7.3.3.8.2.

- Distribution Line Sectionalizing – PG&E installed 257 automated distribution sectionalizing devices before September 1, 2021. More information is provided in Section 7.3.3.8.1.

- Temporary Substation Microgrids – In 2021, PG&E prepared nine substations with back-up generation actively interconnected and tested on site in preparation for

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153 Tool enhancements and automation include: (1) TP and event creation workflow through automation, performance improvement, and implementation of a visualization workflow. As well as the ability to review of duplicate circuit in TPs and other data anomalies to improve Scoping process; and (2) enabled capability to process of EC/P1/P2 tags on PSPS Situational Intelligence Platform – Distribution Asset Health Specialist dashboard, uniquely identify tags resulting in incremental impact and ability for user to flag assets related to compliance tags or high-risk trees in a PSPS event scope.

154 See Resolution Extending De-Energization Reasonableness Notification, Mitigation and Reporting Requirements in D.12-04-024 to all Electric investor-owned utilities (IOU). The PG&E PSPS Potential Risk vs. Benefit Tool represents an analysis comparing these two potential impacts. This assessment tool was developed to address the regulatory requirements set forth in D.21-06-014, which requires California IOUs to quantify the risk/benefits associated with initiating or not initiating a PSPS event for our customers.

enabling customers to remain energized during PSPS events. More information is provided in Section 7.3.3.11.1.B.

- Temporary Distribution Microgrids – PG&E prepared five additional pre-installed interconnection hubs (PIHs) in 2021, totaling eight Distribution Microgrids with constructed PIHs that were ready to operate in 2021. More information is provided in Section 7.3.3.11.1.

- Undergrounding – PG&E completed 2.7 miles of undergrounding projects in 2021 (as of November) specifically intended to mitigate PSPS occurrences. More information is provided in Section 7.3.3.16.

- Temporary Generation for Critical Customers – Throughout 2021, PG&E leveraged our rental fleet of temporary generators to mitigate the impacts of PSPS on our critical customers. The fleet supported 13 stand-alone facilities serving public safety and infrastructure. More information is provided in Section 7.3.3.11.1.

Re-energization Strategy and Protocols:

While the severity and duration of the weather conditions that require a PSPS event are outside the control of PG&E, PG&E has the ability to manage PSPS event duration for customers through effective implementation of post-event patrol and re-energization operations and processes. In 2021, PG&E undertook the following activities to shorten duration of PSPS events:

- Granular Restoration – Weather "All-Clear" Targeting – In 2021, PG&E leveraged improved meteorological capabilities that allowed for more accurate weather "all-clear" targeting and an enhanced system of weather stations and cameras to begin declaring weather "all clears" on a more granular level. This allowed patrol teams to respond sooner to an outage impacted area so customers could be restored earlier as the smaller targeted areas could be declared "all clear" once the weather improved for safe restoration. More information about our re-energization strategy is provided in Section 7.3.6.4.

- Updated Standards, Procedures and Training – PG&E developed an updated PSPS process to improve operational management of PSPS Estimated Time of Restoration (ETOR) and associated customer notifications. This process improvement is documented in Procedure PSPS-1000P-01 ("Public Safety Power Shutoff for Electric Transmission and Distribution"). Training to procedure PSPS-1000P-01 was provided to PG&E field personnel responsible for restoration to ensure the updated processes were clearly communicated and implemented to meet the procedural objectives.

- For additional details on PSPS restoration improvements, see Sections 7.3.6.4 and 7.3.9.5.

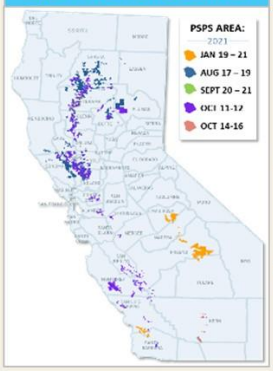
8.1.2 Results from 2021

Overall, the positive PSPS results in 2021 were a combination of favorable weather conditions, PG&E's continuous improvement based on lessons learned from past PSPS events, and our continuing efforts to listen to our customers and communities to find ways to reduce the impact of PSPS outages without compromising safety. PG&E has learned and improved significantly since we executed our first PSPS event in 2018, and we expect to continue to evolve and improve this critical wildfire risk mitigation program in the coming years. Improvements to our PSPS program have included enhanced operations, communication and coordination before, during and after PSPS events – together, these have reduced risk and resulted in more targeted, smaller and shorter events, as indicated Figure PG&E-8.1-4 below.

FIGURE PG&E-8.1-4:
OVERVIEW OF PSPS PERFORMANCE

Operational Performance Overview

2021 YTD PSPS Events



	2018	2019	2020	2021
Number of PSPS Events	1	9	6	**5**
Average Number of Customers Impacted	60,000	226,000	109,000	**16,100**
Largest Customer Impact Event	60,000	968,000	345,470	**48,155**
Average Restoration Time	15 HRS	17 HRS	10 HRS	**12 HRS***

We have strived to make PSPS events:

- **MORE TARGETED**
- **SMALLER**
- **SHORTER**

Note: Based on a PSPS season average, which would exclude the January 19 Event, the 2021 Average Restoration Time would be 8.7 hours for the 2021 PSPS Season.

In 2021, PG&E restored 96.7 percent of the customers within 24 hours from the termination of the PSPS events. When excluding the January 19, 2021 event, that resulted in a massive level of damages that severely impacted restoration, PG&E was able to restore 99.7 percent of the customers within 24 hours in 2021.

PG&E has some ability to augment the size of our patrol and restoration resources through mutual aid and other mechanisms, but restoration time is highly correlated with weather since uncontrollable weather conditions can impact both the timing of weather "all-clears" and the inspection and restoration process based on the extent of damages and hazards. Factors such as the size of the event, difficulty of access caused by concurrent fires (i.e., weather conditions not suitable for flying helicopters), number of circuits damaged, and the distance and ability to reach damaged circuits are all driven by weather and affect the restoration process.

The average restoration time[155] for customers experiencing PSPS events was 8.7 hours for the last four PSPS events in 2021.[156] Since the January 19th, 2021 PSPS event, PG&E has implemented new standards and procedures to improve our restoration process (which are described in more detail in Section 8.1.2), leading to a 10.5 percent improvement in comparison with the 2020 average restoration time of 9.7 hours. Additionally, PG&E's average outage duration[157] excluding the January 19th event is 27.9 hours when compared to 34.5 hours in 2020.

In 2021, we delivered on our goal to make PSPS events less burdensome for our customers. We supported de-energized customers and communities with better communications, resources, and assistance. We conducted PSPS post-event surveys among customers who were impacted by PSPS in the peak wildfire season (August to December) to assess the effectiveness of PG&E's efforts during PSPS events and received suggestions and feedback for improvement. The accomplishments described below would not have been possible without extensive input over the past year from PG&E's advisory councils, regional councils, customers, and state and local officials.

- Customer Notifications – PG&E notified over 97 percent of the affected customers prior to de energization, despite in-event weather shifts that caused PSPS footprint changes in every event. These notifications included improved content that was tested for usability and accessibility. More information is provided in Section 8.2.5.

- Medical Baseline (MBL) Customer Notifications – PG&E notified over 98 percent of impacted MBL customers through automated notifications and in-person door visits, if needed. More information is provided in Section 8.2.5.

- Access and Functional Needs (AFN) customers – PG&E partnered with 63 Community-Based Organizations (CBO) to support AFN customers with resources before, during, and after PSPS events. Together with these CBOs, PG&E provided over 9,500[158] food boxes to vulnerable customers through PG&E's food bank agreements. Through the Disability Disaster Access and Resources (DDAR) program and the Portable Battery Program (PBP), support was provided by delivering over 13,000[159] batteries to qualifying customers. Additional services[160] provided by DDAR include approximately 1,200 food vouchers, 90 gas vouchers, 800 hotel stays, and 30 accessible transit rides. More information is provided in

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155 Restoration time is defined as the total time between the time All-Clears have been issued and re-energization for the area.

156 Excludes the January 19 event as the areas de-energized experienced extremely high winds which caused 423 instances of damage, or approximately one instance of damage per circuit mile. The extensive damage from the January 19 PSPS event increased the time needed to restore customers safely. When including the January 19 PSPS event the average restoration time was 12.1 hours in 2021.

157 Outage duration is defined as the total time between de-energization and re-energization.

158 This includes PG&E's response to the January wind and winter storm.

159 This is the cumulative battery deliveries from the 2020 and 2021 program years.

160 The additional DDAR services are cumulative from the 2020 and 2021 program years.

Section 7.3.10.1. Additionally, PG&E signed an agreement with the CA Network of 211 to provide customers with AFN with a single source of information and connection to available resources in their communities. This agreement will provide PSPS education, outreach, and emergency planning in advance of PSPS season and connect those with AFN to critical resources like transportation, food, batteries, and other social services during PSPS events. More information is provided in Section 8.4.1. In Q3 2021, PG&E began the development of our 2022 AFN Plan in accordance with the Federal Emergency Management Agency (FEMA) Comprehensive Preparedness Guide as required by the CPUC PSPS Phase 3 Decision.[161] To ensure comprehensive representation across various AFN perspectives, PG&E in collaboration with the other IOUs introduced this effort to the broader Joint IOU Statewide AFN Advisory Council plus additional invited organizations such as DeafLink, Hospital Council, American Red Cross, and the California Rural Indian Health Board. PG&E's 2022 AFN Plan was filed with the CPUC on January 31, 2022. More information is provided in Section 8.4.4.

- Translated information – Through new partnerships with multicultural media organizations and in-language CBOs, PG&E shared PSPS preparedness, awareness, and status information broadly across PSPS-affected areas in 15 non-English languages and American Sign Language (ASL), using a variety of social media, news, and written materials.

- Community Resource Centers (CRC) – PG&E provided as many as 34 CRCs during a single PSPS event to support customers in affected local and tribal communities, providing a safe place to access electricity and other resources and information at each CRC. Nearly 10,000 customers visited our CRCs during the 2021 PSPS events.

- Website and call center – PG&E maintained a stable and continuous website and responsive call center support throughout the 2021 PSPS season. More information is provided in Section 8.2.5.

- PSPS Portal Tool – PG&E deployed enhancements to the PSPS Portal in 2021 based on feedback received during the 2020 PSPS season. The Portal User Guide was updated to include additional information on using Application Programming Interfaces (API), detailed instructions for exporting customer data sets and Geographic Information System (GIS) layers, and answers to frequently asked questions. Additional updates included reorganization of the page layout, improvement of data processing capabilities to provide timelier PSPS event updates, combining various map files to be opened quickly from a single source, and refining the Situation Report with intuitive headers and delta reporting to identify changes at a quick glance. PSPS Portal continues to provide essential event information such as maps, situation reports, critical facility lists, and MBL customer lists to local and state agencies and first responders (cities, counties, and tribes) at the time of the initial notification of PSPS events and throughout PSPS events.

161 D.21-06-034, A10.

8.1.3 Lessons Learned

The key lessons learned from PSPS events in 2021, especially from an operational perspective, are more specifically described in PG&E's PSPS Post De-energization Report submissions to the CPUC in compliance with CPUC ResolutionESRB-8. Based on the cumulative lessons learned, PG&E has identified the following areas for continued improvement to the processes, infrastructure and systems that support PSPS.

- Scoping Process and Tools – For 2022, PG&E will continue to focus our efforts on improving scoping processes to reduce the scoping process duration. This will enable PG&E to further handle late weather changes and the subsequent downstream effects weather changes represent on other processes such as customer notifications and mitigation enablement.

- External Communications and Notifications Process – PG&E's external communications and customer notification processes showed large improvements in 2021. PG&E will continue to work on this as an area for further improvement in 2022, focusing on decreasing the amount of time required to send customer notifications, accuracy of notifications, automating processes, and for issuing updated notifications based on scope changes due to weather.

- PSPS Data Management and Alignment – PG&E improved our tools to support improved data clarity (e.g., removing non-critical datasets from production environment) and focused on formalizing training associated with in-event data access and availability. In 2022, PG&E will continue to focus on data management automation where possible (e.g., creation of contingency data management plans) to accelerate scoping and restoration processes such as playbooks creation.

- Estimated Time of Restoration (ETOR) Improvements – During 2021, PG&E identified and executed improvements in our restoration processes to improve our ETOR process to enable more accurate ETOR for customers. For example, PG&E called All-clear Zones faster and more frequently to obtain more granular restoration plans. For 2022, PG&E will continue to improve our restoration processes (e.g., further training on updated processes, automation to reduce cycle time for creating restoration playbooks) to better streamline the restoration process.

- Customer support – Throughout 2021, PG&E expanded our partnership with CBOs to be better positioned to support customers during PSPS events. To that end, PG&E partnered with multiple CBOs, Food Banks, and media partners across our service territory to support critical customer needs during a PSPS event. PG&E also expanded our CRCs footprint, and our language support to our diverse multi-language communities. PG&E will continue to look for ways to better support our customers and communities during PSPS events.

- Virtual Emergency Operations Center (EOC) – Due to the impacts of COVID-19 pandemic, PG&E adjusted our EOC operations to be entirely remote and virtual in 2021. PG&E and external partner organizations exercised simulated PSPS events in the virtual EOC environment two times prior to the PSPS season in 2021 and then applied learnings from those simulations during actual PSPS events. PG&E was able to operate all the PSPS events in 2021 through the utilization of the Virtual EOC and built many tools and processes to keep the EOC team members aligned and coordinated throughout PSPS events.

8.1.4 Future Plans

8.1.4.1 Near Term Plans (2022)

In 2022, PG&E plans to continue to make progress to minimize customer impacts during PSPS events by focusing on three major areas: (1) Customer Support Efforts; (2) Restoration; and (3) Mitigation Initiatives. This section describes the key 2022 plans in each of these areas.

Customer Support Efforts:

In 2022, PG&E will continue to build on customer efforts by grounding our outreach, programs, and services in customer and stakeholder feedback, research, and data to drive continuous improvement. A few areas targeted for improvement in 2022 are highlighted below.

- CRC strategy – PG&E will continue to refine our CRC strategy based on continuous feedback from our local county, tribal, and CBO partners. PG&E will continue site reviews and improvements at additional CRC sites as needed. PG&E will also work with customers to find ways to improve CRCs or provide helpful alternatives to ensure customers have the resources they need during PSPS events. In accordance with D.21-06-034, PG&E will file an updated CRC plan (for both fixed facility and mobile locations) within the 2022 Pre-Season Report no later than July 1, 2022.

- Customer Contact Information – PG&E will improve data collection so that we have the right customer contact information including information on our master-meter customers and other non-account holders (e.g., renters), know our customers' language preferences, and allow opportunities for customers to self-identify as vulnerable without impinging on data privacy laws. In 2022, PG&E is adding six additional categories for which customers can self-identify and will be executing a dedicated outreach campaign to promote self-identification in the newly added categories. More information on categories for which vulnerable customers can self-identify can be found in Section 8.4.1.

- Customer Notifications – PG&E will refine our communications and notifications to make them as clear and accessible as possible for customers and community members (e.g. advanced notifications and ETOR accuracy).

- Food Replacement – PG&E recognizes food replacement is a critical need for some individuals with AFN, particularly those who are low income. In 2022, PG&E will continue to look for opportunities to enhance food bank agreements, partner with Meals on Wheels organizations, and grocery delivery services in additional regions of our service area, as well as opportunities to add family resource centers throughout our service area. More information on our portfolio of resources and services we provide AFN customers can be found in Sections 8.2.1 and 8.4.1.

- Electric Vehicle (EV) Charging Network Support and Resiliency – PG&E will operate and maintain the EV charging station maps[162] and PSPS functionality for the 2022 wildfire season. PG&E plans to take broader learnings from 2021 and make operational changes as needed to PG&E's Mobile Charging Pilot in 2022.

Finally, PG&E anticipates the COVID-19 situation to remain dynamic for much or all of 2022. As we did in 2021, we will continue to monitor the public health situation and adjust plans and programs as necessary, in alignment with the communities we serve.

Restoration:

For 2022, our restoration goal remains the same as it was in 2021; to restore all customers as soon as possible and within 24 hours from the termination of the PSPS event, unless it is unsafe to do so. For any circuits that require more than 24 hours for restoration, we will provide an explanation in our PSPS post-event reports.

PG&E has identified improvement opportunities in two main areas to reduce restoration times:

- Evaluate the development of weather forecasts to identify flying conditions that could affect helicopter availability for safe aerial patrolling
- Evaluate the possibility to implement a field-compatible mobile platform that can provide a visual map of the PSPS event footprint to field patrol personnel enabling them to identify patrol boundary opportunities instead of relying on device numbers only (i.e., MET Polygon[163] overlaid on circuits).

Additional details about PG&E's PSPS re-energization operations are provided in Section 7.3.6.4.

Mitigation Initiatives:

- At the time of this filing, there are no plans to significantly modify the scoping methodology or meteorology models in 2022 as had been previously done in 2020 and 2021. Therefore, potential reductions in PSPS event size in 2022 are expected to come primarily from PG&E's planned mitigations and improvements to existing modeling tools and protocols.
- PG&E's aims to target mitigations to the locations that are most likely to be impacted by PSPS events. The foundational data set that PG&E uses to identify locations most likely to be impacted by PSPS is the analysis of 10 years of historical weather events. This "historical lookback" evaluates actual weather events and models the associated PSPS events that would have occurred, including both transmission and distribution system impacts. This analysis identifies approximately

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162 https://ev.pge.com/charging-stations.

163 A Meteorology (MET) polygon is an enclosed area in GIS software providing potential outage areas.

30 weather events across the past 10 years that would have triggered a PSPS event using the 2021 PSPS decision-making protocols.

- Although a valuable planning tool, the historical lookback is based on experienced climatology and is not a forecast of the locations for future PSPS events. It is not possible to forecast PSPS events more than a week ahead of time, but this lookback provides the best data set to use for planning purposes. Our planning therefore assumes that these locations have a higher likelihood of again experiencing weather conditions that may trigger a PSPS event in the future. However, weather is highly variable year to year, which drives variability in not only the location of events, but also the number of events and their size and duration.

PG&E targets locations that are de-energized most frequently in the lookback analysis and in actual PSPS events for mitigation planning. Based on the 2021 10-year PSPS lookback analysis, PG&E identified potential locations for our transmission and distribution PSPS mitigation programs.[164] PG&E is currently still in the process of finalizing locations for certain 2022 mitigations, but anticipates the following mitigations to come online in 2022:

- Distribution Sectionalizing Devices – In 2022, PG&E plans to install at least distribution sectionalizing devices to enable PG&E to segment distribution circuits near the High Fire Risk Areas (HFRA) boundaries to reduce the scope of PSPS events. More information is provided in Section 7.3.3.8.1.

- Transmission Sectionalizing Devices – PG&E is evaluating locations for potential new Supervisory Control and Data Acquisition (SCADA) enabled switches on High Fire Threat District (HFTD) lines. These devices support the ability to segment the transmission circuits within the HFTD boundary and allow operational flexibility to reduce the scope and impact of PSPS events. More information is provided in Section 7.3.3.8.2.

- Temporary Distribution Microgrids – PG&E is planning to develop additional temporary distribution microgrids with PIHs in 2022 to support critical services such as fire stations, medical facilities, grocery stores, and cellular towers. More information is provided in Section 7.3.3.11.1.

- Distribution System Hardening – PG&E plans to exclude circuits from PSPS that have been undergrounded as part of PG&E's broader wildfire distribution hardening program. For more information see Section 7.3.3.16.

- Fixed Power Solutions (FPS) – In addition to the same mitigation types we have deployed before, PG&E plans to launch our Fixed Power Program in 2022, providing vulnerable customers with a solar and storage system that can power a customer's critical load as backup for the duration of the outages that the customer may face during PSPS events. More details are provided in Section 7.3.3.11.4.

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[164] Some mitigation programs require more than a year of lead time to execute. As a result, some of the mitigations expected to be available in 2022 were identified using earlier data, including the 2020 lookback.

The mitigation strategies described above may be adjusted as PG&E continues to evaluate viable opportunities and technology continues to evolve.

As discussed above, PG&E utilized the 2021 actual PSPS event data and the historical weather lookback data set to identify where and when PSPS events would have occurred in the past four years. While we use the longer 10-year lookback to target mitigations, we used only the most recent 4 years of the lookback to quantify the expected impacts of our mitigations because we consider the 4-year timeframe more representative of expected near term future PSPS impacts. PG&E projected our 2022 portfolio of mitigation work against the 2018-2021 lookback of PSPS events to quantify their impacts on PSPS scope, frequency, and duration. Note that these customer impacts do not include power generators and transmission customers.

To calculate each PSPS mitigation's benefit, PG&E computed the direct impact of each mitigation activity on PSPS scope, specifically, the reduction in number of customers and associated customer hours per PSPS event. Finally, to quantify the reduction of frequency for PSPS events, PG&E evaluated whether any previous PSPS events could have been eliminated applying the utilized mitigations and concluded that none of the 2022 mitigation initiatives completely eliminated any event. In addition, the January 19, 2021 PSPS event was not included in the analysis as it likely would not have met the current PSPS Protocols thresholds and, consequently, would not have been executed. Tables PG&E-8.1-1 and PG&E-8.1-2 below provide the estimated impacts of our 2022 WMP mitigations on PSPS.

TABLE PG&E-8.1-1:
ESTIMATED IMPACT OF 2022 WMP PLANNED MITIGATIONS

WMP Initiative	Mitigations	Customers Mitigated	Mitigated (%)	Customers Mitigated per Event	Customer Hours[a]	Customer Hours per Event[b]
7.3.3.8.2	Transmission Lines – Switching	22,626	1.4%	1,191	746,667	39,298
7.3.3.16	Hardening – Underground Projects	17,611	1.1%	927	433,905	22,837
7.3.3.11.1C	Temporary Distribution Microgrids[b]	6,117	0.4%	322	280,396	14,758
7.3.3.8.1	Distribution Sectionalizing – New Devices	4,217	0.3%	222	96,600	5,084
7.3.3.8.3	Distribution Sectionalizing – Replacing Motorized Switch Operator (MSO) Devices	3,315	0.2%	174	1,657	87

(a) This analysis contains both PSPS transmission and distribution effects.

(b) Includes 11 hours of total of restoration and switching time.

(c) Includes the impacts of four of the five distribution microgrids to be developed in 2022.

More importantly, this lookback analysis accounts for the benefits of our planned 2022 mitigations. PG&E is still in the process of refining our 2022 mitigation workplan, therefore the locations and quantities of the various mitigations assumed in this analysis are based on estimates available to date. The lookback assumes the benefits from all projects expected to be complete in 2022, regardless of when in 2022 they are

expected to be complete. This analysis is also subject to the limitations associated with using a historical weather lookback as previously described in this section.

TABLE PG&E-8.1-2:
ESTIMATED TOTAL IMPACT OF 2022 WMP PLANNED MITIGATIONS

	Target Reductions as Result of PG&E's 2022 WMP Mitigations
Average PSPS Scope per Event	3.2%
Per-Customer Duration per Event	2.4%
Event Frequency	0%

Note: This analysis contains both PSPS transmission and distribution effects.

Includes 11 hours of total of restoration and switching time.

Includes the impact of four of the five distribution microgrids to be developed in 2022.

Based on the mitigations discussed above, the 4-year lookback analysis shows a potential 3.2 percent (53,900 customers) reduction in PSPS event size from 2018 to 2021. New transmission switches and undergrounding emerge as the largest drivers of scope reduction. Note that we have not projected benefits from Remote Grid and FPS, but the contribution of these initiatives to PSPS impact reduction is expected to be relatively small.[165]

This forecast yields a reduction of approximately 82,000 customer hours interrupted per PSPS event, totaling 1,599,000 customer hours. Table PG&E-8.1-1 shows the contribution of PG&E's various mitigation activities towards these reductions.

[165] Remote Grids were excluded from this analysis because Remote Grid designs have not been evaluated for PSPS impacts. However, given that typically only a handful of customers are served by each remote grid location, the contribution of this initiative to PSPS scope reduction is expected to be relatively minor. PG&E did not include FPS because customers and locations targeted for this effort will not be identified until Spring 2022. However, because only 150 units are expected to be deployed in 2022, the contribution of this initiative to PSPS scope reduction is also expected to be small. More information about FPS in Section 7.3.3.11.4.

8.1.4.2 Long Term Plans (2023+)

In the three and ten-year horizons, PG&E plans to pursue three main group of initiatives to reduce PSPS event size over time: (1) Undergrounding; (2) Long-Term Transmission Solutions; and (3) Line technologies and operational practices that enable overhead lines to remain energized during PSPS conditions.

Undergrounding:

In 2021, PG&E announced a multiyear program to underground approximately 10,000 miles of overhead distribution powerlines in and near high wildfire risk areas, and we expect the program to be a large contributor to driving down the number of customers impacted by PSPS over the long term. As described in Section 7.3.3.16, PG&E plans to scale our undergrounding program rapidly, with plans to underground up to 1,200 miles or more per year, but it will take several years to reach that goal.

PG&E identified PSPS circuits for undergrounding in 2023 or later using our new PSPS consequence framework, which assigns every circuit a PSPS risk score based on the frequency, duration, and number of customers expected to be impacted by PSPS, using the latest PSPS weather lookback. Under this PSPS consequence framework, customers identified as being more vulnerable to a PSPS are afforded greater weight. These vulnerable customers include PG&E's MBL, Life Support, and Self-Identified Disabled residential customers as well as PG&E's critical customers, including hospitals, water agencies, correctional facilities, telecommunication facilities, and police and fire stations.

In addition to identifying undergrounding opportunities on circuits selected based on high PSPS consequence framework, PG&E is also assessing critical customers such as individual ICU hospitals, water agencies, and correctional facilities that are at risk of a PSPS to be included for possible undergrounding solutions. These types of critical facilities all face unique challenges during power interruptions. Hospitals may not be able to fully function as surgeries and other major functions may be delayed, water districts in areas with elevation changes cannot supply their customers, and correctional facilities go into emergency lockdowns. Keeping these critical facilities energized is important for public health and safety in local communities. During planned interruptions like PSPS events, these types of critical customers often rely on back-up temporary generation, so undergrounding in these locations may have the potential benefit of mitigating the need for temporary backup generation by these critical facilities.

All the potential undergrounding work for 2023 is currently in early project planning stages, therefore exact mileage, circuit segments, and impacts are still undetermined at this time. While we are focusing on circuits that are strong candidates for undergrounding opportunities, we remain committed to identifying the appropriate and best solutions for customers for each circuit given its topology, configuration, existing mitigations. When a circuit is identified for grid hardening for PSPS, the scoping process will also consider alternative mitigations such as remote grid, sectionalizing devices, temporary distribution microgrids, and FPS.

Long-Term Transmission Solutions:

In addition to installing transmission sectionalizing devices, PG&E may need to consider whether longer-term solutions such as transmission rebuild, transmission undergrounding, or permanent generation at substations is needed to continue to drive down transmission PSPS scope. Currently, PG&E's PSPS transmission scoping tools and protocols continue to improve each year, driving large changes to which transmission lines and substations may need to be de-energized. While these significant changes make it challenging to establish a planning baseline for these potentially larger investments, PG&E continues to explore long-term transmission mitigation opportunities by participating in relevant forums such as the CPUC proceeding on Long-Term Procurement Framework for Substation Microgrid Solutions[166] and the California Independent System Operator (CAISO) Transmission Planning Process.[167]

Line technologies and operational practices that enable overhead lines to remain energized during PSPS conditions:

Promising new technologies and practices currently being piloted, deployed, and tested in this area will be accelerated and scaled, if they prove to be reliable at preventing utility ignitions during high wind events. These line-sensing and operational technologies, two of which are highlighted below, may enable lines that would otherwise be within a PSPS event footprint to remain energized.

Fire Action Schemes and Technology (DTS-FAST) is a PG&E-developed technology that uses fraction-of-a-second technologies to detect objects approaching energized power lines and responds quickly to shut off power, before object impact (see Section 7.1.E). In addition, DTS-FAST may detect elevated fire risk conditions associated with energized power lines, quickly shutting off power when such risks occur, including downed power lines, downed and leaning towers and poles, and equipment failures. The prototype field test installation at the Santa Cruz Service Center was completed in 2021, and PG&E is currently working on approval of the final version.

Another promising technology is Rapid Earth Fault Current Limiter (REFCL), which mitigates ignitions from line to ground faults such as wire down or tree contacts using technology that detects such faults and limits the fault current to below ignition thresholds. PG&E has a demonstration project for REFCL technology installed in Calistoga, an area with wildfire risk and historical line-ground outage events.

PG&E finished construction on the pilot in 2020 and has begun functional testing to determine the overall effectiveness of the technology. The project had some integration setbacks and will continue repairs into 2022, when PG&E plans to complete the evaluation process. If the result of the demonstration project supports additional

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166 Proceeding A.21-06-022 filed on December 17, 2021.

167 http://www.caiso.com/planning/Pages/TransmissionPlanning/2020-2021TransmissionPlanningProcess.aspx.

deployment, a long-term strategy will be developed to install REFCL in PSPS-prone, HFTD areas. More information about the REFCL in Section 7.3.3.17.4.

Instructions for Table 8.1-1:

Anticipated characteristics of PSPS use over next 10 years

Rank order the characteristic of PSPS events (in terms of numbers of customers affected, frequency, scope, and duration) anticipated to change the most and have the greatest impact on reliability (be it to increase or decrease) over the next 10 years. Rank in order from 1 to 9, where 1 means greatest anticipated change or impact and 9 means minimal change or impact on ignition probability and estimated wildfire consequence. To the right of the ranked magnitude of impact, indicate whether the impact is to significantly increase reliability, moderately increase reliability, have limited or no impact, moderately decrease reliability, or significantly decrease reliability. For each, include comments describing expected change and expected impact, using quantitative estimates wherever possible.

TABLE PG&E-8.1-1:
ANTICIPATED CHARACTERISTICS OF PSPS USE OVER NEXT 10 YEARS

Rank Order 1-9.	PSPS characteristic	Significantly Increase; Increase; No Change; Decrease; Significantly Decrease	Comments
1	Number of customers affected by PSPS events (normalized by fire weather, e.g., Red Flag Warning line mile days)	Significant Decrease	PG&E has a suite of mitigations that potentially reduce customers affected through microgrids, segmentation, and resiliency zones in the short term, and we continue to implement and explore new opportunities to remove customers from PSPS scope through system hardening, undergrounding and technology pilots in the long term.
2	Scope of PSPS events in circuit-events, measured in number of events multiplied by number of circuits targeted for de-energization (normalized by fire weather, e.g., Red Flag Warning line mile days)	Significant Decrease	PG&E views the accuracy of the scope of a PSPS event based on how well we forecast weather conditions that meet the criteria for PSPS and the number of circuits that will be adversely affected by the elevated fire weather threat. While a significant reduction in "circuit-events" is expected going forward, there will still be circuits impacted, just in smaller portions. Reducing circuit-events can be influenced by system hardening and segmentation investments in targeted locations. PG&E's objective is to enact smaller and more surgical PSPS events.
3	Duration of PSPS events in customer hours (normalized by fire weather, e.g., Red Flag Warning line mile days)	Decrease	PG&E interprets this as the total number of hours an average customer is de-energized in a PSPS event.[(a)] The duration of a PSPS event is generally attributed to two parts, the weather duration, and the restoration duration. PG&E is enacting actions to further optimize the post-PSPS patrol & re-energization processes, but we cannot control the duration of an elevated fire weather event
4	Number of customers affected by PSPS events (total)	Decrease	While an absolute decrease is expected in the number of customers affected for the reasons described above (1), long-term climate models point to a higher probability of more frequent fire weather conditions. The total number of customers impacted by PSPS in any given year is dependent on the weather patterns and weather events experienced in that year.
5	Scope of PSPS events in circuit-events, measured in number of events multiplied by number of circuits targeted for de-energization (total)	Decrease	While an absolute decrease is expected in circuit events for the reasons described above (2), long-term climate models point to higher probability of more frequent fire weather conditions. The total number of PSPS circuit-events in any given year is dependent on the weather patterns and events experienced in that year.

TABLE PG&E-8.1-1:
ANTICIPATED CHARACTERISTICS OF PSPS USE OVER NEXT 10 YEARS
(CONTINUED)

Rank Order 1-9.	PSPS characteristic	Significantly Increase; Increase; No Change; Decrease; Significantly Decrease	Comments
6	Duration of PSPS events in customer hours (total)	Decrease	While an absolute decrease is expected in customer hours for the reasons described above (3), long-term climate models point to higher probability of more frequent fire weather conditions. The total customer hours driven by PSPS in any given year is dependent on the weather patterns and weather events experienced in that year.
7	Frequency of PSPS events in number of instances where utility operating protocol requires de-energization of a circuit or portion thereof to reduce ignition probability (normalized by fire weather, e.g., Red Flag Warning line mile days)	No Change	No change in the frequency of PSPS events compared to all fire weather days or red flag warnings could occur as PSPS may not be required for marginal weather events based on reasons described above (1) and (2). To reduce the number of PSPS events, the area of the system under threat of adverse weather would need to be either: (1) built to hardened standards to withstand extreme weather, or (2) mitigated by PSPS impact reduction equipment and services. Other alternatives such as switching or sectionalizing equipment may not be fully effective in reducing frequency of PSPS events.
8	Frequency of PSPS events in number of instances where utility operating protocol requires de-energization of a circuit or portion thereof to reduce ignition probability (total)	No Change	While PG&E strives to reduce the frequency of PSPS events, given that long term climate models point to a higher probability of more frequent fire weather conditions, it is expected that the absolute number of PSPS events will not change, or may even increase. The actual number of PSPS events in any given year is dependent on the weather patterns and weather events experienced in that year.
9	Other	N/A	N/A

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(a): External factors include but are not limited: urban expansion in the wildland urban interface, fuels treatment programs performed by state and federal agencies, changes in bark-beetle tree damage and tree mortality (e.g., sudden oak death), fuel loading, general population changes, changes in regulatory requirements, climate change, droughts, and frequency and duration of dry wind events

The absolute number of customers, scope, frequency, and duration during this timeframe is unknown and dependent on numerous external factors.

8.2 Protocols on PSPS

Describe protocols on PSPS (PSPS or de--energization), highlighting changes since the previous WMP submission:

1) *Method used to evaluate the potential consequences of PSPS and wildfires. Specifically, the utility is required to discuss and how the relative consequences of PSPS and wildfires are compared and evaluated. In addition, the utility must report the wildfire risk thresholds and decision-making process that determine the need for a PSPS.*

2) *Strategy to minimize public safety risk during high wildfire risk conditions and details of the considerations, including but not limited to a list and description of community assistance locations and services provided during a de--energization event;*

3) *Outline of tactical and strategic decision-making protocol for initiating a PSPS/de--energization (e.g., decision tree);*

4) *Strategy to provide for safe and effective re-energization of any area that is de--energized due to PSPS protocol;*

5) *Company standards relative to customer communications, including consideration for the need to notify priority essential services – critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies. This section, or an appendix to this section, must include a complete listing of which entities the electrical corporation considers to be priority essential services. This section must also include description of strategy and protocols to ensure timely notifications to customers, including AFN populations, in the languages prevalent within the utility's service territory; and*

6) *Protocols for mitigating the public safety impacts of these protocols, including impacts on first responders, health care facilities, operators of telecommunications infrastructure, and water utilities/agencies.*

In this section, PG&E describes our: (1) method used to evaluate the potential consequences of PSPS wildfires, (2) strategy to minimize public safety risks during high wildfire risk conditions; (3) PSPS decision making protocols; (4) re-energization strategy; (5) customer, agency, and external communications; and (6) protocols for mitigating the public safety impacts of these protocols.

8.2.1 Method Used to Evaluate the Potential Consequences of PSPS Wildfires

The PSPS Risk-Benefit Tool addresses the regulatory requirements presented in D.21-06-014, which requires California IOUs to quantify the risk/benefits associated with initiating or not initiating a PSPS event impacting customers. This tool was developed in collaboration with PG&E's Risk Management and Safety team and Joint IOU PSPS Working Group ahead of the 2021 PSPS season, with alignment on the industry-standard methodology described in PG&E's Risk Assessment and Mitigation Phase (RAMP) and General Rate Case (GRC) workpapers.[168]

We incorporated the aforementioned risk-benefit analysis into the PSPS execution process to help inform the PSPS decision-making process. PG&E appreciates the areas of potential concern which the CPUC previously identified and shared regarding public safety risks,[169] and, where possible, we have worked to incorporate these risks into our PSPS Risk-Benefit analysis. PG&E also recognizes that these risks have not yet been fully examined by the CPUC or other interested stakeholders and guidance is still being developed. As such, PG&E aligns with the current industry-standard Multi-Attribute Value Function (MAVF) framework, as defined through the Safety Modeling Assessment Proceeding (SMAP), which specifies how various consequences are factored into a risk calculation. Utilizing this framework, PG&E incorporates PSPS event forecast information into our PSPS Risk-Benefit Tool, which are further described in Section 8.2.3.7.

Currently, we evaluate how the potential duration of interrupted power can adversely impact reliable energy to all customers located on a specific transmission or distribution circuit and the likelihood of a resulting injury and/or property or structure damage in our risk analysis. We intend to mature this model to better understand how to we can further quantify other potential concerns associated with de-energization in our communities. The output of the tool is a ratio that compares the calculated PSPS potential benefit from initiating an PSPS event (i.e., mitigation of catastrophic wildfire consequence) to the induced risks associated with an event (i.e., impact to customers resulting from a PSPS outage). Key inputs in the analysis include results from Technosylva wildfire simulations specific to the distribution and transmission circuits in scope for a potential de-energization, the number of customers forecasted to be de-energized, and the forecasted number of customer hours across each identified circuit in scope for a potential de-energization.

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168 PG&E response to CPUC Energy Division Data Request GRC-2023-Ph1-DR_ED_001_Q01Supp01.

169 D.21-06-014, pp. 12-14.

After the potential de-energization scope is determined, including the identification of potentially impacted circuits for the PSPS event in question, this scope and the Technosylva wildfire simulation outputs are used as inputs into the Risk-Benefit tool, which quantifies the public safety risk and wildfire risk resulting from the forecasted impacts of the pending weather / PSPS event. During the de-energization decision-making meeting, the PSPS Risk Analyst reviews the results of the risk/benefit analysis with the Officer-in-Charge (OIC) and the Incident Commander (IC) to help inform the decision of whether to de-energize the circuits in scope.

8.2.2 Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions

Strategy to minimize public safety risk during high wildfire risk conditions and details of the considerations, including but not limited to a list and description of community assistance locations and services provided during a de-energization event.

A) Strategy to Minimize Public Safety Risk

As outlined in Section 8.1, PG&E will continue to initiate and improve programs to reduce the impacts of PSPS on customers, while decreasing catastrophic wildfire risks.

B) Mitigating Impacts on De-energized Customers

PG&E recognizes the customer and community impacts that result from a PSPS, and understands, in many cases, the same customers may be impacted by multiple PSPS events in a given year. PG&E aims to minimize PSPS impacts through a variety of customer services and programs.

In 2022, PG&E will continue to ground programs and services from customer and stakeholder feedback, research, and data to continuously improve efforts to support customers and communities. PG&E will use this feedback and research to:

- Refine CRC strategy, working in close collaboration with county, tribal, and CBO partners.
- Enhance solutions for customers frequently impacted by PSPS events (e.g., Butte County).
- Support our most vulnerable customers through expanding identification, identifying needs, and developing and providing programs, operations, and services, with a key focus in driving customer resiliency.

To further explain how PG&E mitigates impacts on de-energized customers, we have broken up this section into the following categories:

1. CRCs
2. Customer Resiliency Programs and Continuous Power Solutions:
    - DDAR Program;
    - PBP;
    - Self-Generation Incentive Program (SGIP);
    - FPS;
    - Backup Power Transfer Meter (BPTM) Program
    - Generator and Battery Rebate Program;

- Backup Power Education through Online Marketplace and Safety Action Center;
- EV Charging Network Support and Resiliency;
- Community Microgrid Enablement Program (CMEP);
- Individual Critical Customer Back Up Power Support; and
- Other Resource Programs.

PG&E also conducts extensive proactive education and outreach (outlined in Section 7.3.10.1), as well as sends customer and community notifications, during a PSPS event to assist with mitigating PSPS impacts (which are described in Section 8.2.5).

1. CRCs

To minimize impacts during a PSPS event, PG&E opens CRCs in potentially impacted counties and tribal communities. CRCs provide customers and residents a safe location to meet their basic power needs, such as charging medical equipment and electronic devices.

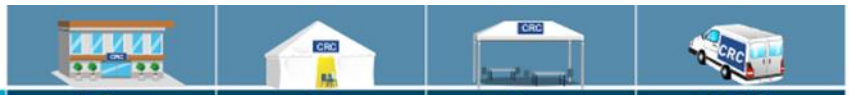
PG&E developed the CRC strategy in consultation with regional, local, and tribal governments, advisory councils, public safety partners, representatives of the disability and AFN communities, senior citizen groups, business owners, CBOs, and public health and healthcare providers.

Resources:

CRCs open the day PG&E de-energizes until the day electric service is fully restored. CRC standard operating hours are from 8 a.m. – 10 p.m.

PG&E adapted our CRC approach to reflect appropriate public health considerations due to COVID-19. PG&E continued to use a combination of indoor, micro (smaller, open air tents) and mobile (vans) CRCs to accommodate physical distancing and COVID-19 guidelines. See the Figure PG&E-8.2-1 outlining the different CRC types and resources available at PG&E's CRCs.

FIGURE PG&E-8.2-1:
CRC TYPES AND RESOURCES



Details/Resources	Indoor	Tent	Micro	Mobile
CRC Overview	Indoor site (i.e., Community Center)	Soft-sided tent at outdoor site	Open air tents at outdoor site	Sprinter van and tents at outdoor site
COVID-19 Health and Safety Measures	X	X	X	X
ADA-Accessible Restroom and Hand-Washing Station	X	X	X	X
Heating and Cooling	X	X		
Device Charging*	X	X	X	X
Wi-Fi Service	X	X	X	X
Bottled Water	X	X	X	X
Non-Perishable Snacks	X	X	X	X
"Grab and go" resource offerings**	X	X	X	X
Tables and Chairs	X	X	X	X
Bagged Ice	X	X		
Blankets (quantities limited)	X	X	X	X
Security Personnel	X	X	X	X
Cellular Coverage	X	X	X	X
Customer Service Staff	X	X	X	X
Wind/Weather-Resistant	X	Limited		

* Medical device charging will be prioritized in times of high demand
** Grab and go bag contains device charger, water, snacks and info card.

To keep PG&E customers and communities safe, all CRCs reflect appropriate COVID-19 health considerations and federal, state, and county guidelines:

- Facial coverings are required regardless of vaccination status and physical distancing is encouraged indoors;
- Supplies are handed out so customers may choose to "grab and go";
- Surfaces are regularly sanitized; and
- For the health and safety of the community, we ask customers not to visit a center if they are exhibiting any symptoms of illness.

As the COVID-19 situation evolves, PG&E will continue to modify these protocols as needed.

Site Criteria/Locations:

When identifying potential CRC locations, PG&E consults with regional, local, and tribal governments, advisory councils, public safety partners, representatives of the disability and AFN communities, senior citizen groups, business owners, CBOs, and public health and healthcare providers.

PG&E's pre-identified indoor CRCs are locations known to the public and identified in coordination with local and tribal agencies, such as community centers, libraries, schools, churches, and senior centers. Outdoor CRCs (Tent, Micro and Mobile) are set up in local lots in similar locations. Where appropriate, PG&E invests in adding an

automatic transfer switch to indoor sites to ensure temporary generation automatically powers on during outages

PG&E takes into consideration the below criteria when identifying and reviewing potential CRC locations:

Indoor CRC Site Criteria:

- Compliant with safety requirements (i.e., earthquake/fire codes, occupancy limits, meets all local codes, possesses interior and exterior lighting);
- Americans with Disabilities Act (ADA)-accessible, meeting all associated facility and parking guidelines;
- Has own back up generation or capable of receiving temporary back up generation;
- Outfitted with restroom(s) and indoor plumbing or and able to accommodate portable ADA-compliant restroom(s);
- Able to accommodate off-street paved parking; and
- Equipped with a level-loading area for loading and unloading materials.

Outdoor CRC Site Criteria:

- Approximately half acre or more in size;
- Paved, ADA-accessible lot; and
- Able to accommodate portable ADA-compliant restroom.

As of December 2021, PG&E has secured 112 indoor and 282 outdoor event-ready locations with site agreements executed between PG&E and landowners.[170] Note that these are PG&E-operated. A list of potential CRC sites is posted in PG&E's PSPS preparedness website.

In-Event Coordination:

During PSPS events, PG&E's dedicated Agency Representatives coordinate with potentially impacted counties and tribes to review the proposed scope of the event. Agreement on the selected locations for the CRCs is based on the anticipated areas of de-energization.

PG&E begins with CRC locations previously identified and vetted by counties and tribes. In some cases, PG&E may procure additional locations during a PSPS event in close coordination with the county or tribe due to county or tribe preference or inability to use a pre-identified site.

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170 As of December 21, 2021.

PG&E may decide not to open a CRC or close one early due to agency requests, faster than anticipated restoration, safety concerns, or other factors.

PG&E shares CRC site locations on our website, social media, and media press releases. These locations are shared with state and county officials as well, in addition to California Foundation for Independent Living Centers (CFILC) and other CBOs to reach our AFN customers.

Disability and Aging/AFN Communities and MBL Considerations:

To meet a variety of safety needs for disability and aging/AFN communities, as well as MBL customers, PG&E has taken the following steps:

- ADA-evaluation and remediation investment at indoor sites, along with compliance checklists for onsite personnel;
- Consultation with counties and tribes via Local Public Affairs (LPA) Representatives, PSS and Tribal Representatives regarding CRC locations based on county, tribal, and/or local demographics;
- Public transit evaluation of distance and accessibility for indoor and outdoor sites;
- Evaluation and/or provision of accessible parking either through restriping, signage, and/or cones; and
- Provision of:
  - ADA-compliant restroom(s) at all CRC sites;
  - Information cards with in-language resources;
  - Clear face shields for customers who are hard of hearing and/or read lips for accessible communication;
  - Language Line technology for real time ASL translation
  - Signage that complies with ADA standards; and
  - Medical equipment charging at all CRC sites.
  - Privacy screens

PG&E will continue site reviews and improvements at additional CRC sites as needed. In accordance with D.21-06-034, PG&E will file an updated CRC plan (for both fixed facility and mobile locations) within the 2022 Pre-Season Report no later than July 1, 2022.

2. Customer Resiliency Programs and Continuous Power Solutions

PG&E offers solutions to reduce adverse impacts of PSPS events to customers, including those who are most vulnerable. In advance of wildfire season and throughout 2022, PG&E will continue to work with partner organizations to provide outreach and

support to vulnerable customers through programs such as the ones listed below. In 2022 PG&E will incorporate FPS, which will provide permanent solutions to customers who are impacted by outages.

See Section 7.3.3.11.1, which describes in detail PG&E efforts to support critical facilities and other customers' generation needs during PSPS events.

- Disability Disaster Access and Resource "DDAR" Program – In April 2020, PG&E and CFILC[171] launched the DDAR Program, a joint effort to aid people with disabilities and older adults who have medical and independent living needs.

  CFILC administers the program through partnerships with participating Disability Disaster Access & Resource Centers (DDARCs)[172] in local communities throughout PG&E's service territory. DDAR enables local DDARCs to provide qualifying customers who use electrical medical devices with access to backup portable batteries through a grant, lease-to-own, or the FreedomTech[173] low-interest financial loan program. DDAR focuses on understanding customer needs through conversation, discussing emergency plan preparedness and assessing the best resiliency solution for each customer during a PSPS event or EPSS outage. PSPS event resources provided by DDAR include accessible transportation, lodging, food vouchers, and gas cards for generator fuel. Throughout the year, DDAR assists customers with disabilities and independent living needs with emergency planning and education and outreach about PG&E programs, such as the MBL Program.

  Table PG&E-8.2-1 describes the resources provided to customers through DDAR in 2020 and 2021 (as of December 31, 2021).[174]

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171 CFILC is a 501(c)(3) non-profit organization that provides a wealth of programs and coalitions to support individuals with disabilities and older adults and offers PG&E a connection with this community to ensure their safety during power shutoffs.

172 The Find a DDARC tool lists participating DDARCs. https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/independent-living-centers.page?WT.mc_id=Vanity_disabilityandaging.

173 https://freedomtech.org/.

174 As of December 31, 2021.

TABLE PG&E-8.2-1:
RESOURCES PROVIDED TO CUSTOMERS THROUGH DDAR PROGRAM IN 2020 AND 2021
(AS OF 12/31/2021)

Resources/Engagement with Customers Before, During and After 2020 and 2021 PSPS Events	Approximate Resources Provided to Customers in 2020	Approximate Resources Provided to Customers in 2021
Customer Energy Assessments	1,750	2,400
Batteries Delivered	1,000	1,370
Food Vouchers	900	350
Hotel Stays	550	270
Gas Cards	50	40
Transportation	30	2

In 2022, PG&E anticipates the DDAR Program will continue to offer a variety of resources to customers including batteries, hotel stays, food vouchers, gas cards, transportation, and other resources. The DDAR program will expand program eligibility to provide support to customers who use durable medical equipment and assistive technology that is required to live independently. In addition, emergency preparedness discussions will not only include PSPS events, but also preparations for unplanned EPSS outages.

- PBP – Launched in August 2020, the PBP provides free portable backup battery solutions to low-income[175] MBL customers in Tier 2 and 3 HFTD areas to support resiliency during PSPS events.

  Five Low-Income Home Energy Assistance Program (LIHEAP) providers administer the PBP: Butte Community Action Agency, Central Coast Energy Services, Community Resource Project, North Coast Energy Services, and Redwood Community Action Agency. Richard Heath & Associates, a third-party energy program implementer focused on underserved communities, is also working with PG&E on the program. These PG&E partner organizations actively reach out directly via mail and phone to all customers who meet eligibility criteria. The delivery partner then completes an assessment[176] of the customer's medical equipment power needs and provides a battery, if appropriate. Customers do not need to apply for the program. Like the DDAR Program, PBP focuses on understanding customers' needs through conversation, discussing emergency plan preparedness, and assessing the best resiliency solution for each customer during a PSPS event.

  The PBP provides a range of batteries from smaller (500 Wh) lightweight batteries to larger (6,000 Wh) batteries in order to meet the power needs of a variety of

[175] Enrolled in CARE or Family Electric Rate Assistance (FERA) Program.

[176] The number of completed energy assessments and battery deliveries depend on customers who respond to outreach, are willing to participate, and have medical devices that are eligible to be supported by a battery.

medical devices. The larger batteries are delivered to those with higher energy needs.

PG&E worked with each of the delivery organizations to design the assessment and develop prioritization guidelines. PG&E provided a targeted list of customers and prioritized the list using historical PSPS and 10-year lookback data to ensure customers most likely to be impacted would be contacted first. Once the PBP partner reached the customer and completed the energy assessment, the battery assignment was at the discretion of the local partner organization. This approach provides a simple, streamlined customer experience that meets local community needs and does not require capital outlay from participating customers.[177] Throughout 2020 and 2021, PBP implementers completed over 16,000 assessments and delivered over 10,700 batteries to PG&E's low-income MBL customers (as of December 31, 2021).

In 2022, PG&E and partner organizations plan to continue delivering portable batteries to qualifying customers. Since the income-qualified MBL population has been targeted exclusively by the PBP for two PSPS seasons and over 10,700 batteries have been delivered, PG&E may expand eligibility for this program to non-income-qualified MBL customers in HFTDs.

- SGIP – SGIP provides incentives for permanent battery systems for backup power. Over the last several years, SGIP has evolved, with a focus on vulnerable customer resiliency. Under SGIP's equity resiliency budget category, incentives can cover up to 100 percent of funding, including battery cost, installation, and rewiring to eligible customers.

  In 2020, the majority of SGIP funding was reserved for customers who met equity and/or equity resiliency criteria,[178] with a focus on MBL customers and customers who rely on electric well pumps at their primary residence. Higher base incentives are reserved for those who are both vulnerable to PSPS outages and provide critical functions for customers during the outage(s).[179]

  PG&E also received approval for the residential component of our SGIP Financial Assistance pilot. This pilot adjusts the timing of SGIP incentive payment structures to provide a fifty percent (50 percent) upfront payment to approved contractors

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177 Customers are responsible for the costs of charging the batteries, but all efforts are made to deliver the battery with a full charge whenever possible.

178 Commission D.19-09-027 established a new "equity resiliency budget" set-aside for customers participating in one of two low-income solar generation programs or vulnerable households that are located in Tier 2 and Tier 3 HFTD, as well as for critical service facilities serving those areas. D.20-01-021 authorized statewide annual ratepayer collections of $166 million annually through 2024 for the SGIP program. This decision prioritized allocation of funds to benefit customers affected by PSPS events or located in areas with extreme wildfire risk, including adopting a resiliency adder and a renewable generation adder to promote critical resiliency needs during PSPS events.

179 Customers eligible for the equity resiliency incentive will receive a $1 per-watt-hour incentive for energy storage projects.

installing SGIP-eligible measures for qualifying residential customers applying for equity and equity resiliency SGIP incentive funds. This payment structure removes cost barriers to enable vulnerable residential customers to improve their energy resiliency before PSPS events and other emergencies. Through the end of 2021 the Pilot has supported 99 projects.

The remaining funds for the residential General Market budget Step 7 reserves 50 percent for customers living in Tiers 2 or 3 HFTDs, or who have been impacted by two or more discrete PSPS events but were unable to apply to the Equity Resiliency budget.

As of December 31, 2021, PG&E managed a total of ~$275M+ or ~5,200 Equity Resiliency applications, including $49M+ or ~2,100 paid in both 2020 and 2021.

- Generator and Battery Rebate Program – In October 2020, PG&E launched the Generator Rebate Program which provides a $300 rebate to rural customers who rely on well-water powered by electricity living in Tiers 2 or 3 HFTD, with an additional $200 for low-income residential customers on PG&E's CARE or FERA programs.

  In June 2021, PG&E updated the program to the "Generator and Battery Rebate Program," and expanded it to include more eligible customers, increased the rebate structure, and added more products[180] to the qualified products list. To qualify, customers must be located in Tier 2 or 3 high-fire threat areas as determined by the CPUC on the High Fire-Threat District map and must meet one of the following criteria: (1) rely on well water pumping for premise water needs; (2) enrolled in the MBL program; or (3) are a small/micro non-critical care essential business (i.e. grocery store, convenience store, veterinarian service, dental office, urgent care/clinic, food bank, etc.).

  The expanded rebate structure includes 3 tiers. Level 1: $300 rebate for products $0-$500, Level 2: $500 rebate for products $501-$1,000, Level 3 $1,000 rebate for products over $1,000. The rebate is capped at the product pricing so customers cannot receive a higher rebate than what they paid. Residential customers on PG&E's CARE/FERA program that are eligible for the program will also receive a $200 additional rebate at each level, so long as the rebate does not exceed the price of the product.

  Finally, the program added portable batteries to the Qualified Products List, in addition to the portable generators. As of December 31, 2021, PG&E has paid over ~1,300 rebates (100+ in 2020, and ~1,200 in 2021).

- FPS – PG&E will implement a FPS to help customers adopt permanent solutions (e.g., solar and storage) to mitigate outage impacts from PSPS and EPSS. The program will be implemented in conjunction with PG&E's grid hardening solutions

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180 Previously, the program only included portable generators. As a result of adding MBL customers to the eligibility criteria, PG&E decided to add portable batteries to the qualified products list.

and will enhance PG&E's ability to quickly and cost-effectively mitigate outage risk to critical customers.

- BPTM – Metering Services and Engineering have developed and patented the BPTM.[181] The BPTM was developed to ***solve grid resiliency*** challenges facing customers who lack PV systems and batteries. This product allows most portable battery stacks or generators a safe, low to no cost, user friendly way to island from the grid and power multiple critical home loads, via the smart meter, when the utility power is unavailable. PG&E completed extensive testing of the BPTM in 2020 and 2021 and started deploying these under the Customer Care pilot program in 2020 and 2021, targeting customers in areas expected to be impacted by PSPS and/or EPSS.

  In May 2021, PG&E launched an internal field test to install 11 BPTMs in the field. In September 2021, PG&E expanded the pilot to provide 50 devices to customers who participated in the Generator and Battery Rebate Program whose generator is compatible with the BPTM. As of December 2021, PG&E installed ~50 devices to customers and is continuing to schedule more. PG&E is planning on installing approximately 1,500-2,000 more devices to additional customers and is currently strategizing on the target audience. The long-term vision is that the BPTM will be available to all customers as a universal solution for micro-gridding capabilities.

- Backup Power Education through Online Marketplace and Safety Action Center – It is important for all customers to be prepared for different types of outages, whether they are PSPS events called by PG&E, wildfire-related outages initiated at the request of first responders such as California Department of Forestry and Fire Protection, or rotating outages initiated by the CAISO. PG&E is supporting customer preparedness and resiliency outreach by providing information and resources to customers interested in backup power solutions. This includes tools for comparing backup power options and an online marketplace (marketplace.pge.com) to find vendors. PG&E Marketplace currently hosts Portable Power Stations and Portable Generator categories to provide customers with the vendor options and retail purchase options. Through our online Safety Action Center (safetyactioncenter.pge.com), PG&E offers customers tools and tips to learn more about backup power safety. PG&E plans to provide information on backup power options during virtual webinars and other outreach events throughout our service territory.

  PG&E will continue to explore additional continuous power-related program offerings to support backup power needs for potentially impacted customers.

- EV Charging Network Support and Resiliency – During PSPS events, PG&E's website defaults to a PSPS information site. Customers looking for information on EV charging stations are redirected to mapping resources found on PG&E's "Locate an EV Charger" page (ev.pge.com/charging-stations), which allows customers to find charging locations near them or along their route. In 2021, to ensure the public

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181 https://www.pge.com/pge_global/common/pdfs/save-energy-money/savings-programs/BPTM-FactSheet.pdf.

had clear information of where supported EV chargers were located during PSPS events, PG&E updated our charger map so PSPS event information is displayed on PG&E's EV Savings Calculator tool in real-time.

In addition, PG&E contracted with Portable Electric to lease six trailer mounted units for the 2021 wildfire season. Each unit consisted of an 80kWh battery and integrated single port 25kW DCFC. PG&E can deploy these units to the El Dorado County Fairgrounds during activation of that CRC. During any activation, Portable Electric will provide full turn-key deployment services to include transportation to/from designated charging locations, charging/discharging operations, unit storage, and O&M. PG&E did not activate the turn-key deployment services in El Dorado County during the 2021 wildfire season as El Dorado County was not in scope for de-energization during PG&E's 2021 PSPS events. PG&E plans to make small operational tweaks after each deployment, as needed, to provide continued and consistent service to customers.

- CMEP – PG&E's CMEP provides incremental technical and financial support to communities seeking resilience for critical facilities and vulnerable customer groups. The program helps communities plan and implement a resilience solution so that they can power critical resources when the utility grid is shut down due to extreme weather or PSPS events. The support includes technical expertise and cost offsets to pay for the cost of distribution system upgrades to enable the safe islanding of a microgrid.

The program consists of four elements:

1. Enhanced Utility Technical Support – Serves to facilitate the development of a multi-customer microgrid from initial concept exploration, through solution assessment, to solution execution.

2. Enhanced Self-Service Information and Project Tools – PG&E's Community Resilience Guide (www.pge.com/resilience) provides updated financial, technical, and interconnection resources for community resilience projects.

3. Community Microgrid Enablement Tariff – PG&E submitted a pro forma tariff as part of our CMEP Advice Letter 5918-E to govern the eligibility, engineering studies, development, and island and transitional operation of community microgrids.

4. Cost Offsets – PG&E will offset the cost of that equipment necessary to enable the safe islanding of a community microgrid, up to $3 million per project.

Following the CPUC's approval with modifications of CMEP in Res. E-5127 on March 18, 2021, PG&E launched the CMEP in April 2021. PG&E also notes that a new Microgrid Incentive Program was adopted in D.21-01-018. PG&E has been working collaboratively with the other IOUs and stakeholders to further define this program to support resilience for our customers. A program implementation plan for the Microgrid Incentive Program was submitted to the CPUC on December 3, 2021.

- Individual Critical Customer Back Up Power Support: See Section 7.3.3.11.1, which describes in detail PG&E's efforts to support critical facilities and other customers' generation needs during PSPS events.

- Other Resource Programs: See Section 8.4 for information on PG&E's PSPS in-event support (e.g., foodbanks, grocery delivery programs etc.) for AFN customers.

See Section 8.2.5 for information on PSPS in-event customer coordination, communications, and notification processes.

8.2.3 PSPS Decision-Making Protocols

Outline of tactical and strategic decision--making protocol for initiating a PSPS/de-energization (e.g., decision tree).

This section describes PG&E's process for determining when to initiate a PSPS event. As of August 2021, we are using our updated PSPS Protocols to assess PSPS events. In September 2021, we completed the development of our new PSPS Transmission Protocols. We will address both the PSPS Distribution and Transmission Protocols and refer to them jointly as the "PSPS Protocols." Whenever we address just a subset of the protocols (i.e., Distribution or Transmission) we will specify this subset as either the PSPS Protocols (Distribution) or the PSPS Protocols (Transmission).

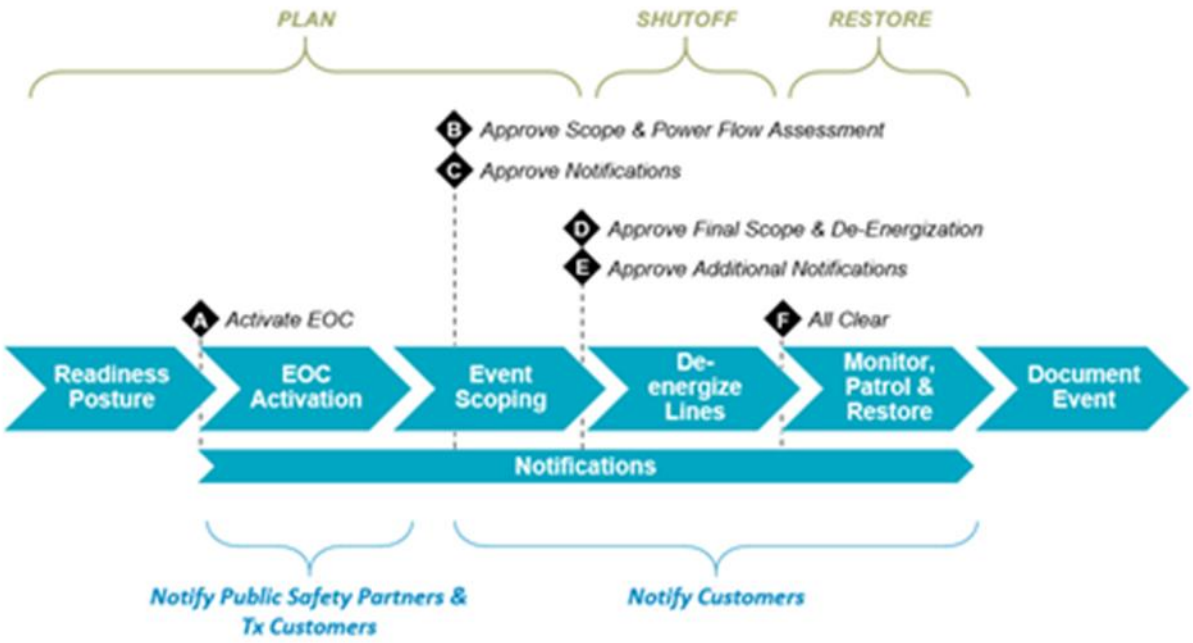
PG&E plans to continue to use the current PSPS Protocols in the 2022 PSPS Season. As part of our PSPS continuous improvement process, we will continue to evaluate our PSPS Protocols and will inform if we have any additional changes.

In the remainder of this section, we will focus on describing our current PSPS Protocols.

8.2.3.1 PSPS Preparation and Scoping Process

This section provides an overview of the process for determining when to initiate a PSPS event under the current PG&E PSPS Protocols. Figure PG&E-8.2-2 shows at a high-level the process PG&E uses to prepare for and conduct a PSPS event.

FIGURE PG&E-8.2-2:
PG&E'S HIGH LEVEL PSPS PROCESS STEPS



PG&E considers implementing a PSPS event when strong gusty winds, critically low humidity levels, and critically low fuel moisture levels pose an unacceptable risk of causing fast-spread, catastrophic wildfires that pose a threat to CA communities we serve. The combination of gusty winds and dry atmospheric and fuel conditions increases the probability of a utility caused outages and ignition as well as a catastrophic fire.

Assessments begin several days before the weather event is forecast to take place. PG&E identifies the weather conditions that could create high fire potential combined with high outage and ignition potential using high-resolution internal and external weather forecasting models as well as data from federal agencies. These external services and sources include the European Center for Medium-Range Weather Forecasts (ECMWF), the Global Forecast System (GFS), the Northern and Southern Operations Predictive Services, and the National Weather Service (NWS). Our thresholds and guidance for identifying critical fire risk and outage/ignition potential are determined by analyzing our current PSPS protocols through three decades of historical weather data in and around California. This process allows us to determine and test if historical fires from utility equipment may have been mitigated through PSPS while simultaneously understanding the scope and scale of PSPS events.

No single factor drives the determination that a PSPS is necessary, as each situation is dynamic and unique. The main drivers considered for PSPS events under the PSPS Protocols are described in the sections that follow. External forecast information from the NWS (e.g., Red Flag Warnings) and other forecast agencies is examined carefully; furthermore, PG&E coordinates with these agencies during high-risk periods to ultimately decide whether to de-energize portions of the grid for public safety.

8.2.3.2 PSPS Protocols Overview

The PSPS Protocols include enhancements to our IPW Model, FPI Model, and the integration of Technosylva Fire modeling into our PSPS Protocols. In addition to the model enhancements described below, the PSPS Protocols also incorporate tree overstrike and high-risk vegetation and asset tags.

FPI Model Enhancements:

Our FPI Model has been significantly enhanced with Machine Learning capabilities, environmental and fire occurrence datasets, new model features, and an enhanced fire occurrence dataset. The FPI Model features, methodology and validation is discussed at length in Section 4.5.1(f). A short summary is provided below.

The FPI Model combines fire weather parameters (wind speed, temperature, and vapor pressure deficit), dead and live fuel moisture data, topography, and fuel type data to predict the probability of large and/or catastrophic fires. The FPI Model was developed and trained on an enhanced fire occurrence dataset developed by Sonoma Technology Inc. that combines agency fire information with sub-daily growth data from satellite fire detections. This was an important development as we can correlate fire growth in sub-daily timeframes to environmental data. Data scientists, meteorologists, and fire scientists tested dozens of new model features for the FPI Model and various model configurations and types, including logistic regression and multiple machine-learning models. These model results were tested using a train-test split ratio of 70 percent-30 percent; this involved training the model with 70 percent of the input data and testing predictions with the remaining 30 percent of fires. We ultimately chose a Balanced Random Forest Classification Machine Learning model for the FPI Model based on model performance.

IPW Model Enhancements:

The IPW Model represents the next generation of distribution outage and ignition probability models building on the 2020 OPW Model. The IPW Model features, methodology and validation is discussed at length in Section 4.5.1(g). A short summary is provided below.

The core model is a new multi-classification machine learning outage model, that provides hourly forecasts of outage probability by specific outage pathways, called classes. The probability of outage output for each class is then transformed to an ignition probability using known outage to ignition rates by each class.

The 2021 IPW model is a multi-classification Cat Boost Machine Learning model. It is a state-of-the-art model based on decision trees with advanced categorical feature support. The IPW model outputs the probability of 5 outage classes for each 2 x 2 km grid cell based on weather variables, tree overstrike per 2 x 2 km grid cell from aerial LiDAR, and a local “node” categorical variable. The model was tested by first training on every hour and grid cell from 2008-2019 and evaluating performance against 2020.

In addition, we built the model to adapt to the weather-outage response overtime in localized areas. We apply a time-weighted approach to weight current years more heavily in the final model output. This time-weighted approach allows changes in local

areas to be learned (both negative - increased tree mortality, asset degradation, etc.; and positive – conductor and pole replacement, vegetation management etc.).

Utilizing the IPW Model further helps PG&E pinpoint the areas where the probability of specific types of outages and ignitions are greatest. In addition, we incorporated tree overstrike risk directly into the IPW Model to further inform vegetation-based outage risk and increase the model's efficacy.

The IPW model is combined with the FPI model in space and time to evaluate the probability of utility caused ignitions, and the probability of a catastrophic fire should an ignition occur.

Integration of Technosylva Fire Spread Modeling:

After testing fire spread simulations across historical and forecast time horizons, we added Technosylva fire spread outputs into the PSPS Protocols. Utilizing Technosylva Fire Spread Modeling allows us to review millions of simulated ignitions to identify the areas where the risk of an ignition growing into a catastrophic wildfire is greatest. In addition, bringing in a third-party vendor to help produce PG&E's PSPS scope allows us to highlight areas where the models do and do not overlap for forecast corroboration and additional insights.

Incorporation of Hardening:

To date, PG&E has installed approximately 700 miles of hardened infrastructure within the approximately 25,500 miles of overhead line miles in the HFTD with strong poles, covered power lines, targeted undergrounding, removal, and remote grids to reduce the wildfire risk and to support PSPS to reduce the wildfire risk and to support PSPS mitigation in PG&E's service area.

To account for the hardening work performed, our Machine-Learning IPW framework accounts for positive and negative changes in grid performance and reliability year-over-year as we apply a time-weighted approach to weight more recent years of learned performance more heavily in the final model output. The model learns the performance of local grid areas hour-by-hour based on the wind speed observed at that hour and if outages or ignitions occur or not. The IPW Model compiles information from 13 models trained on each year separately from 2008-2020. This exponential weighting allows the model to organically account for positive changes in performance from system hardening as well as potentially negative changes due to the current drought and other exogenous factors.

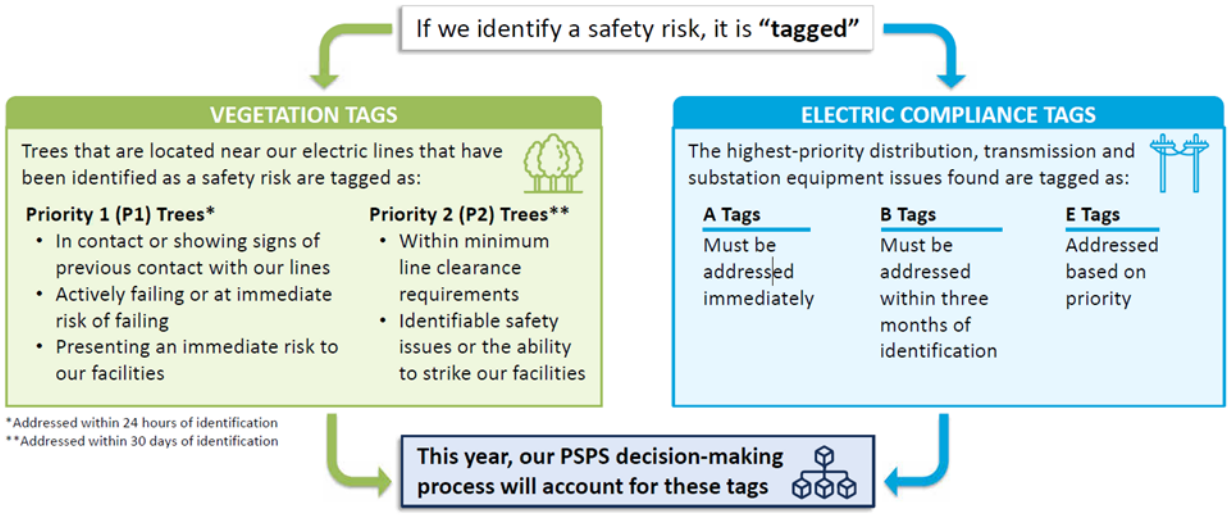
Incorporation of Tree Overstrike:

Our PSPS Protocols (Distribution) utilize a machine learning model to integrate overstrike directly into our IPW Model. Using a machine learning model helps us more accurately incorporate the risk by analyzing risk posed by the several million trees that are capable of striking our lines with approximately 150 million feet of overstrike in PG&E's service territory. The individual tree data were aggregated to a 2 x 2 km grid to help train the core outage model. Not surprisingly, the probability of vegetation caused outages correlates well with the volume of tree overstrike risk.

Incorporation of High-Risk Vegetation and Asset Tags:

Our PSPS Protocols (Distribution) have continued to incorporate any Priority 1 or Priority 2 tree tags[182] that meet our Minimum Fire Potential Conditions (mFPC). In addition to Priority Tags, we are also including any circuits with high-risk compliance tags that meet our mFPCs as part of our PSPS. Figure PG&E-8.2-3 below shows a schematic of our current Vegetation and Asset Hazard Considerations. In addition, in early 2021, PG&E evaluated how to incorporate the presence of high-risk vegetation conditions into our PSPS Protocols. As a result, in 2021 PG&E revised our PSPS Protocols to include consideration of Tree Overstrike Potential and Priority 1 and Priority 2 tags.[183]

FIGURE PG&E-8.2-3:
VEGETATION AND ASSET HAZARD CONSIDERATIONS



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182 "Priority 1" and "Priority 2" vegetation tags are created when trained vegetation inspectors identify trees or limbs that currently present elevated risk and must be worked on an expedited basis. Inspectors use Priority 1 tags for vegetation: (1) in contact or showing signs of previous contact with a primary conductor; (2) actively failing or at immediate risk of failing and which could strike PG&E's facilities; or (3) presenting an immediate risk to PG&E's facilities. Inspectors use Priority 2 tags for vegetation that does not rise to the level of Priority 1 but has encroached within the PG&E minimum clearance requirements or has an identifiable potential safety issue requiring expedited work.

183 Res.M-4856. Ratifies the Executive Director's Letter to PG&E Directing PG&E to Comply with Certain Requirements Pertaining to PG&E's Implementation of Tree Overstrike Criteria in its PSPS De-Energization Decision-Making.

In the following part of this section, we describe our PSPS Protocols (Distribution) and PSPS Protocols (Transmission) followed by our PSPS process once the Distribution and Transmission event scope has been defined.

8.2.3.3 PSPS Protocols (Distribution)

This section describes the PSPS Protocols for the distribution system. To be in-scope for distribution PSPS, grid cells must meet BOTH the mFPCs and at least ONE of the other three factors:

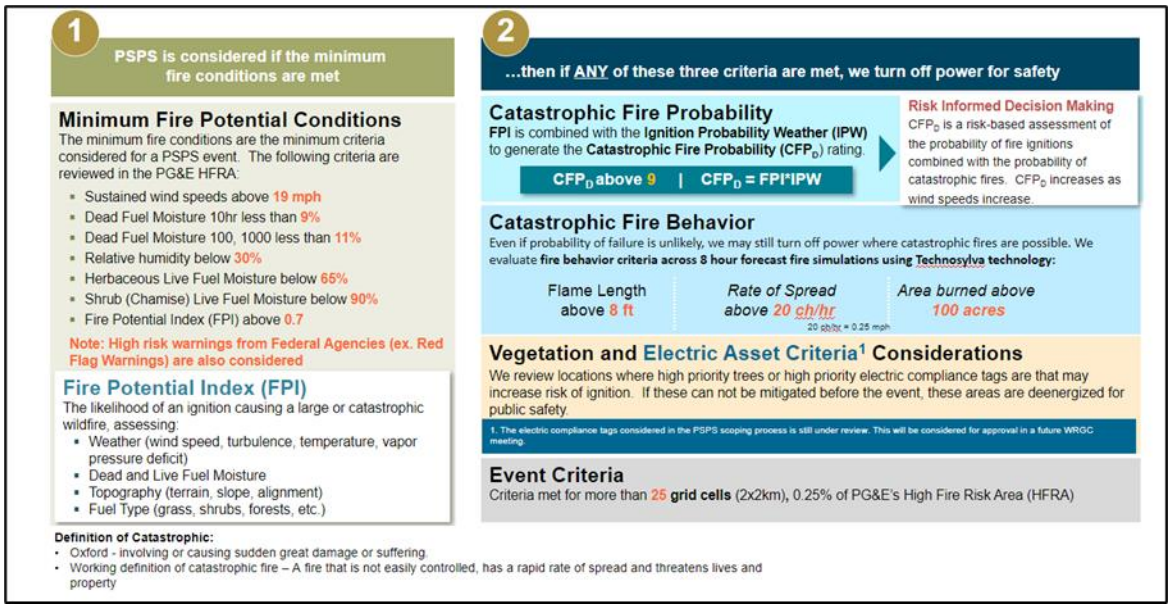
1) mFPC

2) At least one of the following:

- Catastrophic Fire Probability (CFP_D) comprised of the following:
  - IPW
  - Utility FPI
- Catastrophic Fire Behavior (CFB) (via fire spread simulations from Technosylva)
- Consideration of known high-risk vegetation and electric compliance tags

In addition to the meteorological models, we also evaluate the impacts of de-energization against the risk of wildfire should de-energization not occur. This information is reviewed at key decision points in the PSPS process and informs the ultimate decision to de-energize our customers and our communities.
Figure PG&E-8.2-4 below provides a quantitative summary of our PSPS Protocols (Distribution).

FIGURE PG&E-8.2-4:
PSPS PROTOCOLS (DISTRIBUTION)



The mFPC are the minimum weather and fuels filter based on relative humidity values, wind speed, and fuel moisture values that must be exceeded for a PSPS event to be considered.

The machine learning IPW and FPI Models are combined in both space and time to form CFP_D output at a 2 x 2 km resolution. CFP_D provides hourly outputs and highlights locations that have concurrence of an increased probability for large fires and increased probability of wind-related ignitions on the distribution system. Additionally, the CFB criteria are used to identify locations that may have a lower probability of ignition but could result in fires that are not easily suppressed and have potentially high consequences.

Below, we describe the three steps in the PSPS Protocols (Distribution).

Step 1: Evaluation of mFPCs and FPI

The first step of determining the scope of a PSPS event for distribution is evaluating the mFPCs. These conditions serve as a first review of weather conditions for a PSPS event to be considered. A PSPS event will only be evaluated if the following mFPCs are true in a HFRA:[184]

- Sustained wind speeds above 19 mph;
- Dead fuel moisture 10-hr less than 9 percent;[185]
- Dead fuel moisture 100-hr, 1000-hr less than 11 percent;[186]
- Relative Humidity below 30 percent;
- Herbaceous live fuel moisture below 65 percent;
- Shrub (Chamise) Live Fuel Moisture below 90 percent; and
- FPI above 0.7.

These values were established from an examination of historical fire occurrence in the PG&E service area, PSPS sensitivity studies using historical data viewed through the lens of both customer impacts and wildfire risk mitigated, as well as information published by federal agencies regarding fire behavior and criteria used to issue warnings to the public.

Step 2: In-depth review of fire risk

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[184] Revised 2021 WMP, pp. 85-89.

[185] 10-hr. dead fuel moisture represents the modeled moisture content in dead fuels in the 0.25 to 1-inch diameter class and the layer of the forest floor about one inch below the surface.

[186] 100-hr. Dead Fuel Moisture represents the modeled moisture content of dead fuels in the 1-to-3-inch diameter class.

If all the mFPCs in Step 1 are met, we conduct an in-depth review of fire risk using three separate measures. If the criteria for any of these measures are met, then PG&E may need to turn off power for safety:

1. CFP_D – PG&E uses machine learning to assess the likelihood of equipment failure during a given weather event and the subsequent risk of catastrophic wildfires if a failure occurs. This model uses a combination of the IPW and FPI Models. It is a risk-based assessment that evaluates the probability of an ignition (IPW) and the probability of catastrophic fires should an ignition occur FPI. The CFP_D model accounts for changes over time based on actual performance data. Thus, the model will address positive and negative trends in grid performance and reliability year-over-year, incorporating grid improvements such as system hardening, and enhanced vegetation management based on their performance at mitigating outages over time.

2. CFB – PG&E may de-energize customers where the consequence of a potential wildfire starting would be extreme, even if probability of a power line or equipment failure is low.

3. Vegetation and Electric Asset Criteria Considerations – PG&E reviews locations from recent inspections where high-priority tree or electric compliance issues are present that may increase the risk of ignition.

Step 3: Determining the outage area

If weather forecasts indicate a high likelihood of severe fire risk (Step 2), PG&E first identifies the meteorological footprint of severe fire weather and then identifies the distribution lines and other assets within that footprint. Power is turned off if any of the criteria listed on Step 2 above are met over a certain geographic area. This happens if the criteria also meet an area coverage criterion of more than 25 2x2 km grid cells, or 0.25 percent of PG&E's HFRA.

For distribution lines, the PG&E team determines which circuits are impacted and evaluates the ability to sectionalize circuits to limit the de-energization scope and resulting customer impact.

8.2.3.4 PSPS Protocols (Transmission)

This section describes the PSPS Protocols for the transmission system. In addition to analyzing distribution circuits that may need to be de-energized for safety, we also review transmission lines and individual structures for risk of igniting a catastrophic wildfire. Like the PSPS Protocols (Distribution), there is no single factor or threshold that will require shutting off power to a transmission circuit.

The Transmission PSPS decision-making process follows a similar framework as the distribution process but utilizes transmission-specific models. In order to be in-scope for PSPS, transmission structures must meet BOTH the mFPCs and at least one of the other four factors:

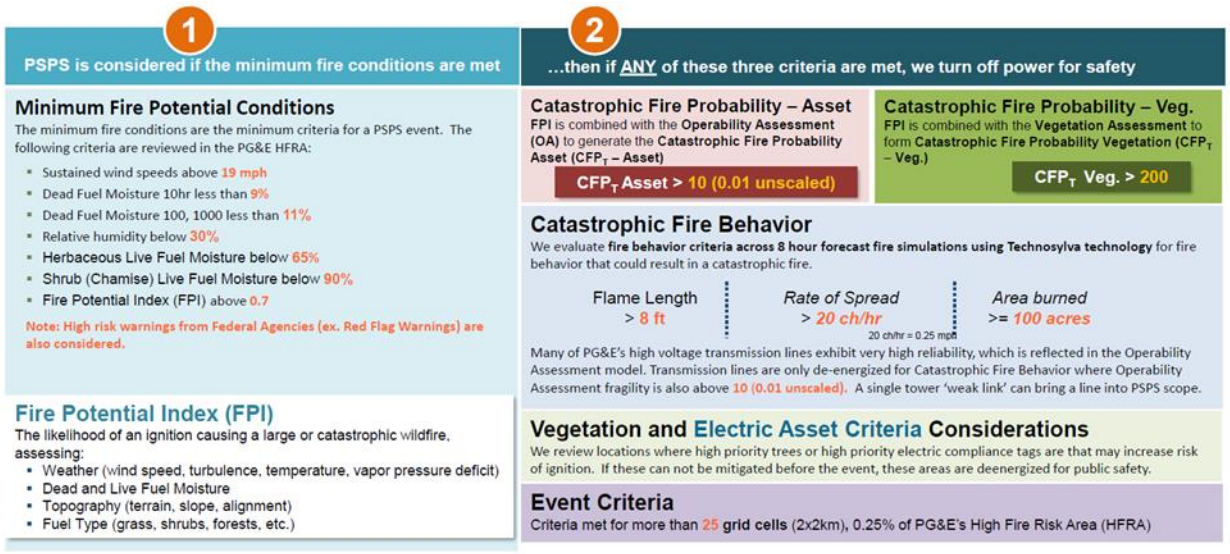
1) mFPC

2) At least one of the following:

- CFP_D from Asset Failures (CFP_T - Asset) comprised of the following:
  - Transmission Operability Assessment (OA)
  - Utility FPI
- CFP_D from Vegetation (CFPT - Veg) comprised of the following:
  - Transmission Vegetation Risk Model
  - Utility FPI
- CFB (via Fire Spread Simulations from Technosylva)
- Consideration of known high risk vegetation and electric compliance tags

Figure PG&E-8.2-5 below provides a quantitative summary of our PSPS Protocols (Transmission).

FIGURE PG&E-8.2-5:
PSPS PROTOCOLS (TRANSMISSION)



Step 1: mFPCs

The first step of determining the scope of a PSPS event on the transmission system is evaluating the mFPCs at the transmission structure level. The same criteria used for the distribution system also apply to the transmission system. These conditions serve as a first review of the weather conditions necessary for a PSPS event to be considered. Once the mFPCs are met, an in-depth review of risk models and other factors is performed.

Step 2: In-depth review of fire risk

If all the mFPCs in Step 1 are met, we conduct an in-depth review of fire risk using three separate measures. If the criteria for any of the measures are met, then PG&E may need to turn off power for public safety:

1. CFP_D - Asset – PG&E uses machine learning to assess the likelihood of equipment failure during a given weather event, and the subsequent risk of catastrophic wildfires if a failure occurs. This model uses a combination of the Operational Assessment (OA) and FPI Models, both in time and space, at every transmission structure to form the Transmission CFP_D model for asset failures. (CFP_T - Asset). The OA Model combines historical wind speeds for each structure, historical outage activity, Bayesian updating, and the condition of assets based on inspection programs to help understand the wind-related failure probability of each structure. The OA Model can be driven with forecast wind speeds to output the probability of failure at the structure level.

2. CFP_D - Vegetation – The transmission-specific vegetation risk model was derived by a collaborative effort between PG&E vegetation management and external contractors such as NV5 and Formation Environmental. This model leverages aerial LiDAR data to map the location and attributes of trees near transmission

lines. The transmission vegetation risk model is based on several factors such as overstrike, the amount of unobstructed fall paths to a wire, the slope between tree and conductor, and tree exposure. The transmission vegetation risk model is combined with the FPI Model in space and time to form CFPT – Veg.

3. CFB – PG&E may de-energize customers where the consequence of a potential wildfire ignition would be extreme, even if the probability of a power line or equipment failure is low.

4. Vegetation and Electric Asset Criteria Considerations – PG&E reviews locations from recent inspections where high-priority trees or electric compliance issues are present that may increase the risk of ignition.

Step 3: Determining the outage area

Based on the criteria above, transmission lines meeting the criteria pass to the next stage of review for PSPS. PG&E conducts a Power Flow Analysis on the in-scope transmission lines (if applicable) to analyze any potential downstream impacts of load shedding, coordinates this effort with the CAISO, and confirms solution feasibility with Transmission System Protection. The de-energization of transmission lines may result in some downstream impacts on substations, transmission lines, and distribution lines that may also lose their source.

8.2.3.5 After Determining the Outage Area (Distribution and Transmission)

After determining the outage area both for Distribution and Transmission, we review the forecasted customer impacts of each circuit against the forecasted wildfire risk of each circuit should an ignition occur on that circuit during the forecasted period of risk for both the distribution and transmission circuits brought into scope from the meteorology models. PG&E then shares this analysis internally during key decision-making points to inform PSPS decision making and further risk modeling.

Starting at 12 hours before the forecasted PSPS de-energization time, PG&E switches from forecasting to observing the weather in real time. Based on real time observations and analysis, we continually evaluate all the outage areas identified in the previous steps to determine whether to initiate PSPS de-energization. We also use external tools and analysis to provide input to the decision to de-energize, as described below.

External Tools and Analysis:

During high-risk periods, PG&E meteorologists participate in daily interagency conference calls that commonly include multiple NWS local offices, the NWS western region headquarters, and representatives from the Geographic Area Coordination Center (GACC). This call is hosted by the Northern California or Southern California GACC offices. Agreements with California Department of Forestry and Fire Protection and United States Forest Service leadership allow participation on these calls (although PG&E participation does not influence any forecasts issued by these independent agencies). During these calls, the agencies present their expert assessment on the upcoming periods and locations of risk, wind speeds and fuel moisture levels, and any other relevant factors to consider. PG&E greatly appreciates these conference calls and the opportunity to coordinate with external and independent forecast agencies on upcoming risk periods. During PSPS events, the lead PG&E meteorologist for the PSPS event, called the Meteorologist in Charge, summarizes these forecasts and discussions for the OIC, who ultimately makes the decision to execute a PSPS event. If external agencies are not in agreement with PG&E's analysis and do not see an upcoming event as high risk for large fires, the OIC may use this intelligence to decide if a PSPS event is warranted.

In addition, PG&E carefully reviews and considers the location of existing fires and where new fires are detected using the Satellite Fire Detection & Alerting System (FDAS), which uses data from six National Oceanic and Atmospheric Administration (NOAA)/ NASA satellites to detect fires, and other information compiled by PG&E's Hazard and Awareness Warning Center such as intel from field observers. If an active fire may require imminent community evacuations, we would consider how best to support those efforts in relation to PSPS decisions. In addition, the following sources and tools are considered before initiating a PSPS event:

- Fire Weather Watches and Red Flag Warning (NWS - Federal)
- Significant fire potential for wind (GACC – Federal)
- Storm Prediction Center (part of NOAA – Federal)
- Daily interagency conference call with agencies during high-risk periods

- Field observer information
- Live weather data from weather stations
- Location of existing fires
- New fires detected – Satellite FDAS
- ECMWF
- North American Mesoscale model
- High-Resolution-Rapid Refresh-Model
- GFS American global model
- Other weather models

Based on the above analyses, we can determine how many customers may be subject to de-energization, and further investigate mitigation options—such as advanced switching solutions, sectionalization, the use of islanding, alternative grid solutions, and temporary generation—to support customers who could lose upstream power sources but are in areas that may be safe to keep energized.

PG&E monitors and forecasts weather over a multi-day horizon, so the Company can anticipate when a PSPS event may be needed and activate our EOC ahead of any PSPS event whenever possible. The PG&E Meteorology team updates weather forecasts approximately four times a day to monitor for changes in weather event timing, strength, and potential locations impacted. Weather shifts may force changes to PSPS scope and impacts at any point in time during PSPS planning and execution; this may allow the Company to avoid de-energization in some areas if fire-critical conditions lessen but can also cause some areas and customers to move into de-energization scope late in the process if forecasted fire-critical weather footprints change or increase. This is driven by the inherent uncertainty in weather forecast models.

8.2.3.6 Timing of the Decision to De-Energize

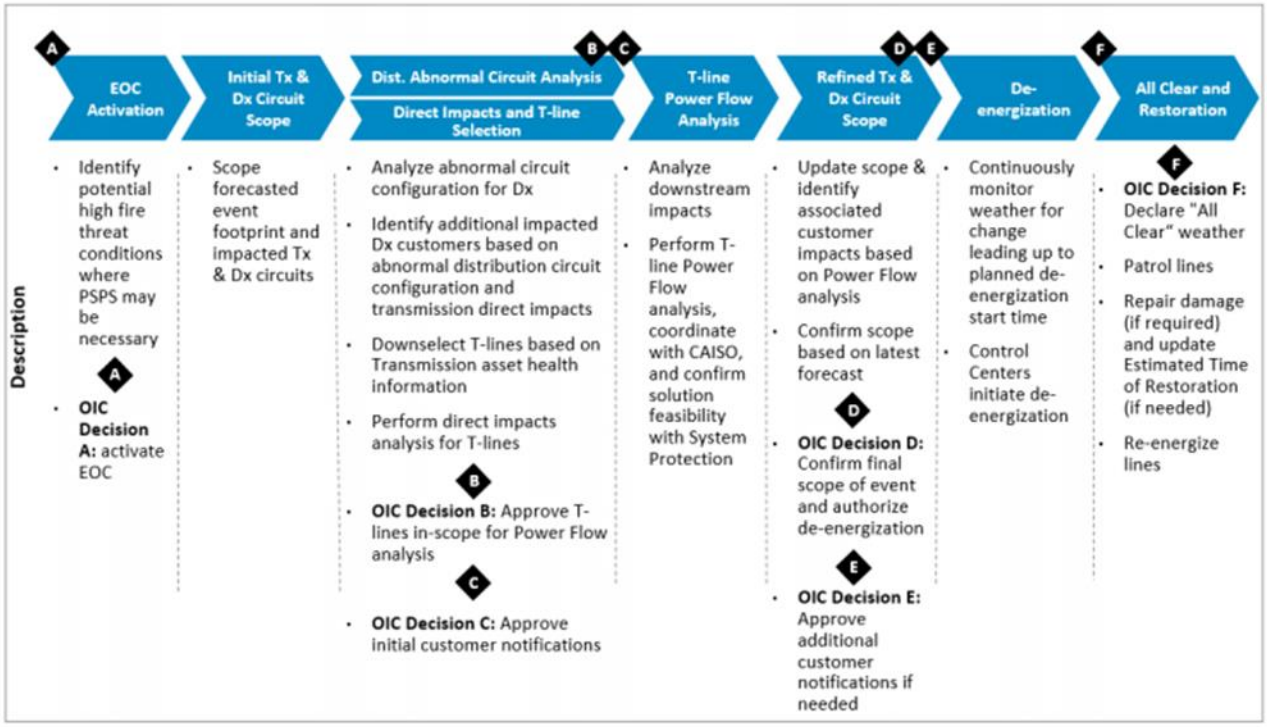
Once PG&E's Fire Science and Meteorology team has identified an upcoming severe weather event (typically a period of adverse weather combined with dry fuels), it is monitored for an increased potential of a PSPS event. At this point, PG&E issues an "Elevated" forecast in the PG&E 7-day PSPS Potential (pge.com/weather). The "Elevated" forecast also triggers an internal transition to PSPS readiness posture, wherein select PG&E employees take on roles to prepare for an EOC activation. PSPS readiness posture allows PG&E to better prepare for EOC activities and potential PSPS, enhancing operational execution. Readiness posture activities are intended to be completed on an as-needed basis, driven by forecasted PSPS potential and dependent on the timing and amount of advanced warning required for the event.

Once the PG&E meteorology team determines that forecast weather and fire potential conditions meet or may meet (if the forecast becomes more severe) the required thresholds for a PSPS event, PG&E activates our EOC, with a designated OIC. PG&E's meteorology team then issues a "PSPS Watch" on PG&E's public facing weather website (pge.com/weather). Under the EOC structure, PG&E Planning and Intelligence, Operations and other Incident Command System (ICS) teams continually monitor weather forecasts and update the OIC on the real-time status of the factors listed above.

During a PSPS event, the OIC is responsible for making the following decisions, which are also depicted in Figure PG&E-8.2-6 below:

- Activating the PG&E EOC in response to a forecasted PSPS event;
- Approving the list of transmission lines determined to be directly within the scope of the PSPS event;
- Approving initial customer notifications;
- Approving de-energization of distribution and transmission lines within the final event scope (including indirectly affected transmission circuits outside the weather polygon); and
- Approving weather "all clear" announcements after weather conditions subside and beginning the process of patrols and restoration.

FIGURE PG&E-8.2-6:
PSPS DECISION MAKING PROCESS WITH OIC DECISION POINTS
(SUBJECT TO CHANGE AS REQUIRED BY PROGRAM EVOLUTION



During a PSPS event, the PG&E meteorology team continually evaluates the latest available forecast data for changes and provides updates to the EOC command staff and OIC regarding how the weather event may be changing and if there are any changes to the timing of the event. The meteorology team bases these updates on their expertise, comparative plots from several forecast models to evaluate confidence and uncertainty, PG&E's CFP_D Model forecasts, and any changes to external forecasts like Fire Weather Watches and RFWs issued by NOAA and forecasts from Northern and Southern California GACC Predictive Services as well as the Storm Prediction Center. The PG&E EOC, Distribution Control Center, and Transmission Grid Control Center (GCC) then coordinate to ensure customers have been identified, notified, and that work is underway to identify and alternatives or mitigations to for possible de-energization.

Before the weather and PSPS event is expected to begin in a local to regional area, which is called the weather start time, a confirm/abort meeting is held by the EOC IC to review the latest set of meteorological and field observation data before switching operations begin. PG&E positions our crews and control centers to be able to perform the switching operations needed to deenergize areas before dangerous conditions arrive. PG&E Meteorology reviews with the EOC IC the latest forecast model data, the model trends, forecast uncertainty and confidence by comparing against other model data, as well as verifying the event is arriving as scheduled, later or weaker than expected. If the event is arriving weaker than expected, by evaluating forecasted pressure gradients and wind speeds versus actuals, a decision may be made to delay or continue monitoring.

On an event-by-event basis, PG&E considers the health of each transmission structure, vegetation risk near each structure, the local area wind speed and Utility FPI Model forecasts. Given the specific forecast and factors listed above, PG&E determines which structures exceed a risk guidance value outputting a preliminary scope of transmission lines to be de-energized based on the PSPS Protocols (Transmission) described in the previous sections. Based on the relative wildfire risk calculated for each transmission structure in the footprint, PG&E will exercise expert judgment to identify which transmission lines, if any, should be considered for de-energization. The transmission lines identified during this evaluation process drive the initial transmission PSPS scope.

PG&E will then conduct a total impact analysis, in coordination with the CAISO, to ensure the initial transmission PSPS scope is feasible and will not compromise reliable bulk power system operations. This step is critical to support compliance with the Federal Energy Regulatory Commission, the North American Electric Reliability Corporation Reliability Standards and to ensure de-energizations will not negatively impact the integrity of bulk power systems.

This assessment process identifies the total count of customers who are likely to be impacted by a transmission PSPS event, including any publicly owned utilities (POU)/electric cooperatives, adjacent jurisdictions, small/multi-jurisdictional utilities, as well as other facilities interconnected at the transmission level. This step may also result in the identification of additional downstream PG&E distribution customers that would be impacted by transmission de-energization. Because of networked configuration of the transmission system, customers and entities impacted by a transmission PSPS event may not be directly located within the weather event footprint itself or in a HFTD area.

If a potential transmission PSPS scope is feasible from a grid operations standpoint, while maintaining compliance with regulatory standards, the benefits of de-energizing the potential transmission lines will be weighed against the public safety risks. If it is determined that the benefits of de-energization outweigh the risks, PG&E will de-energize the identified transmission lines in coordination with the CAISO, following approval by PG&E’s OIC.

8.2.3.7 PSPS Risk-Benefit Tool

The PSPS Risk-Benefit Tool addresses the regulatory requirements presented in CPUC D.21-06-014, which requires California IOUs to quantify the risks and benefits associated with a potential PSPS event. This tool was developed in collaboration with PG&E's Risk Management and Safety team and the Joint IOU PSPS Working Group ahead of the 2021 PSPS season, with alignment on the industry-standard methodology described in PG&E's RAMP and GRC workpapers.[187] It assesses the potential consequence of a PSPS Event on impacted customers and compares that to the potential risk of wildfires that could occur on the circuits being considered for PSPS.

We incorporated the aforementioned tool into our 2021 PSPS execution process to help inform the PSPS decision-making process.

Currently, in our risk analysis we evaluate how the potential duration of interrupted power can adversely impact reliable energy to all customers located on a specific transmission or distribution circuit, and the likelihood of a resulting injury due to potential interruption of power. The output of the tool is a ratio that compares the calculated PSPS potential benefit from initiating an event (i.e., mitigation of catastrophic wildfire consequence) to the induced risks associated with an event (i.e., impact to customers resulting from a PSPS outage). Key inputs in the analysis include results from Technosylva wildfire simulations specific to the distribution and transmission circuits in scope for a potential de-energization, the number of customers forecasted to be de-energized, and the forecasted number of customer hours across each identified circuit in scope for a potential de-energization.

After the potential de-energization scope is determined, including the identification of potentially impacted circuits for the PSPS event in question, this scope and the Technosylva wildfire simulation outputs are used as inputs into the Risk-Benefit tool, which quantifies the public safety risk and wildfire risk resulting from the forecasted impacts of the pending weather / PSPS event. During the de-energization decision-making meeting, the PSPS Risk Analyst reviews the final results of the analysis with the OIC and the IC to help inform the decision of whether to de-energize the circuits in scope. PG&E notes that this is the first iteration of the tool, and PG&E will continue to mature the tool to better understand how to we can further quantify other potential concerns associated with de-energization in our communities.

Risk Assessment:

The PSPS Risk-Benefit Tool utilizes the MAVF framework, as defined through the SMAP. The tool's calculations for risk use an industry-wide standard MAVF, with a non-linear scaling of consequences reflecting our focus on low-frequency/high-consequence risk events without neglecting high-probability/low-consequence risk events. The MAVF is a unitless number that captures the safety, reliability, and financial impact of identified potential risk events. It is used to calculate the potential risk scores for the potential risk events identified in

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187 PG&E response to CPUC Energy Division Data Request GRC-2023-Ph1-DR_ED_001_Q01Supp01.

PG&E's Enterprise Risk Register.[188] MAVF scores developed by the PSPS Risk-Benefit Tool are used to compare the potential de-energization risk from a forecasted PSPS event to the potential risk of wildfires from keeping the circuits energized, specific to the potentially impacted circuits being considered for PSPS de-energization.

The PSPS Risk-Benefit Tool utilizes multiple inputs to estimate the potential PSPS de-energization and Wildfire Risk Scores. The following inputs are used in calculations to build MAVF risk scores for PSPS events and wildfires, which are ultimately weighed against one another:

- Forecasted Circuits – The final list of the distribution and transmission circuits identified to be in-scope for a potential PSPS event.
- Customers Impacted – Forecasted number of customers anticipated to be impacted by the potential PSPS event.
- Customer Minutes – Forecasted outage duration the customers will face by the potential PSPS event.
- Technosylva Wildfire Simulation Data – Fire simulation forecasts on the consequence of a potential wildfire's impacts on population and buildings on each circuit for every three hours. These values are based on Technosylva's sophisticated wildfire modeling, using real-time weather models, state-of-the-art fuel, and 8-hour fire spread modeling.

Once the above data is made available and inputted into the tool, the modeling considerations described below are used to estimate the consequence of the: (1) potential wildfire risk; and (2) PSPS risk at the per-circuit level. Throughout the tool, a variety of modeling considerations are made to facilitate calculations and are included in Table PG&E-8.2-2. and summarized in a visual on Figure PG&E-8.2-7.

188 Full details of the MAVF methodology are provided through the RAMP Report RAMP Report, pp. 3-3 to 3-15 and GRC workpapers in response to Energy Division GRC-2023-PhI_DR_ED_001_Q01Supp01.

TABLE PG&E-8.2-2:
PSPS RISK BENEFIT CONSEQUENCE MODELLING CONSIDERATIONS

Consequence Type	Wildfire Consequence Considerations	PSPS Consequence Considerations
Safety	Calculated based on maximum population impacts derived from Technosylva wildfire simulation models and a fatality ratio based on National Fire Protection Association (NFPA) data.	Calculated from an estimate of Equivalent Fatalities (EF) per million Customer Minutes Interrupted (MMCI). EF/MMCI ratio is estimated from previous PG&E PSPS and other large external outage events.[(a)]
Reliability	N/A	Calculated directly from the potential number of customers impacted and outage duration based on customer minutes interrupted.
Financial	Calculated based on maximum building impacts derived from Technosylva wildfire simulation models and a cost per structure burned previously evaluated in 2020 RAMP Report.[(b)]	Calculated based on two financial estimates (1) distribution of a lump sum cost of execution across all relevant circuits and (2) an estimated proxy cost per customer per PSPS event.[(c)]

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(a) Previous PG&E PSPS events include 2019 2020 PSPS events, and other large external outage events include the 2003 Northeast Blackout in New York City, 2011 Southwest Blackout in San Diego, 2012 Derecho Windstorms, 2012 Superstorm Sandy, and 2017 Hurricane Irma.

(b) See A.20 06 012.

(c) The assumptions used in these calculations, including the proxy cost per customer per PSPS event, are subject to be updated and are not intended to prejudge or create precedent with regard to the development of more precise values of resiliency or cost of PSPS metrics being considered in other ongoing proceedings at the CPUC, such as the Risk Based Decision Making Rulemaking [R.20.07.013] and the Microgrid and Resiliency Strategies.

Potential Wildfire Risk:

Wildfire consequence impacts are based on the Population Impacted by Wildfire and Structures Impacted by Wildfire. This value is used to calculate natural unit values for two consequence components:

- Wildfire Safety Consequence: EF
- Wildfire Financial Consequence: Financial Cost of Wildfire (in dollars)

Potential PSPS Consequence:

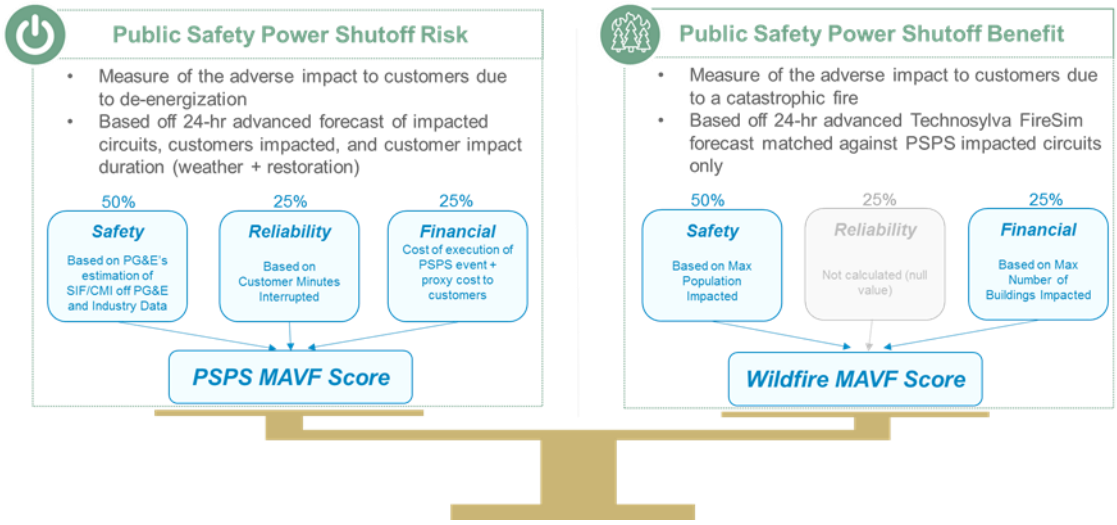
PSPS consequence impacts are based on the following values: Duration of de-energization by circuit, and number of customers impacted by de-energization on each circuit. These input values are used to calculate natural unit values for three consequence components:

- PSPS Safety Consequence – EF as an output of Customer Minutes interrupted

- PSPS Electric Reliability Consequence – Customer Minutes Interrupted
- PSPS Financial Consequence – Financial Cost of PSPS event (in dollars)

Once the consequence values (safety, reliability, financial) are estimated, they are converted into MAVF risk scores as defined through our RAMP and GRC[189] filings. This assessment provides the ability to compare the associated risks between the two scenarios. Once the Risk-Benefit tool calculates the impacts between the PSPS event and a wildfire, it is summarized by indicating if the adverse impact from a PSPS event outweighs the risk of a wildfire.

FIGURE PG&E-8.2-7:
VISUAL REPRESENTATION OF PSPS RISK BENEFIT TOOL



189 Full details of the MAVF methodology are provided through the RAMP Report, pp. 3-3 to 3-15 and GRC workpapers in response to Energy Division GRC-2023-PhI_DR_ED_001_Q01Supp01.

8.2.4 Re-Energization Strategy

Strategy to provide for safe and effective re energization of any area that is de- energized due to PSPS protocol.

When restoring customers during PSPS events, PG&E's main objective is to re-energize our electric facilities safely and in a timely manner. When possible, PG&E prioritizes re-energizing critical infrastructure and transmission lines.

Once PG&E's meteorology team has determined the weather event has passed, PG&E's OIC provides the "all-clear zones" approval. This provides the field team with approval to begin the steps listed below on the impacted assets within the PSPS footprint:

- Preparation for re-energization
- Patrol
- Mitigate hazards/make repairs

Preparation for Re-Energization:

When PG&E opens our EOC for a PSPS event, the restoration team (including Control Centers and Field personnel) conducts the following activities leading up to re-energization:

- Prepare an event-specific restoration plan based on the weather data;
- Identify restoration resources needed, including helicopters, fixed wing aircraft, company personnel, contractors, and mutual aid;
- Provide distribution circuit segment guides to field personnel listing the devices used to segment circuits for patrolling;
- Print distribution circuit segment maps, with a circuit map and individual maps for each segment that needs to be patrolled;
- Distribute switching logs to the field for the de-energization operations; and
- Following de-energization, segment impacted distribution circuits into sections, which are prioritized based on the critical nature of the infrastructure and the number of affected customers.
- Determine if any Customer Owned Lines identified as being at risk are within the event footprint (both transmission and distribution) as detailed in Section 7.3.6.4. These are then isolated either during segmenting activities or during patrols, but in either case, prior to re-energization.

Patrols:

Per PG&E's PSPS-1000P-01 (*Utility Procedure: Public Safety Power Shutoff for Electric Transmission and Distribution*), all impacted transmission and distribution

overhead lines that are identified as “event-specific assets at risk” in HFRA, as directed by the EOC, must be patrolled in their entirety. Additionally, all hazards must be cleared and/or damages repaired prior to re-energization. Hazards include tree branches entangled in the conductor; damages include fallen lines or poles.

Note: for distribution circuits, patrols occur on all impacted primary and secondary that extends beyond primary overhead lines identified with “event-specific assets at risk” in HFRA as directed by the EOC. Secondary does not include service drops.

Patrols are accomplished by a combination of the following methods:

- Ground Patrols – conducted by Journeyman Lineworkers (JL) from PG&E, contractors, and mutual aid utilities (may be accompanied by a non-JL driver).

- Aerial Patrols – distribution and transmission patrols performed by Journeyman Line workers typically using helicopters (or potentially fixed wing aircraft on transmission) during flyable weather/daylight hours.

  – Night Aerial Patrols – These can be completed using InfraRed (IR) technology on aircraft. Night Aerial patrols are currently considered only on transmission lines.

Following the “all clear”, a distribution circuit segment is patrolled and re-energized starting at the source side, then systematically patrolled and re-energized out towards the end of the circuits. Equipment that requires repair is isolated. The field patrol hierarchy typically consists of the following for a given distribution circuit:

- Task Force Lead – The single point-of-contact (SPOC) for a given PSPS impacted distribution circuit(s) who is responsible for ensuring PSPS patrols on their assigned circuit(s) are completed and who works with the Control Center to safely re-energize distribution circuit segment(s). This SPOC methodology promotes increased safety and efficiency due to more focused attention of patrol personnel (both aerial and ground) engaged in the PSPS restoration process. This ensures the Control Center is only providing/receiving direction to/from one person

- Segment Lead – Personnel responsible for oversight of assigned patrol personnel (both aerial and ground) on given segment(s) of a distribution circuit, reports to their assigned Task Force Lead

- Patroller – Individuals (internal, contract and mutual aid) responsible for patrolling assigned portions of a distribution circuit, reports to their assigned Segment Lead.

The transmission line patrol prioritization strategy is driven by electrical system stability. This includes ensuring adequate transmission facilities are in service to support the overall grid and accompanying local loads, ensuring the system protection component is addressed and reviewing customer impacts associated with each line impacted in the event.

When both transmission and distribution assets (including substations) are involved, and it is operationally feasible, PG&E conducts patrols during the re-energization process on all types of assets simultaneously. In some cases, re-energization of the

transmission line is prioritized to ensure that system stability (including the system protection component) is accounted for and to provide a source for substations and associated distribution circuits that could be impacted.

Mitigate Hazards/Repair Damages:

Due to severe weather events, PG&E may find hazards or damages to our facilities during patrols. Prior to restoring power, these hazards need to be removed and damages need to be repaired in order to mitigate the following risks:

- Arcing or sparks being created from damaged equipment when re-energized
- The public getting too close to, or needing access around, damaged equipment
- Electrocution or shock from damaged or unsecured equipment
- Additional equipment damage if circuit is re-energized while faulted
- Increasing the size or duration of the outage if damage is not isolated or repaired prior to re-energizing

For reference, examples of hazards and damages found during the 2021 PSPS events include:

- Damaged cross-arms on poles
- Damaged insulators and wire connectors
- Damaged splices or sections of conductors
- Vegetation intertwined with the electrical lines
- Trees falling onto assets
- Broken poles

If damage is found in an individual segment due to a weather event, PG&E may be able to adjust the restoration order to allow for the overall restoration process to continue while repairs to the affected segment are initiated. This is supported with the visibility provided by the custom distribution circuit maps detailing both the circuit's individual segment(s) and overall circuit connectivity.

Some hazards, like a small tree limb found resting across the conductors, can be removed by the JL performing the patrol using appropriate high voltage tools and Personal Protective Equipment.

Re-Energization:

PG&E's Control Centers coordinate with other centers and field resources to manage all the information related to re-energizing the facilities and then direct the re-energization processes concisely. Many of the customer updates are automatically created by the computer applications being used by the Control Centers while re-energizing. The

Control Centers can also operate remote control devices SCADA to re-energize once the segment or transmission line has been patrolled and released for re-energization.

If no issues or concerns are found, or repairs are completed, the Task Force Lead will coordinate with the Control Center to re-energize a segment up to the next open device (segment boundary). This restoration sequencing is based on the "step restoration" methodology which allows for re-energizing customers in a safe, controlled, and efficient manner, rather than waiting to patrol the entire circuit and then re-energizing. This process typically follows the pre-identified segmenting alphabetical sequence (i.e., A-B-C-D, etc.).

Re-energization information (i.e., segment guides, switching logs, customer owned lines and maps) is provided to both the field and control center personnel prior to executing the PSPS restoration activities.

Customer Owned Lines (as detailed in Section 7.3.6.4) are only re-energized once the customer has confirmed to PG&E that their equipment is both safe and ready to be energized once PG&E has provided the "all clear" and a source is available.

To support the re-energizing activities, resource needs are identified for the scale and scope of the event footprint during the event pre-planning. Resources typically include helicopters, company personnel, contractors and mutual aid. These resources are then provided to the impacted areas and staged to support the event.

2022 Restoration Goal:

For 2022, our restoration goal is to restore all customers as soon as possible and within 24 hours from the "all clear", unless it is unsafe to do so. For any circuits that require more than 24 hours for restoration, we will provide an explanation in our post event reports.

Typical safety exclusions based on past PSPS events have been (but not limited to):

- No access due to:
  - Police activity (i.e., security)
  - Fire activity (i.e., fire agency requests not to re-energize)
  - Road closure (i.e., public/private roadway closed/blocked and requires agency/customer response)

Some additional reasons why circuits may require more than 24 hours to restore include:

- Inability to utilize planned helicopter resources for aerial patrols due to smoke/fog/other visibility concerns
- Resource constraints impacting ability to patrol the impacted event specific overhead assets that were de-energized (historically driven by inability to conduct aerial patrols as noted above or sheer magnitude of event)

- Restoration delayed due to repairs of PSPS hazards or damages required on assets prior to being restored

- Customer equipment damaged (i.e., requires customer repairs prior to energizing) or lack of confirmation from customer (in instances of customer owned lines) that their equipment is safe and ready to be energized.

To further enhance PG&E's restoration efforts and support our overall goal of reducing customer outage durations, key areas have been identified for improvements during the planning and execution phases of the PSPS restoration process. Examples include (but not limited to):

- Developing aviation flight forecasts that identify flying conditions that could affect helicopter availability for patrolling (i.e., wildfire smoke, fog, storm, etc.)

- Developing a field compatible mobile platform to provide an electronic map of the event-specific footprint. This would replace the current non-specific event paper maps in order to provide for enhanced situational awareness for field personnel in addition to identifying event-specific patrol boundary opportunities. These opportunities typically consist of portions of distribution circuits de-energized during a PSPS event (due to connectivity) that are not in the defined event weather boundary "event-specific assets at risk" area, and as such may not require a patrol in order to be re-energized.

- Improving the overall development and communication processes for providing and cascading the Restoration Playbooks to the field operations teams and minimize delays with more process automation and coordination

For more information on PG&E's 2022 plans related to standards, trainings and circuit guides and maps, please see Section 7.3.9.5.

8.2.5 Customer, Agency, and External Communications

Company standards relative to customer communications, including consideration for the need to notify priority essential services—critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies. This section, or an appendix to this section, must include a complete listing of which entities the electrical corporation considers to be priority essential services. This section must also include description of strategy and protocols to ensure timely notifications to customers, including AFN populations, in the languages prevalent within the utility's service territory.

PG&E understands how disruptive it is for our customers, agencies, and communities to be without power. In this section, PG&E outlines the outreach and engagement conducted during PSPS events to ensure customers, agencies, and the general public are notified ahead of a power shutoff and have the information they need until power is fully restored. This section is broken up into the following categories:

A) Automated Notifications (Calls, Texts, Emails)

B) Additional Outreach and Engagement by Customer Type

- Local and State Agencies and First Responders;
- General Customers;
- MBL Customers;
- Communications to Customers with Limited English Proficiency and Other Needs;
- CBO In-Event Support and Resources;
- Critical Facilities and Infrastructure;
- Telecommunications and Water Providers;
- Transmission-level Entities;
- Third-Party Commodity Suppliers; and
- General Public/Media.

PG&E's in-event notifications are in accordance with the CPUC PSPS Guidelines (D.19-05-042).

Based on feedback from agencies and customers on the 2020 PSPS events, PG&E focused our efforts in 2021 on key initiatives to enhance the communications during an event. This includes, but is not limited to:

- Improved verbiage and translations of customer notifications. These notifications include improved content tested for usability and accessibility with simple and straightforward messaging on relevant event information (e.g., location of impact(s),

estimated time of shutoff, and restoration). All text, e-mail notifications, and automated calls are now at parity with English notifications;

- Providing proactive notifications and impacted zip code information to paratransit agencies that may serve all the known transit- or paratransit-dependent persons that may need access to a Community Resource during PSPS events;

- Executing a partnership agreement with the California Network of 211s to provide AFN customers with a single source of information and connection to available resources in their communities. This agreement provides PSPS education, outreach, and emergency planning in advance of a PSPS event and connects customers with AFN to critical resources like transportation, food, hotel accommodations, portable battery backups, and other social services during and after PSPS events. This brings a consistent statewide solution for SPSP response to the AFN community served by an IOU;

- Established new partnerships with HealthCare Partners and re-engaged with the CA Rural Indian Health Board with other IOUs to promote the MBL Program through educational webinars for partners and distribution of applications and collateral;

- Working more collaboratively with cities, counties, tribes, critical service providers and other public safety partners through advisory committees and other forums. This was to gather their feedback, identify their needs during PSPS events and update PG&E's policies and procedures to reflect and act upon the feedback received;

- Transitioning PG&E's agency contact information system to a platform that allows city, county and tribal stakeholders to update their contact information directly in PG&E's system at any point in time. This is to help ensure PG&E has the latest agency contact information for PSPS events;

- Expanding the PSPS EOC staffing plan to have dedicated Agency Representatives that can work with local agencies and address issues in real-time and a dedicated AFN Strategy Lead and an AFN Advisor. The AFN Strategy Lead and AFN Advisor engages with resource partner CBOs (e.g., CFILC, food banks, meals on wheels, and CBOs that provide translations in indigenous languages), as well as information-based CBOs, to manage two-way communication leading up to and during each PSPS event. An Agency Representative is typically a member of the PSS or LPA teams who have existing relationships with these local agencies;

- Posted a comprehensive, accessible, and searchable list of all potential CRC locations on our webpage. During PSPS events, PG&E continued to post a searchable list of open CRC locations and the resources available at each CRC, type of CRC (e.g., indoor, outdoor), COVID-19 policies, and operating hours on PG&E's Emergency Website (pgealerst.alerts.pge.com). Details for CRCs were made available as soon as sites were confirmed (up to two days before de-energization for some locations).

- Launched PSPS Address Alerts for non-PG&E account holders so that any individual served by PG&E or with interest in a location served by PG&E can sign up for PSPS event notifications in any of 16 languages delivered via phone call or

SMS text. Address Alerts replaced the previously available option of Zip Code Alerts;

- Partnering with the CFILC and other CBOs to conduct outreach and provide resources for individuals reliant on power for medical or independent living needs; and

- Providing emergency information in 15 non-English languages on our website, in event PSPS customer notifications and select print material.

For more information on outreach that PG&E conducts on an ongoing basis on wildfire mitigation efforts, see Section 7.3.10.1. Additional information on outreach related to emergency planning and preparedness, see Sections 7.3.9.2 and 8.4.4.

A) Automated Notifications (Calls, Texts, Emails)

When PG&E's EOC activates for a potential PSPS event, PG&E sends notifications to public safety partners[190] and customers at key milestones throughout the event, typically once a day. These are automated notifications via calls, texts, and emails and are supplemented by additional outreach activities. Timing of notifications is subject to change based on weather conditions and other factors.

- Priority (Advanced Notification) – After PG&E's EOC is activated, direct contact is made to California Office of Emergency Services (Cal OES), Public Safety Answering Points (PSAP) and county Office of Emergency Services (OES)/tribal contacts. PG&E also sends automated notifications to all public safety partners that may be impacted by the event. This is to provide public safety partners with advanced notice so they can begin implementing their emergency response plans, ahead of customer notifications;

- Potential De-Energization (Watch Notification) – When weather allows, PG&E sends Watch Notifications two days ahead, one day ahead and on the day-of de-energization to public safety partners and customers. The notifications include potentially impacted addresses, estimated window of de-energization, estimated duration of the weather event, ETOR,[191] and resource links (e.g., PSPS updates webpage with CRC information, resources for customers with AFN, maps and other updates needed for agency emergency response efforts);

- De-Energization Imminent (Warning/Imminent Notification) – PG&E sends Imminent (Warning) notifications to public safety partners and customers when forecasted weather conditions confirm that a safety shutoff will happen soon. Whenever possible, Warning notifications are sent four to 12 hours in advance of power being

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190 Public partners are defined by the CPUC as "first/emergency responders at the local, state, tribal and federal level, water, wastewater and communication service providers, affected Community Choice Aggregators (CCA), POU/electrical cooperatives, the CPUC, the California Governor's OES and the California Department of Forestry and Fire Protection."

191 The initial ETOR provided to customers prior to de-energization is based on the forecasted timing of the end of the weather event and PG&E's goal to restore power within 12 daylight hours of weather clearing.

shut off. These notifications give an estimated time when the customer's power will be shut off and the ETOR;

- De-Energization Initiated (Power Off Notification) – These serve as PG&E's De-Energization Initiated notifications. These notifications give an estimated time of how long the customer's power will be off and the ETOR; the notification is sent once there is confirmation power has been shut off.

  For customers impacted by PSPS late at night or overnight, PG&E does not send notifications to customers between the hours of 21:00 and 08:00 PDT as a courtesy to prevent waking up the customers in the middle of the night. However, PG&E does provide Warning Notifications, when possible, prior to 21:00 PDT, so customers were aware that they would be de-energized between 21:00 and 08:00 PDT.

- Restoration in Progress (weather "all-clear" notification) – PG&E sends notifications to public safety partners and customers after the weather event has passed and the area is declared "all clear" to safely begin patrols and restoration (called the weather "all clear" notification). Customers can opt out of receiving event update notifications after de-energization has occurred; and

- Restoration in Progress – After the weather "all clear" notifications, PG&E sends event update notifications to customers if their ETOR changes from the original ETOR provided based on two scenarios:

  - Once the weather event is over and PG&E begins patrolling – Customers receive an updated ETOR based on field or meteorology conditions, which may be sooner or later than original ETOR provided; and

  - The weather event is over, and damage found during patrols of equipment – Customers receive an updated ETOR accounting for repair time.

  By providing individualized updates at the segment level on a circuit, PG&E gives customers more timely and accurate information about how much longer they might be out of power.

  Additionally, when a microgrid is determined that the microgrid is safe and ready to operate during a PSPS event and is planned for a community, PG&E sends notifications to customers served by the microgrid to indicate that they might experience an outage for up to four hours as we re-configure their service from backup power to the electric grid.

- Restoration Complete Notification – Restoration Complete notifications are sent automatically to customers when customers are safely restored. This is done using an automated process that issues customer notifications every 15 minutes upon restoration of service. For cities, counties, and tribes, Restoration Complete notifications are sent once all customers within the jurisdiction have been restored; and

- Cancellation Notification – Anticipated PSPS events may be avoided altogether if weather conditions improve. In such instances, PG&E will notify public safety

partners and customers that weather conditions have improved in their area, and PG&E does not anticipate the need to turn off power for safety. PG&E also encourages customers to visit safetyactioncenter.pge.com for tips on putting together an emergency preparedness plan for their home or business.

In 2022, PG&E will continue to identify opportunities to improve the notifications, such as:

- Refining communications and notifications to make them as clear and accessible as possible for customers and community members (e.g., ETOR accuracy Streamlining non-PSPS-related outage notifications that can overlap with PSPS-related notifications (e.g., rotating outages); and

- Emphasizing our data collection efforts so that PG&E (1) has accurate customer contact information, including information on master-meter customers and other non-account holders (e.g., renters), (2) knows customers' language preferences, and (3) allows opportunities for customers to self-identify as vulnerable (e.g., self-certified vulnerable, self-identified disabled, alternate format communications) without impinging on any Health Insurance Portability and Accountability Act (HIPAA) and California Consumer Privacy Act (CCPA) data privacy laws.

B) Additional Outreach and Engagement by Customer Type

- Local and State Agencies and First Responders – In addition to the automated notifications noted above, PG&E's Liaison EOC Team is dedicated to conducting outreach and supporting local and state agencies. During emergency events, PG&E follows the ICS of the National Incident Management System structure and protocols to ensure that public safety partners receive timely and appropriate information during PSPS events and other emergencies. This is to ensure that local and state agencies receive timely updates as PSPS event conditions evolve. It is imperative that local and state agencies receive timely updates so that they can initiate their own preparedness efforts to serve their communities. Examples of these locally driven preparedness efforts include, but are not limited to, locally selected CRC locations, procurement of temporary generation for targeted customers and facilities, enhanced public safety personnel resources in impacted areas, and other efforts. The Liaison Team's outreach is supported by the IC, as well as the Public Information Officer (PIO), Customer Strategy Officer, and Planning Team. The outreach includes, but is not limited to:

  - Submitting the PSPS State Notification Form to Cal OES with the latest event information and sending emails to the CPUC at the key event milestones identified by Cal OES;

  - Conducting live calls to PSAP or dispatch centers when PG&E's EOC is first activated to inform them ahead of customers of a potential event, as their call volume may increase as customers' notifications begin;

  - Hosting daily State Executive Briefings with state agencies to provide the latest event information and to answer questions. PG&E's Liaison Officer facilitates the call with updates from the IC, Assistant Customer Strategy Officer, and PIO;

- Hosting daily Systemwide Cooperators Calls, where all Public Safety Partners in the service territory are invited to join and hear the latest event information. PG&E's Liaison Officer facilitates the call and provides event updates, along with a member of the Meteorology Team, the Assistant Customer Strategy Officer, and PIO;

- Hosting Tribal Cooperators Calls with potentially impacted tribes to provide the latest event information and answer unique, local questions in real-time. PG&E's Tribal Liaison Branch Manager facilitates the call and provides event updates;

- Conducting ongoing coordination with local County OES and tribal contacts through dedicated Agency Representatives. Each Agency Representative works with the agency to determine a set cadence and communication type for event updates. These Agency Representatives are directly connected to PG&E's EOC during a PSPS event and coordinate internally to gather critical, timely, and location-specific information requested. During a PSPS event, PG&E's Liaison EOC Team aims to address requests for localized information in a timely manner to complement the standard cadence of notifications to all impacted communities described in this section;

- Embedding a PG&E Agency Representative into the Cal OES State Operations Center to answer questions in real-time, at the request of Cal OES; and

- Providing PSPS-related maps, situation reports, critical facility lists, and MBL customer lists by jurisdiction via the PSPS Portal at the time of the initial notification, twice daily (regardless of scope changes), and as event scope changes. During an activated PSPS event, PG&E's PSPS Portal Team is also available 24/7 to assist public safety partners with access or technical support.

- General Customers – PG&E aims to share what we know about the weather and our equipment as soon as we can, keeping in mind weather conditions can be uncertain. Our goal, whenever the forecast will allow, is to send automated notifications to potentially impacted customers two days before shutting off power and at least once a day until power has been restored.

  Customers who have selected their language preference receive in-language (translated) notifications. For customers without a designated language preference, PG&E provides notifications to customers in English, with information on how to get event information in 15 non-English languages.[192]

  PG&E will continue to look for opportunities to optimize the frequency and accuracy of notifications and will also explore new solutions and improved technologies to best communicate PSPS event updates and impacts with customers across multiple channels. Example approaches include, but are not limited to, considering new approaches for translated notifications or web technologies, and/or exploring options to provide a more personalized customer experience on the web, call center

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192 Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

and/or direct notifications. PG&E continues to pursue feedback from customers, agencies, CBO, tribal leaders, and other relevant stakeholders to inform and improve the customer notification experience;

- MBL Customers and Self-Identified Vulnerable (SIV) Customers[193] – During PSPS events, MBL customers and SIV customers receive automated calls, texts, and emails at the same intervals as the general customer notifications. PG&E provides unique PSPS Watch and PSPS Warning notifications[194] to MBL program customers[195] and SIV customers, and additional calls and texts at hourly intervals until the customer confirms receipt of the automated notifications by either answering the phone, responding to the text, or opening the email. If confirmation is not received, a PG&E representative visits the customer's home to check on the customer (referred to as the "doorbell ring" process) while hourly notification retries continue.[196] If the customer does not answer, the representative leaves a door hanger at the home to indicate PG&E visited. In each case, the notification is considered successful.[197] At times, PG&E may also make Live Agent phone calls in parallel to the automated notifications and doorbell rings, as an additional attempt to reach the customer prior to and/or after de-energization.

  PG&E shares MBL and SIV customer lists with appropriate county, city, and tribal agencies via the PSPS Portal. The MBL and SIV customer lists identify individuals who have not confirmed receipt of their notifications. PG&E notifies agencies that the data is available on the PSPS Portal, encouraging them to inform these customers of available resources. Please note that agencies are required to accept the PSPS Portal online agreement to receive confidential customer information. PG&E also only provides agencies information to customers within their jurisdiction;

- Communications to Customers with Limited English Proficiency and Other Needs – Please see Section 8.4 for a detailed description of our services for limited English proficiency customers and AFN populations;

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193 In accordance with D.12-03-054, customers that are not enrolled or qualify for the MBL Program can "certify that they have a serious illness or condition that could become life threatening if service is disconnected." PG&E uses this designation to make an in-person visit prior to disconnection. This designation remains on their account temporarily for 90 days and can be extended to 12 months if the customers submits an application. Customers can also self-identify with PG&E that they have a person in the household with a disability. This customer designation currently has no end date.

194 All notifications include reference to resources available to customers including a link to Resources for accessibility, financial, language and aging needs (pge.com).

195 Including MBL Program customers who are master-metered tenants (e.g., renters or tenants in mobile home park).

196 Until late evening (approximately 9 pm) or PG&E suspends outreach for the night.

197 For MBL customers, the in-person doorbell ring to Mvisit where a door hanger is left, but no contact made with the customer is considered "successful contact," but not confirmed as "received." If the representative makes contact with the customer, this is considered "received."

- CBO In-Event Support and Resources – Please see Section 8.4 for details on CBO in-event support and resources; and

- Critical Facilities and Infrastructure[198] – Critical facilities and critical infrastructure[199] are those that are essential to public safety and that require additional assistance and advance planning to ensure resiliency during PSPS events. Critical facilities will receive the following notifications and support by PG&E during a PSPS event:

  - Notification in to support for preparedness efforts;

  - Maps of potentially impacted areas in advance of customer notifications; and

  - A dedicated single point of contact to communicate frequently for situational awareness updates and operational support.

  Before a PSPS event, PG&E sends automated notifications to potentially impacted critical facilities and asks them to confirm receipt of the notifications. If these customers do not confirm receipt of the automated notification, PG&E representatives from local Operations Emergency Centers (OEC), Customer Relationship Managers or the Critical Infrastructure Lead (CIL) make direct calls to the critical facility contacts to ensure they are aware of the potential PSPS event. This team also provides localized support for other public safety partners such as water agencies and emergency hospitals.

  In 2021, PG&E continued the Telecommunications Resiliency Collaborative to enhance information sharing and wildfire season preparedness. This forum helped PG&E set realistic service expectations and planning needs, better coordinate during emergency and disaster events and promote overall resiliency with Telecommunication providers in support of mutual communities served. These forums are described in detail in Section 7.3.10.1.

  In June 2021, PG&E sent a letter to water infrastructure and communication service providers within PG&E's electrical service area with information on how to request representation during a PSPS at the PG&E EOC in Vacaville or remotely pending the ongoing COVID-19 pandemic and how to request PG&E representation at their jurisdiction's activated Operating Emergency Center (OEC). The letter also invited water infrastructure and communication service providers to Daily Systemwide Cooperator Calls that are held at noon during each PSPS event to provide situational awareness updates directly from PG&E's EOC leadership. Updates

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198 D.19-05-042, Appendix A and D.20-05-051, Appendix A.

199 PG&E uses the terms 'critical facilities' and 'critical infrastructure' synonymously.

shared during the daily Systemwide Cooperator Calls[200] are similar to the content conveyed during the daily operational briefing at PG&E's EOC and activated OECs.

- Telecommunications and Water Providers – When weather allows, PG&E sends advanced notifications (approximately 72-48 hours in advanced of de-energization) via automated calls, texts, and emails to impacted communications and water providers ahead of general customers, as they are considered public safety partners.

  Water providers receive escalated support through PG&E's local OECs. During a PSPS, PG&E provides telecommunications service providers with a dedicated PG&E contact in the EOC known as CIL, who will share up-to-date event information and answer specific, individual questions. Telecommunication service providers can reach the CIL 24/7 during an event by e-mail or phone. In addition, PG&E will proactively reach out to telecommunications service providers via e-mail or phone as weather changes or new information regarding the PSPS event is available.

- Transmission-level Entities – PG&E's CIL notifies impacted transmission-level entities, including POUs, of the event as soon as practically possible. Transmission level entities receive automated notifications through PG&E's customer notification system once transmission-level impacts are officially determined, which is typically 36 hours in advance of de-energization. PG&E's GCC operators make live calls to these transmission-level entities before both de-energization and reenergization.

  POUs are invited to PG&E's daily Systemwide Cooperator Call to receive situational updates and have access to the PSPS Portal that contains maps and other event information (e.g., maps, impact lists, situation reports).

- Third-Party Commodity Suppliers – When PG&E's EOC is activated for a PSPS event, CCA Relations Managers directly contact the affected CCAs to warn of the possibility of the impending PSPS event. Throughout an event, PG&E's CCA Relations Managers are readily available to the CCA impacted by the event while giving CCAs dedicated support, fielding questions, sharing situational updates, and handling miscellaneous requests. PG&E sends CCAs automated notifications at the same cadence as other public safety partners, invites them to PG&E's daily Systemwide Cooperators Call for situational updates and provides access to and training on the PSPS Portal which contains maps and other event information (e.g., customer impact lists, situation reports).

- Paratransit Agencies – PG&E provides proactive PSPS notifications and impacted zip code information to paratransit agencies that may serve all the known transit- or paratransit-dependent persons that may need access to a CRC during PSPS events. All notifications to paratransit agencies include a link to the PSPS emergency website event updates page, www.pge.com/pspsupdates and a section

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200 The Daily Systemwide Cooperator Calls are open to local and Tribal elected officials, staff and emergency managers, telecommunication providers, water agencies, emergency hospitals, publicly owned utilities, CCA, transportation authorities, and community-based organizations within PG&E's electrical service area.

called “Additional Resources” with a link to a map showing areas potentially affected by a shutoff.

- General Public/Media – In addition to direct customer notifications and communications, PG&E uses multiple platforms to communicate through the various stages of an event including PG&E’s website and contact center, media outlets, including radio and social media channels, and alternative customer notification methods.

  - Alerts[201] – Customers and non-account holders can sign up for pre de-energization alerts (automated calls[202] and texts[203]) based on specified addresses outside of their permanent residence. Anyone can use PG&E’s PSPS Address Alerts including CBOs, tenants of a master meter, renters, and others. This important communication tool allows customers to track certain locations, such as their children’s school or place of work. The functionality is similar to that which is sent to the account holder for that address and replaces previous alerts that customers were able to receive by ZIP Code.

  - Website – PG&E’s website allows **customers** to have access to 24/7 information before, during, and after a PSPS event. During a PSPS event, PG&E’s website tools and resources include, but are not limited to:

    - Customer impact address lookup tool;
    - PSPS event maps and information;
    - Weather awareness updates;
    - PSPS collateral (including translated materials);
    - Media engagement and links to social media; and
    - Short informational or event-specific videos (e.g., process after a weather “all clear” is called, PSPS decision making process, ASL, and translated videos).

    Before the first PSPS event of 2020, PG&E significantly improved our website, including pge.com, and established a new emergency website with better scalability and stability. PG&E’s main website pge.com, currently has the

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201 See pgealerts.alerts.pge.com/outages/psps-address-alert.

202 By June 2021, available in 16 spoken languages - Spanish, Mandarin, Cantonese, Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

203 By June 2021, available in 15 written languages - Spanish, Chinese (Mandarin and Cantonese) Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

capacity to serve 400 million hits[204] per hour and PG&E's emergency website, which maintains the PSPS event update information, can serve 240 million hits per hour. Both sites use a cloud-based provision solution.

During PSPS events, PG&E places banners on multiple pages on pge.com to drive traffic to PG&E's PSPS event site. In addition, upon entering pge.com during a PSPS event impacting a large number of customers, users are taken to a splash screen on the PSPS event site giving the user a choice of visiting pge.com or the PSPS updates web pages. PG&E updates the website with information on CRCs as soon as sites are confirmed (up to two days before de-energization for some locations), including locations listed by county, resources available at each center, type of CRC (e.g., indoor, outdoor) and operating hours. CRC locations are also indicated on the PSPS impact map.

In addition to the PSPS-related websites, which are accessible and translated in 15 non-English languages, PG&E also maintains a special resources webpage[205] that highlights PSPS impact mitigation resources available during an event, including an overview of the services provided through PG&E's partnership with CFILC as described in Section 8.4, and a list of local ILCs to contact. The site also includes a video of an ASL interpreter that provides an overview of the resources available through local ILCs.

- Contact Centers – PG&E operates three contact centers in the state of California and provides 24/7 emergency live-agent service for customers to report emergencies, or obtain PSPS-related **updates**, as needed. PG&E's Contact Center agents are trained in how to handle customers dealing with natural gas and electric emergencies with specific procedures to escalate life—threatening situations, which is available for translation services in 240 languages. PG&E may implement the "PSPS call strategy,"[206] as needed, to increase call center staffing to help ensure elevated service with minimal wait times for customers during a PSPS event.

- Social Media – During an event, PG&E provides event updates on social media to provide awareness and updates on the event. These tactics include:

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204 Website hits measure requests for data sent to a server when a user accesses a webpage (e.g., images viewed, data downloaded). One-page visit or page view can result in one or more hits.

205 www.pge.com/disabilityandaging.

206 During an event, PG&E will consider implementing the PSPS call strategy, as needed, to ensure elevated service with minimal wait times for customers potentially affected by an active PSPS event. The PSPS call strategy includes maintaining full staffing across Contact Center Operations and training Credit and Billing representatives to be able to handle PSPS call types, and only accepting emergency-related calls (including calls related to downed wires, gas leaks, outages and PSPS) when notifications are sent to over 100,000 customers for an active PSPS event.

- Posting information and event updates at regular intervals on a variety of channels (i.e., Twitter, Facebook, Nextdoor, Instagram);
- Varying the information to reflect the current status of the PSPS event;
- Producing social media content in English, Chinese, and Spanish; and
- Sharing an event recap from the public briefings across social channels.

– Advertising – During an event, PG&E secures spot advertisements on local radio and print media outlets, including in-language publications. Information includes but is not limited to:

- Event information and resources for customers in need, including the PSPS Disability and Aging website and recommendations for calling 211 for a full list of support services; and
- Backup communication channels should cell service be unavailable for direct customer notifications.

– Media Engagement – During an event, PG&E proactively and reactively engages with local media to provide awareness, event updates and general education on PSPS events. These engagements include:

- Issuing news releases one to two times a day to update customers and the media on the latest developments;
- Holding evening public briefings which are live streamed with an ASL translator for customers and the media where press outlets are invited to ask questions;
- Distributing morning video updates on social media to provide customers with the latest event updates and ways to prepare; and
- Reaching out for interviews and responding to local media outlet questions and requests for interviews throughout the service territory.

See 2022-02-25_PGE_2022_WMP-Update_R0_Section_8.2.4_Atch01 for a confidential list of priority essential service entities, as defined by the CPUC. Note that the entity name is created by the customer through the account setup process and entities could have multiple accounts, separated by facility location or operational function. Because of this, the attachment may appear to have duplicate listings.

8.2.6 Protocols for Mitigating Public Safety Impacts of PSPS

Protocols for mitigating the public safety impacts of these protocols, including impacts on first responders, health care facilities, operators of telecommunications infrastructure, and water utilities/agencies.

In 2022, PG&E will continue mitigating public safety impacts of PSPS activities on public safety partners (i.e., first responders, health care facilities, operators of telecommunications infrastructure and water utilities/agencies) by engaging in the following:

- Adopting PSPS impact mitigation efforts as described in Section 8.2.1;
- Coordinating with public safety partner(s) to collectively plan and prepare for emergencies, as described in Section 8.2.5;
- Effectively communicating with public safety partners in advance of a potential PSPS event, as described in Section 8.2.5;
- Effectively communicating information regarding planning and preparation (i.e., more detailed planning maps, improvements to the impact map-sharing process, weather conditions and other situational awareness updates, insight into impacted MBL customers, etc.), as described in Section 8.2.5;
- Adjusting protocols based on COVID-19 considerations following state and county guidelines, as described in Section 8.2.1; and
- Deploying temporary backup generation sources to energize substations and temporary microgrids for services supporting community normalcy, standalone facilities serving public safety, hospitals supporting emergency response, and CRCs, as described in Section 7.3.3.11.1.

PG&E will continue improving our PSPS protocols and the resources we provide based on feedback from relevant stakeholders. PG&E will also continue to refine our protocols and procedures based on lessons learned after each PSPS event, as described in the Post Event De-Energization Reports filed by PG&E following PSPS events.

8.3 Projected Changes to PSPS impact

Describe utility-wide plan to reduce scale, scope and frequency of PSPS for each of the following time periods, highlighting changes since the prior WMP report and including key program targets used to track progress over time.

1) By June 1 of current year;

2) By September 1 of current year; and

3) By next WMP submission.

PG&E has developed, and will continuously refine, our PSPS mitigation plan in order to reduce PSPS impacts over the 10-year planning horizon. Please see Section 8.1 for a detailed discussion regarding PG&E's directional vision for the necessity of PSPS.

To calculate the effects of WMP mitigations (i.e., initiatives) planned for 2022, we analyzed four years of PSPS events and identified which customers and circuits could have remained energized had the mitigations been in place based on our current PSPS Protocols. We then averaged the results over the four years to produce a forecast for what impact the mitigations may have on our customers looking forward. Please note that most PSPS mitigations are location dependent, and we will be unlikely to see the exact same weather patterns going forward so they maybe more or less impactful once deployed.

The planned 2022 WMP mitigations would have resulted in the 2018 to 2021 PSPS scope being reduced by 3.3 percent and duration by 2.4 percent when compared to the 2018 to 2021 PSPS scope without WMP mitigations. This forecast best estimates the expected scope of PSPS impacts as a result of the 2022 WMP mitigations when completed.

Table PG&E-8.3-1 and Table PG&E-8.3-2 provide a high-level summary of PG&E's planned Initiative Targets over the next WMP cycle. Although this section contains only initiatives with quantifiable direct impact mitigations (i.e., transmission lines, underground grid hardening, microgrids, etc.), PG&E continues to invest in programs that will have an indirect benefit to PSPS-related issues over time such as model and process improvements, community engagement and support, among others.

2) By September 1 of current year

TABLE PG&E-8.3-1:
PSPS DIRECT IMPACT INITIATIVE TARGETS TO BE COMPLETED BY SEPTEMBER 1, 2022

Plan Area	Unique ID	Section Reference	Target Name	Initiative Target Description	Estimated quantitative reduction of frequency (Number of Events)	Estimated quantitative reduction of scope per event (Number of Customers)	Estimated quantitative reduction of duration per event (Customer Hours)	Commitment Date
Grid Design and System Hardening	C.02	7.3.3.8.1	Distribution Sectionalizing Devices - Install and SCADA commission	Install and SCADA commission 100 new PSPS SCADA enabled Distribution Sectionalizing devices.	0	4,217	96,600	9/1/2022
Grid Design and System Hardening	C.03	7.3.3.8.2.	Transmission Line Sectionalizing - Install and SCADA commission	Install and SCADA commission 15 transmission line switches on lines that traverse the HFTD areas. The switches themselves may not be located in the HFTD areas but can be used to support customer impact reduction.	0	22,626	746,667	9/1/2022

3) Next Annual WMP Update

TABLE PG&E-8.3-2:
PSPS DIRECT INITIATIVE TARGETS TO BE COMPLETED AFTER SEPTEMBER 1, 2022 AND PRIOR TO THE NEXT WMP UPDATE

Plan Area	Unique ID	Section Reference	Target Name	Initiative Target Description	Estimated quantitative reduction of frequency (Number of Events)	Estimated quantitative reduction of scope per event (Number of Customers)	Estimated quantitative reduction of duration per event (Customer Hours)	Commitment Date
Grid Design and System Hardening	C.04	7.3.3.8.3	Distribution Line Motorized Switch Operator (MSO) - Replacements	Replace at least 50 of the 104 remaining Motorized Switch Operators that are located within or are energizing line sections that feed into HFTD areas or HFRA.	0	3,315	1,657	12/31/2022
Grid Design and System Hardening	C.07	7.3.3.11.1C	Temporary Distribution Microgrids	Make operationally-ready at least four additional Distribution Microgrid Pre-installed Interconnection Hub (PIHs). This target will include 1 PIH that completed construction in December 2021 and will be made ready to operate in 2022.	0	6,117[(a)]	280,396[(b)]	12/31/2022
Grid Design and System Hardening	C.11	7.3.3.17.1	System Hardening - Distribution	Complete at least 470 miles of system hardening work which includes overhead system hardening, undergrounding and removal of overhead lines in HFTD or buffer zone areas with the exception of any mileage being undergrounded and tracked separately as part of our Butte County Rebuild efforts (Section 7.3.3.17.6).	0	17,611	433,905	12/31/2022

(a) Includes the impact of 4 of the 5 microgrids expected to be prepared in 2022.
(b) Includes the impact of 4 of the 5 microgrids expected to be prepared in 2022.

8.4 Engaging Vulnerable Communities

Report on the following:

1) *Describe protocols for PSPS that are intended to mitigate the public safety impacts of PSPS on vulnerable, marginalized and/or at--risk communities. Describe how the utility is identifying these communities.*

2) *List all languages which are "prevalent" in utility's territory. A language is prevalent if it is spoken by 1,000 or more persons in the utility's territory or if it is spoken by five percent or more of the population within a "public safety answering point" in the utility territory (D.20 03-004).*

3) *List all languages for which public outreach material is available, in written or oral form.*

4) *Detail the community outreach efforts for PSPS and wildfire--related outreach. Include efforts to reach all languages prevalent in utility territory.*

One of PG&E's highest priorities during wildfire-related emergencies, including PSPS events, is to protect the health and safety of our vulnerable/AFN customers and communities.[207] PG&E conducts outreach related to emergency preparedness, provides an improved notification experience during PSPS events and offers additional services and resources to these customers in advance of and during PSPS events – either directly or in partnership with CBOs.

Throughout 2021, PG&E delivered on many of the CPUC's and PG&E's goals to make PSPS events less burdensome for our customers. These accomplishments include, but are not limited to:

- Developed partnerships with 61 resource CBOs to help support AFN customers with resources before, during and after PSPS events or wildfires. These partnerships included 23 food banks, 25 Meals on Wheels organizations, 16 ILCs, five LIHEAP providers, a grocery delivery organization, a hot meal organization, two family resource centers, and a portable shower/laundry service provider. Together, PG&E provided over 9,500 food boxes to vulnerable customers, conducted more than 9,900 customer energy assessments for backup power support and delivered approximately 6,500 batteries to qualifying customers through the PBP and DDAR Program combined. Additional PSPS resources provided by

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207 In D.19-05-042, p. 28, the Commission adopted a definition that comports with that used by Cal OES, and henceforth referred to vulnerable populations as populations with AFN (AFN populations). The term "AFN populations" refers to those populations with AFN as set forth in Government Code § 8593.3. Government Code § 8593.3 lists 'AFN populations as follows: the "AFN population" consists of individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.

DDAR include approximately 350 food vouchers, 40 gas vouchers, 270 hotel stays, and accessible transportation.

- Increased MBL program enrollment by 36 percent since the Q2 of 2020 – from approximately 193,400 to over 263,000 customers, enabling us to send additional communications and PSPS notifications among other benefits.

- Established and leveraged new partnerships with 38 multicultural media organizations and six in-language CBOs. PG&E was able to amplify our support for customers with limited English-speaking proficiency by sharing PSPS preparedness, awareness, and status information broadly across PSPS-affected areas in 15 non-English languages and ASL, using a variety of forums such as social media, news outlets, written material, and more.

In 2022, PG&E plans to continue our partnerships with CBOs and ensure we are fully integrated into our PSPS operations. PG&E wants to make sure the right programs and services are in place to support our vulnerable/AFN customers. More specifically, PG&E is working to ensure that we know our customers' language preferences and offering more opportunities for customers to self-identify as vulnerable (e.g., self-certified vulnerable, self-identified disabled, alternate format communications) without impinging on any HIPAA and/or CCPA data privacy laws. PG&E's work in this space will be grounded in customer and stakeholder feedback, research, and data so that our solutions align with PG&E's vulnerable customers' needs. As part of this focus, PG&E plans to seek additional resource partnerships with CBOs to provide unique solutions and resources to better serve customers across the service territory.

For this initiative, PG&E has four sub-initiatives: (1) protocols to mitigate public safety impacts during PSPS events; (2) prevalent languages in PG&E's territory; (3) translated public outreach materials; and community outreach efforts for Project Specific Safety Plan and wildfire-related outreach.

Note that PG&E addresses the specific reporting requirements from Res. WSD-011. PG&E's 2022 PSPS AFN Plan, filed January 31, 2022, provides more details on PG&E's goals, strategies, and tactics to support AFN customers and communities before, during, and after PSPS events.

8.4.1 Protocols to Mitigate Public Safety Impacts during PSPS Events

Describe protocols for PSPS that are intended to mitigate the public safety impacts of PSPS on vulnerable, marginalized and/or at-risk communities. Describe how the utility is identifying these communities.

PG&E implements a variety of tactics to mitigate the public safety impacts of PSPS on our most vulnerable customers, including low-income, medically sensitive, and/or limited English proficiency customers. To further explain, this section has been broken up into the following categories:

A. PSPS Protocols to Mitigate Public Safety Impacts

B. Additional Resources and Services

C. Identifying Vulnerable Customers

A. PSPS Protocols to Mitigate Public Safety Impacts

The information below provides a summary of PG&E activities:

- Notifications During PSPS Events – See Section 8.2.5 and the discussion on notifications for MBL customers and customers who self-identify as requiring additional support. PG&E also includes more details in the 2022 PSPS AFN Plan, filed January 31, 2022. PG&E also goes into more details about in-language support during PSPS events later in this section.

- Paratransit Agencies – PG&E provides proactive PSPS notifications and impacted zip code information to paratransit agencies that may serve all the known transit- or paratransit-dependent persons that may need access to a CRC during PSPS events. All notifications to paratransit agencies include a link to the PSPS emergency website event updates page, www.pge.com/pspsupdates and a section called “Additional Resources” with a link to a map showing areas potentially affected by a shutoff.

- Media Engagement – Before and during PSPS events, PG&E engages with the media, including multicultural news organizations to issue press releases, augment paid advertising, issue radio spot advertisements, conduct live streaming news conferences with ASL translators, and participate in media interviews. In turn, these media organizations may provide communications on the radio, broadcast, TV and online.

  PG&E continues to enhance our social media communications to AFN communities, which are currently conducted via Facebook, YouTube, Instagram, Nextdoor, and Twitter. For example, during the 2021 PSPS events, PG&E provided translated event update videos on our local social media platforms in ASL, Spanish,

and Chinese.[208] Leading up to and during PSPS events, PG&E promotes PSPS awareness and preparedness on TV, radio, pre-roll video (advertising videos that play before watching a featured video) and digital banner ads in Spanish, Cantonese, and Mandarin. In 2022, PG&E will further enhance our communications to AFN communities. For example, PG&E is exploring additional communications to better support our deaf and hard of hearing customers who rely on ASL.

- In-Event CBO and Community Partnerships – PG&E has a dedicated CBO team to maintain ongoing communications with CBOs before, during, and after PSPS. This team also maintains engagement with resource providers (e.g., CFILC, food banks, Meals on Wheels and CBOs that provide translations in indigenous languages), as well as information-only CBOs, to manage two-way communication leading up to and during each PSPS event.

  During PSPS events, PG&E invites all CBOs to participate in the daily Systemwide Cooperators Call hosted by EOC staff to share PSPS situational updates. CBOs are also provided courtesy email notifications throughout the event with updates and access to a dedicated email box.

  To ensure CBO Resource Partners are prepared to support PG&E customers during an event, they are sent PSPS advance notifications to prepare resources for deployment. PG&E's dedicated EOC team hosts a CBO Resource Partner coordination call which allows resource CBOs supporting the PSPS event to ask questions and share best practices. Throughout the PSPS event, PG&E will share impacted zip codes by county to Resource Partner CBOs to help them prepare and support their communities. In addition, PG&E will refer MBL customers who call the PG&E Contact Center and request assistance to participating regional ILCs to coordinate the appropriate support through the DDAR Program described in Section 8.2.2.

- In-language CBO and Multicultural Media Partnerships – PG&E holds contracts with five CBOs and 38 multicultural media partners to provide in-language communication support before and during PSPS events to support customers who come from indigenous communities that occupy significant roles in California's agricultural economy.

- Information Sharing with CBO/Multicultural Partnerships – During PSPS events, PG&E leverages our network of over 280 CBOs to support customers. For example, PG&E provides courtesy notification updates, e-mails with links to PG&E's PSPS information toolkit and/or one-on-one direct e-mail communications. The toolkit can include press releases, fact sheets and other relevant information that

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208 See examples of translated social media posts:

- PSPS Alert Banner: https://twitter.com/PGE_Paul/status/1427661401028534279.
- PSPS Event Update in Chinese: https://twitter.com/PGE_Paul/status/1428119806058778625.
- PSPS Event Update in Spanish: https://twitter.com/PGE_Paul/status/1428119530564325378.

partners could share with their constituents, including videos with relevant PSPS updates in 15 non-English languages and ASL. Many CBOs and multicultural media partners help PG&E provide customers with resources (e.g., in-language support, food replacement partnerships) during PSPS events. Additionally, PG&E provides maps of impacted counties, the number of total customers and MBL customers impacted and impacts by ZIP Code to CBO Resource Partners.

- Resource Partnerships – PG&E formed partnerships with more than 60 CBOs to offer additional resources (e.g., food replacement) during and after a PSPS event or wildfire, as more fully described in the *Additional Resources and Services* section below. PG&E will continue to form partnerships to expand the resources available during PSPS. PG&E is exploring additional communications to better support our deaf and hard of hearing customers who rely on ASL.

B. Additional Resources and Services

PG&E provides AFN customers with a suite of resources and services before, during and after PSPS events. Table PG&E-8.4-1 outlines the PG&E programs.

TABLE PG&E-8.4-1:
PG&E CUSTOMER RESOURCES AND SERVICES PROGRAMS

Program	Description
Disability Disaster Access & Resource Program	Enables participating DDARCs to provide qualifying customers who use electric medical devices with access to portable batteries and in-event support including lodging, transportation, food and gas vouchers
PBP	Leverage LIHEAP providers and Richard Heath and Associates to support targeted MBL customers by providing portable back-up batteries
SGIP	Financial incentives for targeted customers to install permanent battery storage
Generator and Battery Rebate Program	Rebate program for customers in Tiers 2 or 3 HFTDs who have well water for their water services or are a MBL customer or on a prequalified small or micro business customer. Additional incentives available for low income customers
Food Bank Resource Partnership	Provide customers experiencing food loss with food replacement
Meals on Wheels Partnerships	Additional meal to impacted PSPS seniors per day of shutoff
Grocery Delivery Services	Grocery bag for homebound individuals due to medical conditions
211	Information service to assist customers in locating resources
Family Resource Center	Grocery gift cards provided based on family size
Portable Shower/Laundry Service	Portable showers and laundry service
Fresh Produce	Fresh vegetables and fruit provided to customers experiencing food loss
MBL Program	Additional notifications before and during PSPS and pre-qualifications to resiliency programs
Energy Savings Assistance (ESA) Programs	Free home weatherization, energy-efficient appliances, and energy education services to income-qualified PG&E customers
CRCs	Locations where community members can access basic resources, including charging stations

- Battery and Generator Programs – See Section 8.2.1 for a description of battery programs and other resources for AFN customers during a PSPS event. This includes a full description of the DDAR Program, PBP, SGIP and Generator & Battery Rebate Program. In addition, please refer to PG&E's 2022 PSPS AFN Plan, filed January 31, 2022, that also details these battery programs.

- Food Bank Partnerships and Grants – We recognize food replacement is a critical need for some individuals with AFN, particularly those who are low income. While PG&E has an existing relationship with the California Food Bank Association and provides resilience grants to the various regional food banks, PG&E also continues

to establish agreements with food banks throughout our service area to seek additional support for customers experiencing food loss. PG&E will continue to look for opportunities to enhance food bank agreements in 2022.

Additionally, PG&E will continue to offer grants to food banks[209] to provide critical services to vulnerable customers during emergencies, including wildfires, power outages and PSPS. PG&E includes more details in our 2022 PSPS AFN Plan, filed January 31, 2022.

- Meals on Wheels Partnerships – PG&E has partnered with Meals on Wheels providers throughout our service area to provide seniors who are impacted by a PSPS event with one or two additional meal(s) per day for the duration of the power shutoff. In addition to the meal, the provider completes an in-person wellness visit that includes messaging about the potential PSPS event and guidance to additional resources available through PG&E. During the PSPS events executed in 2021, PG&E served nearly 600 additional meals and) and wellness checks through the services offered by the Meals on Wheels organizations throughout the territory. PG&E currently has agreements with 25 providers and will explore opportunities for additional partnerships in 2022. PG&E includes more details in the 2022 PSPS AFN Plan, filed January 31, 2022.

- Grocery Delivery Services – Food for Thought, based in Sonoma County, provides groceries to customers who are impacted by a PSPS event and are homebound due to advanced medical conditions (e.g., COVID-19, congestive heart failure, HIV/AIDS). Groceries provide the participating individual enough food for three meals a day for a week. Through this program, during the PSPS events implemented in 2021, PG&E provided food delivery to 10 customers in Sonoma County. In 2022, PG&E will seek to identify similar resource providers in other regions of our service area. PG&E includes more details in the 2022 PSPS AFN Plan, filed January 31, 2022.

- Family Resource Centers – In 2021, PG&E established partnerships with two family resource centers to provide families experiencing food loss with grocery gift cards depending on family size. These family resource centers support Napa and Placer counties. PG&E will continue to look for opportunities to expand agreements to additional family resource centers throughout our service area.

- Fresh Produce – Lost Sierra Food Project in Plumas County has an agreement with PG&E to provide fresh produce and vegetables, from their local farm, to customers experiencing food loss due to PSPS.

- Portable Shower and Laundry Services – Haven of Hope on Wheels in Butte County is partnered with PG&E to deploy portable showers and laundry services in Butte County when customers are without power due to PSPS.

- MBL Program – The MBL Program, is an assistance program for residential customers who have extra energy needs due to qualifying medical conditions. The program includes two different kinds of help for customers (1) an additional monthly

209 Approximately $220,000 of the $675,000 total was provided in Q3 2021.

allotment of energy at the lowest price on customer's current rate plan;[210] and (2) extra notifications in advance of a PSPS event.[211]

- ESA Program – PG&E's ESA program provides free home weatherization, energy-efficient appliances, and energy education services to income-qualified PG&E customers[212] throughout our service territory. PG&E's ESA contractors share information about emergency preparedness, PSPS and the MBL Program. Through December 31, 2021, PG&E completed over 103,000 education sessions.[213] Some of these sessions were done virtually due to COVID-19. Others were done through in home- educational activities, following all public safety protocols. PG&E plans to continue to leverage ESA contractors to help support our income-qualified customers' PSPS readiness.

- CRC – See Section 8.2.2 for a description of CRCs and information on how PG&E tailors CRCs to meet the needs of our vulnerable customers. In addition, refer to PG&E's 2022 PSPS AFN Plan, filed January 31, 2022.

- 211 Referral Services – Through our charitable grant program, PG&E continues to provide grants 211 so that 211 service providers refer individuals to social services available in their community. PG&E signed an agreement with the CA Network of 211 to provide customers with AFN with a single source of information and connection to available resources in their communities. This agreement will provide PSPS education, outreach, and emergency planning in advance of PSPS. Connecting those with AFN to critical resources like transportation, food, batteries, and other social services during PSPS. PG&E includes more details in the 2022 PSPS AFN Plan, filed January 31, 2022.

C. Identifying Vulnerable Customers

PG&E understands the importance of identifying vulnerable/AFN customers to ensure that such populations receive the education and notification they need to maximize resiliency during a PSPS event. To identify and calculate specific customers and/or households that are considered AFN, PG&E uses the following categories for which data is available in our internal databases (e.g., CC&B and others):

- Customers enrolled in the MBL program;

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210 Residential customers on tiered rate plans receive an allotment of energy every month at the lowest price available on their rate, called the Baseline Allowance. Customers who are eligible for MBL receive an additional allotment of electricity and/or gas per month (approximately 500 kilowatt-hours of electricity and/or 25 therms of gas per month. This helps ensure that more energy to support qualifying medical devices is available at a lower rate.

211 See Section 8.2.2 for details on PSPS event notification process for MBL customers.

212 To qualify for the ESA program, a residential customer's household income must be at or below 200 percent of Federal Poverty Guidelines, as required in D.05-10-044.

213 Through December 31, 2021.

- Customers enrolled in CARE or FERA;
- Customers that self-identify to receive an in-person visit before disconnection for non-payment (e.g., vulnerable);[214]
- Customers that self-identify as having a person with a disability in the household (e.g., disabled);[215]
- Customers who self-select to receive utility communications in non-standard format (e.g., in braille or large print); and
- Customers who indicate a non-English language preference.

In 2022, PG&E is adding six additional categories for which customers can self-identify including:

- Customers that self-identify as having a person in the household that uses durable medical equipment
- Customers that self-identify as having a person in the household that uses Assistive Technology
- Customers that self-identify as having a person in the household that has a Hearing Disability (e.g., Deaf or Hard of Hearing)
- Customers that self-identify as having a person in the household that has a Vision Disability (e.g., Low Vision)
- Customers that self-identify as having a person in the household that is Blind
- Customers that self-identify as having a person in the household that is 65+ years old

In 2022, PG&E will continue to promote customer enrollment in the vulnerable categories (e.g., self-certified vulnerable, self-identified disabled, alternate format communications, etc.) without impinging on any HIPAA and CCPA data privacy laws, as well as continue to encourage customers with limited English proficiency to update their account information by selecting their language preference in their PG&E accounts. In

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214 In accordance with D.12-03-054, customers that are not enrolled or qualify for the MBL Program can "certify that they have a serious illness or condition that could become life threatening if service is disconnected." PG&E uses this designation to make an in-person visit prior to disconnection. This designation remains on their account temporarily for 90 days, and can be extended to 12 months if the customers submits an application. The customer characteristic vulnerable senior is no longer included in the Disconnect OIR based on D.20-06-003, p. 14, and therefore not included in this metric.

215 Customers can self-identify with PG&E that they have a person in the household with a disability. This customer designation currently has no end date. In accordance with D.12-03-054, if customers have previously been identified as disabled and identified a preferred form of communication, the utility shall provide all information concerning the risk of disconnection in the customer's preferred format (e.g. phone, text, email, TDD/TTY).

addition, PG&E will execute a dedicated outreach campaign to promote self-identification in the newly added categories.

- MBL Program – As the vulnerable/AFN customer definition is quite broad[216] and extensive, PG&E uses the MBL program as the primary data source to identify customers requiring additional notifications and support during PSPS events.[217] Using this designation, PG&E can ensure that customers dependent upon life-sustaining medical equipment that requires electricity are identified so that PG&E and our public safety partners can ensure they are notified of an impending PSPS event, as well as assist them in developing a -de-energization- and/or emergency preparedness action plan.

  PG&E also coordinates with local and state agencies to ensure they have the right information for MBL customers and ensure their safety.[218] For example, as discussed in Section 8.2.5, PG&E shares lists of the MBL customers who have not confirmed receipt of their notifications with local and tribal agencies twice-daily during PSPS events. Due to customer privacy concerns, this information is only provided via the PSPS Portal to users that have accepted PG&E's online agreement. PG&E also only provides agencies information for customers within their jurisdiction.

- Customer Self-Identified as Vulnerable – For other disabled and vulnerable customers not enrolled in the MBL program,[219] PG&E encourages customers to self-identify if they require an in-person visit before a disconnection, if they have a person with a disability in the household ,if they prefer to receive utility communications in non-standard format (e.g., in braille or large print) if they have a person that uses durable medical equipment and/or assistive technology in the household, and/or if they have a person that is 65+ years old in the household.

  These designations allow PG&E to provide in-event PSPS notifications that meet these customers' diverse needs. PG&E is working to expand the types of customers included in our enhanced notification process (i.e., hourly retries, doorbell rings, or Live Agent phone calls) to additional self-identified categories in 2022.

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216 D.19-05-042, pp. 77-78.

217 Recognizing privacy concerns, the Commission does not require the electric IOUs to develop a comprehensive contact list of AFN customers nor to share individual customer information with local jurisdictions; rather, the Commission encourages that, through local agency partnerships, the electric IOUs and local jurisdictions can together provide up front education and outreach before and communication during a de-energization event in formats appropriate to individual AFN populations…" D.19-05-042, p. 82.

218 D.19-05-042, p. 81.

219 "[E]ach electric IOU shall identify, above and beyond those in the MBL population, households that self-identify to receive an in-person visit before disconnection for nonpayment or receive utility communications in a non-standard format or self-identify as having a person with a disability in the household, to help provide support for those with medical needs during a de-energization event." D.20-05-051, Appendix A, p. 7.

All notifications include and will continue to include a reference to resources available to customers including a link to pge.com/disabilityandaging. Customers that self-identify as vulnerable are also eligible for assistance as part of CFILC's DDAR program, as enrollment in the MBL program is not a requirement to obtain resources.

8.4.2 Prevalent Languages in PG&E's Territory

List all languages which are "prevalent" in utility's territory. A language is prevalent if it is spoken by 1,000 or more persons in the utility's territory or if it is spoken by five percent or more of the population within a "public safety answering point" in the utility territory (D.20-03-004).

PG&E considers the following as prevalent languages[220] in our territory: English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.[221]

Throughout 2020, PG&E expanded the list of languages used for Community Wildfire Safety Program (CWSP) and PSPS communications and notifications from six non-English languages to 15 non-English-languages. This includes the translation of in-event PSPS notifications, as well as PG&E's website.

PG&E recognizes the importance of communicating with customers that occupy significant roles in California's agricultural economy and speak indigenous languages, such as Mixteco and Zapoteco. These languages are served and supported through varying channels such as CBO communications and multi-cultural media outlets, discussed in Section 8.4.

In addition, in the Administrative Law Judge (ALJ) Ruling, the Commission asked the IOUs to investigate languages that might be considered minority languages in particular counties but have more than 1,000 speakers in one or more large IOU territories.[222] As explained in PG&E's Compliance Filing,[223] based on the Public Use Microdata Sample U.S. Census data, PG&E finds that Filipino languages Ilocano and Cebuano; Indian subcontinent languages[224] Gujarati, Bengali, Tamil and Telugu; Pashto; and Min Nan

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220 A language is prevalent if "It is spoken by 1,000 or more people in the affected service territory (based on identified data sources); It is spoken by indigenous communities that occupy significant roles in California's agricultural economy, regardless of prevalence, such as Mixteco and Zapoteco; and it is required by statute, regardless of prevalence, which include English, Spanish, and top three languages: Chinese, Tagalog and Vietnamese, as well as Korean and Russian (where prevalent)." See D.20-03-004, OP 1 and 2.

221 In our CWSP Outreach Workplan *Section 2.2 Identification of Language Prevalence*, filed on May 15, 2020, PG&E explained the methodology we use to determine language prevalence in our service territory. *Administrative Law Judge's Ruling Regarding Compliance Filings Submitted in Response to Decision 20-03-004 Related to In-Language Outreach Before, During and After a Wildfire and Surveys of Effectiveness of Outreach* (ALJ Ruling) further expanded the requirements.

222 ALJ Ruling, p.5.

223 Pacific Gas and Electric Company's Compliance Filing per ALJ's Ruling Regarding Compliance Filings Submitted in Response to D.20-03-004 Related to In-Language Outreach Before, During and After a Wildfire and Surveys of Effectiveness of Outreach, December 31, 2020.

224 PG&E has included Punjabi as one of the prevalent languages in our Community Outreach Budget and Workplan compliance filing.

Chinese are prevalent languages in our territory. PG&E provides outreach to speakers of these languages through call center translation services via vendor Language Line Services and through CBO partners.

8.4.3 Translated Public Outreach Materials

List all languages for which public outreach material is available, in written or oral form.

To explain PG&E's translation approach of public outreach materials, this section is broken up into the following categories:

A. In-Event PSPS Notifications and Communications for Customers with Limited English Proficiency and Other Needs

B. Website

C. Printed Material

A. In-Event PSPS Notifications and Communications for Customers with Limited English Proficiency and Other Needs

PSPS customer notifications are available in the following 15 non-English languages, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

PG&E also has contracts with five CBOs to provide in-language communications to customers in a variety of indigenous languages both for preparedness outreach and in-event communications during a PSPS event. These CBOs provide in-language outreach using social media, in-person communications, and one-on-one phone calls in one or more of the following languages: Mixteco, Tlapaneco, Triqui, Zapoteco, Maya, Nahuatl, Chatino, Chinanteca and Katz el. By partnering with multicultural media outlets, PG&E conducted six in-language webinars on CWSP and PSPS in 2021.

In addition, as an option for in-language support, PG&E directs customers to call the Contact Center. PG&E's Contact Center will continue to be equipped to provide translation support in over 240 languages.

PG&E expanded in-language support services through a new, in-language tool for customer-facing employees to use in the field during customer interactions, such as door knocks to MBL customers during PSPS events. The Insight App helps bridge the communication gap by allowing employees to converse and interact with customers who do not speak English or are deaf or hard-of-hearing in the field by providing video and/or audio translation for customers.

To support customers that are deaf or hard of hearing, PG&E has also published a video in ASL to explain the PSPS process. PG&E collaborates with NorCal Services for Deaf and Hard of Hearing to record PG&E's PSPS event notifications in ASL and messaging directing customers to pge.com for a current list of affected counties. A PSPS overview video recorded in ASL also directs customers to PG&E's address look-up tool during PSPS events. PG&E shares these PSPS ASL recordings on our social media channels (e.g., Facebook and Twitter). PG&E also includes NorCal Services for Deaf and Hard of Hearing and other Deaf agencies in PSPS CBO communications so that the information and links can be shared within the Deaf community.

B. Website

A focused set of “critical” pages, including PG&E’s PSPS webpage and the alert site, is translated in the following written languages: English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.[225] In addition, tools such as the address lookup tool and the outage map are available in-language. Table PG&E-8.4-2 is a list of critical webpages that have been translated.

[225] See example translated sites for the PSPS Updates page, which can also be found by clicking the language icon at the top of the screen on the English page: Spanish: www.pge.com/pspsupdates-es‘; Chinese: www.pge.com/pspsupdates-zh; Korean: www.pge.com/pspsupdates-ko; Russian: www.pge.com/pspsupdates-ru; Tagalog: www.pge.com/pspsupdates-tl; Vietnamese: www.pge.com/pspsupdates-vi.

TABLE PG&E-8.4-2:
CRITICAL PG&E WEBPAGES THAT ARE TRANSLATED

Webpage	URL	Languages Available
PSPS Landing Page	http://www.pge.com/psps	16
PSPS Event Updates Page	http://www.pge.com/pspsupdates	16
Wildfire Safety Landing Page	http://www.pge.com/wildfiresafety	16
PSPS Language Resources Page	http://www.pge.com/pspslangaugehelp	16
MBL Program	http://www.pge.com/medicalbaseline	16
PSPS Updates and Alerts	http://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-updates-and-alerts.page	16
PSPS Address Alert Signup	http://www.pge.com/pspsalerts	16
PG&E Disability and Aging (AFN) Page	http://www.pge.com/disabilityandaging	16 + ASL
Open House Webinar Schedule & Presentations	https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/community-wildfire-safety-open-house-meetings.page	16 + ASL
PSPS Support	http://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-support.page	16
Prepare for PSPS	http://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/prepare/prepare-for-psps.page	16
Why PSPS Events Occur	www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/why-psps-events-occur.page	16
Minimizing PSPS Events	http://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/minimizing-psps-events.page	16
Wildfire Recovery & Support	http://www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-support.page	16
Consumer Protections	https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/consumer-protection.page	16

- Accessibility of Communications – PG&E's online customer communications, including our website and PSPS customer notification emails, are tested for usability and accessibility to meet Web Content Accessibility Guidelines (WCAG) 2.0 AA accessibility standards. Before any new feature is introduced or code change is made to an existing feature, the communications content is tested by our accessibility partner, Level Access. They test the page(s) for functional usability and technical conformance using both automated tools and a manual process, including:

  - Running the site through their automated Accessibility Management Platform (AMP) tool to identify defects; and

  - Testing using Job Access with Speech (JAWS), a popular computer program that allows visually impaired or blind users to read the screen either with a text-to-speech output or by a refreshable Braille display.

  Any severe defects found are fixed and the updated code is resubmitted for testing to ensure there are no severe defects when the code is deployed to production. Videos published online also meet WCAG 2.0 AA accessibility standards, with audio description, closed captioning, and written transcripts. Beginning in 2022, new videos published online will meet WCAG 2.1 AA accessibility standards.

  PG&E remains committed to the continuous improvement of our websites to better meet the diverse needs of our customers. As we launch new features and functionality to www.pge.com and https://pgealerts.alerts.pge.com/, we test to help ensure compliance with WCAG standards. Any new digital platforms planned for development, for example, a mobile app, will be tested to help ensure compliance with WCAG standards. We also seek to improve the customer experience with ongoing manual and functional usability testing for key components.

C. Printed Material

PG&E translates "critical information/documents", which include resources focused on wildfire safety, emergency preparedness and PSPS preparedness in 15 prevalent non-English languages. PG&E's CWSP/PSPS customer information and materials are available in alternate formats, including Braille and large print, upon request. PG&E provides fully translated educational collateral to support in-person education efforts for customers in their preferred language (where prevalent), and to share with partners that help PG&E socialize their messages.

PG&E takes three approaches when translating collateral material, such as brochures and fact sheets, and web content, including:

1. Full translations of "critical information/documents";

2. Tagline translations in 15 languages for non-critical information/documents (unless the primary content has been covered in a key critical document); and

3. Language icon and text in English that points customers to PG&E's Language Services Line for non-critical documents (if space is limited).

The criteria for each approach are described below:

- Full Translation of Critical Information/Documents – Critical information/documents are defined as materials focused on wildfire and PSPS preparedness and available resources, as well as PSPS notifications.

  PG&E reviews collateral materials to ensure items deemed as "critical information/documents" are available in collateral catalog in all 15 prevalent languages. These materials can be downloaded as PDFs for electronic distribution (shared with CBOs, affinity groups, etc.) and/or printed-on-demand where PG&E or third-party representatives can order printed versions for events, presentations, among other engagements.

- Tagline Translations for Non-Critical or Supplemental Information/Documents – For non-critical materials, or materials that supplement those that already exist, and where space is available, PG&E includes a translated sentence referencing customers to call PG&E.

  Additionally, PG&E points customers to the contact center that can provide support in over 240 languages using a universally recognizable language translation icon. PG&E has conducted benchmarking to determine the most appropriate and recognizable universal language icon to leverage in these instances.

- Language Icon for Non-Critical or Supplemental Information/Documents – Items that are classified as non-critical or supplemental and have space constraints contain a universal "icon" and short message in English to inform customers that they can contact PG&E for translated support in additional languages.

  The number that is included on these translated materials directs customers to one of four PG&E Contact Centers in California. Support from live agents is available 24/7 and can support customers in over 240 languages, including 10 indigenous languages, such as Mixteco, Zapoteco, and Triqui. PG&E will continue to leverage the Contact Centers to handle customer inquiries and additional translation services as needed.

8.4.4 Community Outreach Efforts for PSPS and Wildfire-Related Outreach

Detail the community outreach efforts for PSPS and wildfire-related outreach. Include efforts to reach all languages prevalent in utility territory.

PG&E provides a variety of outreach and education for vulnerable customers and communities in advance of wildfire season, and before, during, and after PSPS events. These outreach efforts are critical so that these customers can be prepared to address the unique impacts of wildfire, de-energization and other natural disaster emergencies. PG&E makes a considerable effort to use a diversity of channels to best reach customers in the format of their choice.[226] PG&E intends to continue to explore additional channels and technologies for communications, while also refining details and scope of implementation to improve content, accessibility, awareness, and effectiveness.

In this section, PG&E provides a summary of the community outreach efforts for PSPS and wildfire related outreach, including efforts to reach all languages prevalent in utility territory. The section is broken up by the following categories:

A. Website;

B. Media Engagement;

C. Community Events;

D. PSPS and Wildfire Preparedness Regional Open Houses (Webinars);

E. Community Based Organization Engagement;

F. MBL Customer Outreach;

G. Tribal Community; and

H. Advisory Boards.

Details on wildfire and PSPS-related outreach are included in Sections 7.3.9.2, 7.3.10.1, and 8.2.5. Further, PG&E detailed specific customer and community outreach efforts for AFN populations in the 2022 PSPS AFN Plan.[227]

A. Website

PG&E's website allows customers to have access to a wide variety of information ranging from wildfire preparedness to PSPS event-specific information 24/7, providing customers with convenience and flexibility.

In 2021, PG&E made the following website improvements:

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[226] D.20-03-004, OP 3.

[227] D.21-06-0034, Appendix A.

- Launched the "Learn about PSPS events for large businesses" webpage, which contains resources and information targeted towards large commercial customers;[228]

- Completed customer testing of new language that will be used on the site in 2021, reflecting feedback provided during the 2020 wildfire season;

- Expanded Address-Level Alerts (ALA) by adding SMS text, a new address specific notification option that replaced Zip Code Alerts. This enhanced notification option was developed as a direct result of feedback from the People with Disabilities and Aging Advisory Council (PWDAAC). Alerts can be received via Interactive Voice Recording or SMS and in-language (English and 15 non-English languages). Information for ALAs can be found on pge.com/addressalerts;

- Updated our Emergency Website to make the outage map more user-friendly, particularly in mobile view. This included adjusting the zoom level used when a user shares their location, resizing the pop up on the outage map and collapsing the map legend to increase the visible map area.

- Enhanced the confirmation pages for outage address alerts to show details about the contact method the user provided and the language that the user signed up for;

- Made backend improvements that enhanced monitoring, scaling and cyber security.

- Enhanced the 7-Day PSPS Potential Forecast to improve customer awareness and understanding of upcoming PSPS events. Improvements include a more granular, county-based forecast which can be found at pge.com/pspsweather.

- Updated our PSPS preparation page with additional resources such as locating electrical vehicle charging stations at pge.com/pspsprep.

- Updated the in-language instructions on how to sign up for PSPS event information and notifications at pge.com/pspslanguagehelp.

- Improved access to AFN information and notifications enrollment on the Emergency Website PSPS Event homepage. Made the content part of large design pods to help it stand out further.

- Launched customer testing of the outage map on the Emergency Website to make the outage map more user-friendly, particularly in mobile view. Removed icons that were getting in the way of using the map on smaller phone screens. Tested microgrid language for the Emergency Website Address Lookup Tool to help improve comprehension.

PG&E updates the AFN-targeted webpage, http://www.pge.com/disabilityandaging, during each PSPS event as new resource partners are added. Please see the above

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228 The new webpage can be accessed at the following link: https://www.pge.com/en_US/large-business/outages/public-safety-power-shuttoff/learn-about-psps.page

section, *Translated Public Outreach Materials*, where PG&E discuss in-language offerings as they relate to the website.

PG&E will continue to explore and identify improvements for the website based on continued user and messaged testing, feedback from surveys and more.

B. Media Engagement

PG&E works closely with external media outlets, including both paid and earned media, to provide broad awareness to Californians to share tips related to wildfire and PSPS preparedness, socialize available resources and communicate PSPS event information. PG&E is also focused on enhancing and formalizing coordination with multicultural media organizations for both preparedness outreach and in-event communications.

- Earned Media – To serve non-English speaking customers, PG&E engages with over 150 multicultural media outlets throughout the year in an effort to promote safety initiatives, including PSPS, to monolingual or difficult-to-reach populations that may not have access to mainstream television media and/or read/speak English.

  PG&E shares news releases and coordinates interview opportunities with media outlets to help educate non-English speaking customers on various PG&E programs, including the CWSP, PSPS, emergency preparedness, public safety, consumer protections and income qualified programs, to name a few. PG&E also schedules media visits with these organizations to discuss other partnership opportunities (e.g., Public Service Announcements, advertising, event sponsorships). In 2021, PG&E identified 38 multicultural media outlets to partner with on PSPS and wildfire safety education.

  PG&E also staffs bilingual and multilingual employees to serve in the EOC to support the PIO multimedia engagement function. These employees provide urgent translation support, such as verification and approval of ad hoc written translations during emergencies. These staff assist PG&E with avoiding delays that can occur when engaging outside vendors for translation needs during an active event or wildfire.

- Paid Media and Advertising – To supplement PG&E's outreach efforts during PSPS events, PG&E runs PSPS emergency messages to reach customers via paid media channels, when/where channels are available. PG&E purchases a combination of English and in-language radio ads, as well as digital banners in English and multiplate languages[229] based on targeted ZIP Codes.

  In 2022, PG&E will run a series of print ads across our service territory highlighting in-language support of over 200 languages via the Call Center.

[229] Spanish and Chinese.

- Social Media – PG&E uses social media, including Facebook,[230] Twitter,[231] Nextdoor[232] and Instagram[233] to direct users to the website where they can access important emergency preparedness information, as well as PSPS event resources in their supported language of preference. Using PG&E's social media accounts, PG&E posts key from news releases, invitations to wildfire safety and preparedness webinars,[234] promoting the MBL program,[235] and PSPS event updates including CRC information.[236] PG&E's social media efforts also include publishing content, including informational preparedness and/or event-specific videos, such as PSPS, processes and insight into frequently asked questions.

- Videos – PG&E creates a variety of informational videos ranging from 30 seconds to 30 minutes. These videos provide a high-level overview of expectations and protocols for PSPS for the territory. Additionally, PG&E covers content discussed during PG&E webinars, including approaches to mitigate for wildfire risk and how customers can prepare for emergencies. These videos are available for customers at pge.com/pspsvideos, YouTube and on social media. PG&E also creates PSPS event-specific morning video updates in English, Spanish and Chinese to share on social media.

C. Community Events

PG&E plans to host and/or participate in community events focused on customers with disabilities, seniors, and low-income customers. The format and timing of community events will depend on COVID-19. PG&E anticipates that the bulk of community events will occur virtually, like many 2020-21 events. When it becomes safe for PG&E's customers, communities, and employees to gather, PG&E plans to pivot to in-person events.

In 2020, as part of the State Council on Developmental Disabilities Virtual Conference, PG&E produced a three-minute video starring Christina Mills, CFILC Executive Director, to highlight available resources for the AFN population including DDAR and MBL. The video was used in 2021 at the Supported Life "Self Advocacy" conference on May 7, 2021 and the "Finding Balance" conference on July 22, 2021. The video is posted on PG&E's YouTube channel.[237]

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230 www.facebook.com/pacificgasandelectric/.

231 www.twitter.com/PGE4Me, www.twitter.com/PGE_sactosierra, www.twitter.com/PGE_paul, www.twitter.com/PGE_deanna.

232 www.nextdoor.com/agency-detail/ca/san-francisco/pacific-gas-and-electric-company-13/.

233 www.instagram.com/pacificgasandelectric/.

234 www.instagram.com/p/CRkA28tpMVy/.

235 www.twitter.com/PGE4Me/status/1432739796972187653.

236 www.twitter.com/PGE_Paul/status/1448648059408183301.

237 https://www.youtube.com/watch?v=uvukoac8cYg.

D. PSPS and Wildfire Preparedness Regional Open Houses (Webinars)

PG&E plans to host wildfire safety and PSPS preparedness webinars for representatives of people and communities with AFN. The preparedness webinars include subtitles in English, Spanish and Chinese, and has an ASL interpreter.

During these webinars, PG&E plans to share a summary of PG&E's efforts to mitigate wildfire risk, engagement with local organizations during PSPS events and information on event notifications. In addition, PG&E will share an overview of resources available to customers, including the MBL Program, CRC overview (including COVID-19 contingencies), funding and incentives for backup power resources through the PBP and SGIP, as well as PG&E's DDAR Program offerings (transportation, backup power, hotel and food vouchers).

To facilitate residential customer participation, PG&E plans to host the webinars after standard working hours. For customers who are deaf or hard of hearing and those with limited English proficiency, PG&E will ensure that each webinar includes closed captioning in English and translated closed captioning in Spanish and Chinese. PG&E will record the presentation portion of the webinar in 16 languages, including ASL, and make the recordings available on PG&E's website at pge.com/openhouse.

E. Community Based Organization Engagement

PG&E recognizes the important roles that CBOs play in the community because of their established relationships and ability to serve as trusted communication channels to customers.

PG&E is actively engaged with over 280 CBOs to provide education and awareness information to customers through a variety of channels including the contractors that serve PG&E's income qualified customers. PG&E coordinates with CBOs that have existing relationships and serve disadvantaged and/or hard-to-reach communities to conduct outreach to customers proactively and/or communicate with customers to provide in-language/translated education and/or PSPS event updates. These CBOs are referred to as Informational Partnerships.

Through these partnerships, CBOs help amplify our wildfire and PSPS preparedness messaging and provide event updates with their constituents. PG&E engages with these organizations in one or more of the following ways:

- Conducting bi-annual trainings with contractors that serve PG&E's customers in the CARE program, which include information on relevant PG&E programs, including the CWSP and PSPS, so the contractors can assist with educating their clientele throughout the year;

- Providing CWSP/PSPS literature for sharing through CBO communication channels and ESA contractor networks;

- Offering the CBO Direct program to empower non-profits with resources to assist in the distribution of important safety messaging to their networks of customers in Tier 2 and Tier 3 areas;

- Providing PSPS webinars tailored to the needs of AFN organizations;
- Providing in-person PSPS presentations at local events; and
- Providing a PG&E exhibitor booth at events supporting AFN populations.
- PG&E also partners with CBOs to provide resources to customers before, during, and after PSPS. These CBOs are referred to as Resource CBOs. These CBOs have a formal agreement with PG&E and are compensated for the services that they provide.

PG&E will build on the successes with these CBOs to further support these communities in 2022. In 2022, the format and timing of in-person engagements will depend on the public health safety protocols related to COVID-19. PG&E anticipates that the bulk of CBO engagement will occur virtually, like many 2021 events. When it becomes safe for our customers, CBOs, communities, and employees to gather, PG&E will review the potential to resume in person engagement, based on state and local health guidance.

F. MBL Customer Outreach

PG&E encourages customer participation and enrollment in the MBL Program through direct-to-customer outreach, CBO partnerships, and building strong relationships with the healthcare industry. This outreach aims to help individuals who rely on power for their medical needs to prepare for PSPS and connect with relevant resources for support.

PG&E plans to continue our direct-to-customer outreach tactics in 2022, such as sending emails and letters, and MBL 3rd party bill inserts for MBL program acquisition. PG&E will also continue to send PSPS preparedness brochures, postcards and emails to all MBL customers, in addition to self-certified vulnerable and disabled customers. These brochures feature focused resources and preparedness tips for PSPS.

In addition to the direct-to-customer mail and email campaigns, PG&E will continue to conduct outbound calls to customers who have self-identified as having a disability, seniors, and other vulnerable populations to promote the MBL Program. This outreach also verifies contact information and communication preferences, reviews emergency preparedness plans and promotes other programs and services that could help during a PSPS event. This customer call campaign also promotes our Customer Programs such as the DDAR Program, PBP, and SGIP.

Recognizing the healthcare providers' and medical equipment manufacturers' assistance in informing customers of the MBL Program and encouraging enrollment, PG&E started engaging with a variety of healthcare providers, medical associations and durable medical equipment suppliers to build relationships and provide education about the relevant programs that can help the clients we mutually serve. PG&E is providing these stakeholders with MBL Program application forms and factsheets, including PSPS preparedness information and toolkits.

PG&E has joined healthcare industry conferences and meetings to present information about the MBL program and provided training on the program to healthcare industry

staff, including In-Home Support Services providers. We are asking these partners to promote the MBL Program and encourage customer enrollment by adding a link to PG&E's MBL Program on their websites.

G. Tribal Community

PG&E assists tribal members throughout our service area to mitigate the impacts of PSPS events, and other emergency situations such as the COVID-19 pandemic, wildfires and rolling blackouts. PG&E provides grants to tribes impacted by wildfires and COVID-19 and conducts e-mail outreach to tribal leaders and staff to increase awareness of available assistance options. This assistance options include:

- Offering flexible payment plans;
- Supporting online bill payment while local offices are temporarily closed;
- Providing bill reductions for income-qualified customers through the CARE and FERA programs;
- Offering free energy-efficiency programs to help reduce home energy use;
- Providing online tools to assist tribes in preparation for a PSPS;
- Expanding PSPS tribal outreach to include all 25 tribal health facilities in our service area
- Working with local regional organizations to provide support for AFN community members during PSPS events;
- Providing backup battery suitcases to the Hopland Tribe, Kashia Pomo Tribe, Cahto Tribe and Coyote Valley Tribe and conducting a training for tribal staff and elders on proper use and maintenance; and
- Engaging tribal governments to help them prepare their tribal memberships for PSPS events and other potential outages.
- Inclusion of tribal governments in quarterly regional workgroups
- Outreach to tribal governments on CMEP and MIP program opportunities
- Providing a quarterly tribal newsletter that includes tips for PSPS preparedness

PG&E continues to refine the customer database for tribal lands to facilitate real-time reporting of tribal-specific impacts. For example, PG&E added the Pit River Tribe, Montgomery Creek Reservation, Roaring Creek Reservation and Burney Reservation to our customer database. For additional information related to the PSPS support that PG&E provides tribal leaders, see Section 8.2.5.

H. Advisory Boards

PG&E understands the importance of engaging with interested parties and advisory councils to gain feedback on approaches for serving customers before, during and after

PSPS events. PG&E has instituted advisory boards at the suggestion of representatives of AFN and other stakeholders to inform our wildfire safety and PSPS-related initiatives.

- PWDAAC – PWDAAC ("Council") provides a forum to gather insight on the needs of AFN populations related to emergency preparedness and to facilitate co-creation of solutions and resources to serve customers reliant on power for medical needs in relation to a PSPS event. The PWDAAC is a diverse group of recognized CBO leaders supporting people with developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries and older adult communities, as well as members and advocates from within these communities.

  The Council provides independent expertise to help ensure that PG&E's customer programs, operations and communications incorporate best practices to support these populations now and in the future. The Council:

  - Actively identifies issues, opportunities and challenges related to PG&E's ability to minimize the impacts of wildfire safety including PSPS, and other emergencies to Northern and Central California over the long term;

  - Serves as a sounding board and offers insights, feedback and direction on PG&E's customer strategy, programs and priorities; and

  - Shares experiences, perspectives and best practices for improving PG&E's customer performance.

  In 2021, PG&E met with PWDACC quarterly to gather feedback and provide information on resources, services and program. At a minimum, in 2022, PG&E will convene the Council for four quarterly meetings per year We will continue to use online fora (e.g., WebEx) until in-person meetings are safe to conduct.

- Statewide IOU AFN Advisory Council – The Joint IOUs established the Statewide IOU AFN Advisory Council to engage with members, advocates and leaders across all populations identified as vulnerable, to inform a more holistic and strategic view on how to help the many constituencies served by the utilities. The Joint IOUs will convene the Council no less than four times per year, but likely monthly, consistent with 2021 practices. Ideally the meetings will be in-person, however, given the current COVID-19 pandemic conditions, online forums (e.g., Microsoft Teams) will be used until in-person meetings are safe to conduct. In addition to the quarterly and/or monthly Advisory Council meetings, the Joint IOUs plan to host interim sessions with stakeholders to make meaningful progress in implementing the various recommendations. This Joint IOU will be offering compensation to participants.

- AFN IOU Leadership Meetings – A continuation of the AFN Panel Discussion included in the CPUC Joint IOU PSPS Workshop on March 29, 2021, PG&E, Southern California Edison Company, and San Diego Gas & Electric Company together with state and local agency and community AFN leaders established regular meetings. The group discussed how IOUs can better identify and target AFN customers to ensure unmet needs of AFN customers are addressed during PSPS events. In addition to the IOU Senior Executives, attendees included leaders

from State Council on Developmental Disabilities, Disability Rights California, CFILC, Disability Rights Education and Defense Fund, Cal OES, CPUC, Liberty Utilities, Bear Valley Electric, and Pacific Corp. PG&E will continue to meet with these stakeholders to improve on identification of AFN customers and improve access to resources during PSPS events.

- 2022 AFN Plan Collaborative Planning Team – n Q3 2021, PG&E began the development of our 2022 AFN Plan in accordance with the FEMA Comprehensive Preparedness Guide as adopted by the Phase 3 revised guidelines for PSPS.[238] The IOUs have collaborated to align our approach and to enlist a FEMA expert to assist with the development of the structure. On September 2, 2021 at the AFN IOU Leadership Meeting, the IOU Senior Executive team briefed the stakeholders identified in D.21-06-034 to initiate the collaborative planning team discussions and propose a schedule. In addition, to ensure comprehensive representation across various AFN perspectives, on September 24, the IOUs introduced this effort to the broader Joint IOU Statewide AFN Advisory Council plus additional invited organizations such as DeafLink, Hospital Council, American Red Cross, and the California Rural Indian Health Board, to solicit participation in the planning committee. Throughout the remainder of 2021 and through January 2022, PG&E continued to meet with the AFN Plan Collaborative Planning Team utilizing the six steps outlined by the FEMA Comprehensive Preparedness Guide. PG&E filed our 2022 AFN Plan on January 31, 2022.

- Other Advisory Groups – PG&E will also continue to engage with and solicit feedback on wildfire and PSPS-related outreach from other existing advisory groups, including:

  - Disadvantaged Communities Advisory Group – An advisory group that meets quarterly led by the CPUC and California Energy Commission, with representatives from disadvantaged communities. The purpose of this group is to review and provide advice on proposed clean energy and pollution reduction programs and determine whether those proposed programs will be effective and useful in disadvantaged communities. PG&E engages with this group to provide information and gain input about wildfire mitigation activities, including PSPS;

  - Low Income Oversight Board – A board established to advise the CPUC on low-income electric and gas customer issues and programs. PG&E also engages with this group to provide information and gain input about wildfire mitigation activities, including PSPS

  - Local Government Advisory Councils and Working Groups – PG&E includes representatives from the AFN community on both the PSPS Regional Working Groups. Additionally, PG&E hosts local wildfire safety sessions with each County OES in advance of wildfire season. PG&E's plans to ensure AFN

238 D.21-06-034, Appendix A.

populations are included in these sessions for awareness and opportunity for feedback; and

- Communities of Color Advisory Group – PG&E will continue to solicit input from Communities of Color Advisory Group which assists PG&E in crafting outreach and engagement with communities on color on a broad spectrum of issues impacting diverse communities.

8.5 PSPS Specific Metrics

PSPS data reported quarterly. Placeholder tables below to be filled in based on quarterly data.

Instructions for PSPS table of Attachment 3:

In the attached spreadsheet document, report performance on the following PSPS metrics within the utility's service territory over the past seven years as needed to correct previously -reported data. Where the utility does not collect its own data on a given metric, the utility is required to work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in the "Comments" column.

The comments and notes for this table are in the 2022 WMP Quarterly Data Request Excel file and future subsequent quarterly updates. Please refer to the file for additional information regarding Table 11. Further details regarding the historical lookback of the last four years of weather data and its uses and limitations can be found in Section 8.1.4.1.

8.6 Identification of Frequently De-Energized Circuits

Senate Bill 533 (2021) added an additional requirement to the WMPs. Public Utilities Code Section 8386(c)(8) requires the "Identification of circuits that have frequently been de-energized 19 pursuant to a de-energization event to mitigate the risk of wildfire and the measures taken, or planned to be taken, by the electrical corporation to reduce the need for, and impact of, future de-energization of those circuits, including, but not limited to, the estimated annual decline in circuit de-energization and de-energization impact on customers, and replacing, hardening, or undergrounding any portion of the circuit or of upstream transmission or distribution lines." To comply with this statutory addition, utilities are required to populate Table 8.6-10 and provide a map showing the listed frequently de-energized circuits.

To obtain the list of frequently de-energized circuits, PG&E analyzed circuit level data filtering circuits de-energized three or more times in any calendar year from 2019 to 2021. These circuits are listed on Table PG&E-8.6-1.

PG&E's PSPS Protocols changed significantly with updates in 2021. Therefore, we executed a lookback analysis to identify the circuits from Table PG&E-8.6-1 that would not be de-energized three or more times in any calendar year from 2019 to 2021 when using our current PSPS Protocols. We identified these circuits in the Table PG&E 8.6-1 as "*mitigated with PSPS Protocols*".

Finally, we identified the main measures (i.e., hardening, undergrounding, microgrids, transmission switches, distribution sectionalizing devices, temporary generation, etc.) taken or planned to be taken to mitigate the impact of future de-energization of those circuits. See 2022-02-25_PGE_2022_WMP-Update_R0_Section 8.6_Atch01 for a map showing the listed frequently de-energized circuits.

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
152101101	ALLEGHANY 1101	Dx	SIERRA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	1,028	Sectionalizing Devices; Grid Hardening; Temporary Generation;
152101102	ALLEGHANY 1102	Dx	NEVADA	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/23/19, 10/26/19	151	Grid Hardening;
163561101	ALPINE 1101	Dx	ALPINE	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	276	Mitigated by PSPS Protocols
163561102	ALPINE 1102	Dx	ALPINE	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	303	Mitigated by PSPS Protocols
103261103	ANDERSON 1103	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/26/19, 11/20/19	437	Sectionalizing Devices; Grid Hardening;
42861101	ANNAPOLIS 1101	Dx	SONOMA	10/25/20, 10/26/19, 10/23/19, 10/09/19	222	Mitigated by PSPS Protocols
153661103	APPLE HILL 1103	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	1,260	Grid Hardening;
153661104	APPLE HILL 1104	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	2,413	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
153662102	APPLE HILL 2102	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	4,375	Grid Hardening;
62081101	ARBUCKLE 1101	Dx	COLUSA	10/25/20, 08/17/21, 09/20/21, 10/11/21	3	Sectionalizing Devices; Grid Hardening;
62081104	ARBUCKLE 1104	Dx	COLUSA	10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/09/19, 10/26/19, 11/20/19	13	Sectionalizing Devices; Grid Hardening;
103191101	BANGOR 1101	Dx	YUBA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 06/08/19, 10/26/19, 10/09/19, 10/23/19, 09/23/19, 09/25/19	291	Sectionalizing Devices; Grid Hardening;
152701107	BELL 1107	Dx	PLACER	10/09/19, 10/23/19, 10/26/19	1,420	Mitigated by PSPS Protocols
152701108	BELL 1108	Dx	PLACER	10/25/20, 10/26/19, 10/23/19, 10/09/19	1,559	Mitigated by PSPS Protocols
103751101	BIG BEND 1101	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/05/19, 10/23/19, 10/09/19, 09/25/19, 10/26/19, 09/23/19	234	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103751102	BIG BEND 1102	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 10/05/19, 10/23/19, 10/09/19, 10/26/19, 09/25/19, 09/23/19	318	Grid Hardening;
152301101	BONNIE NOOK 1101	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/23/19, 10/26/19	486	Grid Hardening;
152301102	BONNIE NOOK 1102	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	521	Grid Hardening;
192461102	BRIDGEVILLE 1102	Dx	HUMBOLDT	09/07/20, 10/14/20, 10/25/20, 10/09/19, 10/26/19	262	Mitigated by PSPS Protocols
152921101	BROWNS VALLEY 1101	Dx	YUBA	10/25/20, 10/26/19, 09/23/19, 09/25/19, 10/09/19, 10/23/19	116	Mitigated by PSPS Protocols
152481102	BRUNSWICK 1102	Dx	NEVADA	09/07/20, 09/26/20, 10/25/20, 09/25/19, 10/09/19, 10/23/19, 10/26/19	1,378	Mitigated by PSPS Protocols
152481103	BRUNSWICK 1103	Dx	NEVADA	09/07/20, 10/25/20, 10/09/19, 10/23/19, 10/26/19	3,177	Mitigated by PSPS Protocols
152481104	BRUNSWICK 1104	Dx	NEVADA	09/07/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	2,508	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
152481105	BRUNSWICK 1105	Dx	NEVADA	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19, 09/25/19	3,675	Mitigated by PSPS Protocols
152481106	BRUNSWICK 1106	Dx	NEVADA	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19, 09/25/19	4,480	Mitigated by PSPS Protocols
152481107	BRUNSWICK 1107	Dx	NEVADA	09/07/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	2,650	Mitigated by PSPS Protocols
152481110	BRUNSWICK 1110	Dx	NEVADA	09/07/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	3,048	Mitigated by PSPS Protocols
102211101	BUCKS CREEK 1101	Dx	PLUMAS	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 09/25/19, 10/05/19, 10/26/19, 10/09/19	4	Grid Hardening;
102211102	BUCKS CREEK 1102	Dx	PLUMAS	09/07/20, 09/26/20, 10/21/20, 10/25/20, 10/09/19, 10/26/19	120	Grid Hardening;
102211103	BUCKS CREEK 1103	Dx	PLUMAS	09/07/20, 09/26/20, 10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/26/19	311	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103081105	BUTTE 1105	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/26/19, 06/08/19, 09/25/19, 10/09/19, 10/23/19, 10/05/19	266	Sectionalizing Devices; Grid Hardening;
162211101	CALAVERAS CEMENT 1101	Dx	CALAVERAS	10/25/20, 10/26/19, 10/09/19, 10/23/19	1,159	Mitigated by PSPS Protocols
42711101	CALISTOGA 1101	Dx	NAPA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 08/17/21, 10/11/21, 09/25/19, 11/20/19, 10/09/19, 10/26/19, 10/23/19	1,549	Sectionalizing Devices; Grid Hardening; Temporary Generation;
42711102	CALISTOGA 1102	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/23/19, 11/20/19, 10/09/19, 10/26/19	919	Sectionalizing Devices; Grid Hardening; Temporary Generation;
255451102	CALWATER 1102	Dx	KERN	10/23/19, 10/26/19, 10/09/19	13	Mitigated by PSPS Protocols
103321101	CEDAR CREEK 1101	Dx	SHASTA	09/07/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/26/19, 10/09/19, 11/20/19	731	Grid Hardening;
103201101	CHALLENGE 1101	Dx	PLUMAS	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/23/19, 10/26/19, 10/09/19	668	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103201102	CHALLENGE 1102	Dx	YUBA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/23/19, 09/25/19, 10/26/19, 09/23/19, 10/09/19	827	Grid Hardening;
103091101	CLARK ROAD 1101	Dx	BUTTE	10/05/19, 09/25/19, 10/26/19, 10/23/19, 10/09/19, 06/08/19	15	Grid Hardening;
103091102	CLARK ROAD 1102	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 09/25/19, 06/08/19, 10/23/19, 10/05/19, 10/26/19	1,093	Sectionalizing Devices; Grid Hardening;
42821102	CLOVERDALE 1102	Dx	SONOMA	10/14/20, 10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/23/19, 10/26/19, 10/09/19	39	Sectionalizing Devices; Grid Hardening;
152471101	COLUMBIA HILL 1101	Dx	NEVADA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	1,126	Grid Hardening;
103331101	CORNING 1101	Dx	TEHAMA	10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/26/19, 10/09/19	822	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103331102	CORNING 1102	Dx	TEHAMA	10/21/20, 10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/09/19, 10/26/19	291	Sectionalizing Devices; Grid Hardening; Temporary Generation;
63121101	CORTINA 1101	Dx	COLUSA	10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	8	Sectionalizing Devices; Grid Hardening;
102931103	COTTONWOOD 1103	Dx	TEHAMA	10/25/20, 08/17/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	2,419	Sectionalizing Devices; Grid Hardening;
103351101	DESCHUTES 1101	Dx	SHASTA	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/09/19, 10/26/19	24	Grid Hardening;
103351104	DESCHUTES 1104	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/26/19, 11/20/19	2,366	Sectionalizing Devices; Grid Hardening;
152261103	DIAMOND SPRINGS 1103	Dx	EL DORADO	09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	677	Mitigated by PSPS Protocols
152261104	DIAMOND SPRINGS 1104	Dx	EL DORADO	10/25/20, 10/23/19, 10/26/19, 10/09/19	463	Mitigated by PSPS Protocols
152261105	DIAMOND SPRINGS 1105	Dx	EL DORADO	10/25/20, 10/23/19, 10/09/19, 10/26/19	2,464	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
152261106	DIAMOND SPRINGS 1106	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	68	Mitigated by PSPS Protocols
152261107	DIAMOND SPRINGS 1107	Dx	EL DORADO	10/25/20, 10/26/19, 10/23/19, 10/09/19	1,286	Mitigated by PSPS Protocols
153741101	DOBBINS 1101	Dx	YUBA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19, 09/23/19, 09/25/19	857	Sectionalizing Devices; Grid Hardening;
152321101	DRUM 1101	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	188	Grid Hardening;
43071101	DUNBAR 1101	Dx	SONOMA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/23/19, 10/09/19, 11/20/19, 10/26/19	2,528	Sectionalizing Devices; Grid Hardening;
43071103	DUNBAR 1103	Dx	SONOMA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/09/19, 10/23/19, 11/20/19, 10/26/19	272	Sectionalizing Devices; Grid Hardening;
152762101	EL DORADO P H 2101	Dx	EL DORADO	10/23/19, 10/26/19, 10/09/19	4,560	Sectionalizing Devices;
152762102	EL DORADO P H 2102	Dx	EL DORADO	10/23/19, 10/09/19, 10/26/19	1,592	Sectionalizing Devices;
152762101	EL DORADO PH 2101	Dx	EL DORADO	09/07/20, 09/26/20, 10/14/20, 10/25/20	4,552	Sectionalizing Devices; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
152762102	EL DORADO PH 2102	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20	1,581	Sectionalizing Devices; Grid Hardening;
162161101	ELECTRA 1101	Dx	AMADOR	10/25/20, 10/23/19, 10/26/19, 10/09/19	1,342	Mitigated by PSPS Protocols
42751113	FITCH MOUNTAIN 1113	Dx	SONOMA	10/25/20, 10/26/19, 10/09/19, 10/23/19	568	Mitigated by PSPS Protocols
152181101	FORESTHILL 1101	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/23/19, 10/26/19, 09/25/19	2,206	Sectionalizing Devices; Grid Hardening;
152181102	FORESTHILL 1102	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 09/25/19, 10/23/19	420	Grid Hardening;
192321122	FORT SEWARD 1122	Dx	HUMBOLDT	09/07/20, 10/14/20, 10/25/20, 10/09/19, 10/26/19	89	Mitigated by PSPS Protocols
163451701	FROGTOWN 1701	Dx	CALAVERAS	09/07/20, 10/25/20, 10/23/19, 10/26/19, 10/09/19	1,251	Mitigated by PSPS Protocols
42561102	FULTON 1102	Dx	SONOMA	10/25/20, 10/09/19, 10/26/19, 10/23/19	315	Mitigated by PSPS Protocols
42561107	FULTON 1107	Dx	SONOMA	10/25/20, 11/20/19, 10/23/19, 10/09/19, 10/26/19, 09/25/19	372	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
42891101	GEYSERVILLE 1101	Dx	SONOMA	10/25/20, 08/17/21, 10/09/19, 10/23/19, 10/26/19	89	Mitigated by PSPS Protocols
42891102	GEYSERVILLE 1102	Dx	SONOMA	10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/26/19, 10/23/19, 10/09/19	57	Sectionalizing Devices; Grid Hardening; Temporary Generation;
103401101	GIRVAN 1101	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	1,173	Grid Hardening;
102601101	GLENN 1101	Dx	GLENN	10/25/20, 08/17/21, 09/20/21, 10/11/21, 11/20/19, 10/09/19, 10/26/19	5	Grid Hardening;
152031101	GRASS VALLEY 1101	Dx	NEVADA	10/25/20, 10/09/19, 10/26/19, 10/23/19	331	Mitigated by PSPS Protocols
152031103	GRASS VALLEY 1103	Dx	NEVADA	10/25/20, 10/23/19, 10/26/19, 10/09/19	1,446	Mitigated by PSPS Protocols
24101103	HALF MOON BAY 1103	Dx	SAN MATEO	10/14/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	730	Sectionalizing Devices; Grid Hardening;
152241101	HALSEY 1101	Dx	PLACER	10/25/20, 10/23/19, 10/09/19, 10/26/19	2,283	Mitigated by PSPS Protocols
152241102	HALSEY 1102	Dx	PLACER	10/25/20, 10/09/19, 10/26/19, 10/23/19	2,059	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
152691103	HIGGINS 1103	Dx	NEVADA	10/25/20, 10/09/19, 10/23/19, 10/26/19	1,914	Mitigated by PSPS Protocols
152691104	HIGGINS 1104	Dx	NEVADA	10/25/20, 10/09/19, 10/23/19, 10/26/19	2,709	Mitigated by PSPS Protocols
152691107	HIGGINS 1107	Dx	NEVADA	10/25/20, 10/26/19, 10/23/19, 10/09/19	1,685	Mitigated by PSPS Protocols
152691109	HIGGINS 1109	Dx	NEVADA	10/25/20, 10/26/19, 10/09/19, 10/23/19	1,609	Mitigated by PSPS Protocols
152691110	HIGGINS 1110	Dx	NEVADA	10/25/20, 10/09/19, 10/26/19, 10/23/19	972	Mitigated by PSPS Protocols
43361102	HIGHLANDS 1102	Dx	LAKE	10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/09/19, 10/26/19	24	Mitigated by PSPS Protocols
43361103	HIGHLANDS 1103	Dx	LAKE	10/14/20, 10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/26/19, 10/09/19, 11/20/19	52	Sectionalizing Devices; Grid Hardening; Temporary Generation;
43361104	HIGHLANDS 1104	Dx	LAKE	10/25/20, 11/20/19, 10/26/19, 10/09/19	23	Mitigated by PSPS Protocols
42251101	HOPLAND 1101	Dx	MENDOCINO	10/25/20, 10/09/19, 11/20/19, 10/23/19, 10/26/19	58	Mitigated by PSPS Protocols
103441101	JESSUP 1101	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/26/19, 10/09/19, 11/20/19	1,527	Sectionalizing Devices; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103441102	JESSUP 1102	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	1,487	Sectionalizing Devices; Grid Hardening;
103441103	JESSUP 1103	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 11/20/19, 10/26/19, 10/09/19	145	Sectionalizing Devices; Grid Hardening;
103221101	KANAKA 1101	Dx	BUTTE	09/07/20, 10/14/20, 10/25/20, 10/11/21, 09/25/19, 09/23/19, 10/09/19, 10/05/19, 10/26/19, 11/20/19, 10/23/19	581	Grid Hardening;
253911102	LAMONT 1102	Dx	KERN	09/07/20, 12/03/20, 01/18/21, 10/11/21, 10/23/19, 10/09/19, 10/26/19	5	Grid Hardening;
153701104	LINCOLN 1104	Dx	PLACER	10/23/19, 10/09/19, 10/26/19	217	Mitigated by PSPS Protocols
103142102	LOGAN CREEK 2102	Dx	GLENN	10/25/20, 08/17/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	9	Sectionalizing Devices; Grid Hardening;
192411101	LOW GAP 1101	Dx	TRINITY	09/07/20, 10/14/20, 10/25/20, 10/26/19, 10/09/19	700	Sectionalizing Devices; Grid Hardening;
43351103	LUCERNE 1103	Dx	LAKE	10/25/20, 10/26/19, 10/09/19, 10/23/19	2,128	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
63172101	MADISON 2101	Dx	YOLO	10/14/20, 10/21/20, 10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	10	Sectionalizing Devices; Grid Hardening;
163011101	MARTELL 1101	Dx	AMADOR	10/25/20, 10/09/19, 10/23/19, 10/26/19	475	Mitigated by PSPS Protocols
62881105	MAXWELL 1105	Dx	COLUSA	10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/26/19, 10/09/19	44	Grid Hardening;
43141101	MIDDLETOWN 1101	Dx	LAKE	09/07/20, 09/26/20, 10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/23/19, 10/26/19, 11/20/19	82	Sectionalizing Devices; Grid Hardening; Temporary Generation;
43141102	MIDDLETOWN 1102	Dx	LAKE	10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/09/19, 10/26/19	2,313	Mitigated by PSPS Protocols
43141103	MIDDLETOWN 1103	Dx	LAKE	10/25/20, 10/11/21, 10/26/19, 11/20/19, 10/09/19	143	Mitigated by PSPS Protocols
43302103	MONROE 2103	Dx	SONOMA	10/26/19, 10/09/19, 10/23/19	10	Mitigated by PSPS Protocols
43302107	MONROE 2107	Dx	SONOMA	10/26/19, 10/23/19, 10/09/19	106	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
43051101	MONTICELLO 1101	Dx	NAPA	10/14/20, 10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/23/19, 06/08/19, 10/26/19, 09/25/19, 11/20/19, 10/09/19	444	Sectionalizing Devices; Grid Hardening;
152282101	MOUNTAIN QUARRIES 2101	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	1,774	Mitigated by PSPS Protocols
153132101	NARROWS 2101	Dx	YUBA	10/25/20, 09/25/19, 09/23/19, 10/26/19, 10/09/19, 10/23/19	264	Grid Hardening;
153132102	NARROWS 2102	Dx	NEVADA	10/25/20, 09/25/19, 10/09/19, 09/23/19, 10/23/19, 10/26/19	3,395	Mitigated by PSPS Protocols
153132105	NARROWS 2105	Dx	NEVADA	10/25/20, 09/25/19, 10/09/19, 10/26/19, 09/23/19, 10/23/19	3,913	Mitigated by PSPS Protocols
102041104	NOTRE DAME 1104	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/25/20, 10/26/19, 06/08/19, 10/23/19, 10/05/19, 10/09/19, 09/25/19	226	Mitigated by PSPS Protocols
163541102	OLETA 1102	Dx	AMADOR	10/26/19, 10/23/19, 10/09/19	1,058	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103521103	OREGON TRAIL 1103	Dx	SHASTA	10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/26/19, 11/20/19, 10/09/19	236	Grid Hardening;
103521104	OREGON TRAIL 1104	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 11/20/19, 10/09/19, 10/26/19	952	Grid Hardening;
103031101	ORO FINO 1101	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 06/08/19, 10/05/19, 10/26/19, 09/25/19, 10/09/19, 10/23/19	2,275	Grid Hardening;
103031102	ORO FINO 1102	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 09/25/19, 10/23/19, 10/05/19, 10/26/19, 10/09/19, 06/08/19	1,968	Grid Hardening;
102521104	OROVILLE 1104	Dx	BUTTE	10/09/19, 09/25/19, 06/08/19	57	Mitigated by PSPS Protocols
103461101	PANORAMA 1101	Dx	SHASTA	10/21/20, 10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/26/19, 10/09/19	1,117	Mitigated by PSPS Protocols
103461102	PANORAMA 1102	Dx	SHASTA	10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/26/19, 10/09/19	72	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
102831103	PARADISE 1103	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 06/08/19, 10/26/19, 10/05/19, 10/23/19, 10/09/19, 09/25/19	62	Sectionalizing Devices; Grid Hardening; Temporary Generation;
102831104	PARADISE 1104	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/26/19, 09/25/19, 10/23/19, 10/09/19, 10/05/19, 06/08/19	1,872	Sectionalizing Devices; Grid Hardening;
102831105	PARADISE 1105	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/23/19, 09/25/19, 10/26/19, 10/05/19, 10/09/19	1,347	Sectionalizing Devices; Grid Hardening; Temporary Generation;
102831106	PARADISE 1106	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21, 10/26/19, 10/23/19, 09/25/19, 10/09/19, 10/05/19	402	Grid Hardening;
152201101	PIKE CITY 1101	Dx	YUBA	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	384	Grid Hardening;
152201102	PIKE CITY 1102	Dx	SIERRA	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	24	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
163751101	PINE GROVE 1101	Dx	AMADOR	10/25/20, 10/23/19, 10/09/19, 10/26/19	1,345	Mitigated by PSPS Protocols
163751102	PINE GROVE 1102	Dx	AMADOR	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	3,458	Mitigated by PSPS Protocols
103732101	PIT NO 3 2101	Dx	SHASTA	09/07/20, 10/21/20, 10/25/20	150	Grid Hardening;
103501101	PIT NO 7 1101	Dx	SHASTA	09/07/20, 10/14/20, 10/21/20, 10/25/20, 08/17/21	2	Grid Hardening;
153081109	PLACERVILLE 1109	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/26/19, 10/09/19	502	Mitigated by PSPS Protocols
153081110	PLACERVILLE 1110	Dx	EL DORADO	09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	1,197	Mitigated by PSPS Protocols
153081111	PLACERVILLE 1111	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	1,087	Mitigated by PSPS Protocols
153081112	PLACERVILLE 1112	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	2,052	Mitigated by PSPS Protocols
153082106	PLACERVILLE 2106	Dx	EL DORADO	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19, 10/23/19	5,139	Sectionalizing Devices; Grid Hardening;
42281105	POTTER VALLEY P H 1105	Dx	MENDOCINO	10/25/20, 10/23/19, 10/09/19, 10/26/19	120	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
43291104	PUEBLO 1104	Dx	NAPA	10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/26/19, 11/20/19, 10/09/19	265	Sectionalizing Devices; Grid Hardening;
43291105	PUEBLO 1105	Dx	NAPA	10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/26/19, 10/09/19, 11/20/19	434	Sectionalizing Devices; Grid Hardening;
43292102	PUEBLO 2102	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 11/20/19, 10/09/19, 10/26/19, 10/23/19	42	Sectionalizing Devices; Grid Hardening;
43292103	PUEBLO 2103	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/23/19, 10/09/19, 10/26/19, 11/20/19	11	Sectionalizing Devices; Grid Hardening;
63681102	PUTAH CREEK 1102	Dx	YOLO	10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/26/19, 06/08/19, 10/09/19	185	Mitigated by PSPS Protocols
63681105	PUTAH CREEK 1105	Dx	YOLO	08/17/21, 09/20/21, 10/11/21, 10/09/19, 10/26/19	9	Sectionalizing Devices; Grid Hardening;
103541101	RED BLUFF 1101	Dx	TEHAMA	10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/26/19, 11/20/19	173	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
103541103	RED BLUFF 1103	Dx	TEHAMA	08/17/21, 10/11/21, 10/26/19, 11/20/19, 10/09/19	214	Mitigated by PSPS Protocols
103541104	RED BLUFF 1104	Dx	TEHAMA	08/17/21, 10/11/21, 10/09/19, 11/20/19, 10/26/19	865	Sectionalizing Devices; Grid Hardening;
103541105	RED BLUFF 1105	Dx	TEHAMA	08/17/21, 10/09/19, 10/26/19, 11/20/19	981	Mitigated by PSPS Protocols
43191101	REDBUD 1101	Dx	LAKE	10/25/20, 08/17/21, 10/11/21, 10/09/19, 10/26/19, 11/20/19	1,282	Sectionalizing Devices; Grid Hardening;
43321101	RINCON 1101	Dx	SONOMA	09/07/20, 10/25/20, 08/17/21, 10/26/19, 11/20/19, 10/23/19, 10/09/19	3,649	Sectionalizing Devices; Grid Hardening; Temporary Generation;
43321102	RINCON 1102	Dx	SONOMA	09/07/20, 10/26/19, 10/23/19, 10/09/19	4,558	Mitigated by PSPS Protocols
43321103	RINCON 1103	Dx	SONOMA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 09/25/19, 10/23/19, 10/09/19, 11/20/19, 10/26/19	2,020	Sectionalizing Devices; Grid Hardening;
43321104	RINCON 1104	Dx	SONOMA	09/07/20, 10/23/19, 10/09/19, 10/26/19	3,951	Mitigated by PSPS Protocols
163692101	SALT SPRINGS 2101	Dx	CALAVERAS	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	384	Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
163692102	SALT SPRINGS 2102	Dx	CALAVERAS	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	1,973	Mitigated by PSPS Protocols
42151104	SANTA ROSA A 1104	Dx	SONOMA	09/07/20, 10/25/20, 10/23/19, 10/26/19, 11/20/19, 10/09/19	456	Mitigated by PSPS Protocols
258131101	SCE TEHACHAPI 1101	Dx	KERN	12/03/20, 01/18/21, 09/20/21, 10/14/21	3	Grid Hardening;
152431101	SHADY GLEN 1101	Dx	PLACER	09/07/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	22	Sectionalizing Devices; Grid Hardening; Temporary Generation;
152431102	SHADY GLEN 1102	Dx	PLACER	09/07/20, 09/26/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	667	Grid Hardening;
153652109	SHINGLE SPRINGS 2109	Dx	EL DORADO	10/25/20, 10/23/19, 10/09/19, 10/26/19	1,695	Mitigated by PSPS Protocols
43432102	SILVERADO 2102	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/23/19, 10/09/19, 10/26/19, 11/20/19	344	Sectionalizing Devices; Grid Hardening;
43432103	SILVERADO 2103	Dx	NAPA	09/07/20, 10/25/20, 08/17/21, 10/23/19, 11/20/19, 10/26/19, 10/09/19	3	Sectionalizing Devices; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
43432104	SILVERADO 2104	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 08/17/21, 10/11/21, 11/20/19, 10/23/19, 10/09/19, 10/26/19	2,350	Sectionalizing Devices; Grid Hardening; Temporary Generation;
43432105	SILVERADO 2105	Dx	NAPA	09/07/20, 10/14/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19, 11/20/19	159	Mitigated by PSPS Protocols
153791101	SMARTVILLE 1101	Dx	YUBA	10/23/19, 09/23/19, 09/25/19, 10/26/19, 10/09/19	255	Mitigated by PSPS Protocols
42721102	SONOMA 1102	Dx	SONOMA	10/14/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	153	Sectionalizing Devices; Grid Hardening;
42721103	SONOMA 1103	Dx	SONOMA	10/14/20, 10/25/20, 08/17/21, 10/23/19, 10/26/19, 10/09/19	311	Sectionalizing Devices; Grid Hardening;
42721106	SONOMA 1106	Dx	SONOMA	10/14/20, 10/25/20, 10/23/19, 10/26/19, 10/09/19	95	Sectionalizing Devices; Grid Hardening;
152251101	SPAULDING 1101	Dx	NEVADA	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/09/19	160	Grid Hardening;
162821701	STANISLAUS 1701	Dx	CALAVERAS	09/07/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	1,785	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
162821702	STANISLAUS 1702	Dx	CALAVERAS	09/07/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	4,882	Mitigated by PSPS Protocols
103561101	STILLWATER 1101	Dx	SHASTA	10/14/20, 10/21/20, 10/25/20, 08/17/21	36	Grid Hardening;
103561102	STILLWATER 1102	Dx	SHASTA	10/14/20, 10/21/20, 10/25/20, 08/17/21	724	Grid Hardening;
102971111	SYCAMORE CREEK 1111	Dx	BUTTE	09/26/20, 10/14/20, 10/25/20, 10/11/21, 10/05/19, 10/26/19, 10/23/19, 10/09/19	456	Mitigated by PSPS Protocols
252931102	TEJON 1102	Dx	KERN	09/07/20, 12/03/20, 09/20/21, 10/11/21, 10/14/21, 10/26/19, 10/09/19	592	Grid Hardening; Temporary Generation;
252931103	TEJON 1103	Dx	KERN	09/07/20, 12/03/20, 01/18/21, 10/11/21, 10/14/21, 10/23/19, 10/09/19, 10/26/19	15	Mitigated by PSPS Protocols
161380201	TIGER CREEK 0201	Dx	AMADOR	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/26/19, 10/09/19	14	Mitigated by PSPS Protocols
103571105	TYLER 1105	Dx	TEHAMA	10/25/20, 08/17/21, 09/20/21, 10/11/21, 11/20/19, 10/09/19, 10/26/19	227	Sectionalizing Devices; Grid Hardening; Temporary Generation;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
42871101	UPPER LAKE 1101	Dx	LAKE	10/25/20, 10/09/19, 10/26/19, 10/23/19	538	Mitigated by PSPS Protocols
63601104	VACAVILLE 1104	Dx	SOLANO	10/25/20, 08/17/21, 09/20/21, 10/11/21, 10/09/19, 10/26/19	52	Sectionalizing Devices; Grid Hardening;
63601108	VACAVILLE 1108	Dx	SOLANO	10/25/20, 08/17/21, 09/20/21, 10/11/21, 11/20/19, 10/26/19, 10/09/19	230	Sectionalizing Devices; Grid Hardening;
102541101	VOLTA 1101	Dx	TEHAMA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 08/17/21, 10/11/21, 10/23/19, 10/09/19, 10/26/19, 11/20/19	1,289	Grid Hardening; Temporary Generation;
102541102	VOLTA 1102	Dx	SHASTA	09/07/20, 09/26/20, 10/14/20, 10/25/20, 08/17/21, 11/20/19, 10/26/19, 10/09/19	2,558	Sectionalizing Devices; Grid Hardening; Temporary Generation;
152491101	WEIMAR 1101	Dx	PLACER	09/07/20, 10/25/20, 10/09/19, 10/23/19, 10/26/19	27	Grid Hardening;
152491102	WEIMAR 1102	Dx	PLACER	10/25/20, 10/09/19, 10/26/19, 10/23/19	635	Grid Hardening;
163201101	WEST POINT 1101	Dx	AMADOR	09/07/20, 09/26/20, 10/25/20, 10/26/19, 10/23/19, 10/09/19	1,750	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
163201102	WEST POINT 1102	Dx	CALAVERAS	09/07/20, 09/26/20, 10/25/20, 10/23/19, 10/09/19, 10/26/19	2,808	Mitigated by PSPS Protocols
152811105	WHEATLAND 1105	Dx	YUBA	10/23/19, 10/26/19, 10/09/19	197	Mitigated by PSPS Protocols
103601101	WHITMORE 1101	Dx	SHASTA	09/07/20, 10/25/20, 08/17/21, 10/26/19, 10/09/19, 11/20/19	311	Grid Hardening;
152271102	WISE 1102	Dx	PLACER	10/09/19, 10/23/19, 10/26/19	1,700	Mitigated by PSPS Protocols
24251101	WOODSIDE 1101	Dx	SAN MATEO	10/14/20, 10/25/20, 10/09/19, 10/26/19, 10/23/19	74	Sectionalizing Devices; Grid Hardening;
102911102	WYANDOTTE 1102	Dx	BUTTE	09/25/19, 09/23/19, 10/26/19, 10/09/19, 10/23/19, 06/08/19	33	Mitigated by PSPS Protocols
102911103	WYANDOTTE 1103	Dx	BUTTE	09/07/20, 09/26/20, 10/21/20, 10/25/20, 10/26/19, 06/08/19, 11/20/19, 09/25/19, 10/23/19, 10/09/19, 09/23/19, 10/05/19	1,350	Sectionalizing Devices; Grid Hardening;
102911105	WYANDOTTE 1105	Dx	BUTTE	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20, 10/26/19, 09/23/19, 10/09/19, 10/23/19, 09/25/19, 10/05/19	516	Mitigated by PSPS Protocols

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
102911106	WYANDOTTE 1106	Dx	BUTTE	09/25/19, 10/09/19, 10/26/19, 10/23/19, 06/08/19, 09/23/19	166	Mitigated by PSPS Protocols
102911107	WYANDOTTE 1107	Dx	BUTTE	09/07/20, 09/26/20, 10/25/20, 10/09/19, 09/25/19, 09/23/19, 06/08/19, 10/23/19, 10/26/19	945	Sectionalizing Devices; Grid Hardening;
102911109	WYANDOTTE 1109	Dx	BUTTE	10/09/19, 09/23/19, 06/08/19, 10/26/19, 09/25/19, 10/23/19	3,460	Mitigated by PSPS Protocols
102911110	WYANDOTTE 1110	Dx	BUTTE	09/25/19, 09/23/19, 10/23/19, 10/26/19, 10/09/19	1,638	Sectionalizing Devices; Grid Hardening;
ETL.1110	BRIDGEVILLE-COTTONWOOD 115 KV	Tx	HUMBOLDT, SHASTA, TRINITY	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Island; Transmission Segmentation; Grid Hardening;
ETL.6220	BRIDGEVILLE-GARBERVILLE 60 KV	Tx	HUMBOLDT	10/26/19, 09/07/20, 10/14/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Island; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.6230	BURNS-LONE STAR #1 60 KV	Tx	SANTA CRUZ	10/09/19, 10/09/19, 10/26/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6240	BUTT VALLEY-CARIBOU 115 KV	Tx	SANTA CRUZ	10/25/20, 09/07/20, 09/26/20, 10/14/20, 10/21/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.3190	CARIBOU-PALERMO 115 KV	Tx	BUTTE, PLUMAS	10/09/19, 10/23/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.4440	CARIBOU-TABLE MOUNTAIN 230 KV	Tx	BUTTE, PLUMAS	09/07/20, 09/26/20, 10/14/20, 10/21/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Island; Grid Hardening;
ETL.6300	CARIBOU-WESTWOOD 60 KV	Tx	LASSEN, PLUMAS	10/21/20, 09/07/20, 10/14/20, 10/25/20	1	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6310	CASCADE-BENTON-DESCHUTES 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	1	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.1240	CASCADE-COTTONWOOD 115 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.6320	CENTERVILLE-TABLE MOUNTAIN 60 KV	Tx	BUTTE	06/08/19, 10/05/19, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 10/05/19, 09/25/19	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.6330	CENTERVILLE-TABLE MOUNTAIN-OROVILLE 60 KV	Tx	BUTTE	06/08/19, 10/05/19, 10/09/19, 10/23/19, 10/29/19, 10/05/19, 09/25/19	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.6480	COLGATE-CHALLENGE 60 KV	Tx	YUBA	10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.6490	COLGATE-GRASS VALLEY 60 KV	Tx	NEVADA, YUBA	10/09/19, 10/23/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.6500	COLGATE-PALERMO 60 KV	Tx	BUTTE, NEVADA, YUBA	06/08/19, 10/09/19, 10/26/19, 10/29/19, 09/25/19	0	Transmission Tags; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.6520	COLGATE-SMARTVILLE #2 60 KV	Tx	NEVADA, YUBA	10/09/19, 10/26/19, 10/29/19, 09/25/19	0	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.1330	CORTINA-MENDOCINO #1 115 KV	Tx	COLUSA, LAKE, MENDOCINO	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6650	COTTONWOOD-BENTON #2 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19, 11/20/19	0	Transmission Tags; Grid Hardening;
ETL.1350	CRAG VIEW-CASCADE 115 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6690	DEER CREEK-DRUM 60 KV	Tx	NEVADA, PLACER	10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6720	DESABLA-CENTERVILLE 60 KV	Tx	BUTTE	06/08/19, 10/05/19, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 10/05/19, 09/25/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.1400	DONNELLS-MI-WUK 115 KV	Tx	TUOLUMNE	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.6375	DRUM #2 P.H. 115 KV TAP	Tx	PLACER	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.6760	DRUM-GRASS VALLEY-WEIMAR 60 KV	Tx	NEVADA, PLACER	10/31/18, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.4393	DRUM-HIGGINS 115 KV	Tx	NEVADA, PLACER	10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.1420	DRUM-RIO OSO #1 115 KV	Tx	NEVADA, PLACER, SUTTER	10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.1430	DRUM-RIO OSO #2 115 KV	Tx	NEVADA, PLACER, SUTTER	10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6770	DRUM-SPAULDING 60 KV	Tx	NEVADA, PLACER	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Grid Hardening;
ETL.1440	DRUM-SUMMIT #1 115 KV	Tx	NEVADA, PLACER	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.1450	DRUM-SUMMIT #2 115 KV	Tx	NEVADA, PLACER	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Grid Hardening;
ETL.1470	EAGLE ROCK-CORTINA 115 KV	Tx	COLUSA, LAKE, SONOMA	10/26/19, 10/29/19, 11/20/19	1	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.1480	EAGLE ROCK-REDBUD 115 KV	Tx	LAKE, SONOMA	10/09/19, 10/26/19, 10/29/19, 11/20/19	0	Transmission Tags; Grid Hardening;
ETL.1530	EL DORADO-MISSOURI FLAT #1 115 KV	Tx	EL DORADO	10/09/19, 10/23/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.1540	EL DORADO-MISSOURI FLAT #2 115 KV	Tx	EL DORADO	10/25/20, 09/07/20, 10/25/20, 10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.6722	FORKS OF THE BUTTE TAP 60 KV	Tx	BUTTE	06/08/19, 10/05/19, 10/05/19, 09/25/19	0	Transmission Tags; Grid Hardening;
ETL.6870	FRENCH MEADOWS-MIDDLE FORK 60 KV	Tx	PLACER	10/31/18, 10/09/19, 10/26/19, 10/29/19, 09/07/20, 09/26/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.6880	FULTON-CALISTOGA 60 KV	Tx	LAKE, NAPA, SONOMA	10/25/20, 08/17/21, 10/31/18, 10/23/19, 10/26/19, 10/29/19, 11/20/19	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.6890	FULTON-HOPLAND 60 KV	Tx	MENDOCINO, SONOMA	10/09/19, 10/23/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.2823	FULTON-LAKEVILLE-IGNACIO 230 KV	Tx	SONOMA	10/23/19, 10/26/19, 10/29/19, 11/20/19	0	Transmission Tags; Grid Hardening;
ETL.6990	HALSEY-PLACER 60 KV	Tx	PLACER	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.7060	HILLSDALE JCT-HALF MOON BAY 60 KV	Tx	SAN MATEO	10/09/19, 10/26/19, 10/29/19	1	Transmission Tags; Grid Hardening;
ETL.7260	KESWICK-CASCADE 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.7290	KILARC-CEDAR CREEK 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19, 11/20/19, 09/07/20, 10/14/20, 10/21/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.7300	KILARC-DESCHUTES 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.3505	KM GREEN 115 KV TAP	Tx	AMADOR	09/07/20, 09/26/20, 10/25/20	0	Transmission Tags; Grid Hardening;
ETL.7360	LAKEVILLE #1 60 KV	Tx	SONOMA	10/09/19, 10/25/20, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.2410	MENDOCINO-REDBUD 115 KV	Tx	LAKE, MENDOCINO	10/09/19, 10/26/19, 10/29/19	1	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.8405	MIDDLE FORK #1 60 KV	Tx	PLACER	10/31/18, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/25/19, 09/07/20, 09/26/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.5140	MIDDLE FORK-GOLD HILL 230 KV	Tx	EL DORADO, PLACER, SACRAMENTO	10/09/19, 10/26/19, 10/29/19, 09/07/20, 09/26/20, 10/25/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.1073	MI-WUK-CURTIS 115 KV	Tx	TUOLUMNE	10/09/19, 10/26/19, 10/29/19	1	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.7590	MONTA VISTA-BURNS 60 KV	Tx	SANTA CLARA, SANTA CRUZ	10/09/19, 10/26/19, 10/29/19, 10/14/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.6721	ORO FINO TAP 60 KV	Tx	BUTTE	06/08/19, 10/05/19, 10/05/19, 09/25/19	0	Transmission Tags; Grid Hardening;
ETL.7730	PALERMO-OROVILLE #1 60 KV	Tx	BUTTE	06/08/19, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/25/19	0	Transmission Tags; Grid Hardening;
ETL.4396	PARADISE-BUTTE 115 KV	Tx	BUTTE	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.4316	PARADISE-TABLE MOUNTAIN 115 KV	Tx	BUTTE	10/09/19, 10/26/19, 10/29/19, 09/07/20, 09/26/20	0	Transmission Tags; Vegetation Management; Grid Hardening;
ETL.3500	SALT SPRINGS-TIGER CREEK 115 KV	Tx	AMADOR, CALAVERAS	10/26/19, 10/29/19, 09/07/20, 09/26/20, 10/25/20	1	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.7980	SMARTVILLE-MARYSVILLE 60 KV	Tx	YUBA	10/09/19, 10/26/19, 10/29/19, 09/25/19	0	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.8000	SMARTVILLE-NICOLAUS #2 60 KV	Tx	PLACER, SUTTER, YUBA	10/09/19, 10/26/19, 10/29/19, 09/25/19	0	Transmission Tags; Grid Hardening;
ETL.7212	SNEATH LANE-HALF MOON BAY 60 KV	Tx	SAN MATEO	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Vegetation Management; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.8060	SPAULDING-SUMMIT 60 KV	Tx	NEVADA, PLACER	10/09/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	1	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.5780	TIGER CREEK-ELECTRA 230KV	Tx	AMADOR	10/09/19, 10/23/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.5790	TIGER CREEK-VALLEY SPRINGS 230 KV	Tx	AMADOR, CALAVERAS	10/26/19, 10/09/19, 10/23/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.8180	TULUCAY-NAPA #1 60 KV	Tx	NAPA, SOLANO	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Transmission Segmentation; Grid Hardening;
ETL.8290	VOLTA-DESCHUTES 60 KV	Tx	SHASTA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.8300	VOLTA-SOUTH 60 KV	Tx	SHASTA, TEHAMA	10/09/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;
ETL.7560	WEIMAR #1 60 KV	Tx	PLACER	10/31/18, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/25/19, 09/07/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;
ETL.8340	WEIMAR-HALSEY 60 KV	Tx	PLACER	10/09/19, 10/23/19, 10/26/19, 10/29/19	0	Transmission Tags; Grid Hardening;

TABLE PG&E-8.6-1:
LIST OF FREQUENTLY DE-ENERGIZED CIRCUITS
(CONTINUED)

ID of Circuit	Circuit Name	Transmission (Tx) / Distribution (Dx)	County	Dates of Outages	Number of Customers Affected	Measures Taken or to Be Taken
ETL.8350	WEST POINT-VALLEY SPRINGS 60 KV	Tx	AMADOR, CALAVERAS	10/31/18, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Island; Transmission Segmentation; Grid Hardening;
ETL.4220	WOODLEAF-PALERMO 115 KV	Tx	BUTTE	10/05/19, 10/09/19, 10/23/19, 10/26/19, 10/29/19, 10/05/19, 09/25/19, 09/07/20, 10/25/20	0	Transmission Tags; Vegetation Management; Transmission Segmentation; Grid Hardening;

PACIFIC GAS AND ELECTRIC COMPANY

2022 WILDFIRE MITIGATION PLAN

SECTION 9

APPENDIX

9. Appendix

9.1 Definitions of Initiative Activities By Category

These definitions were provided by the Office of Energy Safety Infrastructure for the purposes of the utilities in categorizing wildfire mitigation activities into initiatives in Section 7.3. These initiative definitions have been reproduced here for ease of cross-referencing and to maintain consistent organization for Section 9.

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY

Category	Initiative activity	Definition
A. Risk mapping and simulation	A summarized risk map that shows the overall ignition probability and estimated wildfire consequence along the electric lines and equipment	Development and use of tools and processes to develop and update risk map and simulations and to estimate risk reduction potential of initiatives for a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.
	Climate-driven risk map and modeling based on various relevant weather scenarios	Development and use of tools and processes demonstrating medium and long-term climate trends based on the best available climate models demonstrating the most wildfire- relevant impacts (e.g., warming trends, fuel moisture trends, soil moisture trends, vegetation distribution trends). Describe how these trends are being incorporated into risk modeling or other risk-informed analyses.
	Ignition probability mapping showing the probability of ignition along the electric lines and equipment	Development and use of tools and processes to assess the risk of ignition across regions of the grid (or more granularly, e.g., circuits, spans, or assets).
	Initiative mapping and estimation of wildfire and Public Safety Power Shutoff (PSPS) risk-reduction impact	Development of a tool to estimate the risk reduction efficacy (for both wildfire and PSPS risk) and risk-spend efficiency of various initiatives.
	Match drop simulations showing the potential wildfire consequence of ignitions that occur along the electric lines and equipment	Development and use of tools and processes to assess the impact of potential ignition and risk to communities (e.g., in terms of potential fatalities, structures burned, monetary damages, area burned, impact on air quality and greenhouse gas, or GHG, reduction goals, etc.).
B. Situational awareness and forecasting	Advanced weather monitoring and weather stations	Purchase, installation, maintenance, and operation of weather stations. Collection, recording, and analysis of weather data from weather stations and from external sources.

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
	Continuous monitoring sensors	Installation, maintenance, and monitoring of sensors and sensorized equipment used to monitor the condition of electric lines and equipment.
	Fault indicators for detecting faults on electric lines and equipment	Installation and maintenance of fault indicators.
	Forecast of a fire risk index, fire potential index, or similar	Index that uses a combination of weather parameters (such as wind speed, humidity, and temperature), vegetation and/or fuel conditions, and other factors to judge current fire risk and to create a forecast indicative of fire risk. A sufficiently granular index is required to inform operational decision-making.
	Personnel monitoring areas of electric lines and equipment in elevated fire risk conditions	Personnel position within utility service territory to monitor system conditions and weather on site. Field observations required to inform operational decisions.
	Weather forecasting and estimating impacts on electric lines and equipment	Development methodology for forecast of weather conditions relevant to utility operations, forecasting weather conditions and conducting analysis to incorporate into utility decision-making, learning and updates to reduce false positives and false negatives of forecast PSPS conditions.
C. Grid design and system hardening	Capacitor maintenance and replacement program	Remediation, adjustments, or installations of new equipment to improve or replace existing capacitor equipment.
	Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Remediation, adjustments, or installations of new equipment to improve or replace existing fast switching circuit breaker equipment to improve the ability to protect electrical circuits from damage caused by overload of electricity or short circuit.
	Covered conductor installation	Installation of covered or insulated conductors to replace standard bare or unprotected conductors (defined in accordance with GO 95 as supply conductors, including but not limited to lead wires, not enclosed in a grounded metal pole or not covered by: a “suitable protective covering” (in accordance with Rule 22.8), grounded metal conduit, or grounded metal sheath or shield). In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
		non-conductive material having the electrical insulating efficiency (12kV/in. dry) and impact strength (20ft.-lbs) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.
	Covered conductor maintenance	Remediation and adjustments to installed covered or insulated conductors. In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12kV/in. dry) and impact strength (20ft.-lbs) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.
	Crossarm maintenance, repair, and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing crossarms, defined as horizontal support attached to poles or structures generally at right angles to the conductor supported in accordance with GO 95.
	Distribution pole replacement and reinforcement, including with composite poles	Remediation, adjustments, or installations of new equipment to improve or replace existing distribution poles (i.e., those supporting lines under 65kV), including with equipment such as composite poles manufactured with materials reduce ignition probability by increasing pole lifespan and resilience against failure from object contact and other events.
	Expulsion fuse replacement	Installations of new and California Department of Forestry and Fire Protection (CAL FIRE)-approved power fuses to replace existing expulsion fuse equipment.
	Grid topology improvements to mitigate or reduce PSPS events	Plan to support and actions taken to mitigate or reduce PSPS events in terms of geographic scope and number of customers affected, such as installation and operation of electrical equipment to sectionalize or island portions of the grid, microgrids, or local generation.
	Installation of system automation equipment	Installation of electric equipment that increases the ability of the utility to automate system operation and monitoring, including equipment that can be adjusted remotely such as automatic reclosers (switching devices designed to detect and interrupt momentary faults that can reclose automatically and detect if a fault remains, remaining open if so).

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
	Maintenance, repair, and replacement of connectors, including hotline clamps	Remediation, adjustments, or installations of new equipment to improve or replace existing connector equipment, such as hotline clamps.
	Mitigation of impact on customers and other residents affected during PSPS event	Actions taken to improve access to electricity for customers and other residents during PSPS events, such as installation and operation of local generation equipment (at the community, household, or other level).
	Other corrective action	Other maintenance, repair, or replacement of utility equipment and structures so that they function properly and safely, including remediation activities (such as insulator washing) of other electric equipment deficiencies that may increase ignition probability due to potential equipment failure or other drivers.
	Pole loading infrastructure hardening and replacement program based on pole loading assessment program	Actions taken to remediate, adjust, or install replacement equipment for poles that the utility has identified as failing to meet safety factor requirements in accordance with GO 95 or additional utility standards in the utility's pole loading assessment program.
	Transformer maintenance and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing transformer equipment.
	Transmission tower maintenance and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing transmission towers (e.g., structures such as lattice steel towers or tubular steel poles that support lines at or above 65kV).
	Undergrounding of electric lines and/or equipment	Actions taken to convert overhead electric lines and/or equipment to underground electric lines and/or equipment (i.e., located underground and in accordance with GO 128).
	Updates to grid topology to minimize risk of ignition in HFTDs	Changes in the plan, installation, construction, removal, and/or undergrounding to minimize the risk of ignition due to the design, location, or configuration of utility electric equipment in HFTDs.
D. Asset management and inspections	Detailed inspections of distribution electric lines and equipment	In accordance with GO 165, careful visual inspections of overhead electric distribution lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
	Detailed inspections of transmission electric lines and equipment	Careful visual inspections of overhead electric transmission lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
		diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
	Improvement of inspections	Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.
	Infrared inspections of distribution electric lines and equipment	Inspections of overhead electric distribution lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify “hot spots”, or conditions that indicate deterioration or potential equipment failures, of electrical equipment.
	Infrared inspections of transmission electric lines and equipment	Inspections of overhead electric transmission lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify “hot spots”, or conditions that indicate deterioration or potential equipment failures, of electrical equipment.
	Intrusive pole inspections	In accordance with GO 165, intrusive inspections involve movement of soil, taking samples for analysis, and/or using more sophisticated diagnostic tools beyond visual inspections or instrument reading.
	LiDAR inspections of distribution electric lines and equipment	Inspections of overhead electric distribution lines, equipment, and right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	LiDAR inspections of transmission electric lines and equipment	Inspections of overhead electric transmission lines, equipment, and right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	Other discretionary inspection of distribution electric lines and equipment, beyond inspections mandated by rules and regulations	Inspections of overhead electric distribution lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations	Inspections of overhead electric transmission lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
	Patrol inspections of distribution electric lines and equipment	In accordance with GO 165, simple visual inspections of overhead electric distribution lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.
	Patrol inspections of transmission electric lines and equipment	Simple visual inspections of overhead electric transmission lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.
	Pole loading assessment program to determine safety factor	Calculations to determine whether a pole meets pole loading safety factor requirements of GO 95, including planning and information collection needed to support said calculations. Calculations must consider many factors including the size, location, and type of pole; types of attachments; length of conductors attached; and number and design of supporting guys, per D.15-11-021.
	Quality assurance / quality control of inspections	Establishment and function of audit process to manage and confirm work completed by employees or contractors, including packaging QA/QC information for input to decision-making and related integrated workforce management processes.
	Substation inspections	In accordance with GO 175, inspection of substations performed by qualified persons and according to the frequency established by the utility, including record-keeping.
E. Vegetation management and inspection	Additional efforts to manage community and environmental impacts	Plan and execution of strategy to mitigate negative impacts from utility vegetation management to local communities and the environment, such as coordination with communities, local governments, and agencies to plan and execute vegetation management work.
	Detailed inspections and management practices for vegetation clearances around distribution electrical lines and equipment	Careful visual inspections and maintenance of vegetation around the distribution right-of-way, where individual trees are carefully examined, visually, and the condition of each rated and recorded. Describe the frequency of inspection and maintenance programs.
	Detailed inspections and management practices for vegetation clearances around transmission electrical lines and equipment	Careful visual inspections and maintenance of vegetation around the transmission right-of- way, where individual trees are carefully examined, visually, and the condition of each rated and recorded. Describe the frequency of inspection and maintenance programs.
	Emergency response vegetation management due to red flag warning or	Plan and execution of vegetation management activities, such as trimming or removal, executed based upon and in advance of forecast weather

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
	other urgent weather conditions	conditions that indicate high fire threat in terms of ignition probability and wildfire consequence.
	Fuel management and, management of all wood and "slash" from vegetation management activities	Plan and execution of fuel management activities in proximity to potential sources of ignition. This includes pole clearing per PRC 4292 and reduction or adjustment of live fuel (based on species or otherwise) and of dead fuel, including all downed wood and "slash" generated from vegetation management activities.
	Improvement of inspections	Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.
	Remote sensing inspections of vegetation around distribution electric lines and equipment	Inspections of right-of-way using remote sensing methods such as LiDAR, satellite imagery, and UAV.
	Remote sensing inspections of vegetation around transmission electric lines and equipment	Inspections of right-of-way using remote sensing methods such as LiDAR, satellite imagery, and UAV.
	Other discretionary inspections of vegetation around distribution electric lines and equipment	Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Other discretionary inspections of vegetation around transmission electric lines and equipment	Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Patrol inspections of vegetation around distribution electric lines and equipment	Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.
	Patrol inspections of vegetation around transmission electric lines and equipment	Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.
	Quality assurance / Quality control of vegetation management	Establishment and function of audit process to manage and oversee the work completed by employees or contractors, including packaging QA/QC information for input to decision-making and workforce management processes. This includes identification of the percentage of vegetation

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
		inspections that are audited annually, as a program target in Table 5.3-1.
	Recruiting and training of vegetation management personnel	Programs to ensure that the utility can identify and hire qualified vegetation management personnel and to ensure that both employees and contractors tasked with vegetation management responsibilities are adequately trained to perform vegetation management work, according to the utility's wildfire mitigation plan, in addition to rules and regulations for safety. Include discussion of continuous improvement of training programs and personnel qualifications.
	Identification and remediation of “at-risk species”	Specific actions, not otherwise described in other WMP initiatives, taken to reduce the ignition probability and wildfire consequence attributable to “at-risk species”, such as trimming, removal, and replacement.
	Removal and remediation of trees with strike potential to electric lines and equipment	Actions taken to identify, remove, or otherwise remediate trees that pose a high risk of failure or fracture that could potentially strike electrical equipment.
	Substation inspection	Inspection of vegetation surrounding substations, performed by qualified persons and according to the frequency established by the utility, including record-keeping.
	Substation vegetation management	Based on location and risk to substation equipment only, actions taken to reduce the ignition probability and wildfire consequence attributable to contact from vegetation to substation equipment.
	Vegetation management enterprise system	Inputs, operation, and support for a centralized vegetation management enterprise system updated based upon inspection results and management activities such as trimming and removal of vegetation.
	Vegetation management to achieve clearances around electric lines and equipment	Actions taken to ensure that vegetation does not encroach upon the minimum clearances set forth in Table 1 of GO 95, measured between line conductors and vegetation, such as trimming adjacent or overhanging tree limbs.
	Vegetation management activities post-fire	Vegetation management (VM) activities during post-fire service restoration including, but not limited to: activities or protocols that differentiate post-fire VM from programs described in other WMP initiatives; supporting documentation for the tool and/or standard the utility uses to assesses the risk presented by vegetation post-fire; and how the utility includes fire-specific damage attributes into our assessment tool/standard.

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
F. Grid operations and protocols	Automatic recloser operations	Designing and executing protocols to deactivate automatic reclosers based on local conditions for ignition probability and wildfire consequence.
	Protective equipment and device settings	The utility's procedures for adjusting the sensitivity of grid elements to reduce wildfire risk, other than automatic reclosers (such as circuit breakers, switches, etc.). For example, PG&E's Fast Trip Settings.
	Crew-accompanying ignition prevention and suppression resources and services	Those firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, and water) that are deployed with construction crews and other electric workers to provide site-specific fire prevention and ignition mitigation during on-site work
	Personnel work procedures and training in conditions of elevated fire risk	Work activity guidelines that designate what type of work can be performed during operating conditions of different levels of wildfire risk. Training for personnel on these guidelines and the procedures they prescribe, from normal operating procedures to increased mitigation measures to constraints on work performed.
	Protocols for PSPS re-energization	Designing and executing procedures that accelerate the restoration of electric service in areas that are de-energized, while maintaining safety and reliability standards.
	PSPS events and mitigation of PSPS impacts	Designing, executing, and improving upon protocols to conduct PSPS events, including development of advanced methodologies to determine when to use PSPS, and to mitigate the impact of PSPS events on affected customers and local residents.
	Stationed and on-call ignition prevention and suppression resources and services	Firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, firefighting foam, chemical extinguishing agent, and water) stationed at utility facilities and/or standing by to respond to calls for fire suppression assistance.
G. Data governance	Centralized repository for data	Designing, maintaining, hosting, and upgrading a platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.
	Collaborative research on utility ignition and/or wildfire	Developing and executing research work on utility ignition and/or wildfire topics in collaboration with other non-utility partners, such as academic institutions and research groups, to include data-sharing and funding as applicable.
	Documentation and disclosure of wildfire-related data and algorithms	Design and execution of processes to document and disclose wildfire-related data and algorithms to accord with rules and regulations, including use of scenarios for forecasting and stress testing.

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY (CONTINUED)

Category	Initiative activity	Definition
	Tracking and analysis of near miss data	Tools and procedures to monitor, record, and conduct analysis of data on near miss events.
H. Resource allocation methodology	Allocation methodology development and application	Development of prioritization methodology for human and financial resources, including application of said methodology to utility decision-making.
	Risk reduction scenario development and analysis	Development of modeling capabilities for different risk reduction scenarios based on wildfire mitigation initiative implementation; analysis and application to utility decision-making.
	Risk spend efficiency (RSE) analysis	Tools, procedures, and expertise to support analysis of wildfire mitigation initiative risk-spend efficiency, in terms of MAVF and / or MARS methodologies.
I. Emergency planning and preparedness	Adequate and trained workforce for service restoration	Actions taken to identify, hire, retain, and train qualified workforce to conduct service restoration in response to emergencies, including short-term contracting strategy and implementation.
	Community outreach, public awareness, and communications efforts	Actions to identify and contact key community stakeholders; increase public awareness of emergency planning and preparedness information; and design, translate, distribute, and evaluate effectiveness of communications taken before, during, and after a wildfire, including Access and Functional Needs populations and Limited English Proficiency populations in particular.
	Customer support in emergencies	Resources dedicated to customer support during emergencies, such as website pages and other digital resources, dedicated phone lines, etc.
	Disaster and emergency preparedness plan	Development of plan to deploy resources according to prioritization methodology for disaster and emergency preparedness of utility and within utility service territory (such as considerations for critical facilities and infrastructure), including strategy for collaboration with Public Safety Partners and communities.
	Preparedness and planning for service restoration	Development of plans to prepare the utility to restore service after emergencies, such as developing employee and staff trainings, and to conduct inspections and remediation necessary to re-energize lines and restore service to customers.
	Protocols in place to learn from wildfire events	Tools and procedures to monitor effectiveness of strategy and actions taken to prepare for emergencies and of strategy and actions taken during and after emergencies, including based on an accounting of the outcomes of wildfire events.
J. Stakeholder cooperation and	Community engagement	Strategy and actions taken to identify and contact key community stakeholders; increase public

DEFINITIONS OF INITIATIVE ACTIVITIES BY CATEGORY
(CONTINUED)

Category	Initiative activity	Definition
community engagement		awareness and support of utility wildfire mitigation activity; and design, translate, distribute, and evaluate effectiveness of related communications. Includes specific strategies and actions taken to address concerns and serve needs of Access and Functional Needs populations and Limited English Proficiency populations in particular.
	Cooperation and best practice sharing with agencies outside CA	Strategy and actions taken to engage with agencies outside of California to exchange best practices both for utility wildfire mitigation and for stakeholder cooperation to mitigate and respond to wildfires.
	Cooperation with suppression agencies	Coordination with CAL FIRE, federal fire authorities, county fire authorities, and local fire authorities to support planning and operations, including support of aerial and ground firefighting in real-time, including information-sharing, dispatch of resources, and dedicated staff.
	Forest service and fuel reduction cooperation and joint roadmap	Strategy and actions taken to engage with local, state, and federal entities responsible for or participating in forest management and fuel reduction activities; and design utility cooperation strategy and joint stakeholder roadmap (plan for coordinating stakeholder efforts for forest management and fuel reduction activities).

9.2 Citations for Relevant Statutes, Proceedings, and Orders

Throughout the Wildfire Mitigation Plan (WMP), cite relevant state and federal statutes, California Public Utilities Commission (CPUC or Commission) directives, orders, and proceedings. Place the title or tracking number of the statute in parentheses next to comment, or in the appropriate column if noted in a table. Provide in this section a brief description or summary of the relevant portion of the statute. Track citations as end-notes and order (1, 2, 3…) across sections (e.g., if section 1 has 4 citations, Section 2 begins numbering at 5).

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
1.2 Initial Explanatory Notes and Comments	1. CPUC R.08-11-005, D.14-02-015	1. Decision adopting regulations to reduce fire hazards with overhead electric utility facilities and aerial communications facilities
2. Adherence to Statutory Requirements	1. Public Utilities Code (PUC) § 8386(c) 2. PUC § 768.6	1. Statute setting out duties of electrical corporations relating to wildfire risk mitigation 2. Statute related to emergency and disaster preparedness plans
3.2 Summary of Ratepayer Impact	1. CPUC I.19-06-015, D.20-05-019 2. CPUC A.20-09-019 3. CPUC A.15-09-001, D.17-05-013 4. CPUC A.18-12-009, D.20-12-005 5. CPUC R.19-09-009 6. CPUC A.18-03-015 7. CPUC A.17-07-011, D.18-06-029 8. Assembly Bill 1054 9. CPUC A.18-03-015, D.19-04-039 10. CPUC A.21-06-021 11. CPUC A.21-09-008	1. Decision approving proposed settlement agreement with modifications 2. PG&E application for recovery of recorded expenditures related to wildfire mitigation and catastrophic events 3. Decision authorizing PG&E General Rate Case (GRC) revenue requirement for 2017-2019 4. Decision addressing the Test Year 2020 GRC of PG&E 5. Rulemaking on microgrids pursuant to SB 1339 6. Application of PG&E to recover costs recorded in the Catastrophic Event Memorandum Account pursuant to PUC 454.9 and Res. ESRB-4

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		7. Alternate decision authorizing establishment of Wildfire Expense Memorandum Account 8. Public Utilities: wildfires and employee protection 9. Decision granting PG&E CEMA costs 10. PG&E 2023 general rate case application 11. PG&E application to recover wildfire costs
4.1 Lessons Learned: How Tracking Metrics on the 2020 Plan has Informed the 2021 Plan	1. CPUC Res. M-4852	1. PG&E Enhanced Oversight and Enforcement process
4.2 Understanding Major Trends Impacting Ignition Probability and wildfire Consequence	1. CPUC General Order (GO) 95, Rule 31.1 2. CPUC A.15-05-002, D.18-12-014 3. CPUC A.15-05-002, D.16-08-018 4. CPUC R.08-11-005, D.14-02-015 5. CPUC R.96-11-004, D.98-07-097 6. CPUC R.20-07-013	1. Overhead electric/telecom line construction (Rule 31.1) 2. Decision adopting Safety Model and Assessment Proceeding (S-MAP) settlement agreement 3. Decision adopting the multi-attribute approach directing utilities to uniform risk management framework 4. Decision adopting regulations to reduce fire hazards with overhead electric utility facilities and aerial communications facilities 5. Decision adopting final rules to govern major power outages 6. Rulemaking to develop risk-based decision-making framework for electric and gas utilities
4.2.1 Service Territory Fire-Threat Evaluation and Ignition Risk Trends	1. CPUC R.15-05-006, D.20-12-030 2. CPUC R.15-05-006, D.17-01-009	1. Decision modifying HFTD boundaries 2. Decision adopting a work plan for the development of a fire map
4.3 Change in Ignition Probability Drivers	1. CPUC R.08-11-005, D.14-02-015 2. CPUC A.20-06-012	1. Decision adopting regulations to reduce fire hazards with overhead electric utility facilities

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		and aerial communications facilities 2. Application of PG&E to submit our 2020 RAMP Report
4.4.2 Research Findings	1. Public Resources Code (PRC) § 4292	1. Firebreak maintenance
4.5.1 Additional models for ignition probability, wildfire and PSPS risk	1. CPUC A.15-05-002, D.18-12-014	1. Decision adopting S-MAP settlement agreement
4.5.2 Calculation of key metrics	1. Government Code § 8593.3 2. CPUC R.18-12-005, D.19-05-042 3. 38 Code of Federal Regulations (CFR) § 17.701 4. CPUC GO 165	1. Integration of access and functional needs population into county emergency plan 2. Decision adopting de-energization guidelines (Phase 1 guidelines) 3. Definitions of highly rural 4. Inspection requirements for electric distribution and transmission facilities
5.2 The Objectives of the Plan	1. PUC § 8386(a)	1. Duties of electrical corporations relating to wildfire risk mitigation
5.3 Plan Program Targets	1. PUC § 8386.3(c)(5)	1. Statute creating notification requirements related to vegetation management
5.4 Planning for Workforce and Other Limited Resources	1. CPUC GO 95	1. Rules for overhead electric line construction
5.4.1 Target Role: Vegetation Inspections	1. CPUC GO 95 2. CCR, Title 8	1. Rules for overhead electric line construction 2. Industrial relations
5.4.2 Target Role: Vegetation management projects	1. CPUC GO 95	1. Rules for overhead electric line construction
5.4.3 Target Role: Asset Inspections	1. CCR, Title 8	1. Industrial relations
7.1.A PG&E's Approach to Managing Wildfire Risk	1. CPUC A.15-05-002, D.18-12-014	1. Decision adopting S-MAP settlement agreement
7.1.B Risk Modeling Outcomes in Decision-Making and Mitigations	1. CPUC GO 95	1. Rules for overhead electric line construction

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.1.D Challenges Associated With Limited Resources	1. SB 247	1. Senate Bill related to wildland fire prevention
7.1.E(1) Impact on Strategies	1. CPUC R.11-10-003, D.12-05-037	1. Decision establishing EPIC Program
7.1.E(2) Implementation Approach and Integration of New or Emerging Technologies	1. CPUC R.11-10-003, D.11-12-035 2. CPUC R.19-10-005, D.21-11-028	1. Decision establishing Interim research, development and demonstration, and renewables programs funding levels 2. Decision continuing the EPIC Program
7.2.A Monitor and Audit WMP Implementation	1. PUC § 8386.3(c) 2. CPUC, I.19-06-015 3. CPUC Res. M-4855	1. The WSD shall oversee compliance with the WMP 2. Order Instituting Investigation and Order to Show Cause 3. Resolution implementing an Independent Safety Monitor
7.2.B WMP Deficiencies	1. CPUC Res. M-4852	1. PG&E Enhanced Oversight and Enforcement process
7.2.D Report in a Format that matches across WMPs, Quarterly Reports, Quarterly Advice Letters, and annual compliance assessment	1. CPUC GO 96-B	1. Rules that Govern AL Submittals
7.3.1.2 Climate Driven Risk Map and Modeling Based on Various Relevant Weather Scenarios	1. CPUC D.19-10-054	1. Decision defining climate change adaptation for utilities
7.3.3.3 Covered Conductor Installation	1. CPUC GO 95, Rule 22.8 2. CPUC GO 95, Rule 21.6 3. CPUC GO 165	1. Protective covering standards 2. Definition of insulated 3. Inspection requirements for electric distribution and transmission facilities
7.3.3.4 Covered Conductor Maintenance	1. CPUC GO 95, Rule 22.8 2. CPUC GO 95, Rule 21.6 3. CPUC GO 165	1. Protective covering standards 2. Definition of insulated 3. Inspection requirements for electric distribution and transmission facilities

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.3.5 Crossarm Maintenance, Repair, and Replacement	1. CPUC GO 95 2. CPUC GO 165	1. Rules for overhead electric line construction 2. Inspection requirements for electric distribution and transmission facilities
7.3.3.6 Distribution Pole Replacement and Reinforcement, Including with Composite Poles	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities
7.3.3.11.1 Generation for PSPS Mitigation	1. CPUC A.21-06-022 2. CPUC R.19-09-009 3. CPUC R.19-09-009, D.20-06-017 4. CPUC Res. E-5172 5. CPUC R.18-12-005, D.21-06-034	1. PG&E application proposing framework for microgrids 2. CPUC Rulemaking Order Regarding Microgrids 3. Decision adopting actions to accelerate microgrid deployment 4. Resolution adopting PG&E implementation plan for microgrids 5. Decision adopting revised guidelines for PSPS events
7.3.3.12.3 Maintenance, Transmission	1. CPUC GO 95	1. Rules for overhead electric line construction
7.3.3.13 Pole Loading Infrastructure Hardening and Replacement Program Based on Pole Loading Assessment Program	1. CPUC GO 95 2. CPUC GO 95, Rule 44	1. Rules for overhead electric line construction 2. Safety factors
7.3.3.14 Transformers Maintenance and Replacement	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities
7.3.3.15 Transmission Tower Maintenance and Replacement	1. CPUC GO 95	1. Rules for overhead electric line construction
7.3.3.16 Undergrounding of Electric Lines and/or Electric Equipment	1. CPUC GO 128 2. CPUC GO 165	1. Rules for Construction of Underground Electric Supply and Communication Systems 2. Inspection requirements for electric distribution and transmission facilities

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.3.17.2 System Hardening – Transmission	1. CPUC GO 95 2. CPUC Res. SED-6	1. Rules for overhead electric line construction 2. Resolution approving consent order and agreement of SED and PG&E on the Kincade Fire
7.3.3.17.5 Remote Grid	1. CPUC Res. E-5132	1. Resolution approving remote grid standalone power system agreement
7.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment	1. CPUC GO 165 2. CPUC GO 95, Rule 18	1. Inspection requirements for electric distribution and transmission facilities 2. Maintenance programs and resolution of potential violations of GO 95 and safety Hazards
7.3.4.2 Detailed Inspections of Transmission Electric Lines and Equipment	1. CPUC GO 95	1. Rules for overhead electric line construction
7.3.4.6 Intrusive Pole Inspections	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities
7.3.4.6.1 Intrusive Pole Inspections – Distribution	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities
7.3.4.7 LiDAR Inspections of Distribution Electric Lines and Equipment	1. CPUC GO 95	1. Rules for overhead electric line construction
7.3.4.8 LiDAR Inspections of Transmission Electric Lines and Equipment	1. CPUC GO 95	1. Rules for overhead electric line construction
7.3.4.9 Other Discretionary Inspection of Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.4.10 Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations	1. CPUC GO 165	1. Inspection requirements for electric distribution and transmission facilities
7.3.4.11 Patrol Inspections of Distribution Electric Lines and Equipment	1. CPUC GO 165 2. CPUC GO 95, Rule 18	1. Inspection requirements for electric distribution and transmission facilities 2. Maintenance Programs and Resolution of Potential Violations of GO 95 and Safety Hazards
7.3.4.12 Patrol Inspections of Transmission Electric Lines and Equipment	1. CPUC GO 95, Rule 18	1. Maintenance Programs and Resolution of Potential Violations of GO 95 and Safety Hazards
7.3.4.13 Pole Loading Assessment Program to Determine Safety Factor	1. CPUC GO 95 2. CPUC A.13-11-003, D.15-11-021 3. CPUC GO 95, Rule 44 4. CPUC R.08-11-005, D 09-08-029	1. Rules for Overhead Electric Line Construction 2. Decision on Test Year 2015 GRC for Southern California Edison Company 3. Safety Factors 4. Decision in Phase 1 – Measures to Reduce Fire Hazards in California Before the 2009 Fall Fire Season
7.3.4.14 Quality Assurance/Quality Control of Inspections	1. CPUC GO 95, Rule 18	1. Maintenance Programs and Resolution of Potential Violations of GO 95 and Safety Hazards
7.3.4.15 Substation Inspections	1. CPUC GO 174	1. Rules for electric utility substations
7.3.4.16 Substation Inspections Hydro Generation	1. CPUC GO 174	1. Rules for electric utility substations
7.3.5.2 Detailed Inspections of Vegetation Around Distribution	1. CPUC GO 95, Rule 35 2. PRC § 4292 3. PRC § 4293	1. Vegetation management requirements 2. Firebreak maintenance 3. Fire protection responsibility

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
Electric Lines and Equipment		
7.3.5.3 Detailed Inspections of Vegetation Around Transmission Electric Lines and Equipment	1. NERC FAC-003-4 2. CPUC GO 95, Rule 35 3. PRC § 4292 4. PRC § 4293	1. Transmission vegetation management 2. Vegetation management requirements 3. Statute on firebreak maintenance 4. Statute on fire protection responsibility
7.3.5.5 Fuel Management and Management of All Wood and "Slash" From Vegetation Management Activities	1. PRC § 4292	1. Statute on firebreak maintenance
7.3.5.13 Quality Assurance / Quality Control of Vegetation Management	1. PRC § 4292 2. PRC § 4293 3. CPUC GO 95, Rule 35 4. NERC FAC-003-4	1. Statute on firebreak maintenance 2. Statute on fire protection responsibility 3. Vegetation management requirements 4. Transmission vegetation management
7.3.5.17.1 Substation Inspections, Distribution	1. PRC § 4291	1. Statute on defensible space
7.3.5.17.2 Substation Inspections, Transmission	1. PRC § 4291	1. Statute on defensible space
7.3.5.17.3 Substation Inspections Hydro Generation	1. PRC § 4291	1. Statute on defensible space
7.3.5.18.1 Substation Vegetation Management, Distribution	1. PRC § 4291	1. Statute on defensible space
7.3.5.18.2 Substation Vegetation Management, Transmission	1. PRC § 4291	1. Statute on defensible space
7.3.7.3 Documentation and Disclosure of	1. CPUC Res. ESRB-8 2. CPUC R.19-06-015, D.20-05-019	1. Resolution extending de-energization

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
Wildfire-Related Data and Algorithms	3. CPUC D.21-06-014 4. R.18-12-005, CPUC D. 21-06-034	reasonableness notification, mitigation, and reporting requirements 2. Decision approving proposed settlement agreement 3. Decision addressing 2019 PSPS events 4. Decision adopting revised guidelines for PSPS events
7.3.7.4 Tracking and Analysis of Near Miss Data	1. CPUC Res.WSD-011	1. Resolution implementing the requirements of PUC 8389(d)(1), (2) and (4), related to catastrophic wildfire caused by electrical corporations
7.3.9.1 Adequate and Trained Workforce for Service Restoration	1. CPUC GO 166	1. Standards for operation reliability, and safety during emergencies and disasters
7.3.9.2 Community Outreach, Public Awareness, and Communications Efforts	1. CPUC GO 166 2. CPUC R.18-03-011, D.19-07-015	1. Standards for operation reliability, and safety during emergencies and disasters 2. Decision adopting an emergency disaster relief program for electric, natural gas, water and sewer utility customers
Citations for 7.3.9.3 Customer Support in Emergencies	1. CPUC R.18-03-011, D.19-07-015 2. CPUC R.18-03-011 3. CPUC R.18-07-005, D.20-06-003 4. PG&E AL 4014-G/5378-E, D.18-08-004 5. PG&E AL 4145-G/5643-E, D.19-05-037 6. CPUC R.18-10-007, D.19-05-037 7. CPUC Res.M-4842 8. PUC § 8386(c)(18) 9. CPUC R.19-01-011, D.21-11-002	1. Decision adopting an emergency disaster relief program for electric, natural gas, water and sewer utility customers 2. Emergency Disaster Relief Program. 3. Phase I Decision Adopting Rules and Policy Changes to Reduce Residential Disconnections 4. Expansion of Emergency Consumer Protection Plan 5. Revision to the Emergency Consumer Protection Plan 6. Decision on PG&E's 2019 WMP Pursuant to SB 901

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		7. Emergency Authorization and Order Directing Utilities to Implement Emergency Customer Protections to Support California Customers During the Coronavirus (COVID-19) Pandemic 8. Duties of Electrical Corporations Relating to Wildfire Risk Mitigation 9. Decision adopting guiding principles for layering incentives from decarbonization programs
7.3.9.4 Disaster and Emergency Preparedness Plan	1. CPUC GO 166	1. Standards for Operation, Reliability and Safety During Emergencies and Disasters
7.3.9.6 Protocols in Place to Learn from Wildfire Events	1. CPUC GO 166	1. Standards for Operation, Reliability and Safety During Emergencies and Disasters
Citations 7.3.10.1 Community Engagement	1. CPUC R.18-12-005, D.20-05-051 2. CPUC I.19-06-015 3. CPUC R.19-09-009, D.20-06-017 4. PG&E AL 4244-G/58136-E, Res.M-4842 5. PG&E AL 4244-G-A/5816-E-A, Res.M-4842 6. PG&E AL 4244-G-B/5816-E-B, Res.M-4842 7. CPUC R.18-12-005, D.21-06-034 8. CPUC R.18-12-005, D.19-05-042 9.CPUC I.19-06-015	1. Decision Adopting Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk 2. CPUC Order Instituting Investigation Into the Maintenance, Operations, and Practices of PG&E with Respect to its Electric Facilities 3. Decision adopting actions to accelerate microgrid deployment 4. PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19 5. Supplemental PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19 6. Second Supplemental PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		7. Decision adopting revised guidelines for PSPS events 8. Decision Adopting De-Energization Guidelines 9. Order instituting investigation of 2017 wildfires
8.1 Directional Vision for Necessity of PSPS	1. CPUC Res.ESRB-8 2. CPUC R.18-12-005, D.19-05-042 3. CPUC R.18-12-005, D.20-05-051 4. CPUC R.18-12-005, D.21-06-034	1. Resolution Extending De-Energization Reasonableness Notification, Mitigation, and Reporting Requirements 2. Decision Adopting De-Energization Guidelines 3. Decision Adopting Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk 4. Second Supplemental PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19
8.1.3 Lessons Learned	1. CPUC Res.ESRB-8	1. Resolution Extending De-Energization Reasonableness Notification, Mitigation, and Reporting Requirements in D.12-04-024
8.2.2 Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions	1. CPUC R.12-11-005, D.19-09-027 2. CPUC R.12-11-005, D.20-01-021 3. CPUC R.19-09-009, D.21-01-018	1. Decision Establishing A Self-Generation Incentive Program Resiliency Budget etc. 2. Self-Generation Incentive Program Revisions Pursuant To SB 700 and Other Program Changes 3. Decision Adopting Rates, Tariffs, and Rules Facilitating the Commercialization of Microgrids
8.2.5 Customer, Agency, and External Communications	1. CPUC R.18-12-005, D.19-05-042 2. CPUC R.18-12-005, D.20-05-051	1. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 2. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk

CITATIONS FOR RELEVANT STATUTES, PROCEEDINGS, AND ORDERS (CONTINUED)

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
8.4 Engaging Vulnerable Communities	2. CPUC R.18-12-005, D.19-05-042 3. Government Code § 8593.3 4. CPUC Res.WSD-011	2. Decision Adopting De-Energization (PSPS) Guidelines (Phase 1 Guidelines) 3. Integration of Access and Functional Needs Population into County Emergency Plan 4. WSD Implementing the Requirements of PUC 8389(d)(1), (2) and (4), Related to Catastrophic Wildfire Caused by Electrical Corporations
8.4.1 Protocols to Mitigate Public Safety Impacts During PSPS Events	1. CPUC R.04-01-006, A.05-06-005, D.05-10-044 2. CPUC R.10-02-005, D.12-03-054 3. CPUC R.18-07-005, D.20-06-003 4. CPUC R.18-12-005, D. 19-05-042 5. CPUC R.18-12-005, D.20-05-051	1. Interim Opinion Approving Various Emergency Program Changes 2. Decision Adopting Practices to Reduce Disconnections 3. Decision Adopting Rules and Policy Changes to Reduce Customer Disconnections 4. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 5. Decision Adopting Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk
8.4.2 Prevalent Languages in PG&E's Territory	1. CPUC R.18-10-007, D.20-03-004	1. Decision on community awareness and public outreach before, during and after a wildfire
8.4.4 Community Outreach Efforts for PSPS and Wildfire-Related Outreach	1. CPUC R.18-10-007, D.20-03-004	1. Decision on community awareness and public outreach before, during and after a wildfire

9.3 Office of Energy Infrastructure Safety Glossary of Defined Terms

OFFICE OF ENERGY INFRASTRUCTURE SAFETY GLOSSARY OF DEFINED TERMS

Term	Definition
10-hour dead fuel moisture content	Moisture content of small dead vegetation (e.g., grass, leaves, which burn quickly, but not intensely), which can respond to changes in atmospheric moisture content within 10 hours.
Access and functional needs populations	Per Public Utilities Code (Pub. Util. Code) § 8593.3 and D.19-05-042, individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.
Authority Having Jurisdiction	AHJ, party with assigned responsibility, depending on location and circumstance.
Asset (utility)	Electric lines, equipment, or supporting hardware.
At-risk species	Species of vegetation that have an elevated risk of (1) coming into contact with powerlines, (2) causing an outage or ignition, and/or (3) easily ignitable and within close enough proximity to potential arcing, sparks and/or other utility equipment thermal failures. “At-risk species” must be a function of species-specific characteristics including growth rate, failure rate of limbs, trunk, and/or roots (as compared to other species), height at maturity, flammability, vulnerability to disease or insects, etc.
Baseline (ignition probability, maturity)	A measure, typically of the current state, which establishes a starting point for comparison with measures from other states.
Carbon dioxide equivalent	Tons of greenhouse gases (GHG) emitted, multiplied by the global warming potential relative to carbon dioxide.
Circuit mile	The total length in miles of separate circuits regardless of the number of conductors used per circuit.
Contractor	Any individual in the temporary and/or indirect employ of the utility whose limited hours and/or time-bound term of employment are not considered as “full-time” for tax and/or any other purposes.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Critical facilities and infrastructure	For brevity in the WMP, "critical facilitates and infrastructure" may be shortened to "critical infrastructure" and/or "critical facilities" throughout the WMP. Critical facilities and infrastructure is defined in accordance with the definition adopted in D.19-05-042 and modified in D.20-05-051: those facilities and infrastructure that are essential to the public safety and that require additional assistance and advance planning to ensure resiliency during de energization events. Namely: • Emergency Services Sector: – Police Stations. – Fire Station. – Emergency Operations Centers. – Public safety answering points. • Government Facilities Sector: – Schools. – Jails and prisons. • Healthcare and Public Health Sector: – Public Health Departments. – Medical facilities, including hospitals, skilled nursing facilities, nursing homes, blood banks, health care facilities, dialysis centers and hospice facilities (excluding doctor offices and other non-essential medical facilities). • Energy Sector: – Public and private utility facilities vital to maintaining or restoring normal service, including, but not limited to, interconnected publicly owned utilities and electric cooperatives. • Water and Wastewater Systems Sector: – Facilities associated with the provision of drinking water or processing of wastewater including facilities used to pump, divert, transport, store, treat and deliver water or wastewater. • Communications Sector: – Communication carrier infrastructure including selective routers, central offices, head ends, cellular switches, remote terminals and cellular sites. • Chemical Sector: – Facilities associated with the provision of manufacturing, maintaining, or distributing hazardous materials and chemicals (including Category N-Customers, as defined in D.01-06-085). • Transportation Sector: – Facilities associated with automobile, rail, aviation, major public transportation, and maritime transportation for civilian and military purposes.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Customer hours	Total number of customers, multiplied by the average number of hours (e.g., of power outage).
Data cleaning	Calibrating raw data to remove errors (including typographical and numerical mistakes).
Dead fuel moisture content	Moisture content of dead vegetation, which responds solely to current environmental conditions and is critical in determining fire potential.
Detailed inspection	In accordance with GO 165, an inspection where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
Enhanced inspection	Inspection whose frequency and thoroughness exceeds the requirements of the detailed inspection, particularly if driven by risk calculations.
Enterprise System	A centralized information system that ensures data may be shared throughout all functional levels and management hierarchies of an organization, as needed.
Evacuation impact	Number of people evacuated, with the duration for which they are evacuated, from homes and businesses, due to wildfires.
Evacuation zone	Areas designated by CAL FIRE and local fire agency evacuation orders, to include both “voluntary” and “mandatory” in addition to other orders such as “precautionary” and “immediate threat.”
Fire Season	The time of year that wildfires are most likely to take place for a given geographic region due to historical weather conditions, vegetative characteristics and impacts of climate change. Goals and targets which have milestones related to the onset, duration, or end of “fire season” or “height of fire season” must be accompanied with calendar dates.
Frequently de-energized circuit	A circuit which has been de-energized pursuant to a de-energization event to mitigate the risk of wildfire three or more times in a calendar year.
Fuel density	Mass of fuel (vegetation) per area which could combust in a wildfire.
Fuel management	Removing, thinning, or otherwise altering vegetation to reduce the potential rate of propagation or intensity of wildfires.
Fuel moisture content	Amount of moisture in a given mass of fuel (vegetation), measured as a percentage of its dry weight.
Full-time employee	Any individual in the ongoing and/or direct employ of the utility whose hours and/or term of employment are considered as “full-time” for tax and/or any other purposes.
GO 95 nonconformance	Condition of a utility asset that does not meet standards established by General Order 95.
Greenhouse gas (GHG) emissions	Health and Safety Code 38505 identifies seven greenhouse gases that California Air Resources Board is responsible to monitor and regulate in order to reduce emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF_3).

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Grid hardening	Actions (such as equipment upgrades, maintenance, and planning for more resilient infrastructure) taken in response to the risk of undesirable events (such as outages) or undesirable conditions of the electrical system in order to reduce or mitigate those events and conditions, informed by an assessment of the relevant risk drivers or factors.
Grid topology	General design of an electric grid, whether looped or radial, with consequences for reliability and ability to support de-energization (e.g., being able to deliver electricity from an additional source).
High Fire Threat District (HFTD)	Per D.17-01-009, areas of the State designated by the Office of Energy Infrastructure Safety and CAL FIRE to have elevated wildfire risk, indicating where each utility must take additional action (per GO 95, GO 165, and GO 166) to mitigate wildfire risk.
Highly rural region	In accordance with 38 CFR 17.701, "highly rural" must be defined as those areas with a population of less than 7 persons per square mile. For the purposes of the WMP, "area" must be defined as census tracts.
High Wind Warning (HWW)	Level of wind risk from weather conditions, as declared by the National Weather Service. For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch / warnings.[(a)]
HWW overhead (OH) Circuit Mile Day	Sum of overhead circuit miles of utility grid subject to High Wind Warnings (HWW, as defined by the National Weather Service) each day within a given time period, calculated as the number of overhead circuit miles that are under an HWW multiplied by the number of days those miles are under said HWW. For example, if 100 overhead circuit miles are under an HWW for 1 day, and 10 of those miles are under HWW for an additional day, then the total HWW OH circuit mile days would be 110.
Ignition probability	The relative possibility that an ignition will occur, probability is quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certainty there is that the event will occur. (Often informally referred to as likelihood or chance).
Ignition-related deficiency	Any condition which may result in ignition or has previously resulted in ignition, even if not during the past five years.
Impact/consequence of ignitions	The effect or outcome of a wildfire ignition upon objectives, which may be expressed by terms including, although not limited to, maintaining health and safety, ensuring reliability, and minimizing economic and/or environmental damage.
Initiative	Measure or activity proposed or in process designed to reduce the consequences and/or probability of wildfire or PSPS.
Inspection protocol	Documented procedures to be followed in order to validate that a piece of equipment is in good condition and expected to operate safely and effectively.
Invasive species	A species that is: (1) non-native (or alien) to the ecosystem under consideration and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Level 1 finding	In accordance with GO 95, an immediate safety and/or reliability risk with high probability for significant impact.
Level 2 finding	In accordance with GO 95, a variable (non-immediate high to low) safety and/or reliability risk.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Level 3 finding	In accordance with GO 95, an acceptable safety and/or reliability risk.
Life expectancy	Anticipated years that a piece of equipment can be expected to meet safety and performance requirements.
Limited English Proficiency (LEP)	Populations with limited English working proficiency based on the International Language Roundtable scale.
Line miles	The number of miles of transmission and/or distribution line. Differs from circuit miles because individual circuits, such as the two circuits of a double-circuit line, are not counted separately in circuit miles but are counted as separate total miles of line.
Live fuel moisture content	Moisture content within living vegetation, which can retain water longer than dead fuel.
Lost energy	Energy that would have been delivered were it not for an outage.
Major roads	Interstate highways, U.S. highways, state and county routes.
Match drop simulation	Wildfire simulation method that takes an arbitrary ignition and forecasts propagation and consequence/impact.
Member of the public	Any individual not employed by the utility.
Multi-attribute value function	Risk calculation methodology introduced during CPUC's S-Map and Ramp proceedings.
Near miss	Previously used to define an event with probability of ignition. Redefined under "Risk event."
Need for PSPS	When the utility's criteria for utilizing PSPS are met.
Noncompliant clearance	Rights-of-Way whose vegetation is not trimmed in accordance with the requirements of GO 95.
Outages of the type that could ignite a wildfire	Outages that, in the judgement of the utility, could have ignited a wildfire.
Outcome metrics	Measurements of the performance of the utility and its service territory in terms of both leading and lagging indicators of wildfire, PSPS, and other consequences of wildfire risk, including the potential unintended consequences of wildfire mitigation work, such as acreage burned by utility related ignitions.
Overcapacity	When the energy transmitted by utility equipment exceeds that of its nameplate capacity.
Patrol inspection	In accordance with GO 165, a simple visual inspection of applicable utility equipment and structures that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Percentile conditions	Top X% of a particular set (e.g., wind speed), based on a historical data set with sufficient detail. For example "Top 95 percentile wind speeds in the last five years" would refer to the 5% of avg daily wind speeds recorded by each weather station. If 1,000 weather stations recorded average daily wind speeds over 10 days, then the 95th percentile wind speed would be the top 5% of weather station-days. In this example, there will be 10 days each with 1,000 weather station reports and a total of 10,000 weather station-days, so 50 observations will be in the top 5%. The lowest wind speed in this top 5% would be the "95th percentile wind speed".
Planned outage	Electric outage announced ahead of time by the utility.
Preventive maintenance (PM)	The practice of maintaining equipment on a regular schedule, based on risk, elapsed time, run-time meter readings, or number of operations. The intent of PM is to "prevent" maintenance problems or failures before they take place by following routine and comprehensive maintenance procedures. The goal is to achieve fewer, shorter, and more predictable outages.
Priority essential services	Critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies.
Program targets	Quantifiable measurements of activity identified in WMPs and subsequent updates used to show progress towards reaching the objectives.
Progress metrics	Measurements that track how much utility wildfire mitigation activity has changed the conditions of utility wildfire risk exposure or utility ability to manage wildfire risk exposure, in terms of leading indicators of ignition probability and wildfire consequences.
Property	Private and public property, buildings and structures, infrastructure, and other items of value that are destroyed by wildfire, including both third-party property and utility assets.
PSPS event	Defined as the time period from the first public safety partner notified of a planned public safety de-energization to the final customer re-energized.
PSPS risk	The potential for the occurrence of a PSPS event expressed in terms of a combination of various outcomes of the event and their associated probabilities.
PSPS weather	Weather that exceeds a utility's risk threshold for initiating a PSPS.
Red Flag Warning (RFW)	Level of wildfire risk from weather conditions, as declared by the National Weather Service. For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch/warnings.[(b)]
RFW OH Circuit Mile Day	Sum of overhead circuit miles of utility grid subject to Red Flag Warning each day within a given time period, calculated as the number of overhead circuit miles that were under an RFW multiplied by the number of days those miles are under said RFW. For example, if 100 overhead circuit miles are under an RFW for 1 day, and 10 of those miles are under RFW for an additional day, then the total RFW OH circuit mile days would be 110.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Risk event	An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition. The following risk events all qualify as risk events: • Ignitions • Outages not caused by vegetation • Vegetation-caused outages • Wire-down events • Faults Other risk events with potential to cause ignitions
Risk event simulation	Simulation of what the consequence would have been of an ignition had it occurred.
Risk-spend efficiency (RSE)	An estimate of the cost-effectiveness of initiatives, calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate based on the full set of risk reduction benefits estimated from the incurred costs. For ongoing initiatives, the RSE can be calculated by determining the "marginal benefit" of additional spending in the ongoing initiative. For example, the RSE of an ongoing initiative could be calculated by dividing the mitigation risk reduction benefit from a 5% increase in spend by the cost associated with a 5% increase in spend.
Rule	Section of public utility code requiring a particular activity or establishing a particular threshold.
Run-to-failure	A maintenance approach that replaces equipment only when it fails.
Rural region	In accordance with GO 165, "rural" must be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" must be defined as census tracts.
Safety Hazard	A condition that poses a significant threat to human life or property.
Simulated wildfire	Propagation and impact/consequence of a wildfire ignited at a particular point ('match drop'), as simulated by fire spread software.
Slash	Branches or limbs less than four inches in diameter, and bark and split products debris left on the ground as a result of utility vegetation management. This definition is consistent with Public Resources Code Section 4525.7.
Span	The space between adjacent supporting poles or structures on a circuit consisting of electric lines and equipment. "Span level" refers to asset-scale granularity.
System Average Interruption Duration Index (SAIDI)	System-wide total number of minutes per year of sustained outage per customer served.
Third-party contact	Contact between a piece of electrical equipment and another object, whether natural (tree branch) or human (vehicle).
Time to expected failure	Time remaining on the life expectancy of a piece of equipment.

WILDFIRE SAFETY DIVISION GLOSSARY OF DEFINED TERMS
(CONTINUED)

Term	Definition
Top 30% of proprietary fire potential index	Top 30% of FPI or equivalent scale (e.g., ”Extreme” on SCE’s FPI; “extreme”, 15 or greater, on SDG&E’s FPI; and 4 or above on PG&E’s FPI).
Tree with strike potential/danger tree	A tree within or adjacent to the utility right-of-way that has a structural defect or lean that makes it likely to fail in whole or in part and contact electrical equipment or facilities.
Unplanned outage	Electric outage that occurs with no advance notice from the utility (e.g., blackout).
Urban region	In accordance with GO 165, “urban” must be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census.
Utility-related ignitions	Ignitions involving utility infrastructure or employees, including all ignitions determined by AHJ investigation to originate from utility infrastructure or employees.
Vegetation management	Trimming, removal, and other remediations of vegetation used to maintain utility ROW and reduce the risk of outages, ignitions, and other disruption and danger.
Vegetation risk index	Risk index indicating the probability of vegetation-caused outages and/or ignitions along a particular circuit, based on the vegetation species, density, height, growth rate, etc.
Weather normalization	Adjusting metrics based on relative weather risk factors or indices.
Wildfire impact/ consequence	The effect or outcome of a wildfire affecting objectives, which may be expressed, by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.
Wildfire risk	The potential for the occurrence of a wildfire event expressed in terms of ignition probability, wildfire impact/consequence.
Wildfire-only WMP programs	Activities, practices, and strategies that are only necessitated by wildfire risk, unrelated to or beyond that required by minimum reliability and/or safety requirements. Such programs are not indicated or in common use in areas where wildfire risk is minimal (e.g., territory with no vegetation or fuel) or under conditions where wildfires are unlikely to ignite or spread (e.g., when rain is falling).
Wildland-urban interface (WUI)	A geographical area identified by the state as a “Fire Hazard Severity Zone”, or other areas designated by the enforcing agency to be a significant risk from wildfires, established pursuant to Title 24, Part 2, Chapter 7A.
Wire down	Instance where an electric transmission or distribution conductor is broken and falls from its intended position to rest on the ground or a foreign object.

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(a) https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml.

(b) *Id.*

9.4 PG&E Glossary of Additional Defined Terms

PG&E GLOSSARY OF ADDITIONAL DEFINED TERMS

Term	Definition
2017 GRC Decision	California Public Utilities Commission (CPUC) decision in Pacific Gas and Electric Company's (PG&E) 2017 General Rate Case (GRC) proceeding (Decision (D.) 17-05-013).
2020 GRC Decision	CPUC decision in PG&E's 2020 GRC proceeding (D.20-12-005).
2020 RAMP Report	PG&E's 2020 Risk Assessment Mitigation Phase Report filed on June 30, 2020 in CPUC Application (A.) 20-06-012.
2023 GRC	PG&E's General Rate Case for rate year 2023 filed at the CPUC in A.21-06-021
Area Under the Receiver Operating Characteristic (ROC AUC)	ROC AUC is a performance metric designed to test a model's ability to discriminate between cases that were correctly classified (positive examples) versus non-cases (negative examples) and is widely used to evaluate classification models.
Attribute	An observable aspect of a risky situation that has value or reflects a utility objective such as safety or reliability. Changes in the levels of attributes are used to determine the consequences of a Risk Event. The attributes in an Multi Attribute Value Function (MAVF) should cover the reasons that a utility should undertake risk mitigation activities. PG&E uses safety, reliability and financial as Attributes.
Bayesian updating	A methodology by which the wind-based asset strength estimation provided by the Operability Assessment (OA) Model is continuously improved as additional outage data is received (typically on a yearly cadence). In this manner, the OA Model works to maintain relevancy by incorporating new data in the form of newly-reported failures and survivals of transmission assets subjected to windy conditions.
Bow Tie	A tool that consists of the Risk Event in the center, a listing of drivers on the left side that potentially lead to the Risk Event occurring, and a listing of Consequences on the right side that show the potential outcomes if the Risk Event occurs.
Buffer Zone	An extension of the High Fire Threat District (HFTD) Tier 2 or Tier 3 boundary into non-HFTD areas to allow for complete deployment of a mitigation program in the HFTD to account for any deviations in Geographic Information System layers or circuit diagrams.
Cal Fire Redbook	Cal Fire's historical recordings of fire damage: acres burned, buildings destroyed, fatalities.
Catastrophic Fire	A fire that destroys 100 or more structures and results in a serious injury and/or fatality.
Circuit Protection Zone (CPZ)	A CPZ is a segment of a distribution circuit between two protection devices. CPZs are also sometimes referred to as Circuit Segments.

PG&E GLOSSARY OF ADDITIONAL DEFINED TERMS
(CONTINUED)

Term	Definition
Component Model	Also known as a module is layers of risk that can be examined and compared individually, or they can be composited together in various configurations to understand groups of risk, or total risk, at a particular location or for one or more asset types.
Consequence	The effect of the occurrence of a Risk Event. Consequences affect Attributes of an MAVF.
Consequence of Risk Event (CoRE)	The weighted sum of scaled values of the consequence levels of the individual Attributes using PG&E's full MAVF.
Customer Minutes Interrupted (CMI)	The number of minutes a customer is without service during a Public Safety Power Shutoff (PSPS) event.
Destructive Fire	A fire that destroys 100 or more structures but does not result in a serious injury or fatality.
Diablo Wind Event	A Diablo wind event is a dry, northeast wind that occurs over northern California.
Distribution	Electric facilities that have a voltage below 60 kilovolt (kV).
Enhanced Vegetation Management (EVM) Scope of Work	The scope of work planned for PG&E's EVM program in a year.
External Factors	External Factors include, but are not limited to, physical conditions, landholder refusals, environmental delays, customer refusals or non-contacts, permitting delays/restrictions or operational holds, weather conditions, removed or destroyed assets, and active wildfire.
Failure Mode and Effects Analysis (FMEA)	A step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service.
Fire Behavior Index (FBI)	A scale of 1 to 5 that captures fire severity as a function of flame length (intensity of burn) and rate of spread. FBI of 3 or greater is expected to require aggressive suppression.
Fire Index Area	A geographical area over which fire danger determinations are produced.
Fire Index Rating	A rating to determine the risk of fire and its likely behavior. Its calculation and scale from R1 to RS-Plus considers fuel moisture, humidity, wind speed, air temperature, and historical fire occurrence. These ratings are as follows: • R1: Very little or no fire danger. • R2: Moderate fire danger. • R3: Fire danger is so high that care must be taken using fire-starting equipment. Local conditions may limit the use of machinery and equipment to certain hours of the day. • R4: Fire danger is critical. Using equipment and open flames is limited to specific areas and times. • R5: Fire danger is so critical that the use of some equipment and open flames is not permitted. • R5-Plus: The greatest level of fire danger where rapidly moving, catastrophic wildfires are possible. This is typically when fire danger is Extreme, "plus" there are high-risk weather triggers (e.g., strong winds). PSPS triggering event is an example.

PG&E GLOSSARY OF ADDITIONAL DEFINED TERMS
(CONTINUED)

Term	Definition
Fire Potential Index (FPI) R Score	See Fire Index Ratings R1 thru R5-Plus
Flame Length (FL)	Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame. Flame length is an observable, measurable indicator of fireline intensity.
Fragility Curve	Represents the probability of failure (Pf) for any value of a demand parameter.
Hazard	Event that causes the ultimate failure of an asset, i.e., wind, ice, seismic, landslide, vandalism, vehicle impact, *etc*.
High Fire Risk Area (HFRA) Map	The HFRA Map considers catastrophic fire risk factors and utility infrastructure and was developed by considering incremental changes to the HFTD map boundaries to add areas where risk factors for the potential of catastrophic fire from utility infrastructure ignition during offshore wind events is higher.
Ignition Probability Weather (IPW) Model	An extension of the OPW model that outputs the probability of ignition given an outage by cause (e.g., vegetation)
Input data	Any dataset that is fed into the OA model and used as a means of calculating the OA Pf. The input datasets to the OA model are detailed in Section 3. Data elements.
Kaizen	A Lean Six Sigma tool for continuous process improvement.
Large Fire	A fire that burns 300 or more acres but does not meet the definition of a Destructive or Catastrophic fire.
Likelihood of Risk Event (LoRE)	The probability that a given Risk Event will occur with respect to a single element (unit of exposure) of a specified Tranche over a year in the planning period. PG&E computes LoRE based on the Frequency divided by total exposure units in a Tranche.
Maximum Entropy (MaxEnt)	The name given to a family of models that seek to differentiate between the characteristics of locations that have hosted grid events and those that have not
Mitigation	A measure or activity proposed or in process that is designed to reduce the impact/consequences and/or the likelihood/probability of a risk event.
Module	Also known as a composite model is layers of risk that can be examined and compared individually, or they can be composited together in various configurations to understand groups of risk, or total risk, at a particular location or for one or more asset types.
Natural Unit	The way the level of an attribute is measured or expressed. For example, the natural unit of a financial attribute may be dollars.
Outcomes	The final resolution or end result.
PG&E Operational Mesoscale Modelling System (POMMS)	A configuration of the Weather Research and Forecasting model. A numerical weather prediction model.
Pixel	A 100m x 100m area that is used for modeling as the corpus of all locations for which input data is needed and predictions will be made for the Wildfire Distribution Risk Model.

PG&E GLOSSARY OF ADDITIONAL DEFINED TERMS
(CONTINUED)

Term	Definition
Probability of failure (Pf)	A calculated likelihood that an electric transmission asset (structure or related component) will fail at a given windspeed from 1 to 120 miles per hour.
Progress Report	The Progress Report submitted by PG&E to Energy Safety on November 1, 2021 as directed by the Final Action Statement on PG&E's 2021 WMP
Public Safety Specialist (PSS)	Personnel that are dedicated to maintaining established relationships with agency partners and supporting emergency planning activities and information sharing during emergency events
Range (of the Natural Unit)	Part of the specification of an Attribute. For an Attribute with a numerical natural unit, such as dollars, the smallest observable value of the Attribute is the low end of the range and the largest observable value is the high end of the range. Therefore, any Attribute level that results as a consequence of an event, or a risk mitigation action, or of doing nothing should be found within the range.
Rate of Spread (ROS)	The speed with which the fire is moving away from the site of origin measured in Chains (66 feet) per hour.
Risk Driver	A factor that could influence the likelihood of occurrence of a Risk Event. A driver may include external events or characteristics inherent to the asset or system.
S-MAP Settlement	The Safety Model Assessment Proceeding (S-MAP) Settlement Agreement approved by the CPUC in D.18-12-014
Safety and Infrastructure Protection Team (SIPT)	This in-house team consists of two-person crews composed of International Brotherhood of Electrical Workers-represented employees who are trained and certified safety infrastructure protection personnel. They provide standby protection and asset protection services in support of crews and protect critical utility infrastructure within PG&E's service territory, especially in areas at higher risk of wildfire.
Scaled Unit	The scaled unit is set to 0 for the most desirable level of natural unit in the range of natural units. The scaled unit is set to 100 for the least desirable level of natural unit in the range of natural units. For any level of attribute between the most desirable and the least desirable levels, the scale unit is between 0 and 100. The benefit achieved by changing the level of an Attribute in natural units is measured by the corresponding difference in scaled units.
Small Fire	A fire that burns fewer than 300 acres.
Sub-Driver	A further, more detailed categorization of a Risk Driver.
Technosylva	Vendor of fire simulation software whose outcomes are based on available fuels, topography, and weather, and structure and population data. Technosylva simulation outputs are used as the source of spatially resolved fire severity data that is the primary input into the spatial wildfire consequence calculations.
Technosylva Simulation	Computerized simulations of wildfire behavior given an ignition at a location on a particular date. Currently, PG&E uses Technosylva's 8 hour simulation product.
Threat	Degradation mechanism that weakens an asset and decreases the magnitude of a hazard needed to cause ultimate failure, i.e., corrosion, wear, contamination, erosion, etc.

PG&E GLOSSARY OF ADDITIONAL DEFINED TERMS
(CONTINUED)

Term	Definition
Tranche	A logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment.
Transmission	Electric facilities that have a voltage that is 60 kV or above.
Transmission asset	Any component of the electric transmission system such as, the primary structure (tower or pole); crossarms; hangers; insulators; conductor wire; foundation; guy wires; and support structures.
Visible Infrared Imaging Radiometer Suite (VIIRS)	Earth observation satellite data from National Oceanic and Atmospheric Administration, in the visible and infrared bands.
Wildfire OII	CPUC Investigation 19-06-015 initiated in June 2019.
Wildfire Mitigation and Catastrophic Events (WMCE) Application	PG&E's application for our WMCE cost recovery in A.20-09-019.

9.5 PG&E Glossary of Models

Table PG&E-9.5-1 below provides a glossary of the primary models referred to in our 2022 Wildfire Mitigation Plan (WMP) including: the model name, the abbreviation used in the 2022 WMP, a brief description of the model, and the model use (i.e., planning or operational).

TABLE PG&E-9.5-1:
GLOSSARY OF PRIMARY MODELS

Model Name	Abbreviated Name	Brief Description	Model Use
2022 Enterprise Risk Model (ERM)	2022 ERM Model	Bow Tie-based Wildfire risk model for distribution and transmission system.	Planning
2021 Wildfire Distribution Risk Model (WDRM) (Version 2)	2021 WDRM v2	Wildfire risk-based model for overhead (OH) Distribution system.	Planning
2022 WDRM (Version 3)	2022 WDRM v3	Wildfire risk-based model for OH Distribution system.	Planning
Wildfire Transmission Risk Model (WTRM)	WTRM	Wildfire risk-based model for OH Transmission system. This model is also known as the Transmission Composite Model.	Planning
Wildfire Consequence Model (WFC)	WFC Model	Wildland fire simulation model to estimate propagation and consequences of ignitions.	Planning
Enhanced Vegetation Management (EVM) Tree Weighted Prioritization Model	EVM Tree Weighted Prioritization	Wildfire risk-based model incorporating tree density for OH Distribution circuit segments for the purpose of EVM scoping and prioritization.	Planning
Fire Potential Index (FPI) Model	FPI Model	Provides estimates of the probability of large or catastrophic fire growth. Used to identify real-time and near-term forecasted risk due to various weather and fuel components.	Operational
Ignition Probability Weather (IPW) Model	IPW Model	Provides estimates of the probability of an ignition given an outage on an hourly basis. Is built upon and enhances the Outage Probability Weather Model and is used in Public Safety Power Shutoff decision making.	Operational
Transmission Operability Assessment (OA) Model	OA Model	Used to assess physical condition of Transmission facilities for operational and planning decisions.	Operational/ Planning
Public Safety Power Shutoff (PSPS) Consequence Model	PSPS Consequence Model	Projects the impacts and benefits of performing PSPS activities at the circuit or circuit segment level (formerly known as Circuit Protection Zones or CPZs).	Planning

Table PG&E-9.5-2 below provides a glossary of component models referred to in our 2022 WMP including: the component model name, the abbreviation used in the 2022 WMP, a brief description of the component model, and the model (i.e., planning or operational), the Section of the WMP where the component model is discussed and the model that includes the component model.

TABLE PG&E-9.5-2:
GLOSSARY OF COMPONENT MODELS

Component Model Name	Abbreviated Name	Brief Description	Section Mentioning Component Model	Model Use
Atmospheric Corrosion Model (Under development)	N/A	Informing conductor-specific inspections which may lead to further mitigation, such as conductor replacement.	7.3.3.17.2	WTRM
Bayesian Network Model	N/A	Used to produce the required safe egress time.	4.5.1	WDRM, PSPS Consequence Model
Catastrophic Fire Probability (CFP) Model for Distribution	CFP_D	The FPI multiplied by the IPW (FPI * IPW) in space and time. Used in operational PSPS decisions for distribution.	7.3.2.6	PSPS Consequence Model
Contact From Object (CFO) Model	CFO Model	Predicting the likelihood of contact from an external object other than vegetation.	7.3.1.3	WDRM
Conductor Module (formerly known as Equipment Probability of Ignition Model)	N/A	Associated with six specific equipment types: primary and secondary conductor, primary and secondary interrupters, and primary and secondary other equipment (which includes all asset types other than conductors, interrupters, support structures, and transformers).	4.5.1	WDRM
Dead Fuel Moisture (DFM) Model	DFM Model	Model that predicts the amount of moisture in dead fuels. Used in the FPI Model.	4.2.B, 4.5.1	FPI Model, WDRM
Decision Tree Regressor Machine Learning (ML) Model	Decision Tree Regressor ML Model	Predicts a pole's installation year given a set of pole attributes as model covariates.	4.5.1	WDRM
Egress Model	N/A	Approaches the simulation of the time for a community to safely evacuate by estimating the available time to safely evacuate by the speed of a fire to reach the community and the required time to evacuate the community.	4.5.1	PSPS Consequence Model

TABLE PG&E-9.5-2:
GLOSSARY OF COMPONENT MODELS
(CONTINUED)

Component Model Name	Abbreviated Name	Brief Description	Section Component Model is Mentioned	Model Use
Equipment/Facility Failure (EFF) Model	EFF Model	Additional failure modes associated with PG&E Equipment/Facilities that could lead to an ignition beyond Conductor, Structures and Transformers	7.3.1.3	WDRM
European Centre for Medium Range Weather Forecasts (ECMWF) Model	ECMWF	A global, external weather model that PG&E uses and considers before initiating a PSPS event.	8.2.3.5	PSPS Consequence Model
Equipment Probability of Ignition Model	N/A	Provide annual ignition probability due to conductor failures.	4.3	WDRM
Global Forecast System American Global Model	GFS American Global Model	A global, external weather model that PG&E uses and considers before initiating a PSPS event.	8.2.3.5	PSPS Consequence Model
Grid Forming Inverter Model	N/A	Evaluates remote grid component technologies, with a focus on power quality, system protection, and control characteristics.	7.3.3.15.5	WDRM; PSPS Consequence Model
High-Resolution-Rapid Refresh (HRRR)-Model	HRRR	An external weather model that PG&E uses and considers before initiating a PSPS event.	8.2.3.5	PSPS Consequence Model
High-Resolution Weather Model Ensemble Prediction System (EPS)	N/A	An ensemble weather forecast model built upon the POMMS weather model.	7.3.2.1.6	POMMS
2016 LANDFIRE Surface Fuel Model	N/A	Determines “un-burnable” features derived from several land use types.	4.3, 4.5.1	WDRM
Light Detection and Ranging (LiDAR) Risk Score Model	N/A	Calculates the relative risk of individual trees within the High Fire Threat District that have strike potential to a transmission conductor.	7.3.5	EVM Tree Weighted Prioritization
Live Fuel Moisture Model (LFM)	LFM Model	Model that predicts the forecast amount of moisture in live vegetation.	4.2.B	FPI Model
National Weather System’s Meteorological Models	N/A	Areas identified as subject to RFW conditions are based on this model.	7.3.5.4	FPI Model
North American Mesoscale Model	NAM	A tool considered before initiating a PSPS event.	8.2.3.5	PSPS Consequence Model

TABLE PG&E-9.5-2:
GLOSSARY OF COMPONENT MODELS
(CONTINUED)

Component Model Name	Abbreviated Name	Brief Description	Section Component Model is Mentioned	Model Use
2021 Outage Probability Weather Model	OPW Model	A machine learning model that outputs the probability of outage by cause (e.g., vegetation) as a function of weather. Replaced the 2020 Outage Producing Wind Model	4.5.1	IPW Model
PG&E Operational Mesoscale Modelling System Model	POMMS Model	A configuration of the Weather Research and Forecasting (WRF) model. A numerical weather prediction model.	4.5.1	FPI and IPW Models, WDRM
PG&E Operational Mesoscale Modelling System (POMMS) EPS Model	POMMS EPS Model	An ensemble weather forecast model built upon the POMMS weather model.	7.3.2.1.1	POMMS, FPI and IPW Models
Pole Loading Calculation Model	N/A	During a pole's service life, pole loading calculations are performed when a load is added to a pole or if a suspected overload condition is observed during an inspection.	4.5.1, 7.3.3.13	WDRM
Probabilistic Risk Assessment Model	PRA	A decision framework that utilizes the Data Elements of the models.	4.4.2	WDRM, WTRM
Probability of Ignition Given Initiating Events Module	N/A	Estimates how likely ignitions are given initiating events, like outages, under various conditions.	4.5.1	WDRM
PSPS 10-yr Lookback Model	N/A	Shows how many times a line might have been "in scope" for PSPS de-energization. Based on PSPS protocols back-cast through historical data.	7.3.3.8	PSPS Consequence Model
Storm Outage Prediction Program (SOPP) and Model	SOPP Model	One of the primary tools PG&E uses to mitigate operational risk from all adverse weather drivers that create an increased volume of outages above "blue sky" weather days. These drivers are primarily heat, wind, rain, and snow. This model guides PG&E to be proactive and thus prepared for storm events of any type.	7.3.2.6	SOPP
STAR Model	N/A	Used to find the estimated conductor age (the "estimated-age") if the installation date is missing or invalid in ED-GIS.	4.3	WDRM

TABLE PG&E-9.5-2:
GLOSSARY OF COMPONENT MODELS
(CONTINUED)

Component Model Name	Abbreviated Name	Brief Description	Section Component Model is Mentioned	Model Use
Strike Tree Model	N/A	The model is used to simulate the resilience performance of overhead circuits before and after system hardening, using the size and proximity of trees measured via LiDAR.	7.3.4.8	EVM Tree Weighted Prioritization
Support Structure Module	N/A	Associated with support structures (poles, cross arms, guy wires, et al).	4.5.1	WDRM
Transformer Module	N/A	Associated with OH distribution transformers.	4.5.1	WDRM
Transmission Catastrophic Fire Probability Model for Asset Failures (CFP_T - Asset)	CFP_T – Asset	Used for transmission PSPS. It is the FPI multiplied by the OA in space and time.	8.2.3.4	PSPS Consequence Model
Transmission Vegetation Risk Model	N/A	Based on several factors such as overstrike, the amount of unobstructed fall paths to a wire, the slope between tree and conductor, and tree exposure.	8.2.3.4	PSPS Consequence Model
Vegetation Module (formerly known as Vegetation Probability of Ignition Model)	N/A	Associated with vegetation in proximity to PG&E distribution assets (poles, transformers, etc.)	4.3, 4.5.1, 7.3.5.20	WDRM
Weather Research and Forecasting (WRF) Model	WRF Model	A mesoscale numerical weather prediction system. PG&E's WRF application is called POMMS.	4.4.2	POMMS

9.6 List of Acronyms and Abbreviations

LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Term/Definition
A.	Application
AAR	After Action Reviews
ACC	Accumulated Critical Current
ACWA	Association of California Water Utilities
ACSR	Aluminum Conductor Steel Reinforced
ADA	Americans with Disabilities Act
ADF	Asset Data Foundation
ADMS	Advanced Distribution Management System
AFN	Access and Functional Needs
AGA	American Gas Association
AHJ	Agency Having Jurisdiction
AI	Artificial Intelligence
ALJ	Administrative Law Judge
amp	ampere
AMP	Asset Management Plans
ANSI	American National Standards Institute
API	Application Programming Interface
ARCOS	Automated Roster Call Out System
ASL	American Sign Language
AUC	Area Under the Precision/Recall Curve
ATS	Applied Technical Services
AWS	Amazon Web Services
BLM	Bureau of Land Management
BOA	Breaker Oil Analysis
BVLOS	Beyond Visual Line of Sight
CA	California
CAISO	California Independent System Operator
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Governor’s Office of Emergency Services
CAMP	California Association of Medical Product Providers

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
CANSAC	California and Nevada Smoke and Air Committee
CAP	Corrective Action Program
CARE	California Alternate Rate for Energy
CBA	Collective Bargaining Agreement
CBM	Condition-Based Maintenance
CBO	Community Based Organizations
CCA	Community Choice Aggregator
CC&B	Customer Care and Billing
CCPA	California Consumer Privacy Act
CEC	California Energy Commission
CEMA	Catastrophic Event Memorandum Account
CEQA	California Environmental Quality Act
CERP	Company Emergency Response Plan
CERT/NERT	Community/Neighborhood Emergency Response Teams
CEU	Continuing Education Units
CFILC	California Foundation for Independent Living Centers
CHA	California Hospital Association
CIL	Critical Infrastructure Lead
CIM	Common Information Model
CIRT	Centralized Inspection Review Team
CLECA	California Large Energy Consumers Association
CMC	Canadian Meteorologist Centre
CMI	Customer Minutes Interrupted
COA	Compliance & Operational Assurance
CoRE	Consequence of Risk Event
COL	Conclusion of Law
County OES	County Office of Emergency Services
COVID-19	Coronavirus disease of 2019
CPUC or Commission	California Public Utilities Commission
CPZ	Circuit Protection Zone
CRCs	Community Resource Centers
CRESS	Corporate Real Estate Strategy & Services
CRM	Customer Relationship Manager
CSO	Customer Service Offices
Cu	Copper

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
CUEA	California Utilities Emergency Association
CWSP	Community Wildfire Safety Program
D.	Decision
DAC-AG	Disadvantaged Communities Advisory Group
DCC	Distribution Control Center
DCD	Downed Conductor Detection
DDAR	Disability Disaster Access and Resources
DER	Distributed Energy Resource
DERMS	Distributed Energy Resource Management System
DFA	Distribution Fault Anticipation
DFM	Dead Fuel Moisture
DG	Distributed Generation
DGA	Dissolved Gas Analysis
DGEM	Distribution Generation Enabled Microgrid Services
DLT	Division Leadership Team
DM&A	Data Management and Analytics
DMS	Distribution Management System
D-OH	Distribution-Overhead
DPAM	Dynamic Pattern and Analog Matcher
DRI	Desert Research Institute
DRPP	Distribution Routine Patrol Procedure
DRU	Data Response Unit
DTS-FAST	Distribution, Transmission, and Substation: Fire Action Schemes and Technology
EC	Electric Corrective
ECMWF	European Centre for Medium-Range Weather Forecasts
ECOP	Electric Corrective Optimization Program
EDA	Explanatory Data Analysis
EDF	Enterprise Data Foundation
EDGIS	Electric Distribution Geographic Information System
EDMP	Enterprise Data Management Program
EDPM	Electric Distribution Procedure Manual
EEI	Edison Electric Institute
EF	Equivalent Fatalities
EFD	Early Fault Detection

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
EFO	Emergency Forced Outages
EOC	Emergency Operations Center
EORM	Enterprise and Operational Risk Management
EP&R	Emergency Preparedness and Response
EPA	United States Environmental Protection Agency
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
EPS	Ensemble Prediction System (from ECMWF)
ESA	Energy Savings Assistance
ETE	Evacuation Time Estimates
ETOR	Estimated Time of Restoration
ETPM	Electric Transmission Preventive Maintenance
EV	Electric Vehicle
EV	Expected Value
EVM	Enhanced Vegetation Management
EVSP	Electric Vehicle Service Providers
EQM	Electric Quality Management
FAA	Federal Aviation Administration
FAN	Field Area Network
FAS	Field Automation System
FDA	Facility Damage Action
FDAs	Fire Detection and Alert System
FEA	Finite Element Analysis
FERA	Family Electric Rate Assistance
FERC	Federal Energy Regulatory Commission
FF+	Fire Family Plus (aka Family Plus)
FFWI	Fosberg Fire Weather Index
FIA	Fire Index Area
FMEA	Failure Modes and Effects Analysis
FORCE	Field Operations Resource Calculation of Estimated Time of Restoration
FPI	Fire Potential Index
FRP	Fire Radiative Power
FSR	Field Safety Reassessment
ft lb	foot-pound
FTE	Full Time Equivalent

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
FWW	Fire Weather Warning
GACC	Geographic Area Coordination Centers
GADI	Geospatial Asset Data Improvement
GCC	Grid Control Center
GDAT	Grid Data Analytics Tool
GEFS	Global Ensemble Forecast System
GFN	Ground Fault Neutralizer
GFS	Global Forecast System
GIS	Geographic Information System
GO	General Order
GOES	Geostationary Operational Environmental Satellite
GPR	Ground Potential Rise
GRC	General Rate Case
HAWC	Hazard Awareness & Warning Center
HCP	Habitat Conservation Plan
HD	High-Definition
HHW	High Wind Warning
HIPAA	Health Insurance Portability and Accountability Act
HFRA	High Fire Risk Area
HFTD	High Fire Threat District
HN	Hazard Notification
HREF	High Resolution Ensemble Forecast
HRRR	High Resolution Rapid Refresh
HTRS	Hazard Tree Rating System
IA	Internal Audit
IBEW	International Brotherhood of Electrical Workers
IC	Incident Commander
ICS	Incident Command System
IEEE	Institute of Electrical and Electronic Engineers
IID	Imperial Irrigation District
ILCs	Independent Living Centers
ILIS-ODB	Integrated Logging Information System-Operations Data Base
IMT	Incident Management Teams
IOU	Investor-Owned Utility
IPP	Independent Power Producer or Independent Power Production

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
IPP	Integrated Planning Process
IPW	Ignition Probability Weather
IR	Infrared
IRWIN	Integrated Reporting of Wildland-Fire Information
IVM	Integrated Vegetation Management
IVR	Interactive Voice Recording
IWRMC	International Wildfire Risk Mitigation Consortium
JATC	Joint Apprentice and Training Committee
JAWS	Jobs Access with Speech
Km	Kilometer
kV	Kilovolt
kV/in	kilovolts per inch
LADWP	Los Angeles Department of Water & Power
LC	Line Corrective
LDSP	Light Duty Steel Pole
LEP	Limited English Proficiency
LF 2.0.0	LANDFIRE Remap 2016
LIOB	Low Income Oversight Board
LFM	Live Fuel Moisture
LFP_D	Large Fire Probability Model - Distribution
LFP_T	Large Fire Probability Model - Transmission
LiDAR	Light Detection and Ranging
LIHEAP	Low-Income Home Energy Assistance Program
LIOB	Low Income Oversight Board
LMS	Learning Management System
LNO	Liaison Officers
LOB	Line of Business
LoRE	Likelihood of a Risk Event
LPA	Local Public Affairs
MAA	Mutual Assistance Agreements
MADIS	Meteorological Assimilation Data Ingest System
MARAC	Mutual Aid Regional Advisory Council
MARS	Multi-Attribute Risk Scores
MAT	Maintenance Activity Type
MAVF	Multi-Attribute Value Function

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
MBL	Medical Baseline
MEDs	Major Event Days
MEO	Miscellaneous Equipment Operator
MET	Model Evaluation Tools
ML	Machine Learning
MODIS	Moderate Resolution Imaging Spectroradiometer
MOU	Memorandum of Understanding
mph	Miles Per Hour
MSO	Motorized Switch Operator
MW	megawatt
MWC	Main Work Center
NAM	North American Mesoscale Model
NARR	North American Regional Reanalysis
NCAR	National Center for Atmospheric Research
NCEP	National Center for Environmental Prediction
NDC	National Diversity Coalition
NEETRAC	National Electric Energy Testing Research and Applications Center
NEM	Net Energy Metering
NEPA	National Environmental Protection Act
NERC	North American Electric Reliability Corporation
NFDRS	National Fire Danger Rating System
NFMDB	National Fuel Moisture Database
NIC	Network Interface Card
NIMS	National Incident Management Systems
NOAA	National Oceanic and Atmospheric Administration
NPP	National Polar-orbiting Partnership
NPS	National Park Service
NWA	Non-Wires Alternative
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
O&M	Operations and Maintenance
OA	Operability Assessment
OBF	On-Bill Financing
OEC	Operational Emergency Centers
OES	Office of Emergency Services

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
OH	Overhead
OIC	Officer-in-Charge
OII	Order Instituting Investigation
OIR	Order Instituting Rulemaking
OJT	On the job training
OMS	Outage Management System
OMT	Outage Management Tool
OP	Ordering Paragraph
OPW	Outage Producing Wind
OSA	Office of Safety Advocates
OSHA	Occupational Safety and Health Administration
PCC	Provider Cost Center
PCORP	PacifiCorp
PBP	Portable Battery Program
PD	Partial Discharge
PDAC	Primary Distribution Alarm and Control
PEV	Post Enrollment Verification
PG&E or the Company	Pacific Gas and Electric Company
PHMSA	Pipeline and Hazardous Materials Safety Administration
PI	Pre-Inspection
PIH	Pre-installed Interconnection Hubs
PIO	Public Information Officer
Plan	Wildfire Mitigation Plan
PLDB	Pole Landing Database
PLDN	PG&E Lighting Detection Network
PMD	Project Management Database
PMO	Project Management Office
PO	Purchase Order
POC	Point-of-Contact
POMMS	PG&E Operational Mesoscale Modeling System
POU	Publicly-Owned Utilities
PPE	Personal Protective Equipment
PPF	Portfolio Prioritization Framework
PRC	Public Resources Code
PSAP	Public Safety Answering Points

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
PSIP	PSPS Situational Intelligence Platform
PSPS	Public Safety Power Shutoff
PSS	Public Safety Specialists
PSSP	Project Specific Safety Plan
PT&T	Pole Test & Treat
PTZ	Pan/Tilt/Zoom
PUC	Public Utilities Code
PV	Photovoltaic
PWAS	PG&E Wind Alert System
PWDAAC	People with Disabilities and Aging Advisory Council
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
QCR	Qualified Company Representative
QEW	Qualified Electrical Workers
QM	Quality Management
QV	Quality Verification
R.	Rulemaking
RAMP	Risk Assessment and Mitigation Phase
RAWS	Remote Automatic Weather Station
RCA	Root Cause Analysis
REACH	Relief for Energy Assistance through Community Help
REFCL	Rapid Earth Fault Current Limiter
Res.	Resolution
RF	Radio Frequency
RFI	Request for Information
RFW	Red Flag Warning
RH	Relative humidity
RIBA	Risk Informed Budget Allocation
RMAR	Risk Mitigation Accountability Reporting
ROC	Receiver Operating Characteristic
ROW	Right-of-Way
RPS	Renewable Portfolio Standard
RSAR	Risk Spend Accountability Reporting
RSE	Risk Spend Efficiencies

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
RW	Request for Work
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SB 209	Senate Bill 209
SB 247	Senate Bill 247
SBUA	Small Business Utility Advocates
SCADA	Supervisory Control and Data Acquisition
SCADAMATE-SD	Supervisory Control and Data Acquisition Mate – Solid Dielectric
SCCD	State Council on Developmental Disabilities
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company
SED	Safety Enforcement Division
SEMS	Standardized Emergency Management System
SF6	Sulfur Hexafluoride
SGF	Sensitive Ground Fault
SGIP	Self-Generation Incentive Program
SI	Smart Inverter
SIPT	Safety and Infrastructure Protection Teams
SJSU	San Jose State University
SLP	Structured Learning Path
S-MAP	Safety Model and Assessment Proceeding
SmartMeter™	Brand Name for Automated Metering Initiative (AMI)
SMEs	Subject-Matter Experts
SM&C	Substation Maintenance and Construction
SMUD	Sacramento Municipal Utility District
SOPP	Storm Outage Prediction Model
SOW	Statement of Work
SPC	Storm Prediction Center
SPD	Safety Policy Division
SPS	Standalone Power System
SSEC	Space Science and Engineering Center
STAR	System Tool for Asset Risk
TA	Tail Average
TAD	Temperature Alarm Device
TD&D	Technology Demonstration and Deployment

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
T&D	Transmission and Distribution
TG	Temporary Generation
T-OH	Transmission Overhead
TOTL	Transmission Operation Tracking and Logging
TRAQ	Tree Risk Assessment Qualification
TVM	Transmission Vegetation Management
TVMR Program	Transmission Vegetation Management Reliability Program
UAS	Unmanned Aerial Systems
UCLA	University of California Los Angeles
U.S.	United States
USFS	United States Forest Service
USL	Uncoupled Surface Layer
UT	Ultrasonic
VFR	Visual Flight Rules
VIIRS	Visible Infrared Imaging Radiometer Suite
VM	Vegetation Management
VP	Vice President
VPM	Vegetation Program Managers
VRI	Vegetation Risk Index
WAPA	Western Area Power Administration
WBT	Web Based Training
WCAG	Web Content Accessibility Guidelines
WECC	Western Electricity Coordinating Council
WEMA	Wildfire Expense Memorandum Account
WFA	Wildfire Analyst Enterprise
Wh	Watt-hour
WIV	Wild Incident Viewer
WMCE	Wildfire Mitigation and Catastrophic Events Application (A.20-09-019)
WMM	Wildfire Maturity Model
WPE	Work Procedure Error
WRF	Weather Research and Forecast
WRGSC	Wildfire Risk Governance Steering Committee
WRMAA	Western Regional Mutual Assistance Agreement
WSD	Wildfire Safety Division
WSOC	Wildfire Safety Operations Center

LIST OF ACRONYMS AND ABBREVIATIONS
(CONTINUED)

Acronym	Term/Definition
WUI	Wildland-Urban Interface
WV	Work verification
WSIP	Wildfire Safety Inspection Program
WMP	Wildfire Mitigation Plan
WRMAA	Western Region Mutual Assistance Agreement
XLPE	Crosslinked Polyethylene