OFFICE OF ENERGY INFRASTRUCTURE SAFETY

WILDFIRE SAFETY ADVISORY BOARD

STAFF DRAFT: SITUATIONAL AWARENESS AND PROTECTIVE EQUIPMENT AND DEVICE SETTINGS

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EXECUTIVE SUMMARY

Publicly owned utilities and electrical cooperatives must submit wildfire mitigation plans to the Wildfire Safety Advisory Board, which must provide comments, advisory opinions, and recommendations. Staff supporting the Wildfire Safety Advisory Board research “focus areas” of wildfire mitigation practices. Publishing focus areas provides resources to utilities and increases transparency into the Wildfire Safety Advisory Board’s review of utilities’ wildfire mitigation plans. This report presents research on two focus areas: (1) situational awareness and (2) protective equipment and device settings.

Situational awareness is about collecting and making sense of information relating to wildfire risk. System knowledge is the foundation for situational awareness. Grid monitoring includes patrols and inspections as well continuous monitoring. Continuous monitoring is done through supervisory control and data acquisition, advanced metering infrastructure, phasor measurement units, or early fault detection systems which adds both depth and persistence. Dashboards can also help integrate multiple data streams.

Environmental and weather monitoring helps utilities assess both the likelihood of ignition and the consequence if one occurs. Publicly available weather products give every utility a free, reliable starting point for fire weather awareness. Combining data from a utility's own weather stations with regional fire weather forecasts gives operators a more complete and locally grounded picture of near-term weather conditions. Some utilities go further by also engaging meteorologists. Publicly available fuel moisture data can provide a general picture of fuel conditions across a utility's service territory. Utilities can also sample fuel moisture along their own corridors to track local conditions more precisely.

Fire danger rating systems, risk indices, and wildfire spread modeling tools translate multiple inputs into integrated risk assessments. These assessments can inform decisions about patrol frequency, protective equipment and device settings, preemptive de-energization, and crew pre-positioning.

A wildfire detection program can reduce the time between ignition of the fire and fire agency notification and deployment. Predefined notification protocols also reduce decision time when the utility is under pressure after a fire has started. Camera-based or satellite wildfire detection can also extend a utility’s awareness.

However, all situational awareness equipment requires maintenance and calibration.

The practice of making protective equipment and devices more sensitive during periods of elevated wildfire risk is referred to as “protective equipment and device settings.” Many California utilities already mitigate wildfire risk by using protective equipment and device settings and disabling reclosing under specific activation criteria.

Modern protective equipment and devices allow for more rapid reaction to faults, more system information, potential for remote control, and greater selectivity in setting sensitivity than older equipment and devices. Modern protective equipment and devices also allow for improved detection of, and response to, sensitive ground faults and high-impedance faults.

Protective equipment and device settings may decrease reliability. Reliability impacts can be mitigated through refined activation criteria, preparing for outages when using protective equipment and device settings, and addressing outage causes.

Not all strategies for maturing utility wildfire mitigation are appropriate for all utilities. Utilities will select strategies based on their own risk, risk management, and constraints, such as budget and staffing. As technologies and current practices change, utilities should continue to review their options and strategies.

1. INTRODUCTION

Publicly owned utilities (POUs) and electrical co-operatives (co-ops) are required by Public Utilities Code (PUC) section 8387 to "prepare a wildfire mitigation plan and… submit the plan to the California Wildfire Safety Advisory Board [WSAB] at least once every four years on a schedule determined by the California Wildfire Safety Advisory Board." WSAB is required by PUC section 326.2(a) to "[r]eview and provide comments and advisory opinions to local publicly owned electric utilities and electrical cooperatives regarding the content and sufficiency of their wildfire mitigation plans and recommendations on how to mitigate wildfire risk."

PUC section 326.1 established WSAB, a seven-member body of wildfire and utility policy experts appointed by the Governor, Speaker of the Assembly, and Senate Committee on Rules. In addition to providing comments, advisory opinions, and recommendations to POUs and co-ops, WSAB is required by PUC section 326.2(b) "to provide other advice and recommendations related to wildfire safety as requested by Energy Safety."

Each member of the Board brings a unique perspective and their own expertise. Additional information about the Board, its members, and its prior advisory opinions, recommendations, and meetings, can be found on the Board website.[2]

The current members of the Wildfire Safety Advisory Board are:

- Ralph Armstrong
- Marybel Batjer
- Jessica Block, Chair
- Timothy Haines
- John Mader
- Chris Porter, Vice Chair
- Dr. Alexandra Syphard

The WSAB Branch of the Office of Energy Infrastructure Safety (Energy Safety) consists of four staff members whose primary role is to support WSAB. WSAB Branch staff work with WSAB, its members, and committees, to provide logistical support for WSAB operations and meetings. They also research and develop concepts relevant to the Board's work and review materials and draft documents for WSAB's consideration.

1.1 Focus Areas

To support WSAB's work, WSAB Branch staff members continually work to improve their understanding of current practices in utility wildfire mitigation. Staff members focus efforts on a small number of categories of utility wildfire mitigation practices at various times. For example, in 2025, staff researched risk identification and preemptive de-energization as "focus areas." WSAB included sections on these two focus areas in its Advisory Opinions to Publicly Owned Utilities and Cooperatives which was adopted in December 2025.[1]

One purpose of publishing focus areas is to provide resources to utilities. Staff members seek information and perspectives from POU and co-op wildfire mitigation plans (WMPs), investor-owned utility WMPs, utility and academic experts, and others. Sharing that information publicly provides a reference for utilities when considering maturation in their WMPs.

A second purpose of publishing focus areas is to be transparent about WSAB Branch staff's work. WSAB Branch staff will naturally review WMP sections in the focus areas with a keener eye than they may review other sections. Focus areas indicate ways WSAB may look for and advise maturation in future WMPs. However, a utility should not restrict its attention in WMP to published focus areas. The focus areas contain examples of approaches utilities may take as they advance in maturity. However, not every element of the focus area may apply to every utility's WMP.

1.2 Organization of This Report

This report builds on the publication of focus areas in the 2025 Advisory Opinions to Publicly Owned Utilities and Cooperatives. Section 2 is on situational awareness. Section 3 is on protective equipment and device settings (PEDS). Section 4 contains a short conclusion.

2. SITUATIONAL AWARENESS

Situational awareness is about collecting and making sense of information relating to wildfire risk. It gives operators an understanding of existing conditions, what those conditions mean for ignition likelihood and fire behavior, and how those conditions are likely to develop. The decisions that follow are operational responses. Risk identification forms the foundation on which utilities build their situational awareness tools.[2] The tools that support situational awareness range from field observation programs to integrated monitoring platforms.[3] Utilities that continue to develop their situational awareness programs are positioned to act before a dangerous situation becomes an emergency.[4]

System knowledge is the foundation for situational awareness. Wildfire risk is the product of likelihood and consequence, and situational awareness supports both dimensions.[5] Grid monitoring and environmental and weather monitoring provide situational awareness of risk, both forecasted and in real-time. Grid monitoring also helps operators identify equipment conditions that can lead to an ignition. Environmental and weather monitoring helps identify

[1] Advisory Opinions to Publicly Owned Electric Utilities and Electrical Cooperatives, WSAB, pages 11–17.

[2] Wildfire Mitigation Maturity Model, Energy Safety.

[3] Situation Awareness in Dynamic Systems.

[4] Situation Awareness in Dynamic Systems.

[5] Wildfire Mitigation Plan Guidelines, Energy Safety.

impacts on both ignition likelihood and consequence. For instance, high winds can increase the mechanical stress on conductors, raise the probability of contact between lines and vegetation, and accelerate fuel drying and spread likelihood near utility infrastructure.

Fire indices and modeling can help make sense of multiple sources of information. Wildfire detection can decrease the time between an ignition and a response. Mechanical and electronic systems require maintenance and calibration to continue as reliable sources of information. Planning, therefore, can connect awareness to action.

2.1 System Knowledge

Good situational awareness starts with knowing the elements of the system being monitored. Monitoring data becomes more useful as operators build a more complete picture of the equipment is located, what condition it is in, and what a failure at any point means for the rest of the system. System knowledge and monitoring capabilities can develop together, each making the other more effective.

Accurate maps of infrastructure form the geographic foundation of system knowledge, covering lines, equipment, and other assets with particular attention to infrastructure in, or near, high-risk areas.[6] Geographic Information System (GIS) platforms, computer-aided dispatch (CAD) systems, and other digital tools allow utilities to layer real-time monitoring data on top of infrastructure maps, connect field conditions to specific equipment, and make that information accessible across the organization. The analytical capability that digital platforms add is significant, but it depends on the accuracy of the underlying geographic record, which any well-maintained map, paper or digital, must provide.

However, system knowledge goes beyond what maps and records can capture. Records and data systems cannot easily capture some forms of system knowledge. For example, they cannot capture the way a specific canyon funnels wind differently than regional weather models show, which stretch of electrical line has historically been problematic in ways that predate current records, or how equipment behaves under conditions that appear infrequently. Operators and field crews who have worked the same territory through multiple fire seasons often carry this knowledge, and it adds context that documented data may not fully reflect.[7] Structured debriefs and knowledge-transfer processes keep that knowledge available as staff changes over time.[8] Utilities that do not currently have a formal process for capturing and transferring experiential knowledge should evaluate whether key system knowledge, particularly knowledge held by staff approaching retirement or transition, is documented in a form that will survive personnel changes. An annual documented debrief following fire season, focused on what conditions were observed and what responses worked, is a practical starting point.

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[6] Advisory Opinions to Publicly Owned Electric Utilities and Electrical Cooperatives, WSAB, pages 11–13.

[7] Analysis of Risk Perception and Treatment Options, USDA-FS.

[8] Cross-Generational Knowledge Transfer.

A utility without complete maps of its high-risk infrastructure should complete them as the foundational step in building a situational awareness program. Once maps are complete, the next priorities are ensuring they are accessible during an event and that experiential knowledge held by experienced staff is documented before staff turnover occurs. System knowledge requires ongoing maintenance: infrastructure changes, vegetation management alters fuel loads, and staff changes over time.

2.2 Grid Monitoring

Grid monitoring helps utilities track conditions and equipment behavior that can lead to a fire ignition, giving operators information that may be used to intervene before those conditions lead to a fault or ignition. Operators look for two broad categories of warning signs: (1) physical conditions observed in the field, such as unusual stress on equipment, vegetation encroaching on lines, or damaged hardware; and (2) electrical anomalies detected through monitoring systems, such as abnormal current or voltage patterns that signal a problem developing in the grid.

Patrols and inspections are one form of grid monitoring. All utilities patrol and inspect their facilities. However, turning observations into actionable information requires a clear reporting process. Radio calls and verbal reports can form a functional reporting system when crews have clear guidance on what to report, how to report it, and to whom. Some utilities have field observer programs that train crews to recognize specific warning signs and follow standard reporting.[9] Electronic reporting tools can transmit field crew observations directly to operations centers and mapping platforms, getting it to decision-makers faster. In rural areas where cellular coverage, internet access, or satellite connectivity is limited or unavailable, radio and verbal reporting are often the most reliable communication methods and utilities operating in these areas should build their reporting processes around what works consistently in the field.

Patrol frequency can reflect current fire weather conditions, with increased frequency for high-risk circuits during elevated fire weather and red flag periods. Utilities can define patrol schedules in advance and adjust them as a defined response to fire weather triggers rather than on an ad hoc basis.

Field observation is periodic: crews observe conditions when they are in the field, which means developing faults or equipment stress that emerges between visits may go undetected until the next patrol. Continuous monitoring tools address this limitation by providing persistent visibility into grid conditions at specific locations or across distribution circuits without relying on scheduled crew visits.

These tools, including supervisory control and data acquisition (SCADA), phasor measurement units (PMUs), advanced metering infrastructure (AMI), radio frequency sensors, and pole-mounted sensors, generate a persistent stream of data on grid behavior without relying on scheduled crew visits. Each of these tools operates differently and covers different

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[9] Wildfire Mitigation Maturity Model, Energy Safety, Capability 9, page 19.

parts of the system, but all share the characteristic that they are watching continuously rather than periodically.

SCADA systems give operators a real-time view of the electric grid from a central control room.[10] SCADA collects data on electricity flow—load, voltage, and equipment status—and can flag abnormal conditions that may signal equipment stress or growing ignition risk.[11]

PMUs can be installed at substations and on transmission and distribution lines to measure voltage magnitude, voltage angle, current, frequency, and rate of change of frequency at high resolution, typically many times per second, synchronized by global positioning system (GPS) timing. GPS-synchronized timing allows operators to compare measurements across locations in real time and detect grid dynamics that SCADA's lower update rate may not resolve. For wildfire risk management, PMUs are most commonly deployed at the transmission and substation level, where they can provide early warning of equipment stress, unusual loading patterns, and phase deviations that may precede a fault. Distribution-level PMU deployment is less common due to cost and the availability of other continuous monitoring options at that level. Utilities that operate transmission infrastructure or large substations in high fire-risk areas should evaluate whether PMU data would improve the precision and speed of their grid awareness at those locations.

AMI, also known as smart metering, extends monitoring to individual customer meters, beyond the substation and feeder level where SCADA typically operates.[12] SCADA tracks conditions across main distribution circuits, providing visibility into load, voltage, and equipment status at the feeder level. AMI reaches the individual meter locations distributed throughout those circuits, capturing data on conditions that feeder-level monitoring does not directly observe. On circuits in high fire-risk areas, where conditions at the far ends of lines may differ meaningfully from what substation-level data shows, this additional visibility can be operationally significant. Utilities that already deploy AMI for billing or outage management purposes should evaluate whether that data is currently being used for fire risk monitoring and whether early fault detection analysis is applied to circuits in high fire-risk areas.

Early fault detection systems watch for unusual current or voltage patterns that may signal equipment problems or vegetation contact, catching these before an outage or ignition occurs.[13] Radio frequency (RF) sensors monitor partial discharge on distribution lines. Partial discharge consists of small electrical discharges that occur when conductors or insulation begin to degrade, before that degradation produces a detectable fault. RF sensors monitor distribution circuits on an ongoing basis, providing real-time detection of insulation degradation at sensor locations along the circuit from the substation to the ends of branches. On aging infrastructure or circuits with known insulation concerns in high fire-risk areas, RF

[10] Overview of SCADA Systems, Emergency Preparedness Partnerships.

[11] Situational Awareness for SCADA Systems.

[12] Advanced Metering Infrastructure.

[13] Autonomous Technique for Early Fault Detection.

sensors can add a layer of precursor detection. They identify insulation degradation before it produces the current or voltage anomalies that AMI and fault detection systems are designed to catch. Acting on these early signals allows utilities to investigate, adjust equipment settings, or schedule targeted inspections before conditions get worse.

Pole-mounted sensors report measurements at regular intervals and build a record of conditions which can provide location-specific visibility into how the grid behaves under field conditions. Devices such as Gridware's GridScope provide location-specific monitoring of physical conditions at the pole, including vibration, tilt, and conductor movement, alongside electrical measurements, giving operators visibility into mechanical stress and environmental conditions that network-level monitoring does not capture.[14] As operators work with sensor data across multiple fire seasons, they develop a clearer picture of what normal looks like at each location, and what deviations are worth acting on. That accumulated understanding is what turns data into reliable operational judgment over time.

Dashboards that bring together SCADA readings, sensor alerts, AMI anomalies, and field reports give operators a unified picture during high-risk periods—one that no individual data source can provide. Each source becomes more useful when integrated with the others, and that unified view supports faster decisions about equipment settings, crew deployment, and whether to shut off power to at-risk lines.[15]

Utilities evaluating continuous monitoring technologies should assess two practical constraints alongside the monitoring benefit: staffing to interpret and act on the data the tools produce, and communication infrastructure to transmit that data reliably from the field to operations staff. Most continuous monitoring equipment transmits through cellular connections, which may be limited or unavailable in rural or remote areas. Where cellular coverage is insufficient, utilities should evaluate alternative communication options such as satellite links, mesh radio networks, or periodic manual data retrieval.

A utility building a grid monitoring program should start with what it can operate reliably. All utilities already conduct field patrols and inspections. Crews should know what conditions to look for, how to report what they find, and who has authority to act on those reports. Continuous monitoring technologies—SCADA, PMUs at substations and transmission infrastructure, AMI and RF sensors across distribution circuits, and pole-mounted sensors on high-risk circuit segments—add depth and persistence. They also help utilities catch conditions that develop between crew visits and at locations where field observation is infrequent. Dashboards become useful when there are multiple data streams to integrate.

2.3 Environmental and Weather Monitoring

Environmental and weather monitoring help utilities assess both the likelihood of ignition and the consequence if one occurs. Wind, temperature, humidity, terrain, fuel type, and

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[14] Wildfire Mitigation Technologies Database, EPRI: Line Sensing.

[15] Wildfire Mitigation Maturity Model, Energy Safety, Capability 27, page 37.

vegetation dryness all influence whether a fault leads to an ignition of a fire and how fast a fire spreads if it does.

Publicly available weather products give every utility a free, reliable starting point for fire weather awareness. National Weather Service forecasts, fire weather outlooks, and Red Flag Warnings (RFWs) are the most widely used products and are available to any utility. RFWs signal that a combination of low humidity, high winds, and dry fuels is expected to create dangerous fire conditions.[16,17] Many utilities use RFWs as a trigger to implement PEDS, evaluate preemptive de-energization, and increase operational readiness. These warnings cover broad areas and although they may miss local variations, they provide a useful, accessible signal for any utility at any level of monitoring sophistication. Integrating forecasts and real-time data requires expertise that can be built over time.

Weather stations give utilities direct measurement of the atmospheric conditions—temperature, humidity, wind speed, and wind direction—that drive ignition risk and fire behavior. Utilities deploy weather stations in configurations designed to capture those conditions most accurately in their specific territory.

Determining the right weather station configuration requires two related decisions: (1) where to place stations, and (2) how many are needed to capture meaningful variation across the territory. Fixed ground-based stations work best at ridge tops, canyon entrances, and elevation changes: locations where wind accelerates, temperature and humidity shift sharply, and fire weather tends to concentrate.[18] A single station may be adequate for a utility with a compact, topographically uniform service territory, while a utility with complex terrain, multiple drainages, or significant elevation change across its service area, may find that conditions in one part of its territory differ substantially from conditions in another. Utilities should evaluate whether their current station coverage is sufficient to detect those variations.[19]

Pole-mounted weather sensors attach directly to distribution infrastructure, measuring conditions at the equipment they protect.[20] Pole-mounted sensors complement fixed ground-based stations by capturing weather conditions at specific line locations, which may differ from what a nearby station records or what a regional forecast predicts. Portable units can be moved to areas of concern or used to fill gaps during high-risk periods.

California's large investor-owned utilities have built extensive weather station networks across their service territories, and much of the data those networks produce is publicly available through utility weather data portals, the San José State University Wildfire Interdisciplinary Research Center (WIRC), and the Wildfire Forecast and Threat Intelligence

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[16] Types of Fire Weather Forecasts, NWCG.

[17] Watches and Warnings for California, NWS.

[18] Wildfire Mitigation Technologies Database, EPRI: Micro Weather Stations.

[19] Fire Danger Rating Network Density, USDA-FS.

[20] Wildfire Mitigation Technologies Database, EPRI: Line Sensing.

Integration Center (WFTIIC).[21, 22, 23, 24, 25] Smaller public utilities and cooperatives should evaluate what is publicly accessible. If the data is not accessible, a utility may find opportunities to access or share that weather information by reaching out to utilities neighboring its territory. POUs that collect their own weather station data should also evaluate whether sharing that data publicly or with neighboring utilities would improve situational awareness in the region. Participation in regional data-sharing networks is a good way to both access data and contribute to the collective awareness which benefits all utilities operating in the shared fire landscape.

Combining data from a utility's own weather stations with regional fire weather forecasts gives operators a more complete and locally grounded picture of near-term conditions than either source provides on its own. Some utilities go further by engaging dedicated meteorologists, on staff or under contract, who use these combined data sources to assess ignition likelihood at the circuit level and monitor conditions around the clock during high-risk periods.[26]

Dry vegetation is one of the primary reasons fire spreads quickly. Tracking when fuels reach critically dry levels is one of the most direct ways utilities can assess fire spread potential. Publicly available fuel moisture data from the National Fuel Moisture Database, California Department of Forestry and Fire Protection (CAL FIRE), and WFTIIC can provide a general picture of fuel conditions across a utility's territory.[27, 28] Utilities can also sample fuel moisture along their own corridors to track local conditions more precisely.[29] This sampling could occur at regular intervals, especially leading into and during fire season, or through continuous monitoring sensors that can combine with weather station data. The Electric Power Research Institute (EPRI) publishes an environmental monitoring database that catalogs various tools and approaches.[30]

Not all environmental intelligence comes from instruments. Relationships with local fire agencies give utilities access to on-the-ground knowledge—terrain-specific patterns, historical fire behavior, and direct awareness of conditions as they develop—that technical monitoring tools may not capture. Established points of contact at local fire agencies and predefined notification procedures allow utilities to receive timely information when a fire

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[21] Weather and Fire Detection, PG&E.

[22] Weather and Fire Detection, SCE.

[23] Weather Awareness System, SDG&E.

[24] Weather, WIRC.

[25] Wildfire Forecast and Threat Intelligence Integration Center.

[26] Wildfire Mitigation Maturity Model, Energy Safety, Capability 17, page 26.

[27] Fuel Moisture Database, WIRC.

[28] Wildfire Forecast and Threat Intelligence Integration Center.

[29] Fuel Moisture Sampling, NWCG.

[30] Wildfire Mitigation Technologies Database, EPRI: Environmental Monitoring.

starts near their infrastructure. Relationships with local fire agencies also support joint planning, shared exercises, and coordinated response when an event occurs.[31]

Every utility operating in a high fire-threat district should monitor NWS forecasts and RFWs. A utility that already does that should evaluate whether weather station data, its own or from neighboring utilities, would give it more precise local information than regional forecasts provide. A utility with weather station data should also evaluate whether fuel moisture sampling along its own corridors would improve the accuracy of its fire spread assessments. Each step adds precision. The question at each stage is whether that precision changes operational decisions. For most utilities operating in high fire-risk areas, it will.

2.4 Fire Indices and Modeling

Grid monitoring produces information about ignition likelihood, and environmental and weather monitoring produces information about fire behavior and severity. Fire danger rating systems, risk indices, and wildfire spread modeling tools take those inputs and translate them into integrated risk assessments that utilities can act on directly. These systems, indices and modeling tools can inform decisions about patrol frequency, PEDS, preemptive de-energization, and crew pre-positioning. Fire danger rating systems, risk indices, and spread modeling tools each represent a distinct approach, and utilities can use them individually or in combination depending on their data infrastructure and operational capacity.

The National Fire Danger Rating System (NFDRS) and the Fosberg Fire Weather Index (FFWI) are publicly available tools that combine weather and fuel data into single measures of fire potential.[32] Both the NFDRS and the FFWI operate at a regional scale. In California, NFDRS ratings cover broad fire weather zones that may encompass portions of multiple utility service territories. FFWI values are calculated from weather observations at fixed stations, which may be located miles from a utility's infrastructure. In areas with complex topography, a station several miles away may not accurately represent local conditions at the line. Both indices typically update once or twice daily, which means they are most useful for tracking broad trend conditions and setting general operational posture rather than for making precise, real-time decisions about specific circuits. The systems typically update ratings once or twice daily. This means both indices are most useful for tracking broad trend conditions and setting general operational posture instead of making precise, real-time decisions about specific circuits or equipment locations.

The NFDRS draws on weather conditions, fuel type, and historical fire activity to produce fire danger ratings. The FFWI focuses on how weather conditions (temperature, humidity, and wind) affect how a fire would behave if one started.[33,34] Both produce straightforward ratings that require no specialized modeling expertise to generate. Using them effectively, however,

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[31] Wildfire Mitigation Maturity Model, Energy Safety, Capability 51, page 56.

[32] National Fire Danger Rating System, USDA-FS.

[33] Fire Weather Index.

[34] Weather Center, San José State University.

still requires utilities to define in advance what each rating level means operationally. Rating levels can determine which thresholds trigger patrol increases, PEDS, or heightened operational readiness.

Custom risk indices use system-specific data such as fuel maps, circuit-level vulnerability assessments, and past ignition records, to produce risk scores that reflect local conditions rather than regional averages.[35] Utilities that find regional indices too coarse to reflect the variation in conditions across their territory have two options for improving precision. The first option is to use the NFDRS or FFWI framework while substituting locally measured weather and fuel inputs for the regional averages the index would otherwise use. This can be done as an ongoing practice, improving the accuracy of each index calculation without requiring the utility to build a new index from the ground up. The second is to develop a custom fire potential index (FPI) that uses system-specific data, weights factors differently based on local conditions and historical ignition patterns and produces scores at the circuit or segment level. The first approach is more accessible for utilities with limited analytical capacity; the second offers more precision but requires more data infrastructure and ongoing maintenance. When utilities connect indices to monitoring dashboards with visual threshold alerts, the indices translate real-time data into clear signals that prompt operators to evaluate PEDS, consider preemptive de-energization of at-risk lines, or take other operational action.

A utility that does not currently use an FPI can begin with NFDRS or FFWI. These tools are free, require no specialized expertise, and provide an immediate basis for consistent operational decisions. The essential first step is defining, before fire season, what each rating level means: what index value prompts increased patrols, what prompts evaluation of equipment settings, and which prompts activation of preemptive de-energization protocols. These decisions should be made in advance so that operators are implementing a plan rather than developing one under pressure. A utility that is already using NFDRS or FFWI as a foundation and finds that regional ratings do not accurately reflect local conditions should evaluate whether substituting locally measured weather and fuel inputs would improve decision quality. A utility with the data infrastructure and analytical capacity to support it should evaluate whether a fully custom index, built on circuit-level data and past ignition records, would provide the precision its operations require.

Wildfire spread modeling uses weather data, fuel moisture, terrain, and vegetation type to simulate how a fire would move after ignition.[36] For utilities with the data infrastructure and technical expertise to support it, overlaying wildfire spread modeling results on infrastructure maps can inform crew pre-positioning, line de-energization sequencing, and coordination with emergency responders. Truckee-Donner Public Utility District and San Francisco Public Utility District are among the utilities that have integrated spread modeling into operational protocols during high-risk periods, using model outputs to guide decisions about which

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[35] Wildfire Risk Indices & the Built Environment.

[36] Wildfire Mitigation Maturity Model, Energy Safety, Capability 5, page 16.

circuits to de-energize and where to stage crews in advance of deteriorating conditions. Model outputs inform decisions by utility operations staff about whether to implement PEDS, de-energize at-risk lines, where to pre-position crews, and how to sequence response as conditions develop. The utility's role in detection is to confirm that an ignition has occurred and notify fire agencies as quickly as possible. Fire suppression is the responsibility of those agencies. The faster that notification reaches them, the faster suppression resources can be deployed.

2.5 Wildfire Detection

Every minute between an ignition and a suppression response affects how far a fire travels and what lies in its path. A wildfire detection program is created to close the gap between when an ignition occurs and when fire agencies receive confirmed notification and can deploy suppression resources.

The foundation of any detection program is a clear, predefined path from observed ignition to fire agency notification. Field crews trained to recognize and report suspected ignitions provide direct and reliable detection capability, but the value of that capability depends on how clearly notification procedures understood and practiced. When crews know in advance who to contact at fire agencies, what information to provide, and who within the utility has responsibility to initiate the notification, the path from observation to suppression response is shorter and less prone to delay. Research on emergency response consistently shows that predefined protocols reduce decision time under pressure.[37] Knowing in advance what a suspected ignition triggers keeps the response moving toward suppression without delay.

A utility that does not yet have defined notification procedures—written contacts, clear reporting steps, and assigned decision authority—should establish those before investing in any detection technology. Predefined procedures are the foundation that makes everything else work.

A utility with predefined procedures should evaluate camera-based detection. Technology extends detection reach, particularly in areas where access is challenging for field crews. Camera-based systems such as Pano AI and ALERTWest scan wide areas for smoke and flame, operating with minimal human oversight and sending confirmed detections to utility operations centers and fire agency partners simultaneously.[38, 39] Satellite-based monitoring covers large geographic areas and can serve utilities with infrastructure in remote terrain, though it requires more resources to operate than ground-based systems.[40, 41] Utilities evaluating camera-based or satellite-based detection systems should consider several factors: the geographic coverage a given network provides relative to their high-risk

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[37] Decision-Making During High-Risk Events.

[38] AI-Powered Wildfire Detection and Situational Awareness, Pano.

[39] ALERTWest Wildfire Camera Network.

[40] Wildfire Mitigation Technologies Database, EPRI: Smoke Detection.

[41] Wildfire Mitigation Maturity Model, Energy Safety, Capability 10, page 20.

infrastructure, detection latency—how quickly a confirmed ignition alert is generated after smoke or flame appears—false alarm rates and the filtering methods the system uses to reduce them, integration capability with existing operations center tools, and total cost including installation, subscription or licensing fees, and ongoing maintenance. ALERTWest operates as a shared network, which may reduce per-utility cost compared to deploying a proprietary system independently. EPRI's wildfire mitigation technology database includes comparative information on detection system performance that can support evaluation decisions.[42]

Using multiple detection methods and cross-referencing data across those methods to filter false alarms and confirm real events reduces the risk that an actual ignition goes undetected. Automated notification systems that alert fire agencies the moment an ignition is confirmed compress the time between detection and suppression response, which is what the entire detection program exists to accomplish.

2.6 Maintenance and Calibration

Utilities should establish and execute maintenance and calibration programs for all monitoring equipment they operate. The specific maintenance and calibration a utility needs to perform depends on the monitoring tools it operates. A utility running a weather station network and integrated sensor platforms has different upkeep requirements than one relying primarily on field crew observation and public forecasts, but both need consistent processes to ensure the information they act on is accurate.

Weather stations and pieces of grid monitoring equipment each have specific maintenance and calibration requirements. Physical maintenance addresses equipment condition and operability: wind sensors can accumulate debris and develop mechanical wear that distorts readings, and physical components require periodic inspection and replacement.[43] Calibration addresses measurement accuracy: temperature and humidity sensors drift over time and need periodic recalibration against known reference values to ensure the data they produce remains reliable. Fault detection systems and grid diagnostic tools require regular testing to confirm they catch anomalies accurately. Utilities should follow maintenance and calibration schedules based on manufacturer guidance, environmental conditions at each location, and how critical that location is to overall monitoring coverage.

Consistent documentation and written protocols keep maintenance reliable across the organization. Maintenance schedules should reflect the manufacturer's guidance, the environmental conditions at each location, and how critical that location is to overall monitoring coverage. Calibration records that document when technicians performed work, what they adjusted or replaced, and who signed off, create accountability, and help surface patterns in how equipment performs over time. Written protocols with assigned ownership,

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[42] Wildfire Tool Evaluation, EPRI.

[43] Wildfire Mitigation Technologies Database, EPRI: Line Sensing.

schedules, and checklists, ensure that maintenance does not depend on any single person to remember, and that it continues reliably as staff changes over time.[44]

Camera systems and networked sensors require both physical upkeep and information technology (IT) support. Most networked monitoring equipment transmits data through cellular connections, making cellular coverage a practical constraint for utilities with infrastructure in areas where signal is limited or intermittent. Satellite communication links provide an alternative where cellular coverage is unavailable, but the cost of satellite-connected equipment is significantly higher. Utilities can map communication coverage with their monitoring coverage to identify locations where data transmission may be unreliable. Managing software updates, connectivity issues, and cybersecurity risks associated with networked monitoring equipment requires technical expertise, whether that expertise resides within the organization or comes through a service contract.[45] Regularly testing communication pathways between field equipment and central dashboards catches failures before they affect operational decisions.

Backup procedures allow utilities to maintain situational awareness when equipment fails or produces unreliable data. For utilities with simpler monitoring programs, backup procedures may be as straightforward as knowing which regional data sources to consult and ensuring operators know when to treat available data with added caution. More complex programs may include cross-referencing readings from nearby stations or deploying portable monitoring units to fill the gap. For utilities with limited maintenance staff, concentrating upkeep resources on the equipment most critical to monitoring coverage in high-risk areas is a practical way to maintain program reliability. Notifying operators promptly when equipment goes offline lets them account for the missing data when reading and acting on what remains available.

3. PROTECTIVE EQUIPMENT AND DEVICE SETTINGS

Utilities can reduce wildfire risk by making protective equipment and devices more sensitive during periods of elevated wildfire risk. This practice is referred to as protective equipment and device settings (PEDS).[46, 47] For the purposes of this report, PEDS includes changing settings on adjustable protective devices such as automatic circuit reclosers and reclosing fuses[48] that can be set to “one shot” operation and excludes nonadjustable devices such as traditional fuses. The remainder of this section describes PEDS, outlines how utilities implement PEDS in wildfire mitigation, and shares existing common practices and potential

[44] Wildfire Mitigation Maturity Model, Energy Safety, Capability 20, page 29.

[45] Situational Awareness for Electric Utilities, NIST.

[46] Wildfire Mitigation Plan Guidelines, Energy Safety, page A-14.

[47] Protective Equipment and Device Settings (PEDS), CPUC.

[48] BVES 2026–28 Wildfire Mitigation Plan, page 131.

considerations when utilities use PEDS. PEDS can reduce reliability. A utility will have to determine how to appropriately balance reliability with reducing wildfire ignition likelihood.

3.1 Protective Equipment and Devices

Utilities use a variety of protective equipment and devices to interrupt power flow whenever a fault or other unwanted condition is detected on the system.[49] These include circuit breakers, sectionalizers, and switches, along with control relays and sensing equipment and devices. Protective equipment and devices primarily protect system components from potentially damaging situations, such as overcurrent and over-voltage, to help prevent broader power outages. These equipment and devices also provide safe working conditions when workers are performing maintenance on or around energized lines. When adequately coordinated with fuses and automatic circuit reclosers, a utility's protective equipment and devices serve as intentionally engineered "weak links" meant to save damaging more costly system components such as transformers.

Protection engineers have developed protection schemes to coordinate protective equipment and devices under normal operating conditions.[50] Protective equipment and devices work in concert to reliably detect faults, minimize the amount of energy flowing through a faulted line, and minimize the number of customers experiencing an outage. For example, utilities mitigate against injuries to line workers when working around energized lines by adjusting the settings of an upstream automatic recloser to be as sensitive to faults as possible, and by disabling reclosing. This setting is commonly referred to as a "hot line" mode or setting. It allows for near instantaneous de-energization of the line if a fault is detected.

Protection schemes can also reduce wildfire ignition risk. Wildfire ignition likelihood generally increases with fault energy and fault duration.[51] When delivering power in high fire-threat districts (HFTD)[52] or fire hazard severity zones (FHSZ),[53] utilities often develop procedures for adjusting the settings on protective equipment and devices to make them more sensitive and responsive.[54] Energy Safety and the California Public Utilities Commission (CPUC) characterize PEDS as a utility's capabilities and procedures for reducing wildfire risk by "significantly increasing the sensitivity of protective equipment and devices."[55, 56] With

[49] Power Distribution Planning Reference Book, pages 19 and 523–527.

[50] Current Best Practices on Wildfire Risk Reduction, PNNL.

[51] Technical Report on Protection Methods Used to Reduce Wildfire Risk, IEEE.

[52] High Fire-Threat District Map, CPUC.

[53] Fire Hazard Severity Zones Website, CAL FIRE.

[54] Wildfire Risk Mitigation.

[55] 2023–2025 Wildfire Mitigation Plan Technical Guidelines.

[56] Protective Equipment and Device Settings (PEDS), CPUC.

PEDS, utilities can de-energize lines when a fault is detected more quickly, thereby reducing fault energy, fault duration, and overall wildfire ignition likelihood.[57]

3.2 Using PEDS to Reduce Wildfire Risk

Many California utilities already mitigate wildfire risk by using PEDS and disabling reclosing under specific activation criteria. Of the 28 California POUs and cooperatives with overhead facilities in the HFTD, 24 (86%) report either disabling automatic reclosing under activation criteria (e.g., RFW,[58] local fire season, when burn permits are suspended) or keeping automatic reclosing disabled at all times. Four POUs or co-ops reported in their 2025 WMPs that they are working to install or replace older reclosers with newer, faster responding reclosers: Anza Electric Cooperative,[59] Redding Electric Utility,[60] Sacramento Municipal Utility District,[61] and Ukiah Electric Utility.[62] Three utilities reported the ability to adjust settings or differentiate between disabling automatic reclosing (one shot mode) and hot line settings: Glendale Water and Power,[63] Lassen Municipal Utilities District,[64] and Riverside Public Utility.[65] Truckee Donner Public Utility District reported that it is "actively assessing the implementation of fast curve settings on its reclosers"[66] and Healdsburg Electric Department has already implemented PEDS "during high-risk periods."[67]

Commonly known as "fast trip" settings and programs, PEDS used by California investor-owned utilities (IOUs) include Pacific Gas and Electric Company's (PG&E) Enhanced Powerline Safety Settings (EPSS), Southern California Edison's (SCE) Fast Curve (FC) Settings, and San Diego Gas and Electric's (SDG&E) Sensitive Relay Profile (SRP).[68] Table 1 lists representative equipment and devices used and their respective activation criteria. Stanford University researchers used the combination of PEDS and disabled reclosing in high fire-risk conditions as a key marker of utility WMP maturity when they compared wildfire mitigation efforts across utilities.[69]

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57 Wildfire Workbook Chapter Two, NARUC.

58 Red Flag Warning, NWS.

59 Anza Electric Cooperative 2025 WMP, page 31.

60 Redding Electric Utility 2025 WMP, page 42.

61 Sacramento Municipal Utility District 2023–2025 WMP, page 35.

62 Ukiah Electric Utility 2025 WMP, page 18.

63 Glendale Water & Power 2025 WMP, pages 7 and 22.

64 Lassen Municipal Utility District 2025 WMP, page 23.

65 Riverside Public Utilities 2025 WMP, page 23.

66 Truckee Donner Public Utilities District 2025 WMP, page 28.

67 Healdsburg Electric Department 2025 WMP, page 13.

68 Fast Trip Setting: California IOU Comparison.

69 Updated Look at Utility Risk and Mitigation.

Table 1. Table of Investor-Owned Utilities' PEDS Programs[70]

Utility	Program Name	Current Scope	Equipment and Devices Used	Activation Criteria (i.e., "if any of the following")
PG&E	Enhanced Powerline Safety Settings (EPSS)	HFTD / High Fire-Risk Areas (HFRA)[71] / select non-HFTD Buffer	Circuit Breakers, Line Reclosers, Fuse Savers	• Fire Potential Index (FPI) >= "R3" • Relative Humidity <20% • Projected wind speeds >=25 mph • Dead Fuel Moisture <9%
SCE	Fast Curve (FC) Settings	HFTD / HFRA	Circuit Breakers, Line Reclosers, Current-Limiting Fuses	• RFW declared by National Weather Service • Fire Weather Threat declared by SCE • Fire Climate Zone declared by SCE • Thunderstorm Threat declared by SCE
SDG&E	Sensitive Relay Profile (SRP)	RFW / PSPS	Circuit Breakers, Line Reclosers, Pad-mounted Fault Interrupters	• Extreme FPI • Forecasted PSPS events

Utilities using PEDS have reported reductions in wildfire risk. For example, using PEDS during high-risk fire conditions can be significantly "cost-effective at reducing wildfire damage to structures."[72] Figure 1 compares the effectiveness of PG&E's implementation of certain wildfire mitigation measures based on cost per avoided structure burned. In this study, PEDS was the most cost-effective wildfire mitigation measure.

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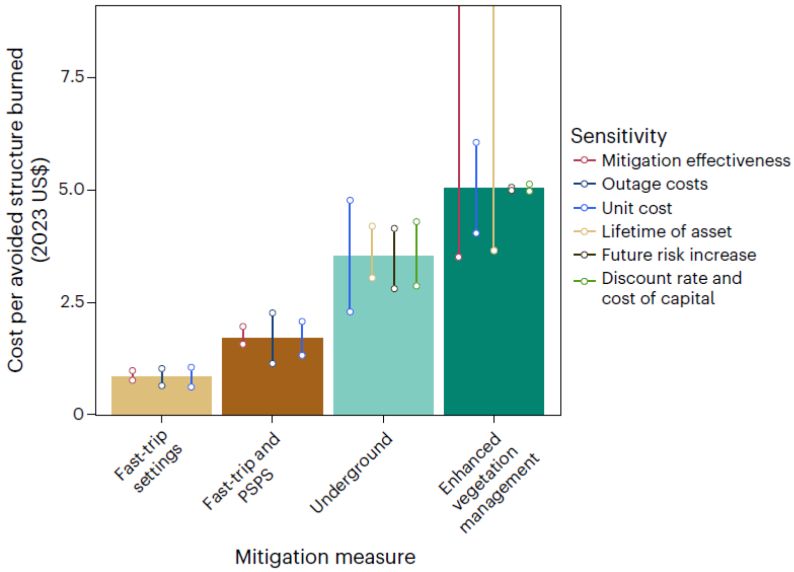
[70] Fast Trip Setting: California IOU Comparison.

[71] Wildfire Mitigation Plan Guidelines, Energy Safety, page A-8.

[72] Dynamic Grid Management Technologies Reduce Wildfire Adaptation Costs.

Figure 1. Cost Efficiency of Wildfire Adaptation Investments



Utility-led research has also measured how well PEDS reduces wildfire ignition risk.[73, 74] Utilities often use PEDS in conjunction with an established preemptive de-energization plan as part of a layered and cost-effective wildfire mitigation strategy.[75] For example, PG&E estimates using EPSS and Public Safety Power Shutoffs (PSPS),[76] what it calls PEDS and preemptive de-energizations, respectively, to reduce its wildfire risk by more than 60%. Figure 2 plots this calculated reduction in wildfire risk using a monetized risk score and modeled data to quantify both risk reduction and customer impacts.

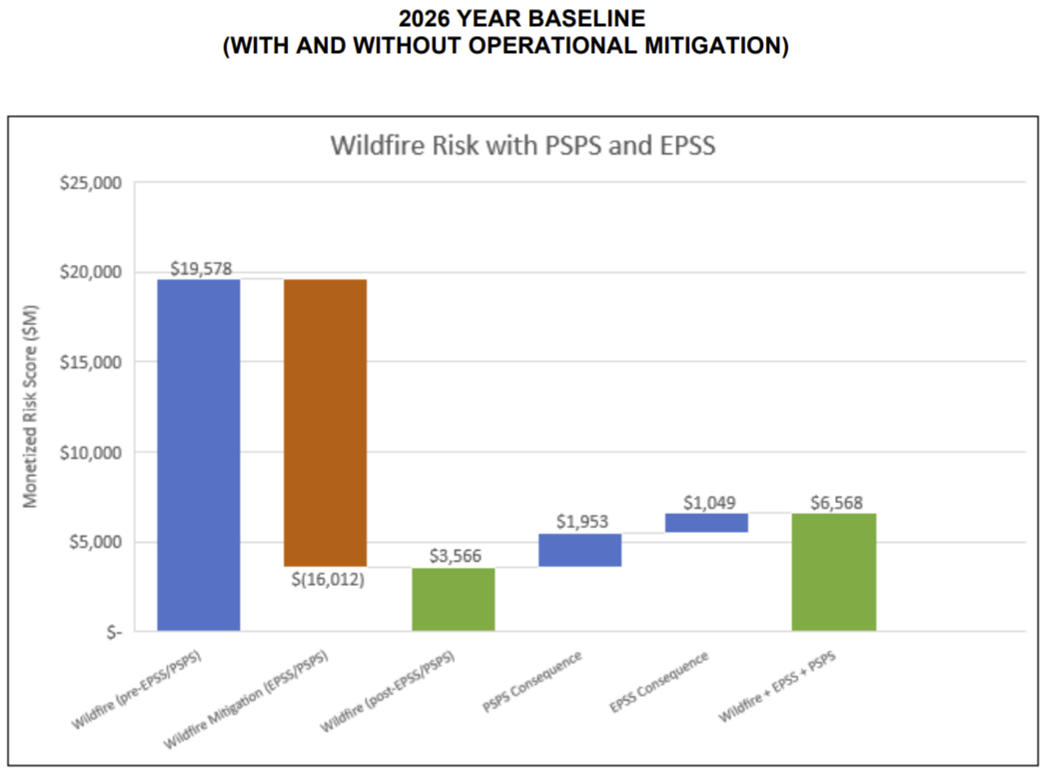
[73] PG&E 2026–2028 Wildfire Mitigation Plan, Volume 1, pages 134–137.

[74] Joint IOU Grid Hardening Working Group Report.

[75] Dynamic Grid Management Technologies Reduce Wildfire Adaptation Costs.

[76] Public Safety Power Shutoffs (PSPS), CPUC.

Figure 2. PG&E's Modeled Wildfire Risk with PSPS and EPSS[77]



3.3 Implementing PEDS

Utilities should evaluate and refine their choices to use PEDS for wildfire mitigation as new data, technologies, and lessons learned become available.[78, 79] As a starting point, any utility considering PEDS should have an inventory of its assets to determine the age, type, location, and adjustability of existing equipment and devices. An inventory establishes what is possible for a utility and helps to inform planning.

The following are examples of opportunities for a utility to establish and advance its use of PEDS. While there is no single protection recipe for starting up and building upon a PEDS program, the following examples are roughly ordered from simplest to the most involved.

3.3.1 Basic PEDS

Existing protective equipment and devices will allow for PEDS options: hot line settings or disabling automatic reclosing. A utility should define activation criteria for PEDS, for example, during times of higher wildfire risk, such as certain times of the year, local fire season, or

[77] PG&E 2026–2028 Wildfire Mitigation Plan, Volume 1, page 136.

[78] Current Best Practices on Wildfire Risk Reduction, PNNL.

[79] Powerline Bushfire Safety Taskforce: Final Report.

forecasted and observed high-risk weather conditions such as RFWs or high Santa Ana Wildfire Threat Index[80] (SAWTI) ratings.[81]

3.3.2 Upgrading Equipment and Devices

A utility intent on improving its PEDS capabilities may want to upgrade older (e.g., slower responding) or outdated protective equipment and devices with modern and more capable versions. Modern protective equipment and devices allow for more rapid reaction to faults, more system information, potential for remote control (e.g., SCADA), and greater selectivity in setting sensitivity.[82]

Adequate system protection requires equipment and devices that are compatible with one another so that downstream and upstream equipment and devices can be coordinated. For example, older electromechanical equipment and devices may not work well or integrate with newer microprocessor-based equipment and devices.[83] Wildfire risk mitigation may be improved with better protection coordination, which can require upgrading to ensure the protective equipment and devices work together as intended.

3.3.3 Protection Schemes for Harder-to-Detect Faults

For wildfire ignition risk, faults may be categorized by the path of current flow (either direct contact or arcing faults), and by the proximity of potential fuel to the electrical arc.[84] Faults are generally detected by the magnitude of their associated current (i.e., fault current).[85] The fault current is determined by the impedance of the fault and by the “ability of the power source to sustain the voltage” while an abnormal current is flowing through the fault.[86] Most faults are associated with high currents and low impedances. These large magnitude fault currents primarily endanger electrical equipment and are reliably detected by existing protective equipment and devices.

Conversely, fault currents associated with high impedance faults (HIF), which can also potentially ignite wildfire, are difficult to reliably detect because the observed fault currents may be too low (i.e., within normal operating limits). One study reported that anywhere from 5% to 32% of distribution faults are HIF, including down-conductors.[87] Utilities rely on

[80] Santa Ana Wildfire Threat Index, U.S.D.A. Forest Service and Predictive Services.

[81] Wildfire Mitigation Maturity Model, Energy Safety, Capability 27, page 37.

[82] Joint IOU Grid Hardening Working Group Report.

[83] Comparison of Protection Settings Used by Electrical Utilities.

[84] Technical Report on Protection Methods Used to Reduce Wildfire Risk, IEEE.

[85] Power Distribution Planning Reference Book, pages 523–524.

[86] Electric Power Systems, pages 188–194.

[87] High Impedance Fault Detection.

measurements other than fault overcurrent to help detect HIF, such as voltage differences between equipment and devices, current phase angles, and magnetic field intensity.[88]

Research on reliably detecting HIF is ongoing. Modern protective equipment and devices allow for improved detection of and response to faults that have historically been challenging to address, such as sensitive ground faults and HIF. Some utilities are piloting algorithms that use smart meter voltage data (e.g., AMI) to assess the effectiveness of HIF detection.[89] Other utilities are piloting new technologies to detect HIF, such as the Rapid Earth Fault Current Limiter (REFCL), to work in conjunction with PEDS.[90]

3.4 Additional Considerations

3.4.1 Older Protective Equipment and Devices

Older equipment and devices have limited setting adjustability compared to newer equipment and devices. For example, older automatic reclosers (e.g., with hydraulic control) may only have one "fast curve" option (i.e., faster responding) or offer limited storage for different sensitivity settings. In contrast, modern microprocessor-based or electronically controlled reclosers are more easily customized, including the flexibility to be programmed with a variety of "fast curve" responses. They also offer additional data logging and fault locating capabilities as well as expanded storage for multiple sensitivity settings. Furthermore, newer protective equipment and devices usually incorporate remote settings adjustment, while older protective equipment and devices require manual settings adjustment in the field. Efforts to upgrade equipment and devices may take years to plan and install and could be affected by supply chain challenges and workforce availability.

3.4.2 Transmission and Distribution Faults

There are several notable differences between transmission and distribution line fault behavior and wildfire ignition risk. For one, HIF are more prevalent at lower voltages (e.g., distribution lines).[91] Physical factors may also decrease relative ignition risk from transmission lines compared to distribution lines, including the proximity of vegetation to the lines, "height above ground, conductor spacing, and the stoutness of transmission construction."[92] While most of the discussion has focused primarily on distribution line applications, PEDS can also be applied on transmission lines.[93]

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[88] High Impedance Fault Detection.

[89] Joint IOU Grid Hardening Working Group Report.

[90] Rapid Earth Fault Current Limiter (REFCL) Projects, SCE.

[91] Technical Report on Protection Methods Used to Reduce Wildfire Risk, IEEE.

[92] Technical Report on Protection Methods Used to Reduce Wildfire Risk, IEEE.

[93] Glendale Water and Power 2025 WMP.

3.4.3 Ongoing Protection Coordination

PEDS and disabled reclosing likely supersede existing system protection coordination. Once a utility determines PEDS is appropriate, system protection coordination must also account for forecast load growth and continued fault isolation coordination. System expansion and load changes may alter the relationship between upstream and downstream equipment and devices and make the existing protection coordination less effective. In other words, the sensitivity and responsiveness of PEDS will likely need to be reassessed and re-engineered as electrical systems expand or energy demands change (e.g., inverter-based resources, distributed energy resources, data centers).[94, 95]

3.5 Addressing Reliability Impacts

Utilities balance safety and reliability when engineering power protection system schemes. Utilities using PEDS can develop procedures to address potential operational impacts, such as more frequent outages and de-energizations. Unlike preemptive de-energizations, outages due to PEDS are automatic and unplanned. Potential impacts may disproportionately affect remote communities and customers with access and functional needs (e.g., physical disabilities, chronic conditions, injuries, transportation disadvantaged).[96]

3.5.1 Refining PEDS Activation and Deployment Procedures

Specific environmental conditions that elevate wildfire risk, such as high winds, low fuel moisture, and high temperatures, can be established as triggers to disable reclosers and use PEDS to reduce ignition risk. Once thresholds for these conditions have been identified, a utility can use available situational awareness data (see Section 2) to inform when to implement PEDS. Extreme weather (e.g., extreme wind, low humidity) and dry fuel conditions often serve as signals for when to use PEDS. Improved situational awareness, supported by adequate risk identification and modeling, could inform dynamic use of PEDS rather than anchoring settings to a particular time of year.[97] More deliberate and precise use of PEDS can help limit the number of affected customers.

Risk identification allows a utility to determine where in its system it is appropriate to deploy protective equipment and devices and when to operationally adjust the sensitivity of its PEDS.[98, 99] Identifying circuits susceptible to dangerous fire weather conditions, like especially high wind gusts, can help determine whether a circuit should be further sectionalized and when PEDS should be activated. For example, POUs and co-ops that disable automatic

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[94] Data Center Growth and Grid Readiness.

[95] Impact of Renewables on Distribution Protection and Control.

[96] Government Code Section 8593.3.

[97] Fast Trip Setting: California IOU Comparison.

[98] Advisory Opinions to Publicly Owned Electric Utilities and Electrical Cooperatives, WSAB, pages 11–13.

[99] Wildfire Mitigation Plan Guidelines, Energy Safety, pages 99–101.

reclosing during the local fire season may begin to observe outages along a particular section of overhead distribution line. This outage information may help inform viable next steps, including reassessing that section's vegetation management or installing animal guards as well as potentially sectionalizing that circuit.

3.5.2 Outage Response

Ensuring timely response to outages is important. A utility can develop appropriate staffing levels and outage response procedures that are triggered by the same environmental thresholds used to implement PEDS. This can help ensure that the utility can support patrols of any tripped and de-energized lines before re-energization.

3.5.3 Outage Causes

Outage information can help a utility identify affected customers and inform its efforts to minimize reliability impacts.[100] For example, a utility can compare sustained interruption information when circuits are and are not using PEDS and, in combination with outage cause information, identify potentially susceptible sections of their system during certain extreme conditions like high winds.

PEDS can cause more outages due to incidents such as vegetation and animal contact. Measures to mitigate outage impacts can include the following:

- Targeted vegetation management
- Improved protection of conductors (e.g., covered conductor, animal and avian protection)
- Expanded installation of sensors that enable improved fault detection
- Battery back-up for eligible customers[101, 102]
- Procedures to minimize outage response time when PEDS are enabled.

Maintaining consistent and timely communication with potentially impacted customers is another important consideration. Most utilities already alert customers when an outage occurs, provide an estimated time of power restoration and regular updates to the restoration efforts, and notify customers when power is restored. Figure 3 shows a timeline for potential customer notifications in the event of a PEDS-related outage. Importantly, this idealized timeline also identifies when outage analysis should occur and the importance of communicating any relevant reliability improvements to address the outage cause.[103]

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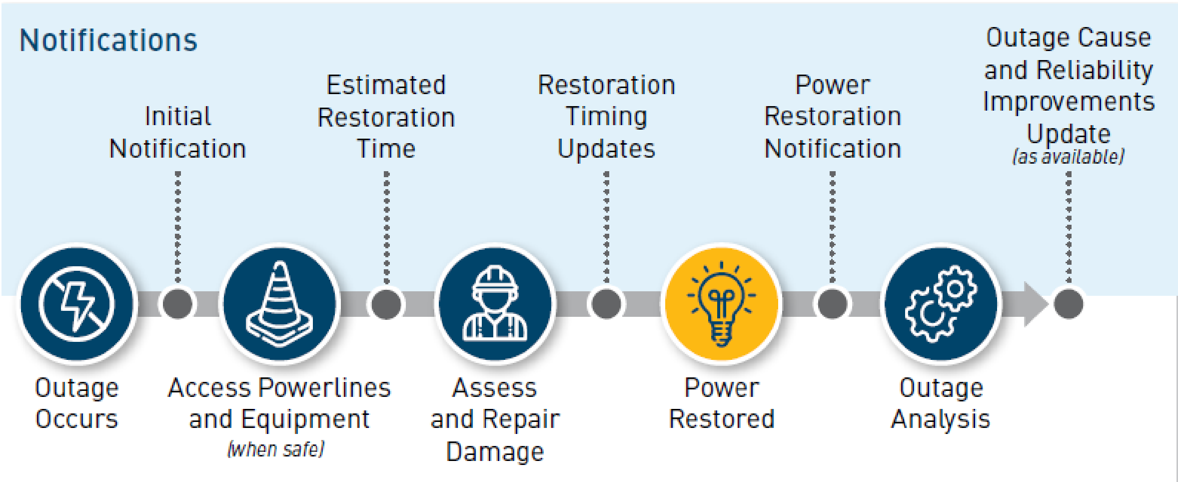
[100] Guide for Electric Power Distribution Reliability Indices.

[101] PG&E 2026–2028 Wildfire Mitigation Plan, Volume 1, page 335.

[102] SCE 2026–2028 Wildfire Mitigation Plan, page 474–475.

[103] Guidebook for Utilities, Version 2, pages 51–55.

Figure 3. Example Customer Communications Timeline for PEDS Outage[104]



[104] Guidebook for Utilities, Version 2, page 54.

4. CONCLUSION

This report describes options or steps for maturing utility wildfire mitigation strategies. Not all strategies are appropriate for all utilities. Utilities will select strategies based on their own risk, risk management, and constraints, such as budget and staffing. As technologies and current practices change, utilities should continue to review their options and strategies.

Situational awareness encompasses system knowledge, grid monitoring, environmental data, weather forecasting, detection capabilities, and models. A utility's situational awareness program may draw on any combination of these capabilities.

A program can initially be built on public weather forecasts, strong field observation, and solid agency partnerships. Programs should grow as risk, utility capacity, and available tools evolve. Utilities operating in high fire-risk areas with greater infrastructure exposure and organizational capacity may add grid monitoring equipment, weather stations, and fuel moisture monitoring. Dashboards, risk indices, modeling, and dedicated meteorological support can collect and make sense of multiple sources of information. Integrating real-time data and forecasts requires expertise that can be built over time. Utilities with strong grid and weather monitoring can add wildfire detection cameras. Maintenance and calibration are necessary to keep all equipment reliable.

The value of situational awareness depends on its connection to clear operational protocols and coordinated action with emergency partners. Checking data for accuracy, testing procedures through exercises, and learning from each fire weather event produce better and faster decisions when conditions deteriorate. Better decisions reduce both the chances that utility equipment starts a fire and the damage a fire causes when extreme conditions make ignition possible despite every precaution.

Utilities can reduce wildfire risk by using PEDS but must balance wildfire risk and reliability. Utilities interested in using PEDS in their operational procedures should start by inventorying their assets to determine the age, type, location, and adjustability of existing protective equipment and devices deployed in the system. A utility can use existing settings on protective equipment and devices—hot line settings and disabling automatic reclosing—when wildfire risk is higher, such as during RFWs or high SAWTI days. As a utility develops its situational awareness capabilities, it may identify additional environmental conditions as triggers for when to use PEDS, including high winds, low fuel moisture, and high temperatures.

As a utility continues to develop and mature its PEDS capabilities, it may want to upgrade older or outdated protective equipment and devices with modern and more capable versions. Doing so will allow a utility to react more rapidly to faults, collect more system information, control protective equipment and devices via SCADA, and offer more adjustability in sensitivity settings. A utility will need to ensure newer equipment and devices are compatible with one another so that system protection coordination is maintained. As newer protective equipment and devices are incorporated into the system, a utility may also consider layering new technologies along with PEDS to protect against historically hard-to-detect faults like sensitive ground faults and HIF.

Throughout a utility's development and use of PEDS, it should consider potential reliability impacts and mitigation options. A utility should ensure timely responses to and consistent and timely communication about outages, especially for remote communities and customers with access and functional needs. A utility can mitigate outage impacts in several ways, including targeted vegetation management, improved protection of conductors, and the development of procedures to minimize outage response time when PEDS is enabled.

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