2022 Wildfire Mitigation Plan

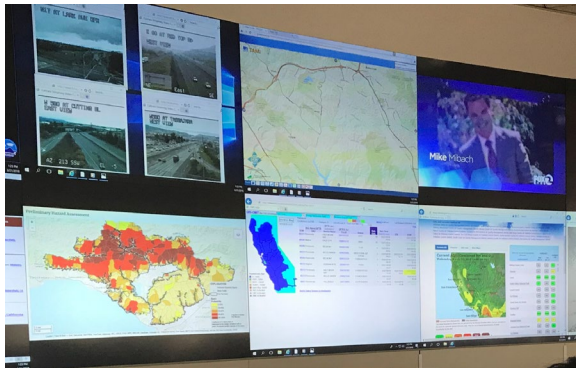
Risk Modeling & Assessment

Paul McGregor, Director

March 10, 2022

Together, Building
a Better California

Overview



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 for our Wildfire Distribution Risk Model;
- **MODELING** critical components of our transmission assets through the Wildfire Transmission Risk Model;
- **DEVELOPING** an initial PSPS Consequence Model at a circuit level; and,
- **DEVELOPING** spatial model visualization in our enterprise data management platform to inform EVM and System Hardening programs.

In 2022, we will continue building on this foundation to effectively make risk informed decisions in the planning and execution of wildfire risk reduction activities by:

- **DEVELOPING** additional models for equipment failure and foreign object contact ignition risk;
- **UTILIZING** the PSPS Consequence Model;
- **DEVELOPING** an approach on how to incorporate ingress/egress into risk modeling; and,
- **ACTIVELY PARTICIPATING** in the risk modeling working group led by Energy Safety.

2021 Wildfire Distribution Risk Model (Version 2)

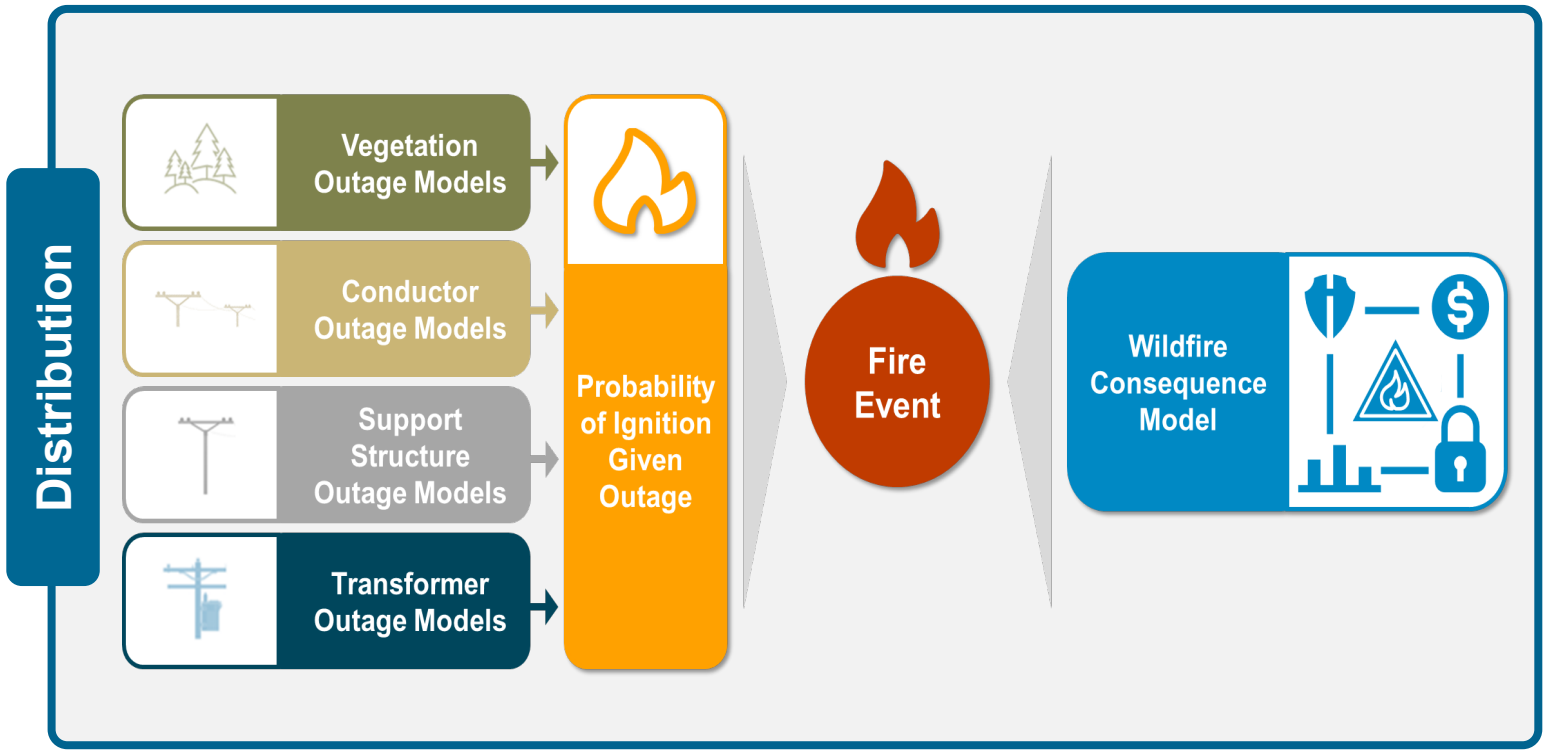
Our 2021 models quantified risk using the approach:

Risk = Probability (Ignition) x Wildfire Consequence

2022 Wildfire Distribution Risk Model (Version 3)

Our Version 3 models expand our analysis to include failures and their propensity to result in ignitions:

Risk = Probability(Outage) x Probability(Ignition Given Outage) x Wildfire Consequence



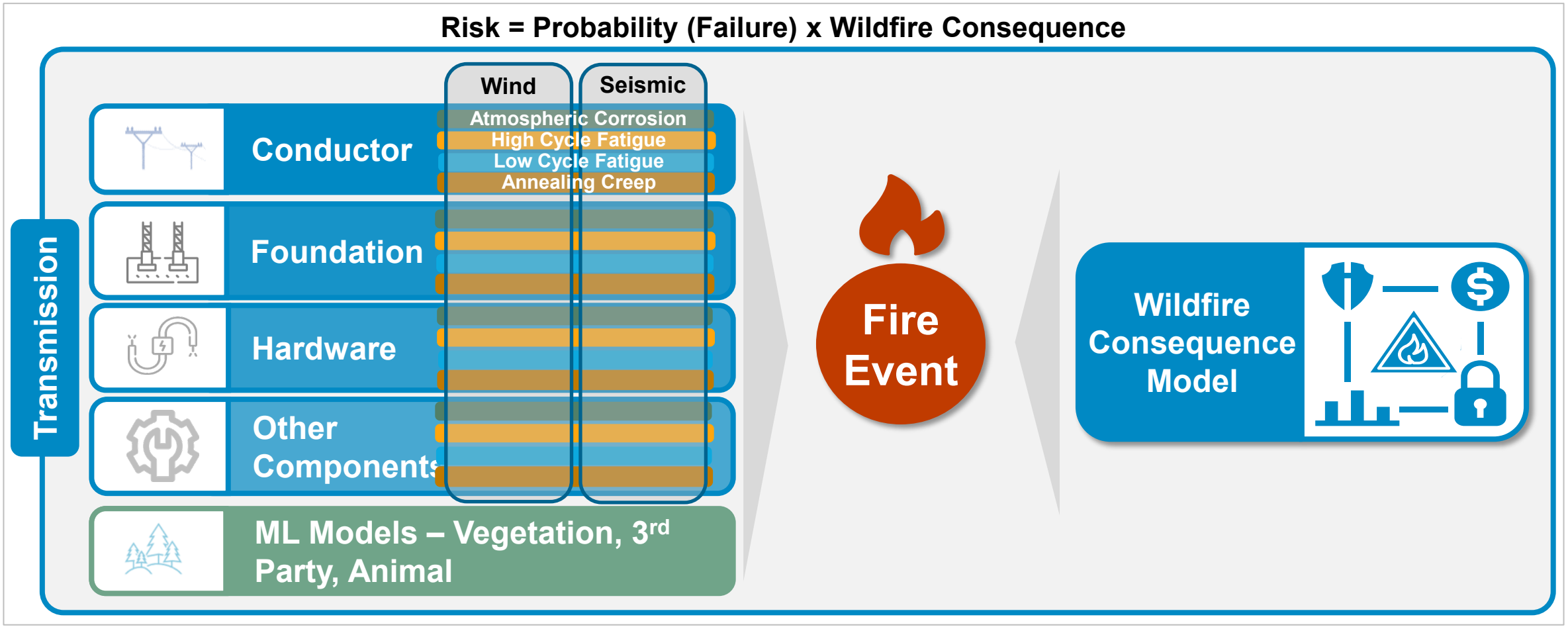
- Enhanced Vegetation Management Prioritization
- System Hardening Prioritization
- Undergrounding Prioritization
- EPSS Prioritization
- Repair Tag Prioritization
- Inspection Ordering & Cadence

Evolution of Wildfire Distribution Risk Models

		2019 WDRM v1	2021 WDRM v2	2022 WDRM v3
Probability	Exposure	HTFD T2/3	HTFD T2/3	**Service Territory**
	GIS Vintage	2018	2020	**2022**
	Risk Event	2015-2018 Ignitions	2015-2019 Ignitions	**2015-2020 Outages / Ignitions / Damages**
	Vegetation	Yes	Yes	Yes
	▶ LiDAR Data	No	No	**Yes**
	Conductor	Primary	Primary	Primary and Secondary
	Support Structures	No	No	**Yes**
	Transformers	No	No	**Yes**
	Compositing	No	No	Yes
	Mitigation Effectiveness	No	No	Yes
Consequence	Exposure	HTFD T2/3	HTFD T2/3	**HTFD + Burnable T1**
	GIS Vintage	2016	2019	**2022**
	Fuels	2012 LANDFIRE	2020 Fuels Snapshot	**2030 Forecast Growth**
	Simulation Duration	6 Hours	8 Hours	8 Hours
	Consequence Formulation	Reax Index	FBI >=2 and Acres >= 300 and Buildings >= 50, OR FBI >=3	**FPI >= R4, OR FL >= 5 and ROS >= 12**

2022 Wildfire Transmission Risk Model

Our Transmission Risk Models focus on the impact of Threats and Hazards on Failures related to Critical Component Groups:



Risk Spend Efficiency

Improving risk-based decision-making

- **EXPANDING** use of RSE for decision making to provide greater risk reduction per dollar invested, especially in system hardening mitigation selection;
- **MODELING** granular tranches based on the Wildfire Distribution Risk Model for RSE;
- **BENCHMARKING** with other CA IOUs with workgroups on risk scores and effectiveness used for RSE calculations;
- **DEVELOPING** RSE Governance team to standardize communications and application of RSE implementation;
- **ENGAGING** in ongoing developments in risk models and RSE calculations in WMP, S-MAP, RAMP, and GRC filings.

Mitigation Initiative Categories	RSE Scored
7.3.1 Risk Assessment and Mapping	2
7.3.2 Situational Awareness and Forecasting	10
7.3.3 Grid Design & System Hardening	19
7.3.4 Asset Management and Inspections	9
7.3.5 Vegetation Management and Inspections	4
7.3.6 Grid Operations and Protocols	6
7.3.7 Data Governance	-
7.3.8 Resource Allocation Methodology	-
7.3.9 Emergency Planning and Preparedness	1
7.3.10 Stakeholder Cooperation and Community Engagement	-
Grand Total	**51**

Initiative Targets

2022 Initiative Targets	Date
Develop additional Equipment/Facility Failure (EFF) and **Contract From Object (CFO)** sub-models and assess effectiveness to enhance the WDRM.	12/31/2022
Develop Threat and Hazard (risk drivers) sub-models and asses if sub-models are to be included in the WTRM.	12/31/2022
Conduct an assessment of the PSPS Consequence model to determine if it is fit for use to inform PSPS mitigation plans to minimize customer impact.	6/1/2022
Develop an approach on how to incorporate ingress/egress into the Wildfire Consequence Model.	12/31/2022
Evaluate an approach to incorporate "Resistance to Control" into the Wildfire Consequence Model.	12/31/2022
Evaluate running the FPI and IPW Models with the ensemble mean output of the POMMS-EPS.	9/1/2022
Develop and share RSE Governance Process with Energy Safety.	9/30/2022

Questions & Feedback

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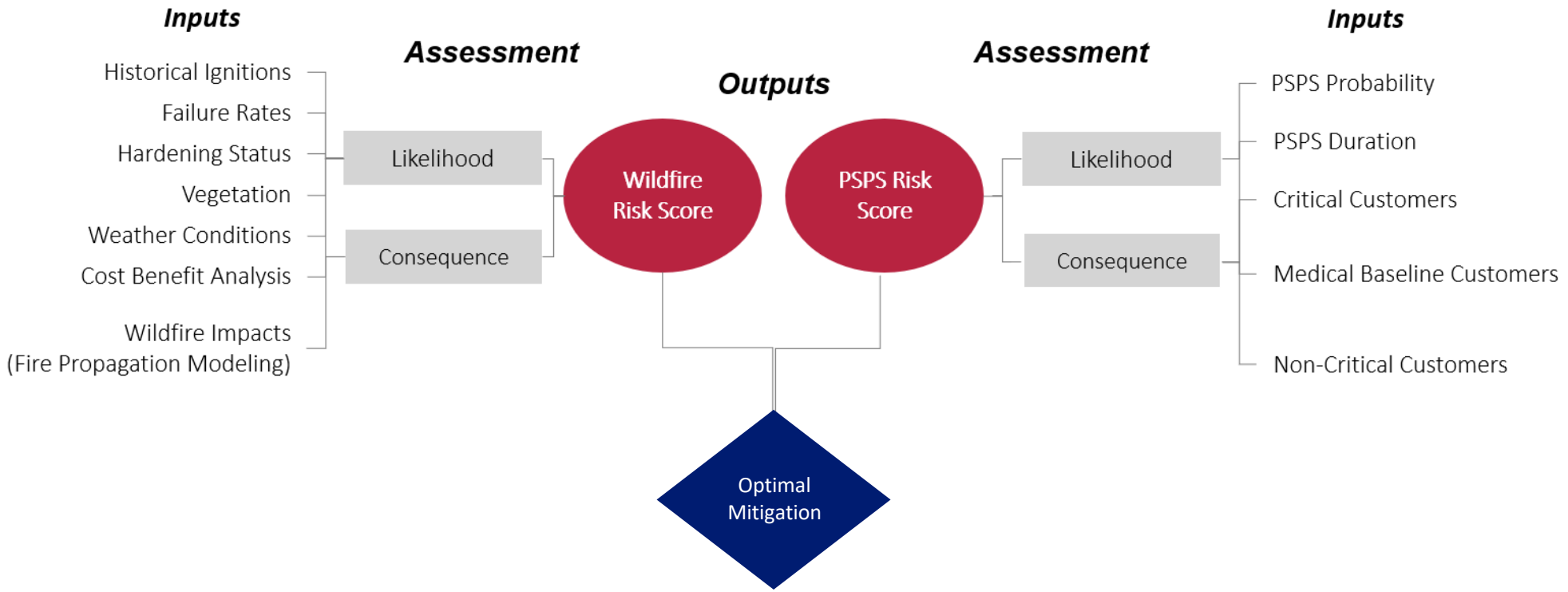
Risk Modeling & Assessment

Nisha Menon
Team Lead, Wildfire Regulatory Analytics Team Lead

Risk Assessment – WiNGS Planning Model

Wildfire Next Generation System (WiNGS)



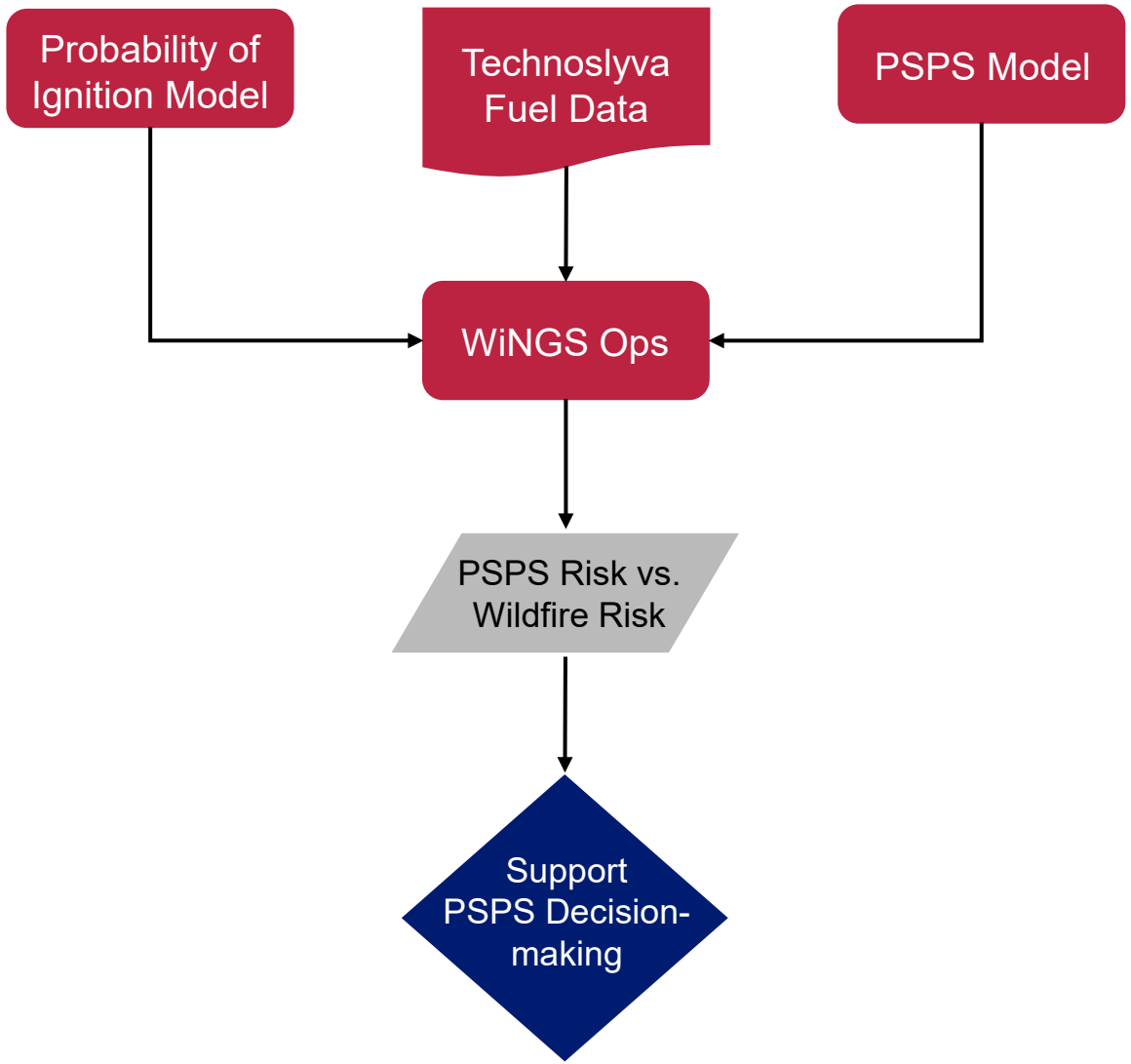
2021 Accomplishments

- **Initiated automation** of WiNGS Planning
- Investigated and refined risk calculation methodologies & model assumptions
- Developed **proof of concept tool** for visualization

2022 Planning

- **Increase automation** of risk modeling
- Update & incorporate **broader range of input** in risk assessments & PSPS decision-making tools

Risk Assessment – WiNGS Ops Model



2021 Accomplishments

- Updated data & algorithms to improve consequence modeling
- Developed a probabilistic conductor risk model
- Developed preliminary ignition prediction models
- Initiated the Cloud migration of risk models

2022 Planning

- Update & incorporate broader range of input in risk assessments & PSPS decision-making tools
- Increase automation of risk modeling
- Improve & iterate models for predicting ignitions
- Migrate & execute risk models in the Cloud

Top Risk Spend Efficiencies by Category

Grid Hardening

- **3273** PSPS Sectionalizing Devices
- **529** Expulsion Fuses
- **211** Lightning Arrestors
- **200** Hotline Clamps
- **197** SCADA Capacitors
- **172** Strategic Undergrounding
- **31** Traditional Hardening
- **29** Covered Conductor

Operations

- **30M** Automatic Recloser Operations
- **230k** Sensitive / Fast Protection Settings
- **254** Personnel Work Procedures
- **160** Infrastructure Protection Teams
- **115** Aviation Firefighting

Asset Replacement

- **429** Distribution Patrols
- **345** Transmission Infrared Inspections
- **165** Transmission Drone Inspections
- **159** Wood Pole Inspections
- **156** Detailed Distribution Inspections

Resiliency

- **853** Generator Assistance Program
- **375** Generator Grant Program
- **204** Microgrids
- **160** PSPS & Mitigation
- **83** Standby Power Programs

SOUTHERN CALIFORNIA EDISON®

RISK MODELING AND ASSESSMENT

2022 WMP Technical Workshop

March 10, 2022

2022 WILDFIRE MITIGATION PLAN UPDATE

Energy for What's Ahead®

Agenda

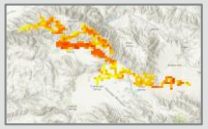
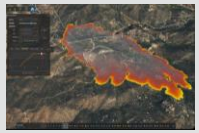
Presenter: Adam Dow – Principal Manager, Risk Management

Topics

1. Wildfire Risk Modeling Evolution
2. Risk Assessment and Modeling Advancements
3. 2022 Risk-Informed Look Ahead

Wildfire Risk Modeling Evolution

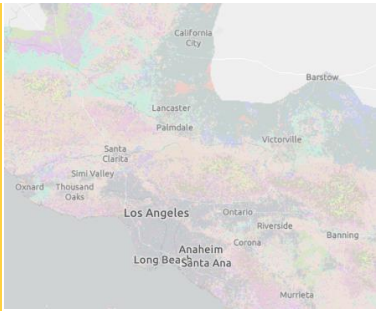
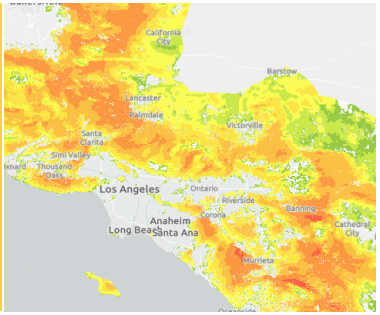
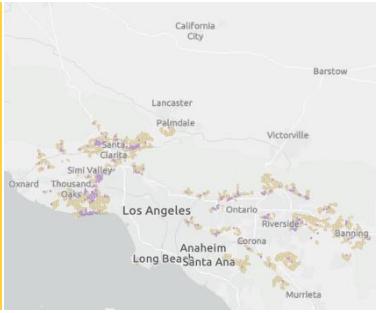
In 2021, SCE achieved several key milestones in enhancing our wildfire risk modeling capabilities, including:

2018 GSRP	SMAP / RAMP	2019 WMP	2021 GRC	2020-2022 WMP	2021 WMP Update	2022 WMP Update
• Fault-to-Fire Mapping • Mitigation-to-Fault Mapping • Mitigation Effectiveness / Cost Mitigation Ratios • High Fire Risk Area (HFRA) Definition	*System-wide* • Bowtie (Drivers, Outcomes, and Consequences) • Multi Attribute Risk Score (MARS) • Mitigation Risk Spend Efficiency (RSE)		*Circuit and Circuit Segment Level* • Asset risk prioritization to inform mitigation deployment • Probability of Ignition for Distribution assets • REAX Fire Propagation Algorithm	Fire Incident Analysis (FIPA) • Enhanced Mitigations and Tranching • RSE Calculation Enhancement • Began transition to Technosylva Fire Propagation Algorithm	• Probability of Ignition for Transmission and Sub transmission assets • Inclusion of PSPS reduction to circuit prioritization • PSPS Risk Modeling	• Fire Propagation refinements • Updated fuels model • 400+ additional wind & weather scenarios • Severe Risk Methodology and integration with population risks
					*Wildfire + PSPS Risk*	

Sept 2018 → Nov 2018 → Feb 2019 → Aug 2019 → Feb 2020 → Feb 2021 → Feb 2022

- Expanded **Weather Scenarios** for improved ignition risk analysis
- Enhanced **Fuel Regrowth Model** to understand speed and intensity in which wildfires may propagate
- Developed new **Severe Risk Methodology** to identify locations with heightened egress, wind, or extreme fire risk

Risk Assessment and Modeling Advancements

Category	Advancement	Detailed Benefits
Fuel Regrowth Model 	• **+19** custom fuel models • Fuel Regrowth projection **extended through 2030**	• Enhanced analysis of rapidity and intensity in which fires may propagate • Replication of local environments and impact • Recovery of fuels to better reflect local conditions in areas heavily impacted by extensive scarring (e.g., El Dorado, Apple, Bobcat)
Weather Scenarios 	**+ 400 scenarios** • 2021: 41 worst weather days • 2022: 444 worst weather days	• Better representation of wildfire conditions in North Coast and High Sierras. • Expanded weather days provide more capability to understand wildfire ignition risk (e.g., Santa Ana wind days, Sundowner Events).
Severe Risk Methodology 	Developed **Severe Risk Methodology**	More effective identification of locations that are: • Egress constrained; • At risk of extreme consequence wildfire; and/or, • High wind areas and subject to more frequent PSPS events.

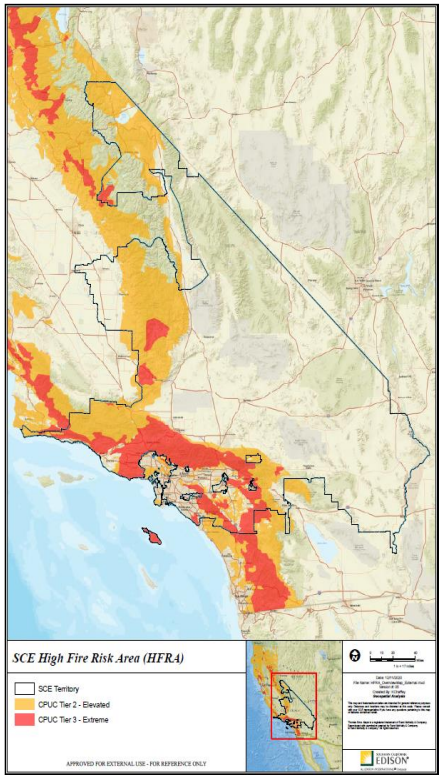
Risk Assessment and Modeling Advancements

Higher Resolution HFRA Risk Mapping

Risk model advancements enable a more data-driven and risk-informed methodology to conduct fire-threat assessments across its HFRA

Methodology drives Boundary Assessment to evaluate potential refinements to High Fire Risk Area (HFRA) to **better reflect utility ignition risk**

Boundary Assessment may result in recommendations to **add and remove areas from HFRA** designation



SCE is collaborating with CAL FIRE to capture risk of fires along the urban periphery

Risk Spend Efficiency (RSE)

RSE analysis and calculations expanded to **39 scored activities**, which incorporate 6 enabling activities

RSE provides an indicator of the risk reduction compared to the costs for that activity

Informs decision making process

- Evaluating alternative mitigations
- Selecting new programs for deployment
- Making changes to the scope of deployed programs

RSE Scored Activities	2021 WMP	2022 WMP
Situational Awareness	2	4
Grid Design & System Hardening	9	15
Asset Management & Inspections	6	7
Vegetation Management*	4	5
Grid Operations & Protocols	2	4
Data Governance	0	0
Emergency Planning & Preparedness	0	2
Stakeholder Cooperation & Community Engagement	1	1
Alternative Technology	0	1
Enabling Activities**	0	6
Total	24	45

** Vegetation Management counts shown include Line Clearing*
*** Enabling Activities are shown separately, but comprised of activities from Asset Management & Inspections (1), Vegetation Management (1), Data Governance (2), and Stakeholder Cooperation & Community Engagement (2)*

2022 Mitigations Informed by Risk Analysis

SCE's wildfire risk models provide critical analysis for decision-making and prioritization of wildfire mitigation activities. For example:

HARDENING THE GRID

Prioritization largely informed by Wildfire Risk Reduction Model (WRRM) considering both probability of ignition and consequence

SITUATIONAL AWARENESS

Utilize machine learning (ML) to advance our predictive modeling capabilities of potentially dangerous winds and elevated fire potential.

Enhanced fire spread modeling and other weather modeling increase our situational awareness of weather, dry vegetation, and fire activity

HIGH FIRE RISK-INFORMED INSPECTIONS

Overhead transmission and distribution equipment inspections targeted to the highest-risk structures, as well as equipment in targeted areas based on emergent fire weather conditions.

- Risk evaluated for each structure in consideration of probability of ignition and consequence
- Additional inspections scoped pursuant to increased fuel-driven and/or wind-driven fire risk primarily due to elevated dry fuel levels

MANAGING VEGETATION

Inspect, trim, and remove trees to prevent vegetation from encountering electrical equipment and potentially sparking a fire.

- Tree Risk Index developed and will prioritize inspections for line clearing, hazard trees, and quality control
- Establishes methodology to classify locations with high vegetation contact risk – considers both probability and consequence

Thank You