California Wildfire Safety Advisory Board

Wildfire Safety Advisory Board Quarterly Meeting

March 3, 2021, 1-4 pm

Online via Webcast, WebEx, and Telephone.

Participation Information

Please choose one participation option. Using more than one technical option may create feedback.

- **Webcast:** www.adminmonitor.com/ca/cpuc
- **Phone:** Oral comments possible with assistance of an operator.
  - Number: 1-800-857-1917, passcode: *17 67 567*
  - For public comment portion of the meeting: Dial * 1 (star one) to be placed in a queue by the operator.
- **Email:** Written comments may be sent by mail or email to WildfireSafetyAdvisoryBoard@cpuc.ca.gov.
- **Public Advisor:** If there are technical issues, the Public Advisor can help. Email public.advisor@cpuc.ca.gov, or call (866) 849-8390.

About the Wildfire Safety Board

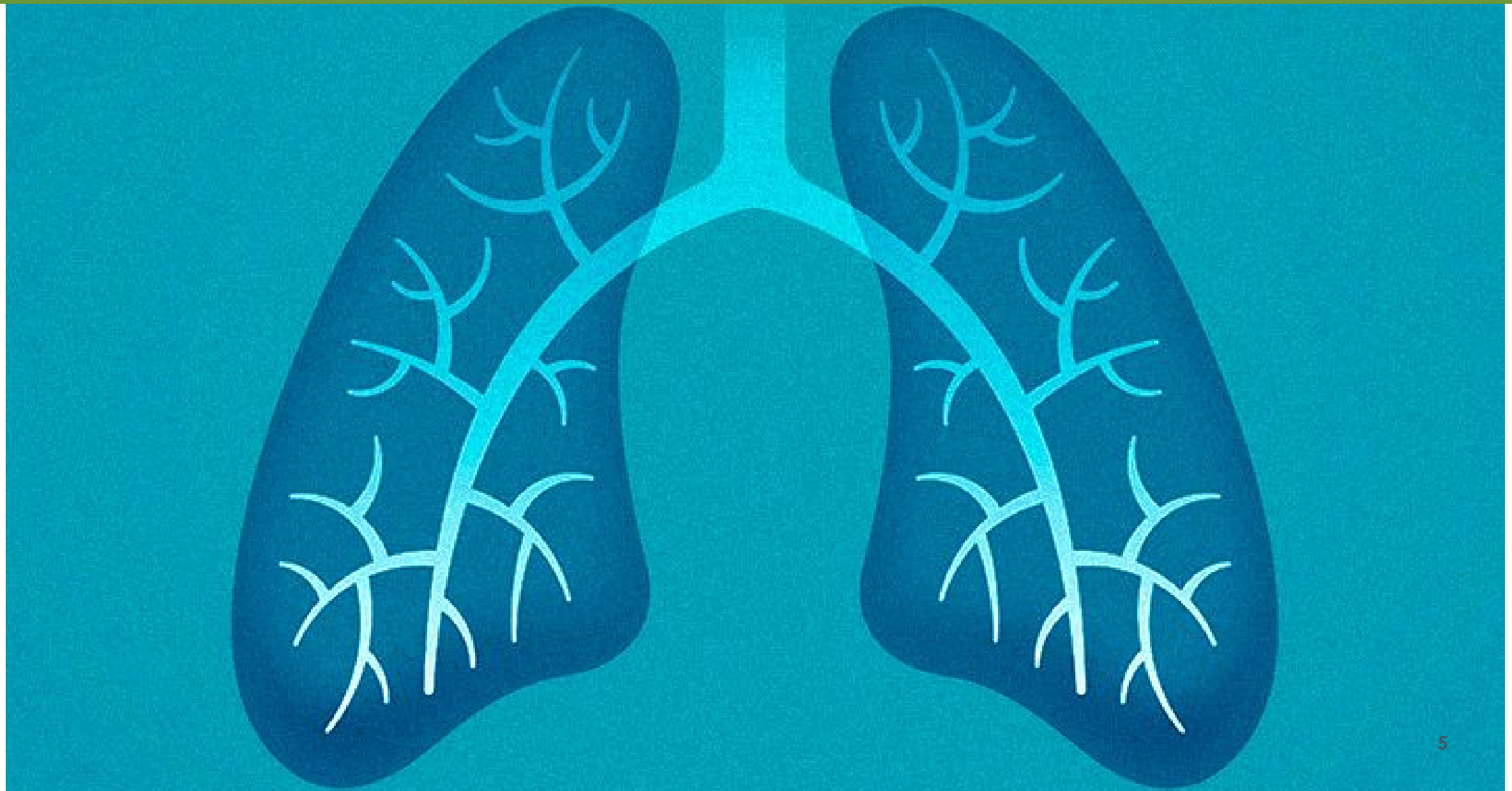
Members:

- Marcie Edwards, Chair
- Diane Fellman, Vice Chair
- Ralph M. Armstrong Jr., Board Member
- Jessica Block, Board Member
- John Mader, Board Member
- Christopher Porter, Board Member
- Alexandra Syphard, Board Member

More information about the Board and its Members can be found here: https://www.cpuc.ca.gov/WSAB/.

Pledge of Allegiance

Safety Moment

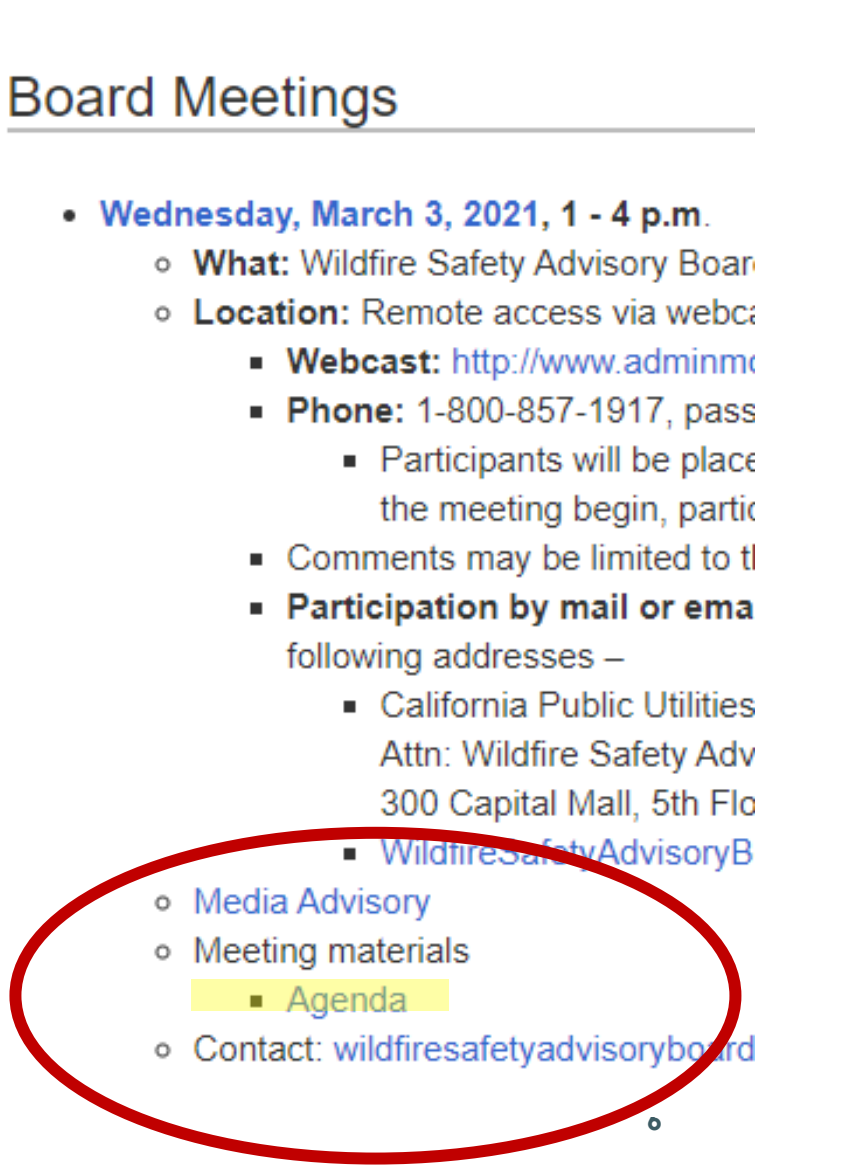


Finding Meeting Materials

Materials Available:

www.cpuc.ca.gov/wsab

- Agenda
- Board Meeting Presentation



California Wildfire Safety Advisory Board

Agenda

[1] Opening Public Comment

[2] Dec. 9, 2020 Meeting Minutes

[3] Presentation on the Appendix to the POU 2021 WMP Updates

- *Barry Moline, CMUA*

[4] Wildfire Safety Division Presentation

[5] Stretch Break

[6] Presentations from IOUs on the 2021 WMP Updates

- *Jonathan Woldemariam, SDG&E*
- *Justina Louie, PG&E*
- *Bill Chiu, SCE*

[7] Work Plan for 2021

[8] Closing Public Comment

[1] Opening Public Comment

Participation Options:

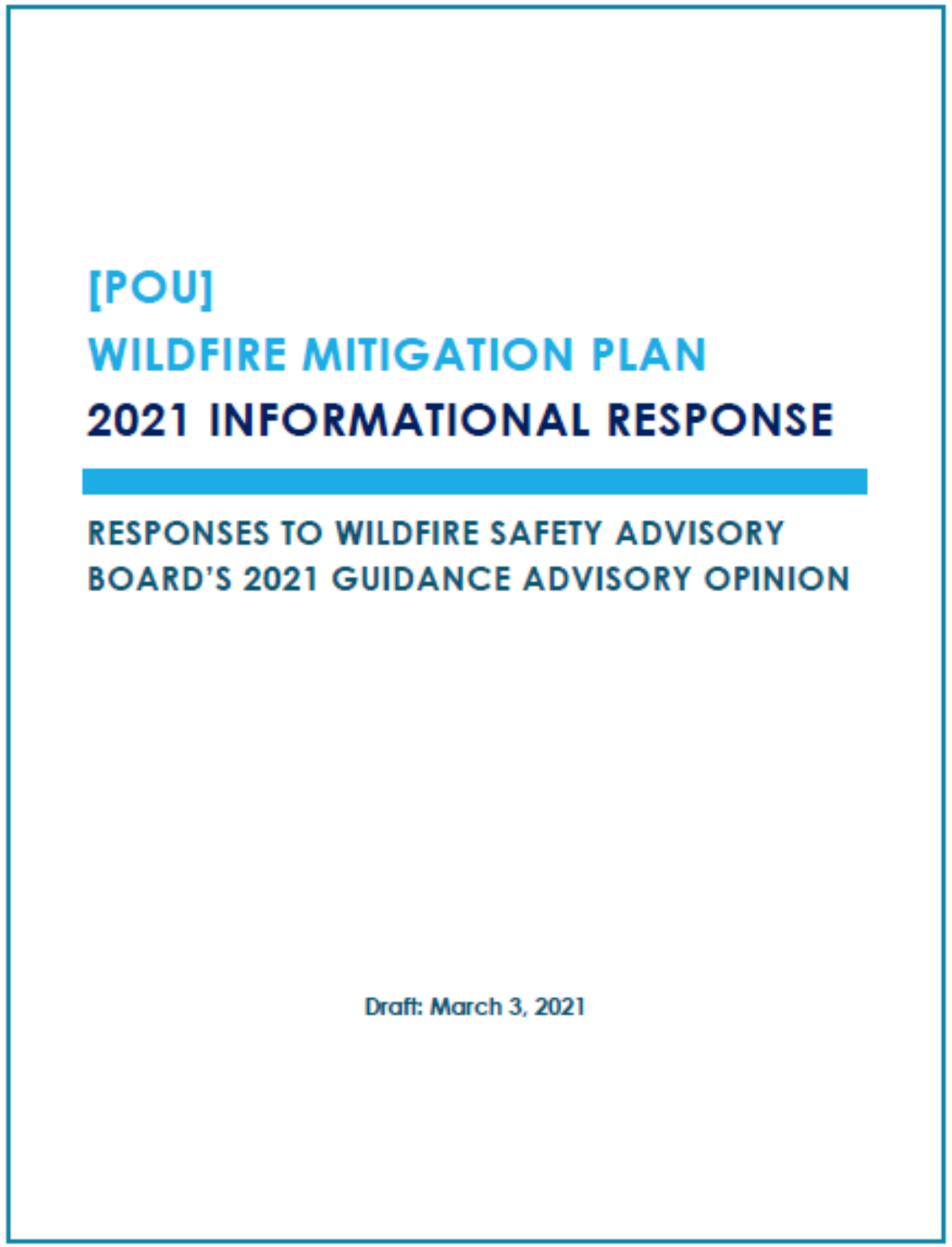
Please begin your comment by stating your name and organization (if applicable).

- **Phone:** Number: 1-800-857-1917, passcode: *17 67 567*
  - Dial * 1 (star one) to be placed in a queue by the operator.
- **Email:** Written comments may be sent email to WildfireSafetyAdvisoryBoard@cpuc.ca.gov. Staff will read these comments out loud during the meeting.
- **Public Advisor:** If there are technical issues, the Public Advisor can help. Email public.advisor@cpuc.ca.gov, or call (866) 849-8390.

[2] Vote on Minutes from December 9, 2020 Meeting

Discussion

Vote



[3] Presentation on the Appendix to the Publicly Owned Electric Utility and Cooperative 2021 Wildfire Mitigation Plan Updates

Discussion with Barry Moline, CMUA

CMUA
CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION

[4] Wildfire Safety Division Presentation

Koko Tomassian

Supervisor, Wildfire Mitigation Branch

Wildfire Safety Division

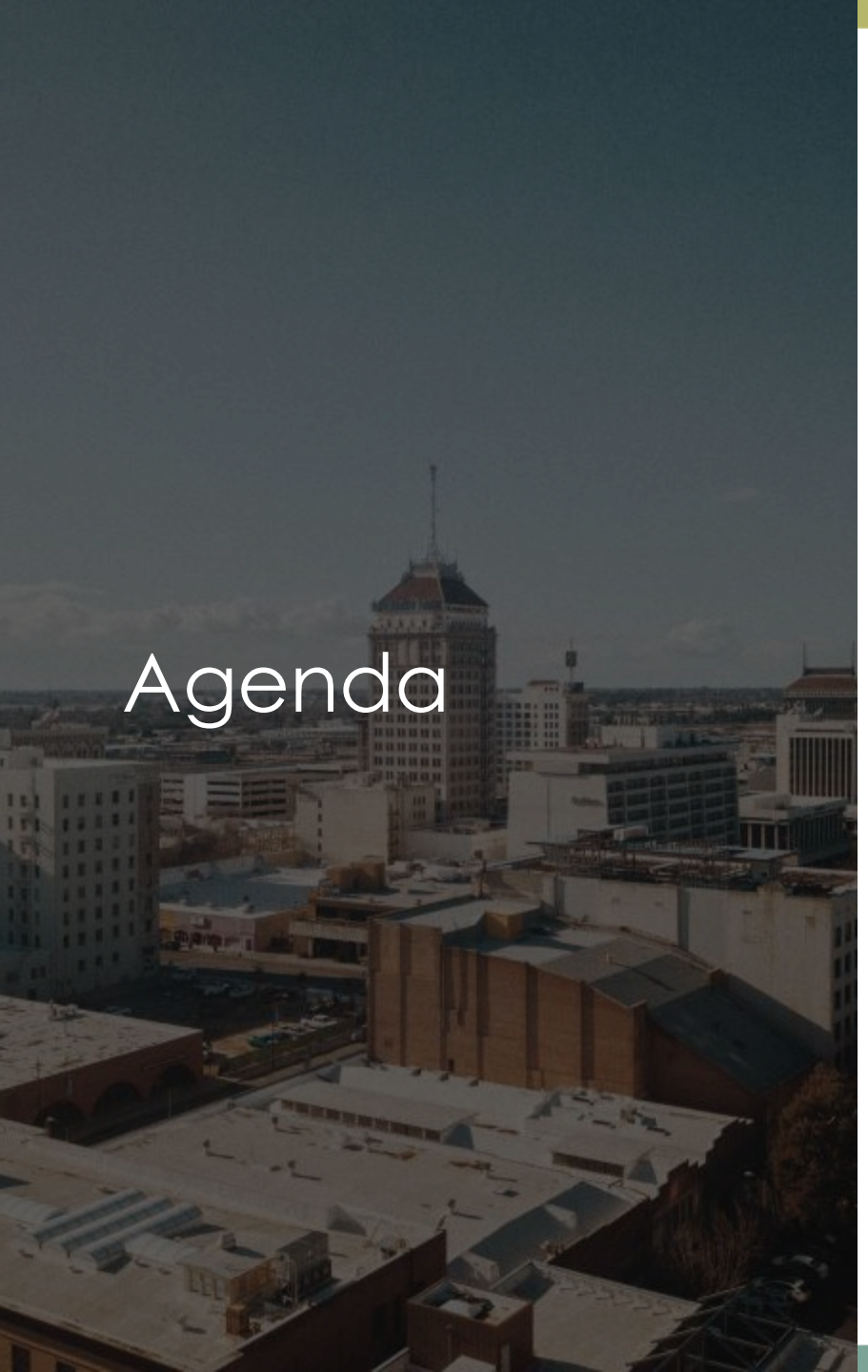
Question & Answer

California Wildfire Safety Advisory Board

WSD Activities Update

March 3, 2021

California Public
Utilities Commission

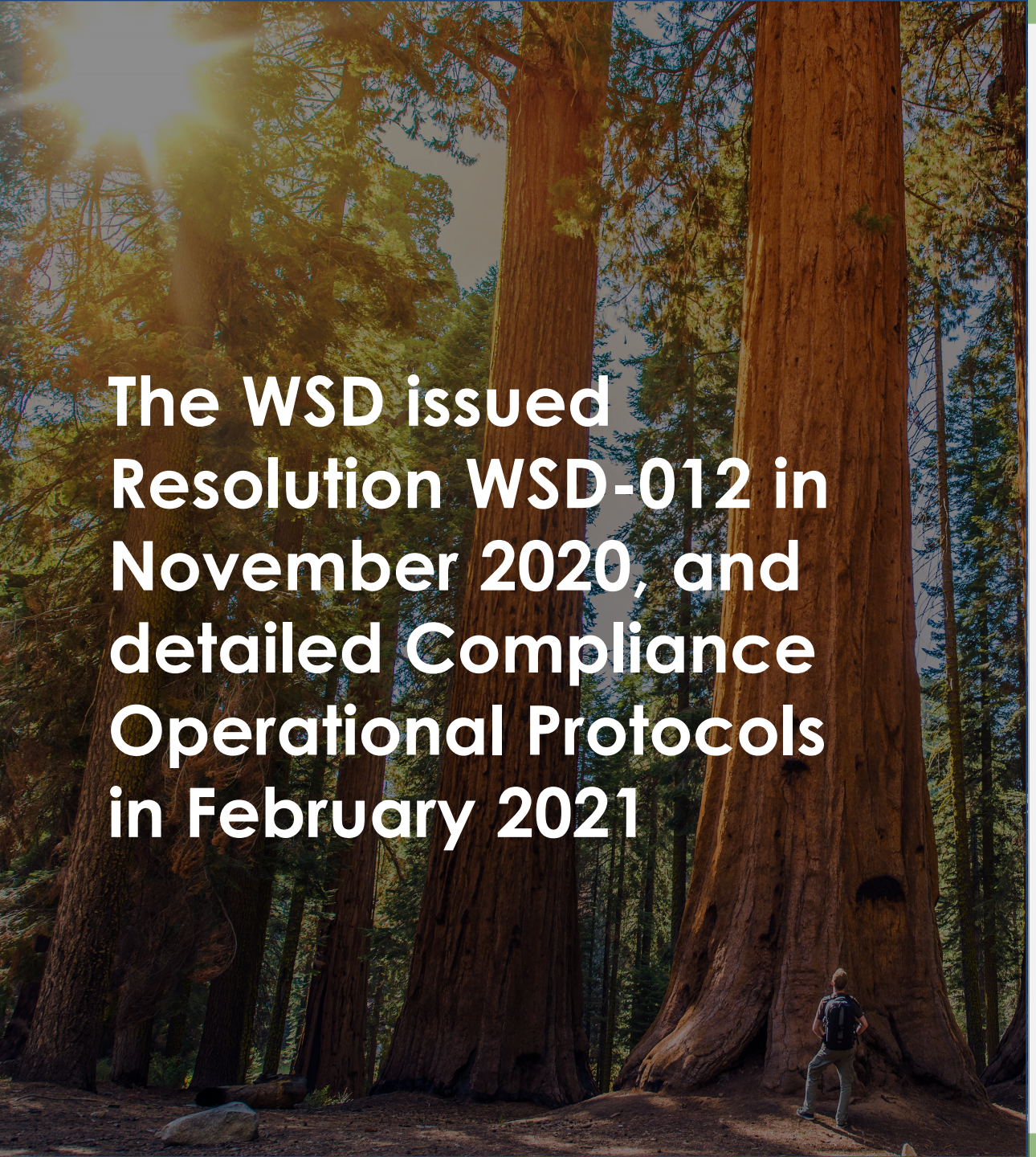


Agenda

1. Compliance Process and Operational Protocols
2. Safety Culture Assessment Requirements and Process
3. WSD to OEIS Transition
4. WSD Request for WSAB Comments on 2021 WMP Updates

WSD Compliance Process and Operational Protocols

AB 1054 requires the WSD to develop, adopt, and approve a **“wildfire mitigation plan compliance process”** which includes **“appropriate performance metrics and processes for determining an electrical corporation’s compliance with its approved wildfire mitigation plan."**



The WSD issued Resolution WSD-012 in November 2020, and detailed Compliance Operational Protocols in February 2021

WSD-012 provided a high-level overview of the WMP compliance process

The Compliance Operational Protocols provided guidance for annual and quarterly Compliance reporting requirements

WSD-012 outlines 2 components of compliance process

1 Compliance Assessments

- Annual assessments of compliance with approved WMPs via ***WSD Annual Reports on Compliance (ARC)***[1]
- Ongoing assessments to determine compliance, tracked via ***WSD Monthly Performance Reports***[2]
  - WSD conducts inspections (site visits) and audits (paper) to assess compliance
- Audits of vegetation management work, via ***Substantial Vegetation Management Audit Reports***[3]

2 Consequences of Assessments

- WSD is also responsible **for resolving instances of WMP noncompliance** (defects) with utilities
- Potential enforcement actions are coordinated with the CPUC's Safety Enforcement Division (SED)

Notes: 1. WSD ARC is a holistic assessment of a utility's compliance with its WMP; 2. Overview of WSD inspection and audit activities, with high-level inspection findings for each utility; 3. Verification and audit of each utility's vegetation management work.

The Compliance Operational Protocols outline detailed reporting requirements, which are intended to:

- **Standardize data submissions** from utilities to the WSD
- **Streamline communications** between the WSD and utilities

Compliance reporting from utilities has four components

Report	Contents	Format	Cadence
Quarterly Advice Letter (QAL)	Statutorily mandated qualitative status updates across all WMP initiatives and required for safety certification issuance	PDF	Quarterly
Quarterly Initiative Update (QIU)	Annual targets (quantitative and qualitative) for all WMP initiatives and expected quarterly progress,[1] with cumulative quarterly progress updates against targets *Supplemental documentation to be requested for audits on as-needed basis*	Excel, kiteworks	Quarterly
Quarterly Data Report (QDR)	Spatial data and non-spatial data tables for all planned, in-progress, and completed WMP initiative activities to-date	ArcGIS, Excel	Quarterly
Annual Report on Compliance (ARC)	Annual summary of the utility's compliance with its WMP	PDF	Annual

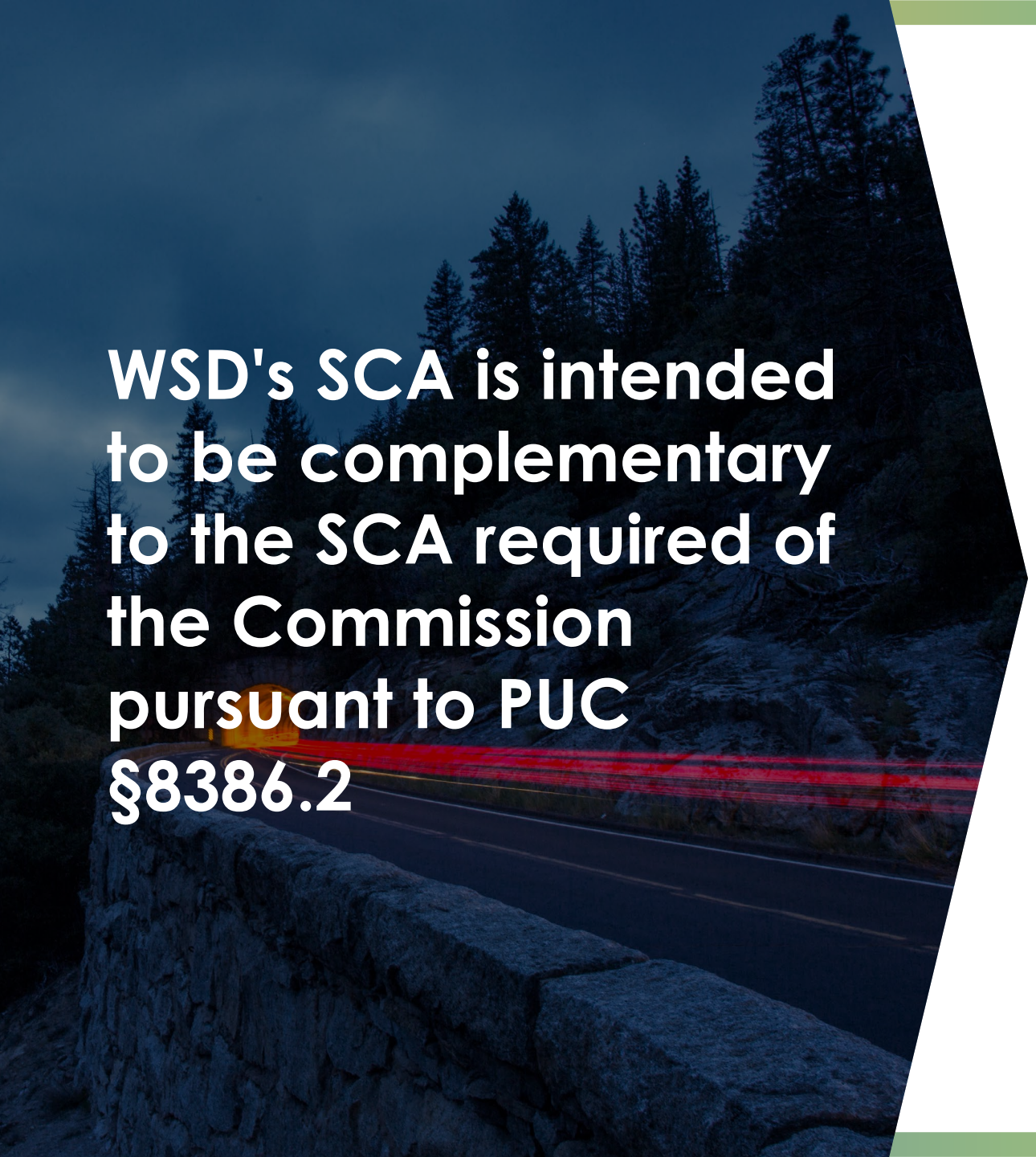
Notes: [1] Annual targets and expected quarterly progress shall be provided in the Q1 QIU each year; cumulative quarterly progress updates will be provided in each quarter.

Safety Culture Assessment

Overview of Safety Culture Assessment Requirements

Requirements finalized in January 2021

The WSD seeks to understand outcomes over time and incorporate continuous learning



WSD's SCA is intended to be complementary to the SCA required of the Commission pursuant to PUC §8386.2

Safety culture is broader than wildfire

WSD Focus: Whether safety culture broadly has permeated to settings most relevant to wildfire risk

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Additionally, WSD's SCA presents the opportunity to set a new standard for SCAs via sharing of best practices

Distinction of WSD's SCA from existing SCAs

As safety culture applies to a large range of operations beyond wildfire, the WSD's SCA will **ensure that wildfire safety is prioritized.**

Wildfire safety culture reaches into **decision-making processes that are not the focus of** general safety culture processes (e.g., raising wildfire hazard concerns).

Not every requirement applies to every electrical corporation

Overview of requirements by electrical corporation

Requirement	Large IOUs[2]	SMJUs[2]	ITOs[3]
Workforce Survey	✓	✓	
Self-assessment and plan summary	✓		
Supporting documentation[1]	✓	✓	✓
Interviews	To be determined by the WSD upon review of submissions		

1. Some supporting documentation requests may be appropriate for certain electrical corporations while not for others. Requests for supporting documentation are at the WSD's discretion.

2. **Large IOUs:** Pacific Gas and Electric Company, San Diego Gas & Electric, Southern California Edison Company
SMJUs: Liberty Utilities (CalPeco), PacifiCorp, Bear Valley Electric Service, Inc.

3. **ITOs:** Horizon West Transmission, Trans Bay Cable. As ITOs are much smaller organizations with a lower risk profile, the WSD will focus on understanding objectives and lessons learned to determine whether additional requirements are appropriate.

Directional timeline

January 2021
WSD released final requirements and submission deadlines for each electrical corporation

Late spring 2021
Deadline for electrical corporations to submit responses to requirements

Summer 2021
WSD will conduct its first annual SCA

WSD Transition

Transition to the Office of Energy Infrastructure Safety (OEIS)

- Per AB 1054, WSD transitions to the OEIS under the California Natural Resources Agency (CNRA) on July 1, 2021
- Efforts continue to ensure a smooth transition
  - IT
  - Equipment
  - MOUs
- WSD is on track to successfully complete the transition

WSD Request

WSD requests WSAB input on 2021 WMP updates for consideration during evaluations

Thank you!

California Public Utilities Commission

[5] Stretch Break

[6] Presentations on the 2021 WMP Updates

Jonathan Woldermariam

Director, Wildfire Mitigation & Vegetation Management

San Diego Gas & Electric

Justina Louie

Principal, Community Wildfire Safety Program

Pacific Gas & Electric

Bill Chiu

Managing Director, System & Asset Strategy

Southern California Edison

2021 Wildfire Mitigation Plan Update Workshop

March 3, 2021

Agenda

Risk Assessment, Mapping & Resource Allocation Methodology

Risk model evolution

Vegetation Management: Inspection, Strategy, and Pilots

Vegetation management practices progression

Grid Design and System Hardening: Inspections, Mitigation Choices, Emerging Technologies

Prioritization using risk-modeling

PSPS: Reducing the Scale, Scope and Frequency

What is the utility doing to reduce PSPS events?

2020-2022 WMP Expenditures

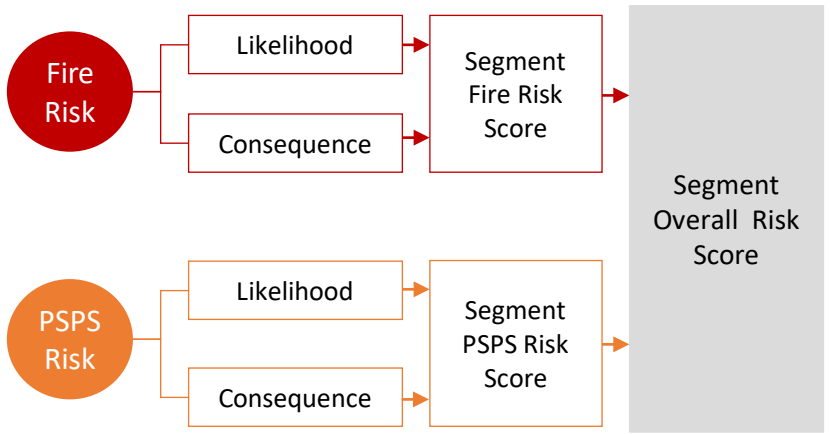
WMP Category	2020 WMP Planned	2020 Actual	Difference	2021 Planned	2022 Planned	2020-22 Planned (w/ 2020 Actual)
Risk and Mapping	$1,400	$1,191	($209)	$1,539	$1,881	**$4,611**
Situational Awareness	$6,845	$5,890	($955)	$7,914	$12,445	**$26,249**
Grid Design and System Hardening	$265,972	$343,782	$77,810	$415,358	$459,632	**$1,218,772**
Asset Management and Inspections	$56,790	$81,591	$24,801	$68,357	$58,745	**$208,693**
Vegetation Management	$62,322	$79,264	$16,942	$71,639	$71,640	**$222,543**
Grid Operations	$20,167	$17,110	($3,057)	$20,731	$15,719	**$53,559**
Data Governance	$315	$7,480	$7,165	$22,693	$16,579	**$46,752**
Resource Allocation	$11,985	$5,342	($6,643)	$7,387	$5,617	**$18,347**
Emergency Planning	$13,821	$14,353	$532	$17,626	$15,231	**$47,211**
Stakeholder Cooperation and Community Engagement	$4,928	$13,234	$8,307	$13,222	$12,379	**$38,835**
Total	**$444,544**	**$569,237**	**$124,693**	**$646,466**	**$669,869**	**$1,885,572**

WiNGS Overview

A risk-based decision-support tool to determine **most cost-effective wildfire and PSPS risk reduction investments**

What's our current risk level today?

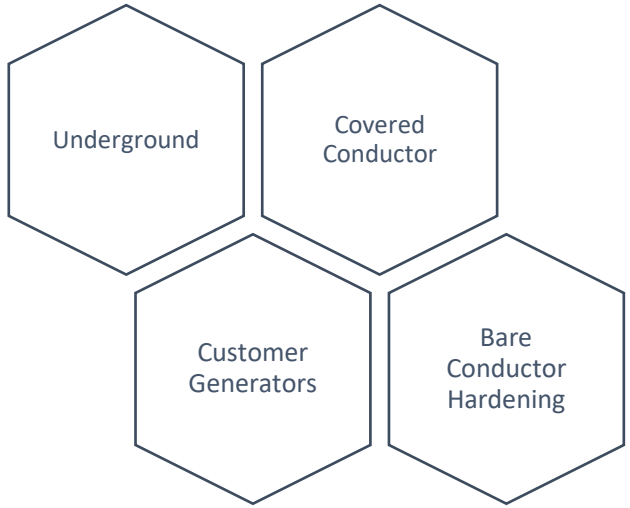
Baseline Risk Level



Segment-by-Segment Risk Analysis

Which mitigation is most cost-effective?

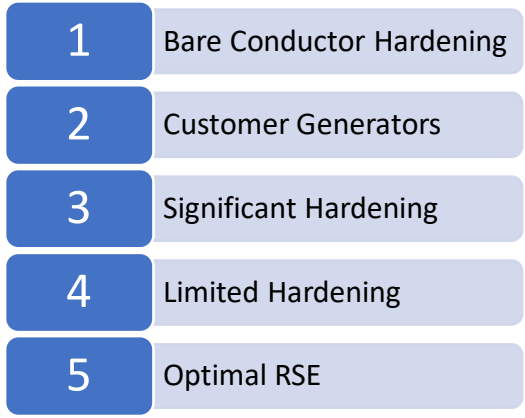
Alternatives Analysis



Segment-by-Segment RSE Analysis

What's the right mix of strategies to deploy?

Portfolio Analysis



Aggregated Portfolio Analysis

WiNGS Model Inputs and Outputs

Inputs

Wildfire

Likelihood	Consequence
• Historic ignitions • Wind speed • Tree strikes • Hardening status • Vegetation density ★ • Critical Health Index (CHI) ★ • Conductor age ★	• Maximum WRRM conditional impact

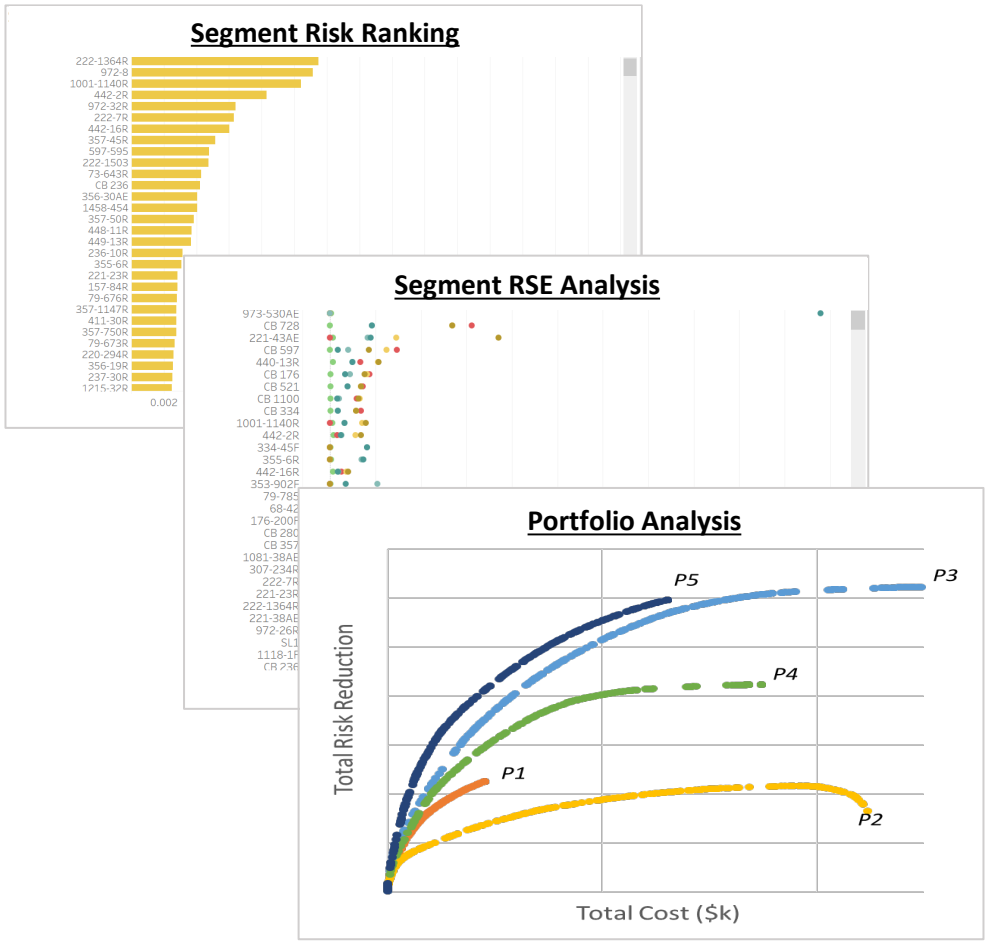
PSPS

Likelihood	Consequence
• Annual RFW data • Historic wind speed patterns • Circuit connectivity ★	• Number of customers • Customer type ★

★ Recent Improvement

WiNGS Model

Outputs



Top 10 HFTD Distribution Risk Drivers

- Average ignitions represent the potential ignitions per year, per driver, based upon historical frequency of risk events and ignition rate
- Top 10 risk drivers make up 85% of ignition risk in the HFTD
- Greater understanding of HFTD ignition risk is utilized to prioritize wildfire mitigation programs

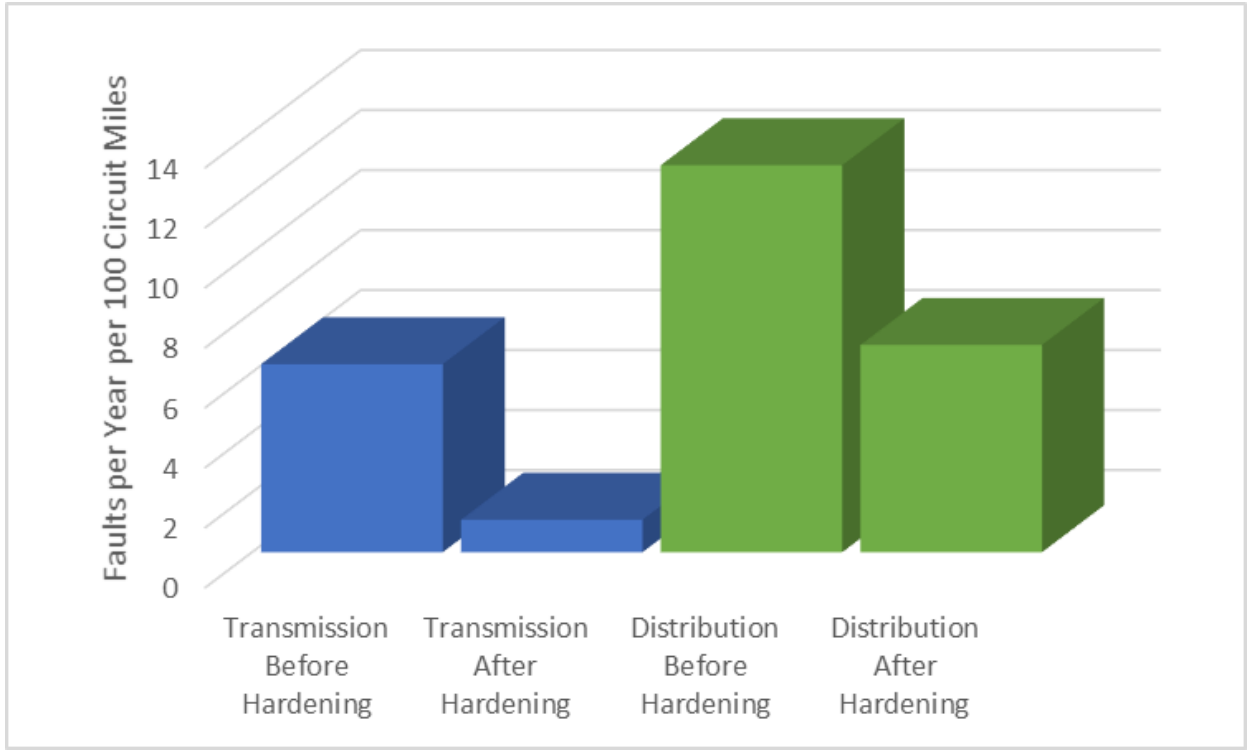
	Historical Risk Summary (2015-2020)			
Risk Driver	**Average Outages**	**Average Ignition rate**	**Average Ignitions**	**Risk Ranking**
Vehicle contact	38.2	6.55%	2.50	1
Veg. contact	12.2	13.70%	1.67	2
Lightning arrestor damage or failure	10.8	12.31%	1.33	3
Balloon contact	11.7	10.00%	1.17	4
Other	8.0	12.50%	1.00	5
Animal contact	44.7	1.87%	0.83	6
Connection device damage or failure	17.5	3.81%	0.67	7
Other contact from object	14.2	4.71%	0.67	7
Conductor damage or failure	19.0	3.51%	0.67	7
Transformer damage or failure	24.3	2.74%	0.67	7

Measured Efficacy of Wildfire Mitigations

In 2020, SDG&E performed several efficacy studies to measure the actual impacts of several wildfire mitigation programs:

- Transmission Hardening
- Distribution Hardening
- Expulsion Fuse Replacement
- Sensitive Relay Settings
- Inspection Program Repair Timelines
- Other Special Work Procedures / Infrastructure Protection Teams

The results of these studies provided a more granular understanding of the effectiveness of programs on specific risk event drivers and informed our RSE calculations



**Based on reliability fault data from 2000-2019 on 214 distribution hardening project line segments

Risk Spend Efficiency

- Risk Spend Efficiency (RSE) methodology in RAMP
- Benefit per dollar spent
- PSPS expected reductions were included in RSE calculations

Hardening Programs	3 Year RSE
Covered Conductor	71
OH Distribution Hardening - Bare	44
Strategic Undergrounding	58

Programs with Top 10 RSE's	3 Year RSE
Recloser Protocols	458,336
Sensitive/Fast Protection Settings	79,025
PSPS Sectionalizing Enhancements	584
SCADA Capacitors	546
Expulsion Fuse Replacement	477
Resiliency Assistance Programs	373
Patrol Inspections of Distribution Electric Lines	369
Infrared Inspections of Distribution Electric Lines	366
Advanced Protection	281
Infrared Inspections of Transmission Electric Lines	245

Traditional Hardening

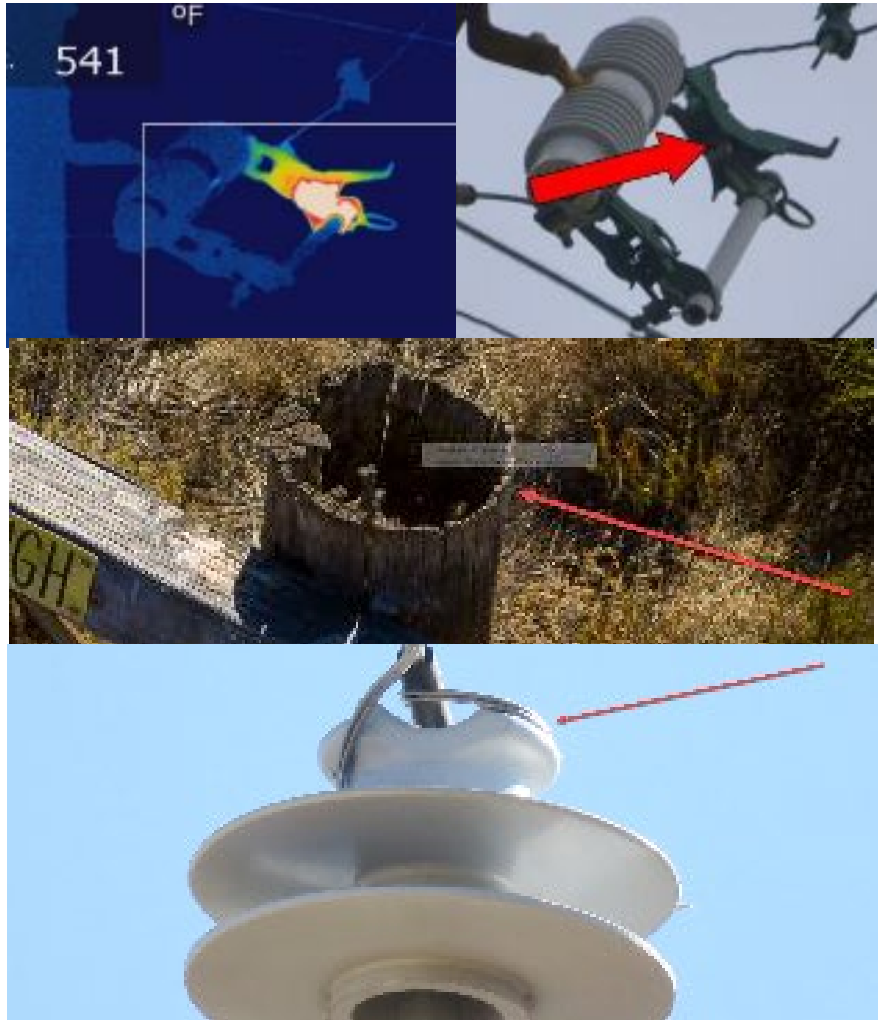
- FiRM: Re-conductor small wire and wood to steel
- PRiME: Assess and remediate highest risk poles in HFTD
- CNF: Wood to steel and underground conversion in Cleveland National Forest
- Transmission: Wood to steel and increased loading/spacing

Traditional Hardening	Mileage	Capital $ (Direct)
2020	221	$227M
2021	116	$111M
2022	76	$29M

Advanced Inspections

- DIAR: Drone inspections in HFTD
  - 40 pictures per pole
  - Photos reviewed by QEW and prioritized
- Distribution Infrared Inspections
  - Pilot in Tier 3 and moving to Tier 2

DIAR Inspections	Inspections	Cost $ (Capital + O&M)
2020	37,310	$67.9M
2021	22,000	$49.0M
2022	22,000	$39.9M



Asset Specific Programs

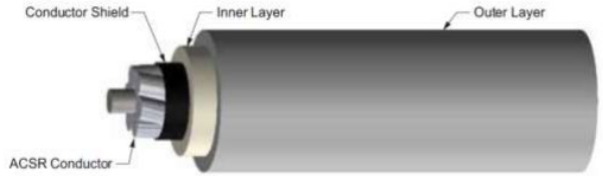
- Expulsion Fuse Replacements
  - Install new CAL FIRE approved fuses
- Hotline Clamp Replacements
  - Replace high risk hotline clamp connectors
- SCADA Capacitors
  - Modernize capacitors in the HFTD
- Lightning Arrestors
  - Install CAL FIRE approved lightning arrestors

Program	Year	Units	Capital $ (Direct)
Expulsion Fuses	2020	3,179	$6.5M
	2021	3,970	$10.2M
	2022	906	$3.1M
Hotline Clamps	2020	2,061	$3.3M*
	2021	2,250	$5.3M*
	2022	1,650	$4.3M*
SCADA Capacitors	2020	30	$992k
	2021	32	$1.6M
	2022	40	$1.8M
Lightning Arrestors	2020	0	$19k
	2021	924	$1.3M
	2022	1,848	$2.6M

*Hotline Clamp $ is O&M, not Capital

Covered Conductor

- Covered conductor helps reduce risk from animal contact, flying debris, balloon contacts, etc.
- In 2020, SDG&E completed 1.9 miles of covered conductor, and informed development of work methods and construction standards
- In 2021, $55M to install 20 miles of covered conductor
- Total: 81.9 miles 2020-2022



3-layer Covered Conductor

Covered Conductor	Mileage	Capital $ (Direct)
2020	1.9	$1.8M
2021	20.0	$55M
2022	60.0	$96M

Strategic Undergrounding

- Strategic undergrounding includes reducing wildfire and PSPS risk
- To keep critical facilities energized during PSPS events
- In 2021, scope will be in HFTD: Alpine, Boulevard, Cameron and Descanso
- Total: 135 miles 2020-2022

Strategic UG	Mileage	Capital $ (Direct)
2020	30	$76.8M
2021	25	$126.3M
2022	80	$197.2M

Microgrids

Ramona Air Attack Base	Cameron Corners	Butterfield/Agua Caliente	Shelter Valley	South Campo	Sherilton Valley
CAL FIRE Air Support U.S. Forest Service Air Support Fire-retardant mixing stations	CAL FIRE Station, a school, and telecom switching center (east San Diego County)	Desert community (far east San Diego County)	Desert community San Diego Fire Station Community Center (far east San Diego County)	Feeding America distribution center, San Diego County Sheriff, Community Center, USPS (east San Diego County)	Vulnerable Community located in HFTD Tier 3 (east San Diego County)
Portable generator in place	Portable fossil fuel generator will serve customers this fire season	Portable fossil fuel generator will serve customers this fire season	Portable fossil fuel generator will serve customers this fire season	Portable fossil fuel generator will serve customers this fire season	Evaluating Solutions for 2021 Fire Season
Renewable source completion by July 2021	Renewable source completion by July 2021	Renewable source completion by December 2021	Renewable source completion by December 2021	Renewable source completion by Q1 2023	Renewable source completion by Q1 2023
Energy Storage	Solar + Energy Storage	Solar + Energy Storage	Solar + Energy Storage	Design in Progress	Design in Progress

Microgrids	Locations	Capital $ (Direct)
2020	4	$3.5M
2021	2*	$18.9M
2022	1*	$12.9M

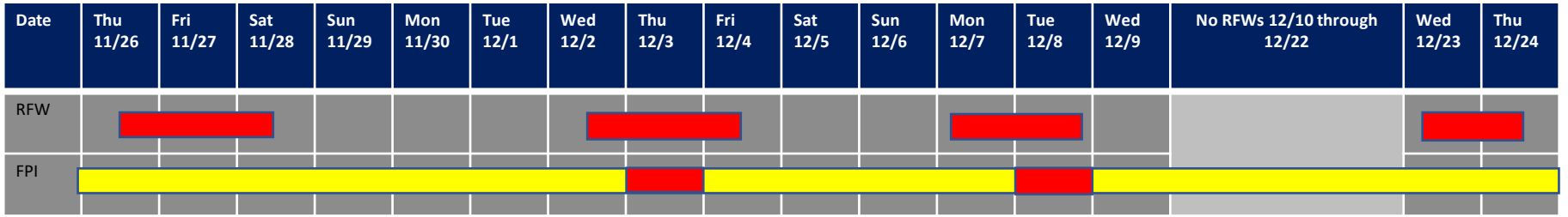
*Additional Sites

Generators

Generator Grant Program (GGP) + AFN	Mobile Home Park Project (MHP)	Generator Assistance Program (GAP)	Fixed Backup Power (FBP)
Medical Baseline Customers 2,000 (Grants) + AFN Customers **2020: $5.1M** **2021: $7.6M** **2022: $7.6M**	MHPs located in HFTD (Stoneridge at Warner & Pine Valley Trailer Park + 2 TBD sites) **2020: N/A** **2021: $400K** **2022: $400K**	HFTD 2/3, low income Rebate program: 1,250 Rebates **2020: $761K** **2021: $1.8M** **2022: $1.8M**	Grid hardening alternative targeting most PSPS prone customers 413 Grants **2020: $1.7M** **2021: $10.4M** **2022: $10.4M**
Full Grant, no out of pocket for customer	Full Grant, no out of pocket for customer	$300 Standard rebate $450 CARE eligible rebate	Full Grant, no out of pocket for customer
Completion between Sept - Oct	Complete before end of 2021	Rebate Coupons Expire 12/31/2021	Construction complete by Q4 2021
Goal Zero Yeti 3000 + multiple re-charging sources	Generac PWRcell	Portable generators & batteries (available online and in store)	Generac 7173
			

Late Season RFWs & PSPS

In 2020, there were 4 late-season RFW/PSPS events out of a total of 11 RFW/PSPS events for the season



Red Flag Warning
11/26-11/28

- Top 20 Average Gusts: 48 mph
- Wind Speed Records: 0
- Peak Gust: **56 mph**
- Stations Reaching 95%: 75
- Station Reaching 99%: 8
- PSPS Customers Notified: 2,739
- PSPS Customers affected: **0**
- CRCs Opened: 0

Red Flag Warning
High Wind Warning
12/2-12/4

- Top 20 Average Gusts: 71 mph
- Wind Speed Records: 43
- Peak Gust: **94 mph**
- Stations Reaching 95%: 170
- **Station Reaching 99%: 126**
- PSPS Customers Notified: 95,000
- PSPS Customers affected: **73,000**
- CRCs Opened: 10 (2,667 cars)

Red Flag Warning
High Wind Warning
12/7-12/8

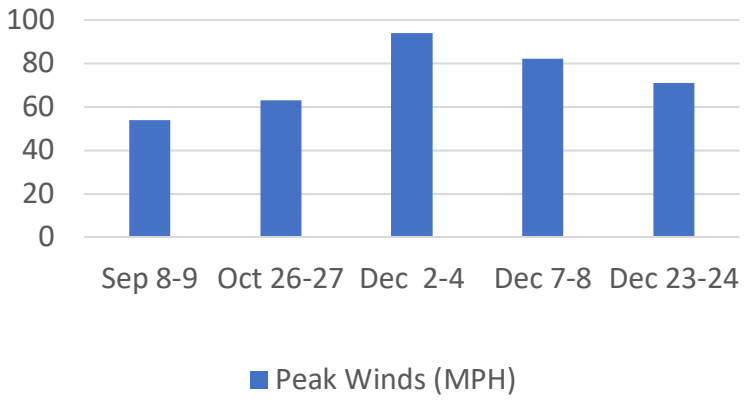
- Top 20 Average Gusts: 59 mph
- Wind Speed Records: 2
- Peak Gust: **82 mph**
- Stations Reaching 95%: 145
- Station Reaching 99%: 67
- PSPS Customers Notified: 50,483
- PSPS Customers affected: **15,300**
- CRCs Opened: 6 (415 cars)

Red Flag Warning
12/23-12/24

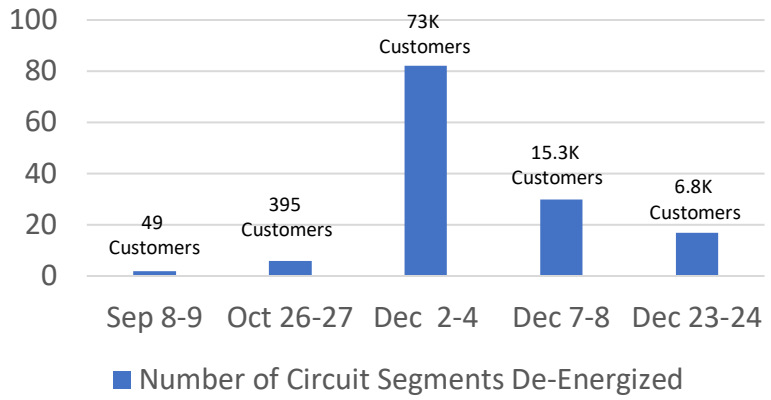
- Top 20 Average Gusts: 57 mph
- Wind Speed Records: 2
- Peak Gust: **71 mph**
- Stations Reaching 95%: 152
- Station Reaching 99%: 66
- PSPS Customers Notified: 30,394
- PSPS Customers affected: **6,797**
- CRCs Opened: 4 (59 cars)

2020 PSPS Event Summary

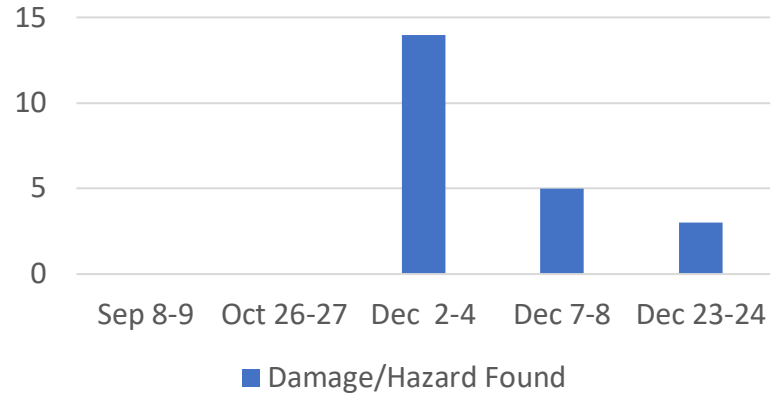
Peak Winds



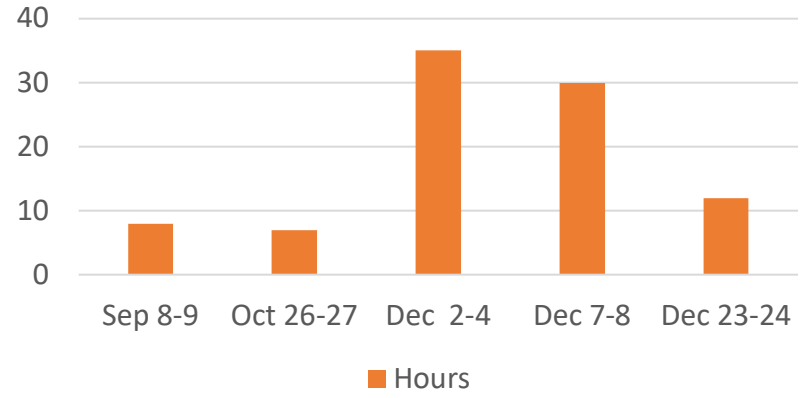
Circuit Segments De-Energized



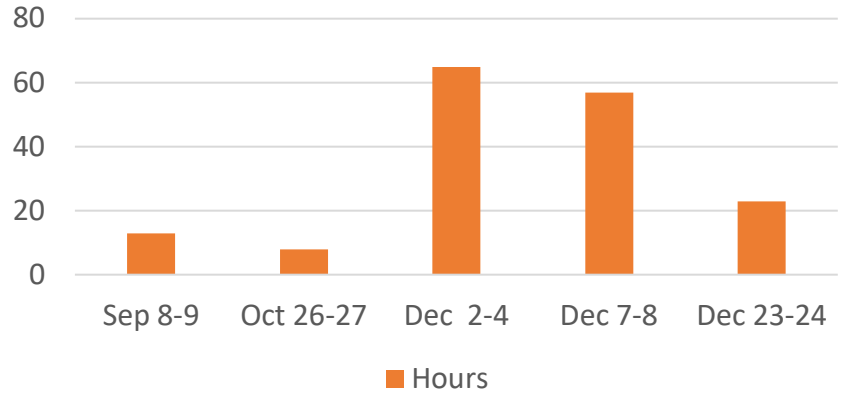
Damage/Hazard Found



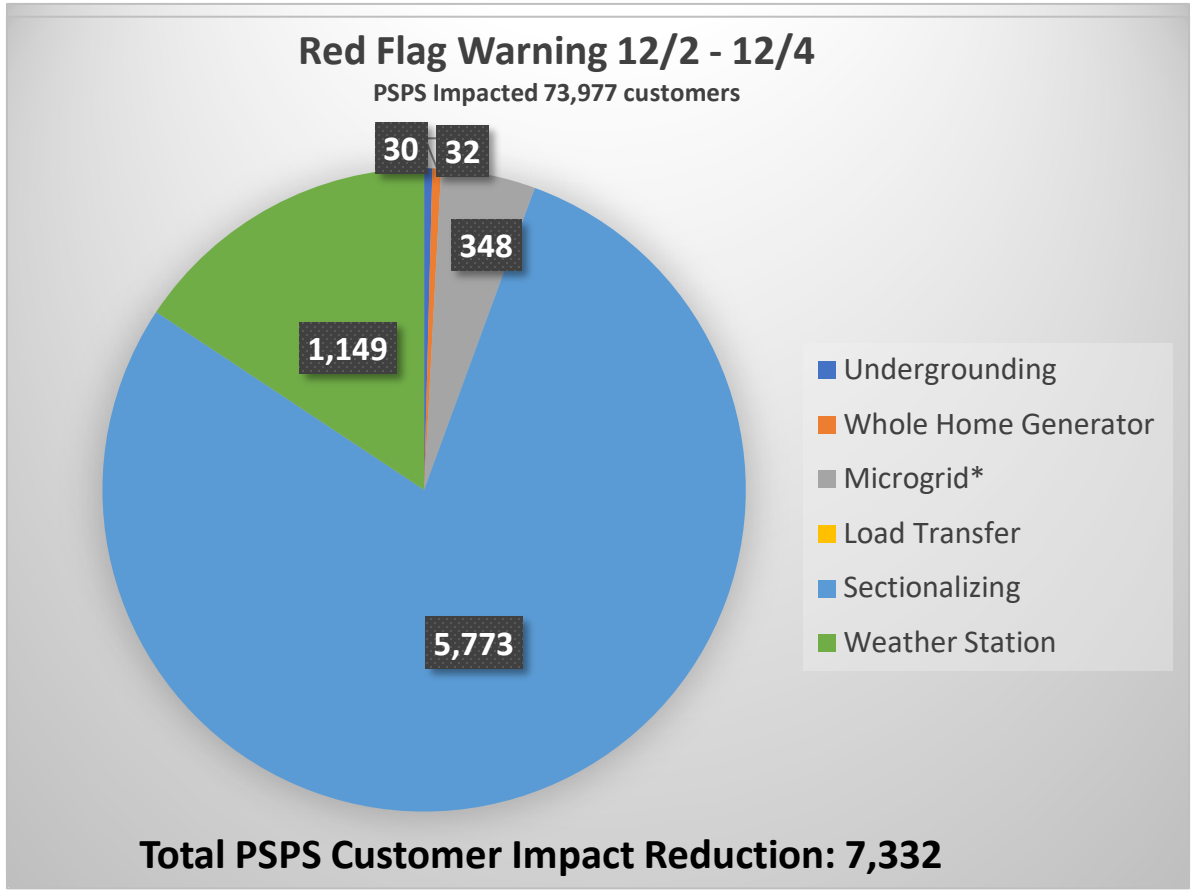
Average Outage Duration



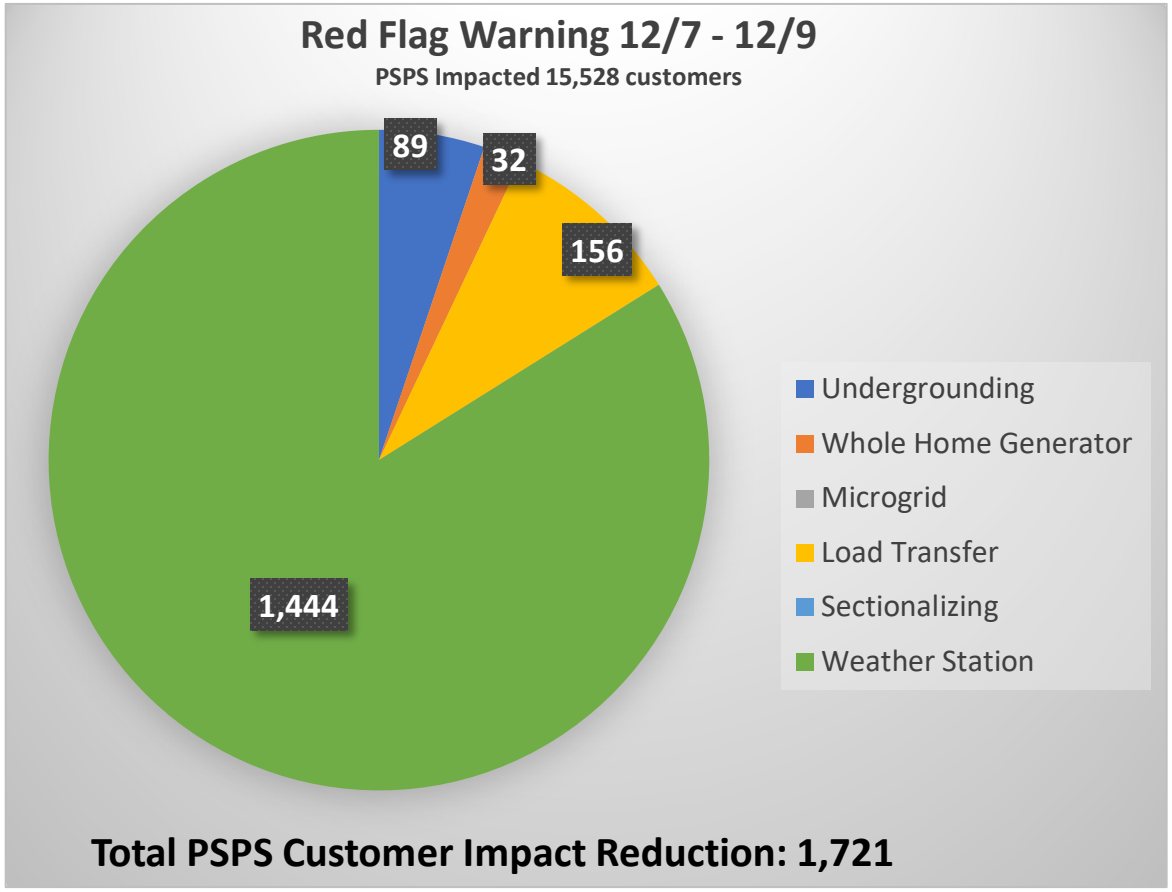
Longest Outage Duration



2020 PSPS Customer Impact Reduction

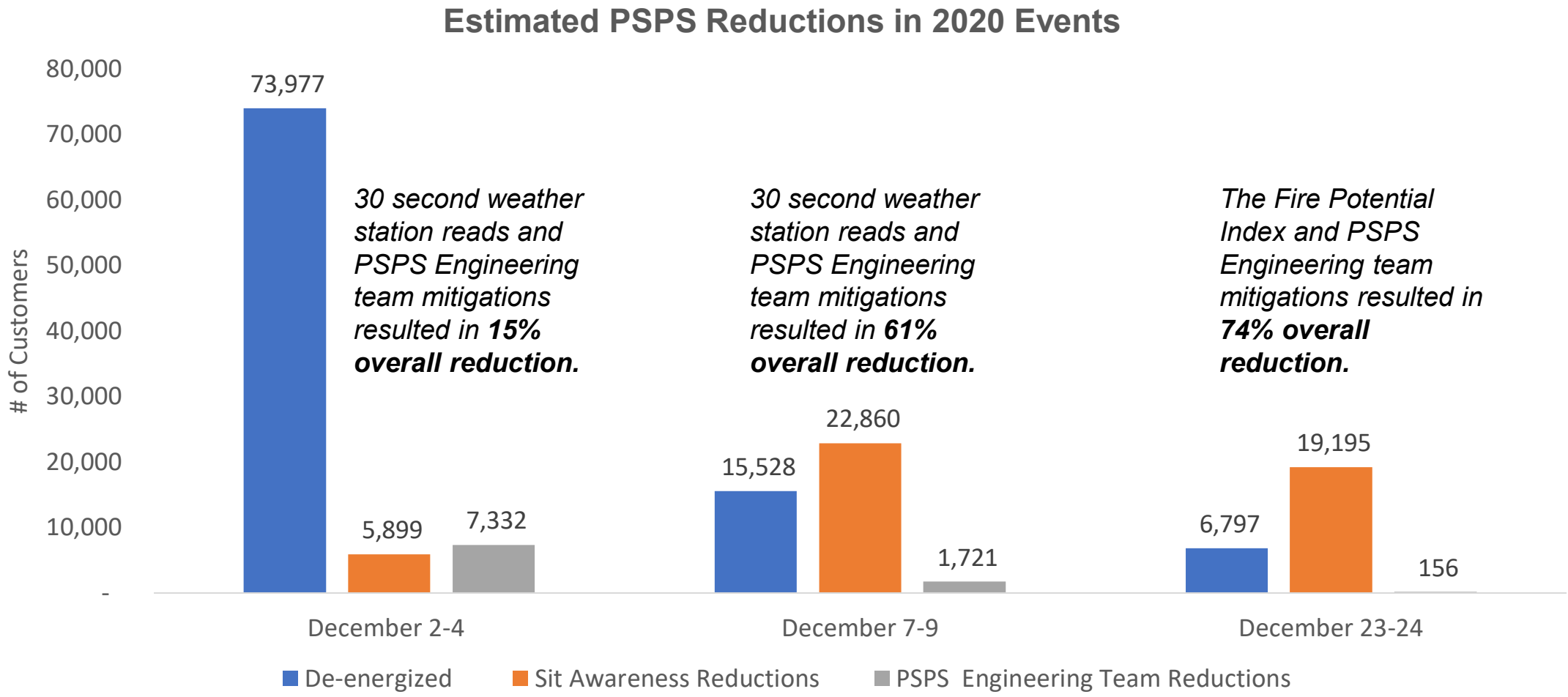


Total PSPS Customer Impact Reduction: 7,332



Total PSPS Customer Impact Reduction: 1,721

2020 PSPS Customer Impact Reduction



*30 second weather station reads and PSPS Engineering team mitigations resulted in **15% overall reduction.***

*30 second weather station reads and PSPS Engineering team mitigations resulted in **61% overall reduction.***

*The Fire Potential Index and PSPS Engineering team mitigations resulted in **74% overall reduction.***

2021 PSPS Impact Reduction

WMP Program	2021 Number of Locations	2021 Customer PSPS Impact Reduction
PSPS Sectionalizing	10	3223 – 5145*
Standby Power Programs	300	300**
Resiliency Grant Programs	~	1000
Microgrids	6	578
Undergrounding	9	1127
Total		3223 – 7500*

*Weather events will dictate the actual number of customers reduced by the project
**Portable generators

Questions

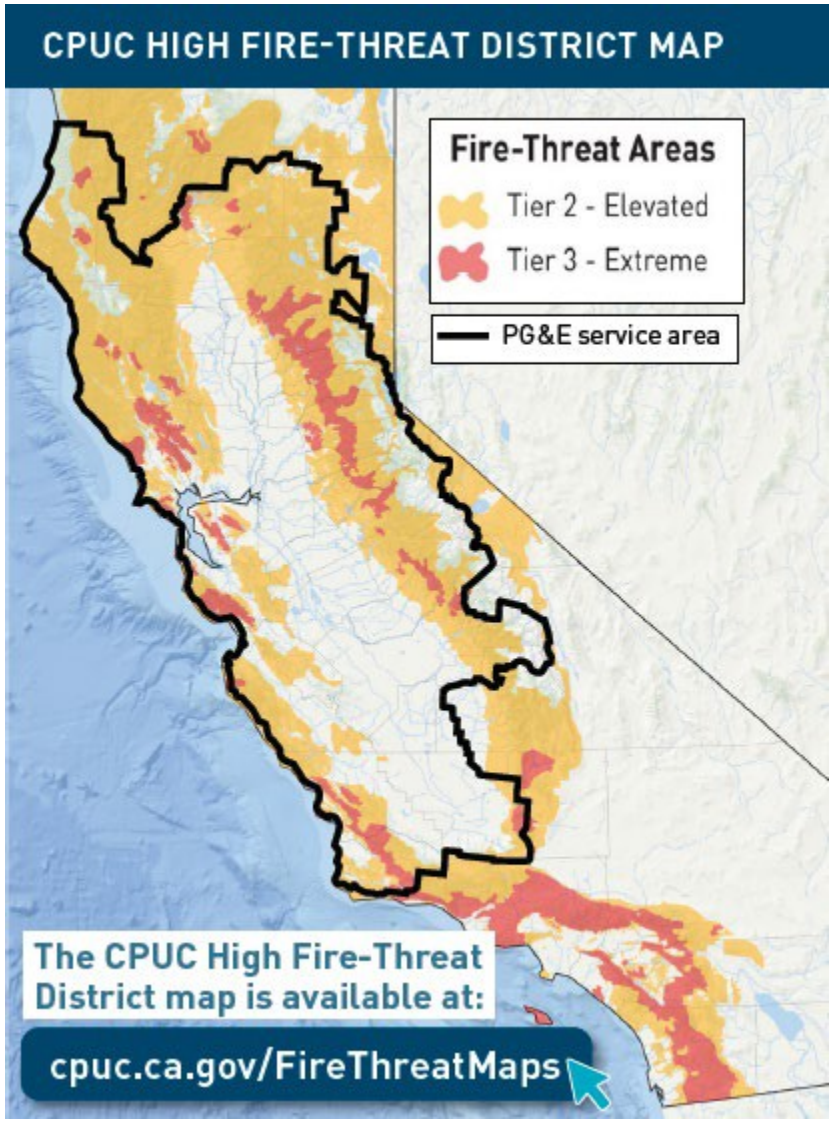
2021 Wildfire Mitigation Plan Overview

Wildfire Safety Advisory Board
March 3, 2021

Wildfire Risk Across PG&E's Service Territory

Wildfire Risk Across PG&E's Service Area	PG&E SYSTEMWIDE	HIGH FIRE-THREAT DISTRICTS
Electric customers served	5.5M	505,600
Overhead distribution line miles	81,000	25,500
Overhead transmission line miles	18,200	5,500

- Over half of PG&E's service territory lies in the High Fire Threat Districts (HFTD) Tiers 2 and 3
- Nearly one-third of the electric lines that provide power to our customers are now located in HFTD areas
- High temperatures, extreme dryness, and record-high winds have increased fire risks across the areas that PG&E serves
- 2020 was another unprecedented wildfire season with five of the six largest wildfires in California's history occurring in 2020, all in PG&E's service territory



Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Introduction to the 2021 Wildfire Mitigation Plan

PG&E recently submitted its Wildfire Mitigation Plan where it outlines the steps the company will take this year, and into the future, to help prevent wildfires

- 2021 WMP continues many of the actions undertaken in our 2019 and 2020 WMPs
- Reflects an evolution to a more precise, technology-based approach to assess and mitigate wildfire risk
- Implements lessons learned from 2020 WMP, and incorporates feedback received from the Wildfire Safety Division, PG&E's Federal Monitor, and many other partners
- 2021 WMP has three overarching goals

REDUCE WILDFIRE IGNITION RISK

- Asset inspection and repair
- Enhanced vegetation management (EVM)
- System hardening
- Public Safety Power Shutoffs (PSPS)

ENHANCE SITUATIONAL AWARENESS

- Weather stations
- High-definition cameras
- Wildfire Safety Operations Center
- Meteorology

REDUCE IMPACT OF PSPS

- Reduce number of impacted customers
- Reduce duration
- Improve timeliness and accuracy of information

Supported by updated Wildfire Risk Modeling that informs prioritization and decision making

The 2021 Wildfire Mitigation Plan is available at: www.pge.com/wildfiremitigationplan

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Wildfire Ignition Risk Reduction & System Upgrade Programs

PROGRAM	2019–2020 Progress	2021 GOAL	2022 Goal
Enhanced and Targeted Inspections Inspection of distribution, transmission and substation equipment to address potential risks	Inspected every asset in HFTD in 2019, re-inspections begun in 2020	Annual inspections in Tier 3 & Zone 1 and every 3 years for Tier 2; focus on highest risk components and areas	
Enhanced Vegetation Management Meeting and exceeding state vegetation and safety standards	4,376 miles	1,800 high risk miles	1,800 high risk miles
System Hardening Installing stronger poles, covered lines and/or targeted undergrounding	513 miles	180 high risk miles	470 high risk miles
Expulsion Fuse Replacements Replacing existing expulsion fuses with new, safer, CAL FIRE exempt equipment	1,351 fuses	1,200 fuses	1,200 fuses
Surge Arrestor Replacements Replacing existing surge arrestors with new, safer, CAL FIRE exempt equipment	14,855 surge arrestors	15,000 surge arrestors	Completing surge arrestors in HFTD
Transmission and Distribution Sectionalizing Devices Separating the distribution grid into smaller sections for more targeted PSPS events	831 Distribution & 54 Transmission Devices	250 Distribution & 29 Transmission Devices	100 Distribution & 65 Transmission Devices
Microgrids Readying substations and the distribution system to receive temporary generation during severe weather (these numbers are cumulative reflecting total number of microgrids each year)	3 Installed + 2 Temporary Microgrids	8 Installed Microgrids	15 Installed Microgrids

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Data as of February 5, 2021, and is subject to change

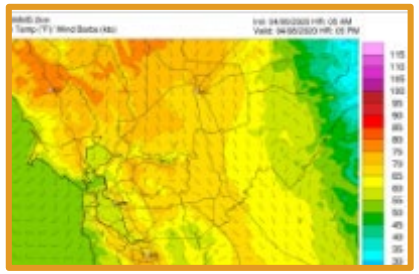
Enhanced Situational Awareness

Wildfire Safety Operations Center

- Tracks weather and potential wildfire data from satellite monitoring, HD cameras, weather stations, work crews and more
- Integrated wildfire reporting from other agencies (e.g. CAL FIRE)
- Insight into other utility systems (SMUD, SCE) to support utility- to-utility coordination

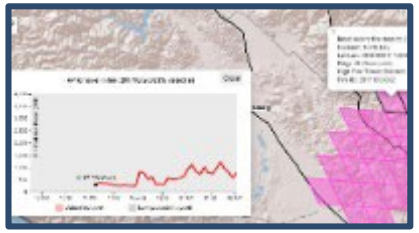
Weather Stations and HD Cameras

- A network of advanced weather stations tracks temperatures, wind speed and humidity in real-time
  - **1,000** installed to date, **1,300** by the end of 2021, one station every 20 miles in high fire-threat areas
- High-definition cameras provide an early warning for fires, shared with agencies
  - **350** installed to date, **600** by the end of 2022, covering more than 90% of high fire-threat areas



Meteorology

- Continuous review of weather conditions indicating increased wildfire risk
- In 2020, increased weather model resolution from 3 x 3 km to 2 x 2 km
- Conducted 1.25 billion fire spread simulations during 607 worst fire days over 30 years



Satellite Monitoring

- Data from best-in-class satellite systems can detect potential wildfires and send immediate alerts
- Allows faster response, awareness and tracking of emerging incidents
- Partnership with Space Science and Engineering Center at the University of Wisconsin – Madison

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

2020 PSPS Improvements

FEWER CUSTOMERS IMPACTED

55% **fewer customers** were impacted in 2020 compared to similar weather events from 2019

628,600 **customers were kept energized** because of enhancements to our electric grid technology

We kept the power on for more customers during events in 2020 due to:

- Better weather technology
- Electric grid improvements
- Microgrids and temporary generators
- Sectionalizing devices

REDUCED RESTORATION TIMES

Reduced the time to restore power after the severe weather by:

41%

AVERAGE OUTAGE DURATION AFTER WEATHER "ALL CLEAR"	
2019	16.8 hours
2020	9.7 hours

Inspection and restoration efforts for each 2020 event were supported by as many as:

- **3,200** On-the-ground personnel
- **65** Helicopters
- **1** Airplane

BETTER INFORMATION AND RESOURCES

Provided improved resources and support for customers before, during and after PSPS events

PROGRAMS & PARTNERSHIPS

- **4,500** **Customers served** through partnerships with community-based organizations
- **30,400** **Food packages provided** through partnerships with local food banks
- **6,550+** **Batteries distributed** via CFILC Disability Disaster Access and Resources Centers and PG&E's Portable Battery Program

IMPROVED NOTIFICATIONS

12.3M+ **PSPS notifications** delivered in customers' preferred language via calls, texts, emails and door knocks*

These enhanced alerts were more clear and precise, providing details such as the timing at specific addresses for shutoff and restoration.

**Medical Baseline customers received door knocks if had not confirmed receipt of notification prior to a PSPS event.*

COMMUNITY RESOURCE CENTERS

245 Community Resource Centers opened

50,105 Total visitors

For more information visit **pge.com/wildfiresafety**

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Public Safety Power Shutoff Improvements

We are continuing to improve our Public Safety Power Shutoff (PSPS) Program. Improvements to the program have included enhanced operations, communication and coordination before, during and after PSPS events.

2018

Launch Community Wildfire Safety and PSPS Programs

- PSPS scope included **Tier 3 distribution lines and low-voltage transmission lines** (potential to impact ~500K total customers)

Key Learning: program scope too limited

1 Event | **60K** Customers

2019

Expand PSPS Program Scope

- Expanded PSPS scope to **all distribution and transmission lines in Tier 2/Tier 3 areas**
- **Public awareness campaign** rolled out for more than 5M customers

Key Learning: customer support and event execution must improve

9 Events | **2M** Customers

2020

Target PSPS Events to Highest Risk Areas

- Top to bottom re-engineering of entire PSPS operation
- Developed more granular meteorological scoping capabilities
- Developed a structure-by-structure analysis of the transmission system to allow more targeted scoping
- Improved local partnerships and customer support

Key Learning: program must continue to evolve to capture catastrophic wildfire risk

6 Events | **653K** Customers

2021

Continuous Improvement & Further Risk Reduction

- Improve distribution scoping analysis to further incorporate tree overstrike potential
- Focus on opportunities to support customers repeatedly impacted (e.g., backup power rebates, other offerings)
- Continue to increase resiliency to offer other wildfire risk mitigations in lieu of PSPS

1 Event | **5K** Customers

All numbers are approximate

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Improvements to Risk Modeling in 2021

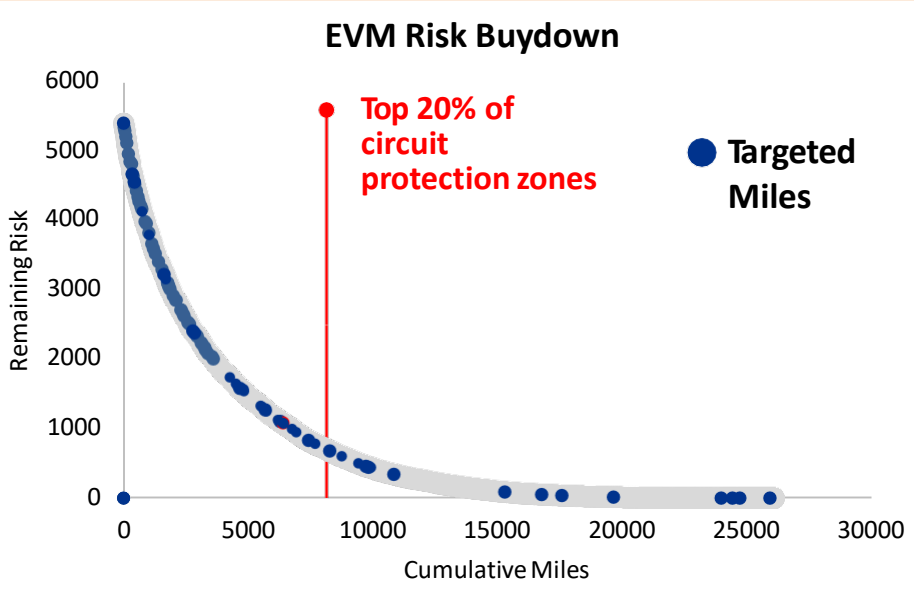
Key Improvements

1. **Using machine learning and field expertise** to move from a static consequence model to a dynamic consequence model
2. Updates made to **ignition probability variables and consequence values** allow us to better target key wildfire safety measures
3. New models place more importance on **consequence of wildfires over potential ignitions**

New Model Benefits

- Increased model accuracy and efficacy
- Highlights importance of fast-burning fuels and potential "ladder" effects
- Up-to-date prediction of fire behavior
- Drives focus of 80% of the work towards the top 20% of the circuit protection zones

Sample Risk Buydown: Enhanced Vegetation Management



Field Verification

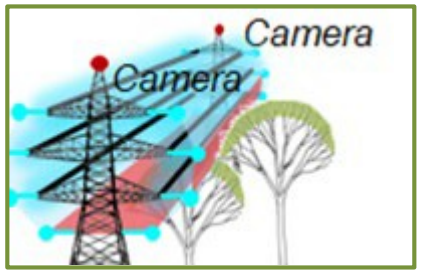
- A **team of Public Safety Specialists (PSS)** is field validating the new risk model
- The PSS electric team has **expanded from five experts** in 2018 **to more than 30** in 2021
- PSS's are **subject matter experts with a background largely in emergency management and wildfire**, hired on a geographic basis for their local knowledge and experience
- PSS's **local expertise is helping with field validation** of program and execution priorities

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

New Technologies

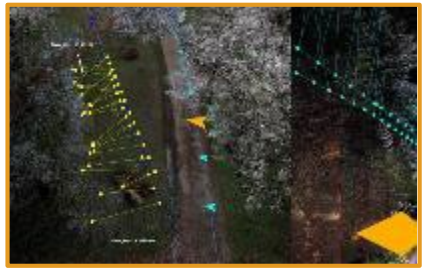
Rapid Earth Fault Current Limiter

- Automatically and rapidly reduces the flow of current and risk of ignition in single phase to ground faults
- Reduces the potential for fire ignitions and better detection of wire-on-ground conditions
- Pilot program to be completed by July 2021; additional planning if successful



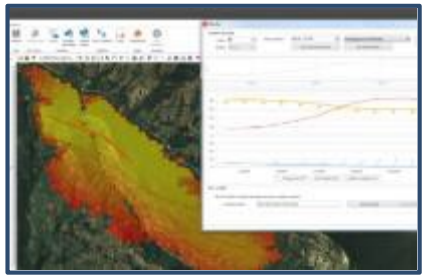
Distribution, Transmission and Substation – Fire Action Schemes and Technology (DTS-FAST)

- Quickly detects objects approaching energized power lines and shuts off power before object impact
- Uses a series of cameras mounted on PG&E equipment for detection
- Pilot underway to assess the technology's efficacy at mitigating wildfire risks
- If pilot is successful, PG&E will target high-impact areas, based on risk analysis



LiDAR

- Implementing the use of ground-based LiDAR with vehicles to review and record completed vegetation management work
- Can address ~70% of HFTD circuits
- Provides a digital time-stamped record of work verification



Technosylva

- Real-time analysis of wildfire behavior and simulates the spread of wildfires
- Comprehensive set of outputs and tools for analyzing wildfire conditions and potential
- Used to prepare new risk model and to analyze the efficacy of PSPS events

Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead®

2021 Wildfire Mitigation Plan Update

CPUC Wildfire Safety Advisory Board

March 3, 2021

SCE's WMP Strategy Grounded in Fire Science to Protect Public Safety and New Activities Reflect Lessons Learned and Enhancements

2019

Foundational Strategy

Grid hardening
- Covered conductor
- Fire resistant poles
- Current limiting fuses
- Automatic reclosers

Bolstering situational awareness capabilities
- HD cameras
- Weather stations

Enhancing operational practices
- Enhanced overhead inspections
- Expanded Line Clearing
- Hazard Tree Management Program
- Public Safety Power Shutoff (PSPS)

2020

Granular Wildfire Risk, PSPS Mitigation & Pre-Fault Detection

Improving wildfire risk assessments and models
- More granularity in analysis
- Transition from REAX to Technosylva

Refining scope of high fire risk inspections
- 360-degree inspections
- Risk-informed

Minimizing PSPS impacts
- Sectionalization
- Additional weather stations
- Critical Care Back-up Battery Program
- Back-up generator rebates

Advancing new technologies
- Open Phase Detection
- Distribution Fault Anticipation
- Early Fault Detection

2021

Lessons Learned, Fire Suppression, Data Platforms, and PSPS Risk

Risk analysis
- Evaluate PSPS risk by incorporating safety, reliability and customer financial impacts into granular risk modeling

Inspection strategy evolution
- Planning and readiness for expanded inspections based on emergent fuel conditions

Expanded grid hardening
- Long-span remediation
- Transmission hardening measures
- Targeted covered conductor deployment to reduce PSPS

Technology enhancements
- Next generation data management and analytics
- Improved work management tools

Aerial fire suppression
- Strategically located resources to protect infrastructure

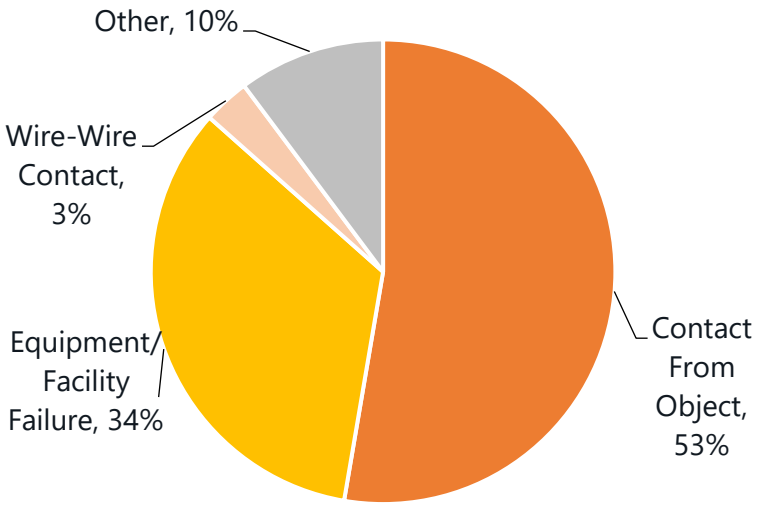
SCE's Foundational Mitigation Deployments

	2019 Actuals	2020 Actuals	2021-22 WMP Forecasts
Infrastructure Hardening	**Covered Conductor:** 372 circuit miles completed	More than 960 circuit miles	Install at least 1,000 circuit miles in 2021 and 1,600 circuit miles in 2022. Scope will be added if feasible.
	Undergrounding: leverage risk & engineering analysis and identified opportunities	Identified 17 miles for 2021-22	Approximately 4-6 miles in 2021 and 11 miles in 2022
Enhanced Operational Practices	**Inspections:** All HFRA distribution and transmission structures inspected	Inspected 199,000+ distribution structures and 35,500+ transmission structures by ground; performed repairs and replacements within due dates	Risk-informed ground & aerial inspection program covering ~50% of HFRA structures annually
	Vegetation Management: expanded line clearances to 12 feet; removed ~5,900 hazard tree (below target of 7,500); cleared brush at base of >100,000 poles	Maintained line clearance, completed 99,500+ hazard tree assessments and 12,200+ tree removals, cleared brush at base of 230,000+ poles	Continue expanded line clearances; focus on hazard tree assessments and timely removal; expand brush clearing at base of poles to 200,000-300,000
	PSPS: de-energization based on circuit-specific wind speed thresholds	Same de-energization approach	Same de-energization approach with new circuit-specific mitigation plans and customer care programs to reduce customer impacts
Situational Awareness	**Weather Stations:** 357 installed	575 installed	375-475 weather stations per year
	HD Cameras: 91 installed	5 installed (completed at a total of 166 cameras)	Deployment complete as coverage in high fire risk areas effectively maximized

SCE's WMP Built on the Foundation of Detailed Risk Analysis

Wind-driven weather events is the key contributor to wildfire ignitions associated with utility power lines

Initial Risk Assessment Determined Distribution Infrastructures Represented the Highest Frequency of Ignition Events in High Fire Risk Areas
(5-Year Average, 2016-2020)



SCE's covered conductor program is a foundational mitigation activity complemented by risk-informed enhanced overhead inspections

Prioritize mitigation deployment for most expeditious risk reduction

Advances in Risk Analysis Informed the Priority of Greatest Risk Reduction

Probability of Ignition (POI) **x** Consequence (Technosylva)

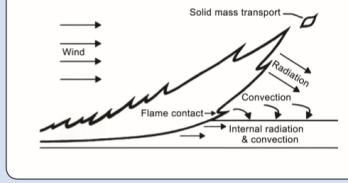
EFF/CFO Models

- Transformer Model
- OH Conductor Model
- Switch Models
- Capacitor Bank Model
- CFO Model

Fault to Fire Mapping

Rothermel model for fire propagation

$$R = \frac{I_R \xi (1+\phi_w+\phi_s)}{\rho_b \epsilon Q_{ig}}$$



- High Fire Risk Areas
- SCE Circuits
- Fuel Conditions
- Population Density
- Structure Density

Public Safety Power Shutoff & Mitigation Efforts

While PSPS has been an effective mitigation measure, SCE fully recognizes the hardship for our impacted customers and are actively working to further reduce the impact of PSPS

Key Principles of SCE Approach to PSPS

- Incident Command System (ICS) with well-trained Incident Management Teams (IMT) to conduct all operational activities relating to PSPS
- PSPS decisions are based on actual grid & weather conditions at individual circuit level
- Leverage our automation and sectionalizing investments in the grid to de-energize only a sub-portion of those circuits at risk

2020 PSPS Results (2019 differential):

- **12** PSPS activations (**25%** ↓)
- **230k** customers de-energizations (**16%** ↑)
- **138k unique** cust. de-energized (**13%** ↑)
- **18** hours of avg. outage duration (**33%** ↓)

More de-energizations occurred in 2020 vs 2019 due to weather differences; however, PSPS mitigations implemented reduced number of activations and duration of outages

Continue to improve and evolve SCE's PSPS program[1]:

- Further advancing customer care programs based on community and customer feedback (e.g., alternate power source for communication needs)
- Targeted deployment of system hardening, including covered conductor, to reduce the need for PSPS

PSPS Action Plan

- Reduce the use of PSPS
- Transparency of the decision-making process
- Mitigate impacts of PSPS
- Keep partners and customers informed
- Enhance and improve post-event reporting

[1] Impact to customers and employees given the evolving COVID-19 pandemic have been considered in our PSPS protocols since mid-2020

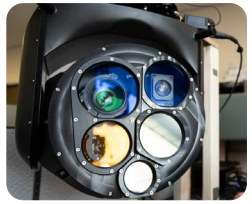
SOUTHERN CALIFORNIA EDISON®

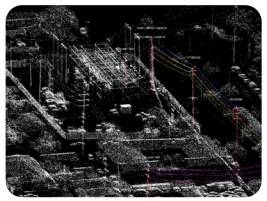
Advancing New Technologies & Capabilities to Accelerate Wildfire Risk Mitigation

Active scanning of technologies with progressive implementation into programmatic mitigations and/or embed into routine operational practices to mitigate wildfire risk and improve resiliency

Inspection Technologies

Multi-spectral imaging with high resolution IR/Corona and LiDAR



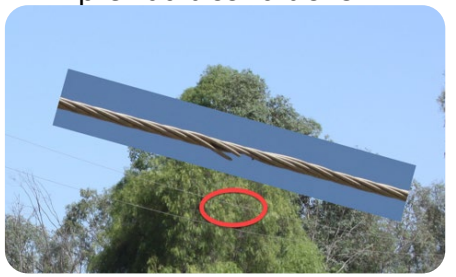


Artificial Intelligence & Machine Learning

Leveraging AI and ML algorithm to advance risk modeling (probability of ignitions) and detect asset defects very quickly without

Sensors and Protective Relay to Detect Incipient Degradation

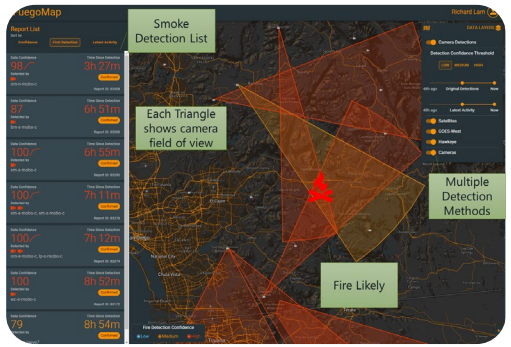
Distribution Fault Anticipation (DFA) & Early Fault Detection (EFD) combination of EMF sensors and analytics that identify pre-fault conditions



Fire Suppression Applications

Explore application of fire retardant & drone deployment of fire suppression agent

Early Fire Detection Data Management – FuegoMap



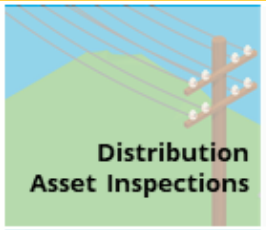
Big Data Analytics

Smart Meter algorithm to detect energized down conductors and Cloud-connected plug-in device and smartphone app that detects issues in a home's wiring system that may be indicative of broader network issues or safety hazards

Appendix

Year-End 2020 Progress Report

WILDFIRE MITIGATION ACTIVITIES



Distribution Asset Inspections

2020 Completed/Target: 199,000/105,000 assets inspected

190% completed

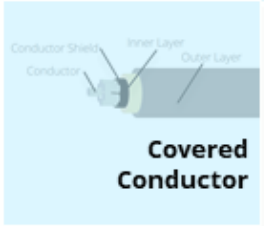
Completed Since 2018: 584,300 assets inspected

Transmission Asset Inspections

2020 Completed/Target: 35,500/22,500 assets inspected

158% completed

Completed Since 2018: 86,100 assets inspected



Covered Conductor

2020 Completed/Target: 960/700 circuit miles installed

137% completed

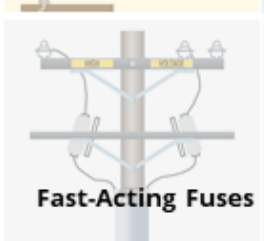
Completed Since 2018: 1,480 circuit miles installed

Fire-Resistant Poles

2020 Completed/Target: 6,090/5,200 poles installed

117% completed

Completed Since 2018: 7,510 poles installed



Fast-Acting Fuses

2020 Completed/Target: 3,025/3,025 fuses installed

100% completed

Completed Since 2018: 12,900 fuses installed

Sectionalizing Devices

2020 Completed/Target: 49/45 devices installed

109% completed

Completed Since 2018: 100 devices installed

Hazard Tree Management

2020 Completed/Target: 99,500/75,000 trees assessed

133% completed

Completed Since 2018: 228,500 trees assessed

Weather Stations

2020 Completed/Target: 590/375 weather stations installed

157% completed

Completed Since 2018: 1,050 weather stations installed

High-Definition Wildfire Cameras

Cameras thoroughly covering our high fire risk areas were installed by 2020.

Completed Since 2018: 166 cameras installed

Community Resource Centers

56 sites available

Community Crew Vehicles

8 vehicles available

Long-Term Wildfire Mitigation Plan Capabilities (1/2)

SCE is increasingly leveraging big data and advanced analytics to inform wildfire mitigation deployment in the short-term and portfolio optimization in the long-term

	2020 – 2022 (Current Focus)	2023 – 2030 (Potential Future Focus)
Data	• Establish data governance framework to manage, collect, and maintain data • Build data centralization capability using cloud, platform-centric architecture that consolidates data from disparate enterprise systems	• Leverage centralized system to further enhance wildfire mitigation efforts through real-time data analytics • Data to inform risk analysis and portfolio optimization
Risk	• Higher resolution in ignition risk and consequence calculation • Advance our risk calculation and methodology (e.g., Multi-Attribute Framework, PSPS)	• Leverage granular risk calculations to determine optimal locational wildfire mitigation deployment • Integrate models with more real-time vegetation, weather, and asset data
Optimize	• Develop asset management framework (e.g. asset classes) • Leverage risk-spend efficiencies, operational realities, and external factors to determine wildfire mitigation portfolio	• Cross-optimize wildfire risk with other enterprise risks (e.g. cybersecurity) • Leverage cross-optimization to develop robust portfolio-wide risk-based resource allocation

Long-Term Wildfire Mitigation Plan Capabilities (2/2)

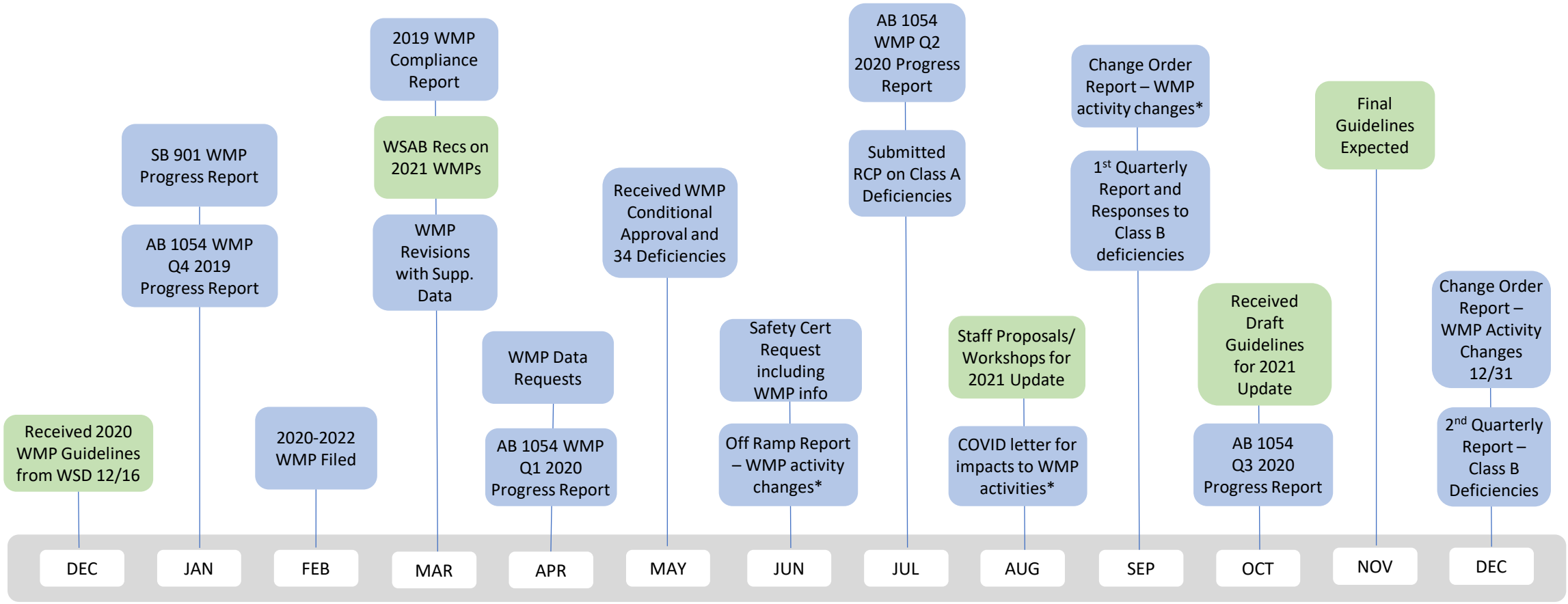
SCE's foundational wildfire mitigation strategy will be substantially deployed in the short-term and continue to be expanded and refined in the long-term

	2020 – 2022 (Current Focus)	2023 – 2030 (Potential Future Focus)
Grid Hard	• Maximize risk reduction in the shortest amount of time through deployment of covered conductor, fire-resistant poles, targeted undergrounding, and long-span initiatives	• Scale any promising advanced technology pilots (e.g. early fault detection) • Evaluate potential for expanded undergrounding opportunities to further reduce risk
Op. Pract.	• Risk-informed 360-degree inspection program • Expanded vegetation management program in high fire risk area (e.g. expanded clearances, hazard tree program, expanded pole brushing) • Reduce the impact of PSPS	• Implement semi-automated asset and vegetation inspection auditing • Develop predictive modeling of asset and vegetation failures • Reduce the use of PSPS
Sit. Awar.	• Deploy weather stations to increase weather modeling accuracy and PSPS sectionalization capability • Pilot incipient fault detection equipment	• Continue to improve weather forecasting capabilities • Incorporate real-time weather impacts to assets • Improve ability to detect fires

SCE Hopes to Engage in Forward-Looking Discussions to Streamline WMP Reporting and Review Cadence and Content

2020 WMP Deliverables and Reporting Requirements

(does not include PSPS reports or new requirements proposed by WSD on quarterly reporting)



[7] 2021 Work Plan

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Expected Timeline	Recommendations
Early Q2	2021 Large IOU WMP Updates
Mid Q2	2021 Small IOU & ITO WMP Updates
Late Q2	2022 IOU WMP Update Guidelines, Performance Metrics, Safety Culture
Late Q3	Guidance Advisory Opinions on 2021 POU/Co-op WMP Updates

[8] Closing Public Comment

Participation Options:

Please begin your comment by stating your name and organization (if applicable).

- **Phone:** Number: 1-800-857-1917, passcode: *17 67 567*
  - Dial * 1 (star one) to be placed in a queue by the operator.
- **Email:** Written comments may be sent email to WildfireSafetyAdvisoryBoard@cpuc.ca.gov. Staff will read these comments out loud during the meeting.
- **Public Advisor:** If there are technical issues, the Public Advisor can help. Email public.advisor@cpuc.ca.gov, or call (866) 849-8390.

California Wildfire Safety Advisory Board

Adjourn

For more information:

www.cpuc.ca.gov/wsab

WildfireSafetyAdvisoryBoard@cpuc.ca.gov