

Pacific Gas and Electric Company

ENHANCED POWERLINE SAFETY SETTINGS (EPSS) WORKSHOP

March 17, 2023





Discussion Topics and Presenters

- 1 Reducing Wildfire Risk for Our Customers and Hometowns

- 2 Enhanced Powerline Safety Settings: A Proven Wildfire Prevention Tool

- 3 Different Types of Outages

- 4 Supporting Customers with Resources and Information

- 5 Q&A

PG&E SPEAKERS

Mark Quinlan

Vice President, Electric System Operations

Dave Canny

Director, Enhanced Powerline Safety Settings Program

Dave Meier

Senior Manager, Customer Emergency Planning and Operations

Reducing Wildfire Risk for Our Customers and Hometowns



By The Numbers

16M
PEOPLE SERVED

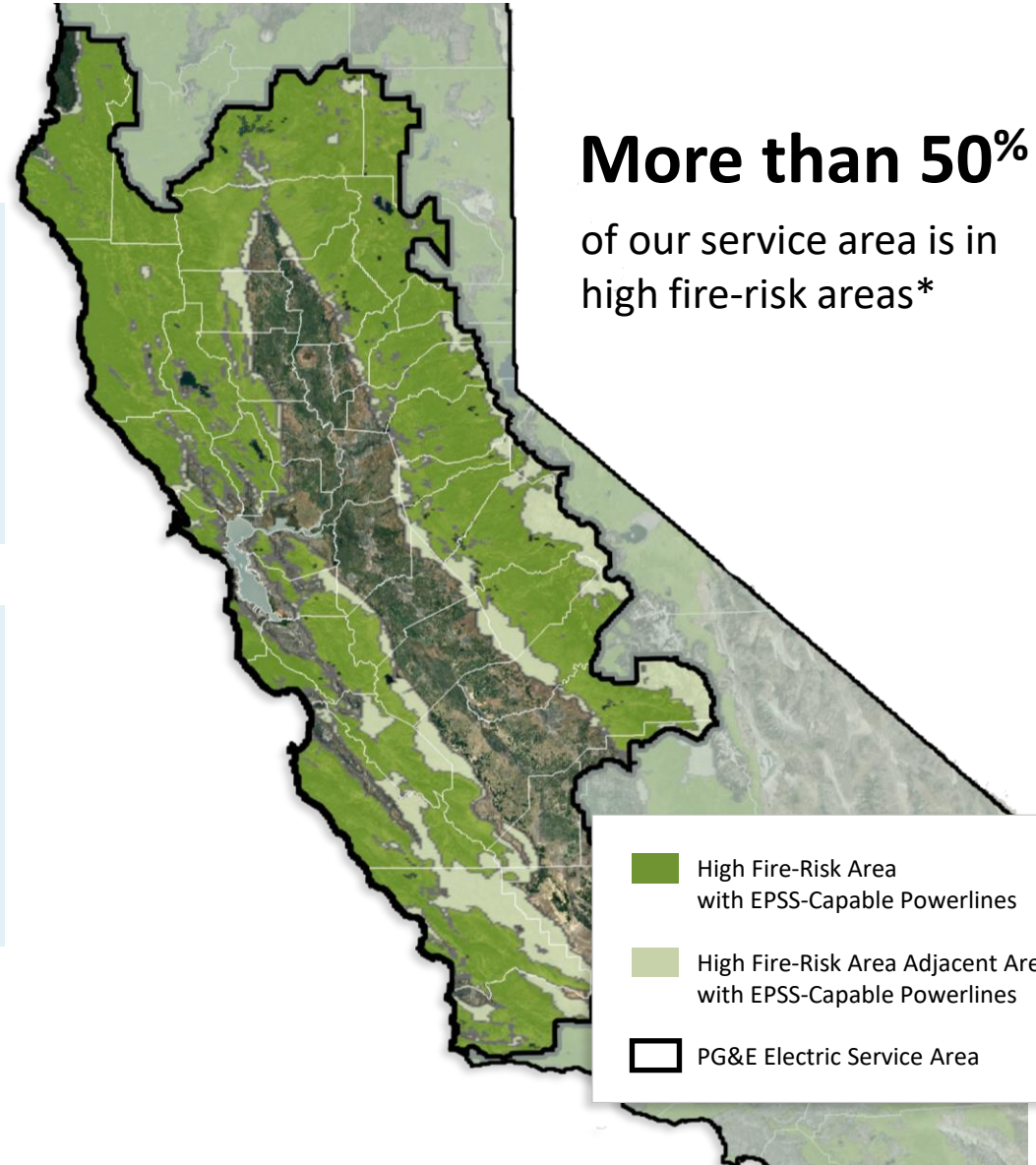
5.5M electric accounts

4.5M gas accounts

70,000
SQUARE MILE
SERVICE AREA

106,700 circuit miles of electric
distribution lines

42,100 miles of natural gas
distribution pipeline



Responding to Evolving Wildfire Risk

2020

2021

2022

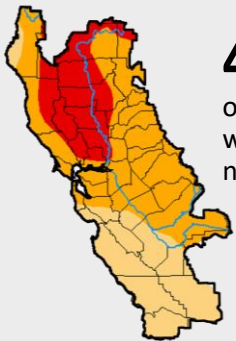
2023

CLIMATE CHANGE LEADING TO A PROLONGED AND INTENSIFIED WILDFIRE SEASON

Drought-intensified wildfire risk

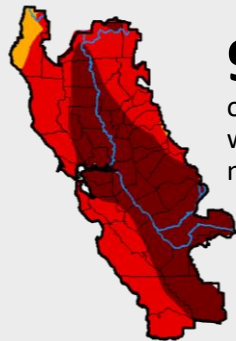
Moderate drought conditions

Significant increase in wildfire activity on non-Red Flag Warning (RFW) days



47%
of acreage burned by
wildfires ignited on
non-RFW days

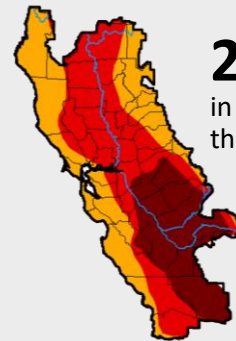
U.S. drought monitor
Map as of 12/29/2020



95%
of acreage burned by
wildfires ignited on
non-RFW days

U.S. drought monitor
Map as of 11/2/2021

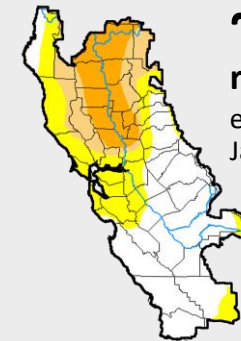
★ **Implementation
of EPSS pilot**



2nd driest year
in the last 128 years
through peak wildfire
season

U.S. drought monitor
Map as of 11/1/2022

Expansion of EPSS to all
high fire-risk areas



~43% of CA
remains in drought
even with 13th wettest
January in 129 years

U.S. drought monitor
Map as of 3/7/2023

Adding additional protection
and refining EPSS

● **99% reduction in acres burned
68% reduction in ignitions**

Key Wildfire Safety Objectives This Year

Prevent Wildfires



Reduce Customer Impacts



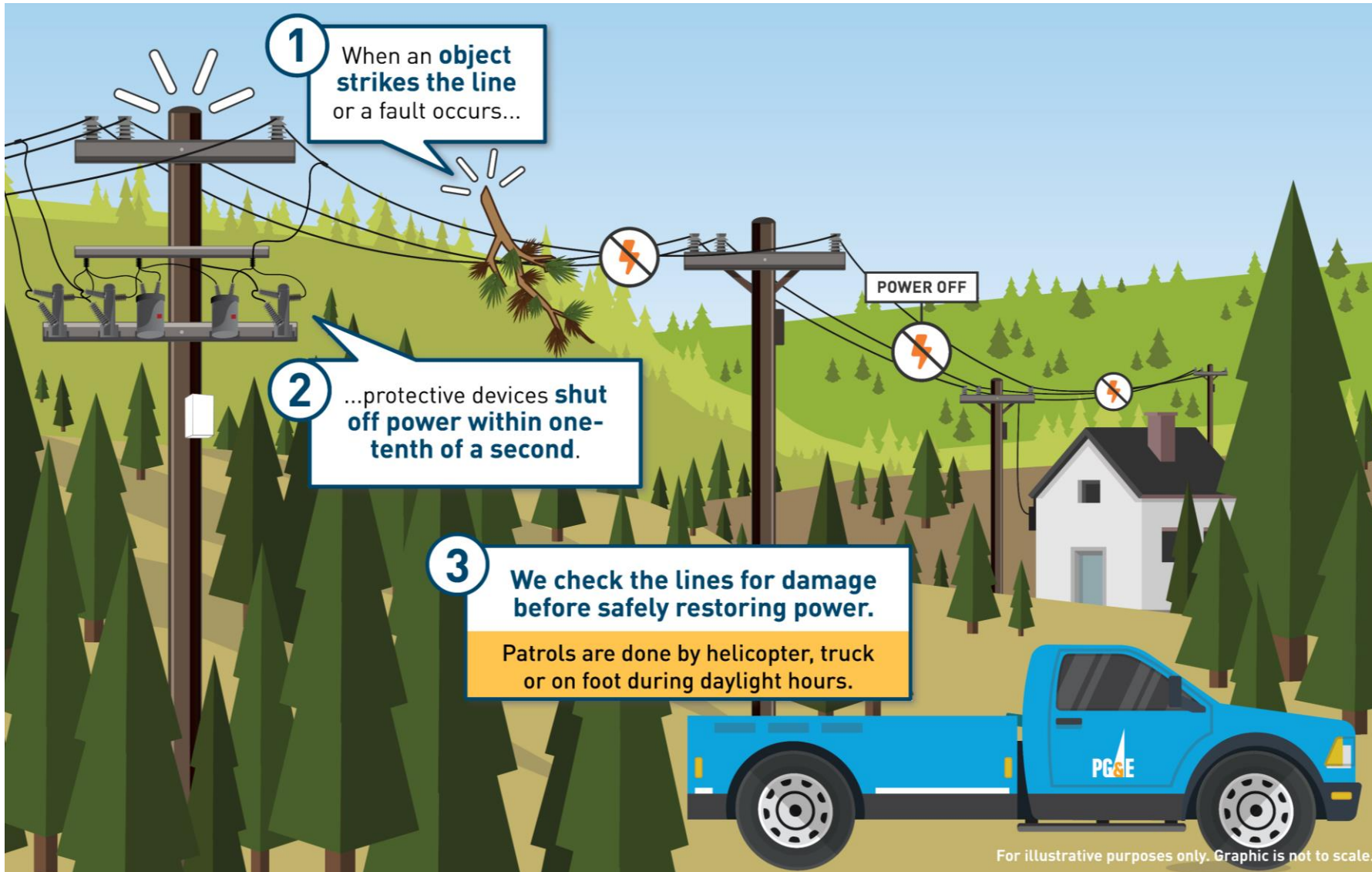
Provide Better Resources



Enhanced Powerline Safety Settings: A Proven Wildfire Prevention Tool



What Are Enhanced Powerline Safety Settings (EPSS)?



Fast Fault Detection

Safety settings detect distribution primary faults quickly and automatically

Fuse Single-Phase Operation Reduction

Detect faults beyond fuses to de-energize all three-phases


Higher Impedance Fault Detection

Sensitive ground fault (SGF) elements implemented to help isolate for higher impedance faults


Mitigating Wildfire Risk

Last year, we expanded the use of EPSS to all powerlines in high fire-risk areas. **Expansion drove improvements and these settings effectively helped to prevent wildfires, even with higher risk conditions.**

2022 Program Expansion

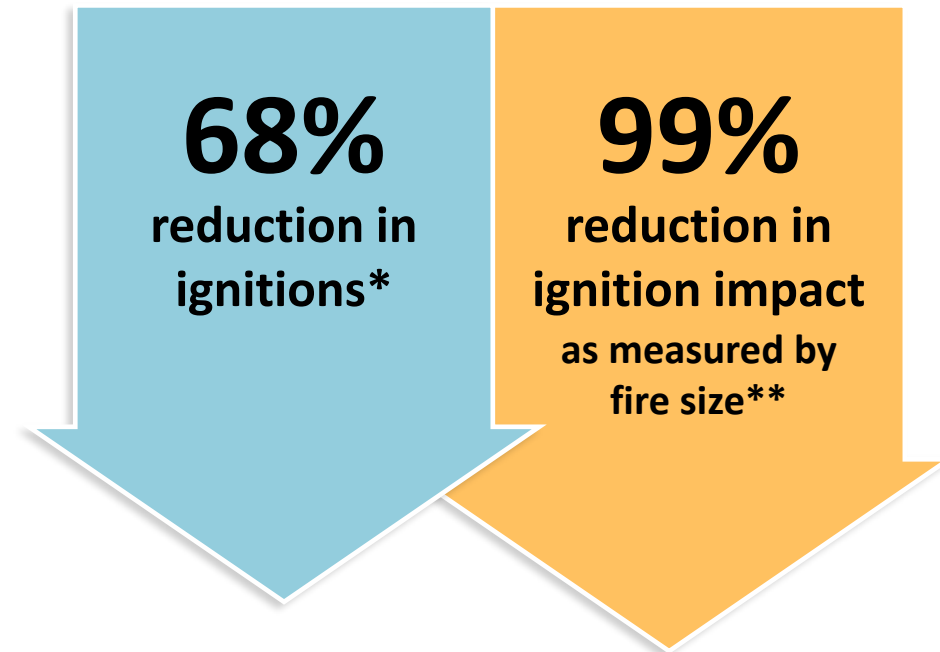


100%
of high fire-risk area line miles protected



1.82M customers protected
374% increase compared to 2021

Despite 31% more days in R3+ conditions we saw a:



*Data is approximate; *Based on 2022 performance for CPUC-reportable ignitions in HFTD compared to 2018-2020 weather-normalized performance; **Relative to 2018-2020*



Minimizing Customer Impacts

Through real-time and continuous improvements, we mitigated customer impacts, without compromising the wildfire prevention benefits of EPSS.

2022 System Performance

<3 Hours

Average outage length

~770K

Customers impacted

56%

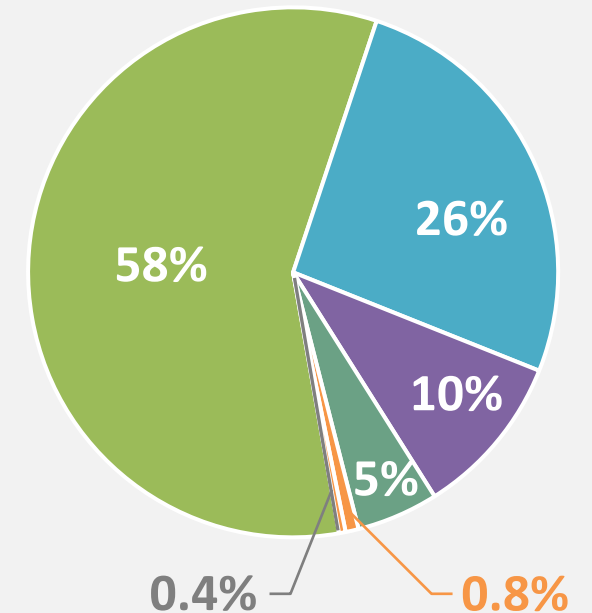
Average outage duration reduction compared to 2021

877

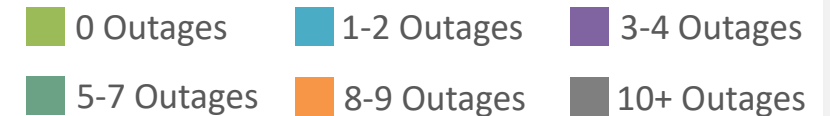
Customers on average impacted per outage

1.82M

Customers protected



CUSTOMERS EXPERIENCING





Program Expansion and Improvement

By turning 2021 learnings into action, we simultaneously expanded and improved the EPSS Program last year.

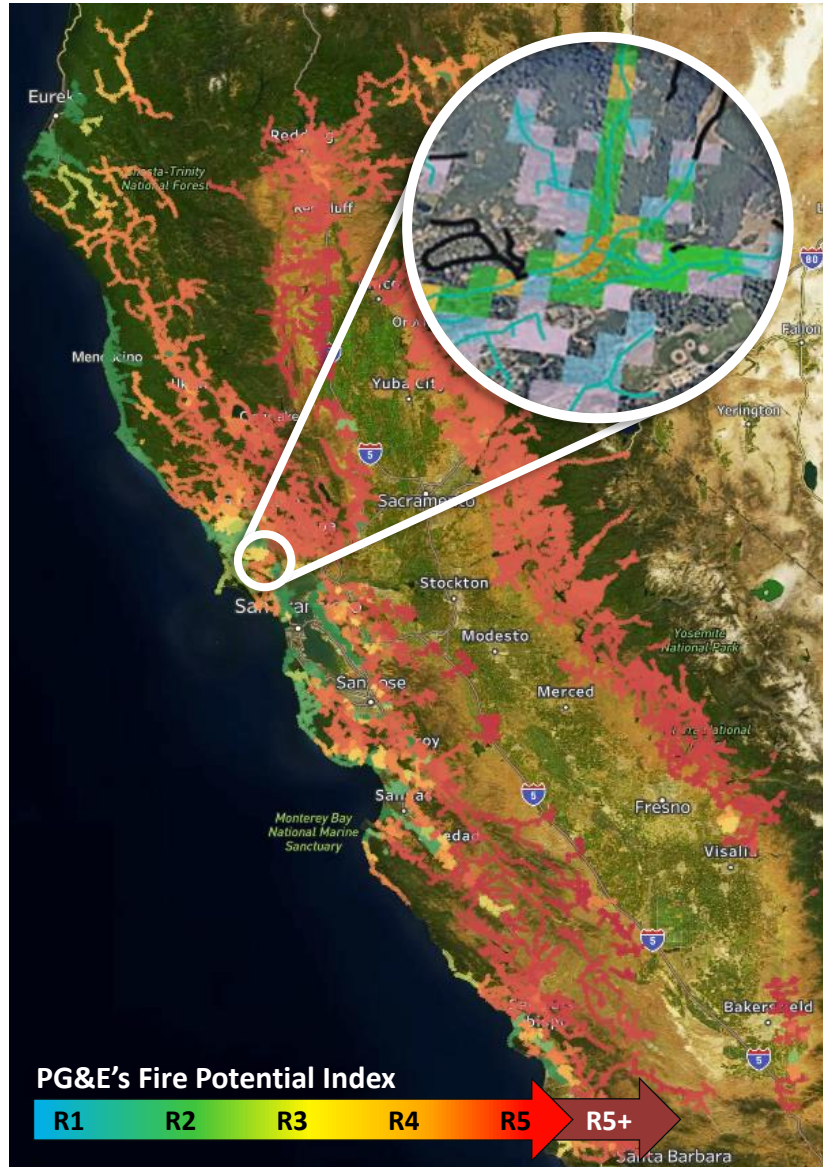
Key 2022 improvements based on 2021 learnings:

- Engineered and installed coordinated settings
- Developed and executed circuit-level enablement to maximize risk reduction and reliability
- Refined circuit patrols and better identified fault locations
- Leveraged the Regional Service Model to institute daily outage reviews locally where trends and actions to reduce outages are identified

	2021	2022	Improvements
Avg. outage length	~7 hrs	<3 hrs	56% decrease
Avg. customers impacted per outage	~1,100	877	20% decrease
Customers protected	~380,000	~1.82M	374% expansion
Miles protected	45% of HFRA	100% of HFRA	122% increase

Data is approximate

State-of-the-Art Tools to Prevent Wildfires



PG&E's Fire Potential Index (FPI)

helps us identify wildfire risk by measuring:

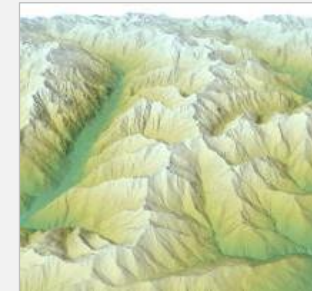
Weather



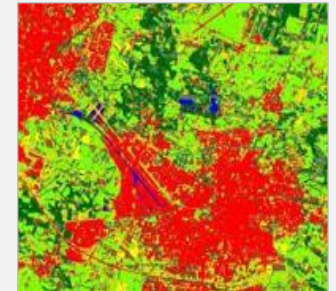
Fuel Moisture



Topography



Fuel Model Type



FPI is calculated each day using:



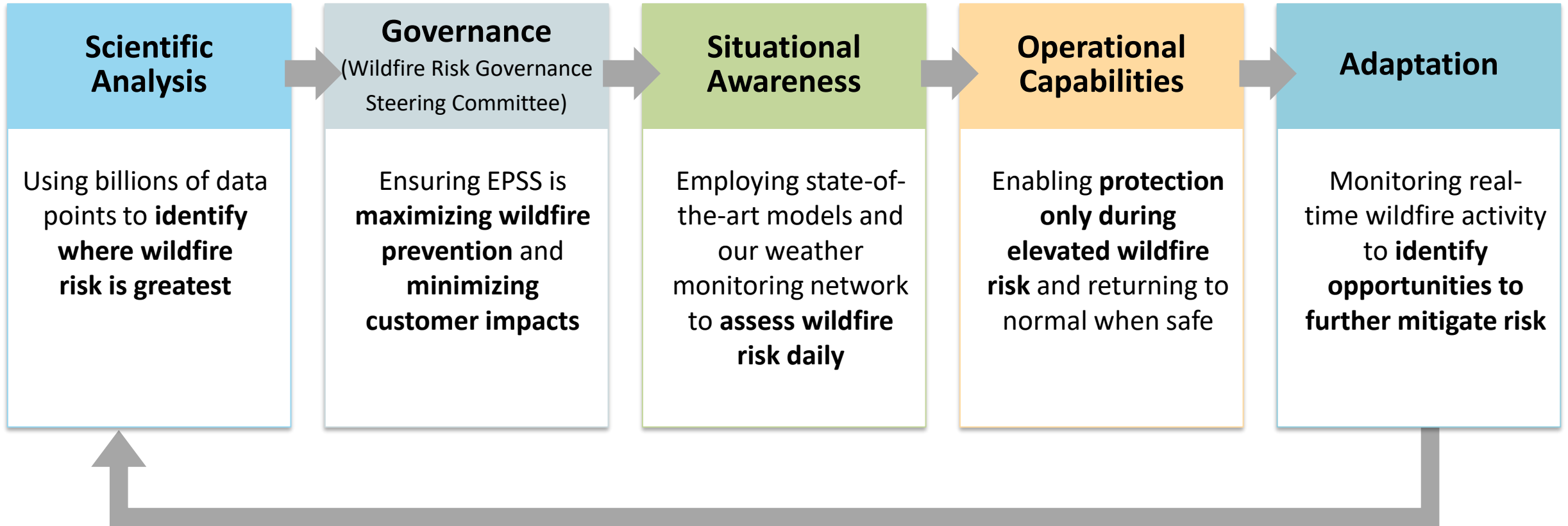
Over 8 billion data points leveraging advanced artificial intelligence and machine learning models



2x2 km grid cells across the entirety of our high-fire risk areas



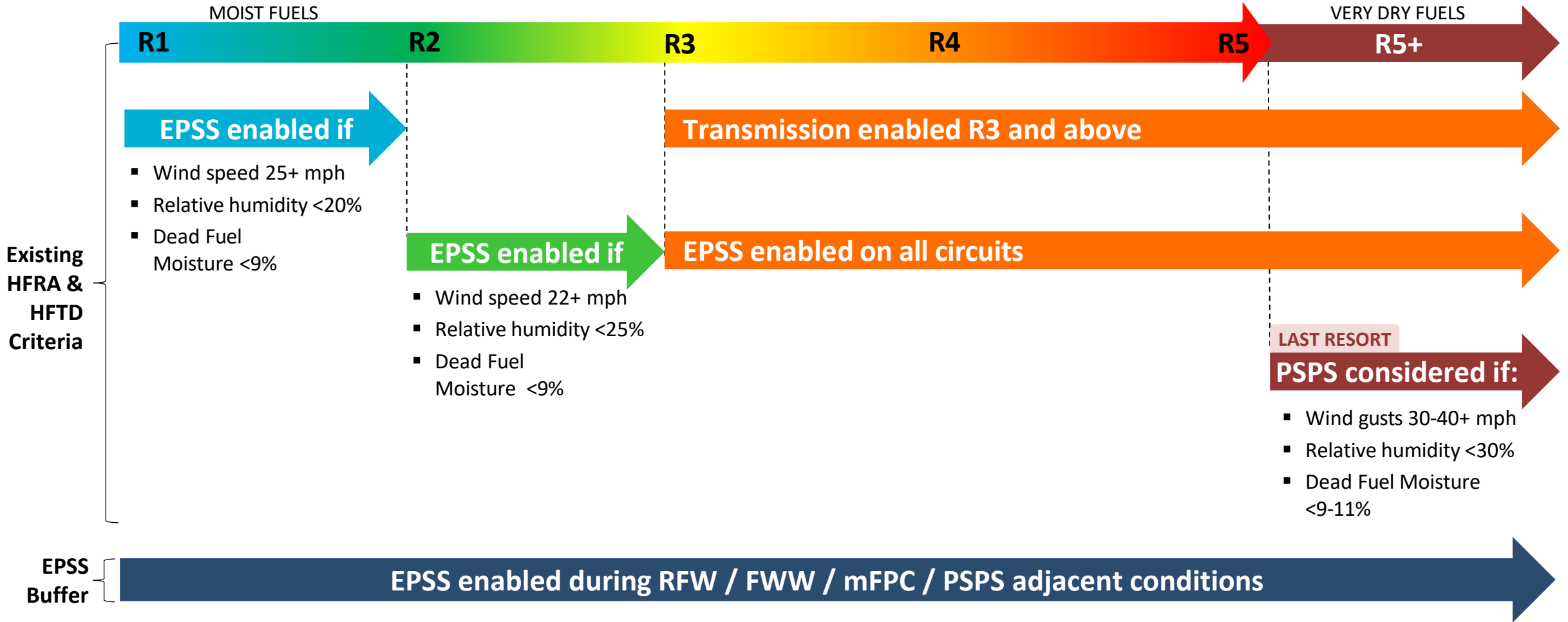
129-hour look-ahead, rolling forecast





FPI in Action: Current EPSS Enablement Criteria

PG&E Utility Fire Potential Index



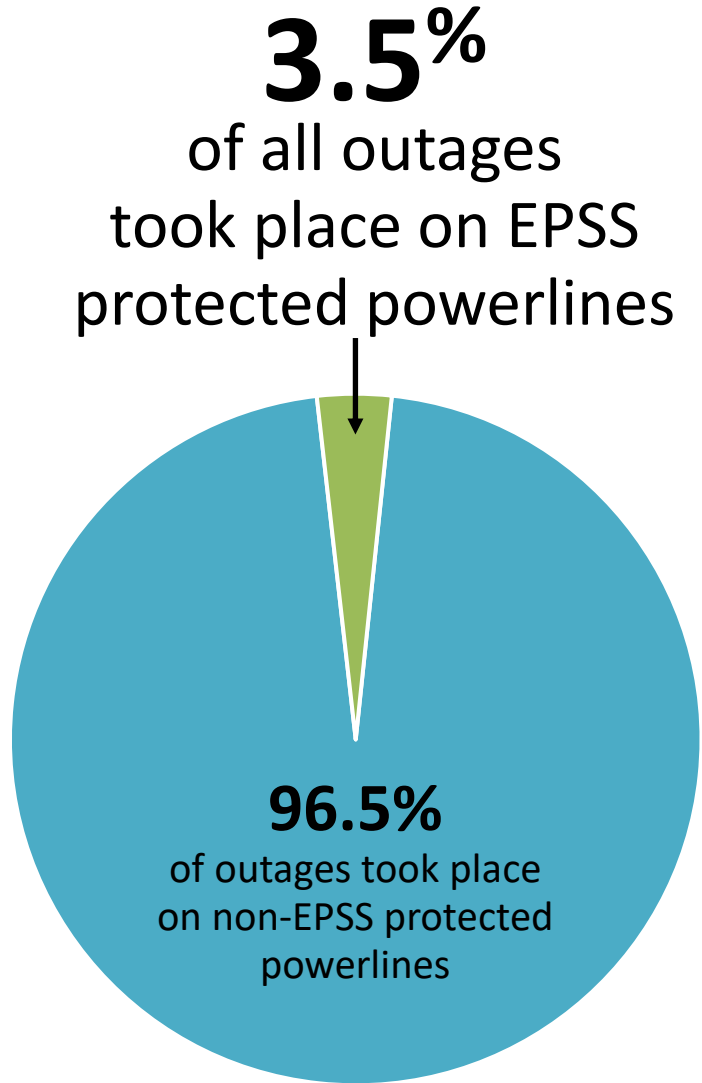
RFW = Red Flag Warning; FWW = Fire Weather Watch; mFPC = Minimum Fire Potential Conditions; PSPS = Public Safety Power Shutoff

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

Different Types of Outages



Total Outages in 2022

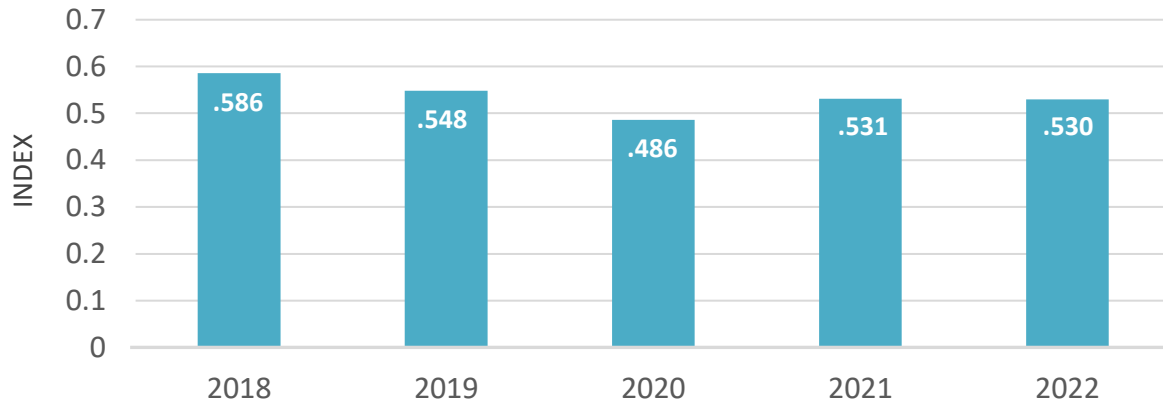


Outage Cause	Outages on Non-EPSS Protected Powerlines	Outages on EPSS Protected Powerlines
PLANNED		
System Resiliency Work	16,375	0
Maintenance	23,801	0
UNPLANNED		
Company Initiated	0	106
3 rd Party	2,611	225
Animal	1,871	391
Vegetation	3,068	265
Environmental Impact	443	12
Equipment Failure	11,770	293
Undetermined	6,427	1,083

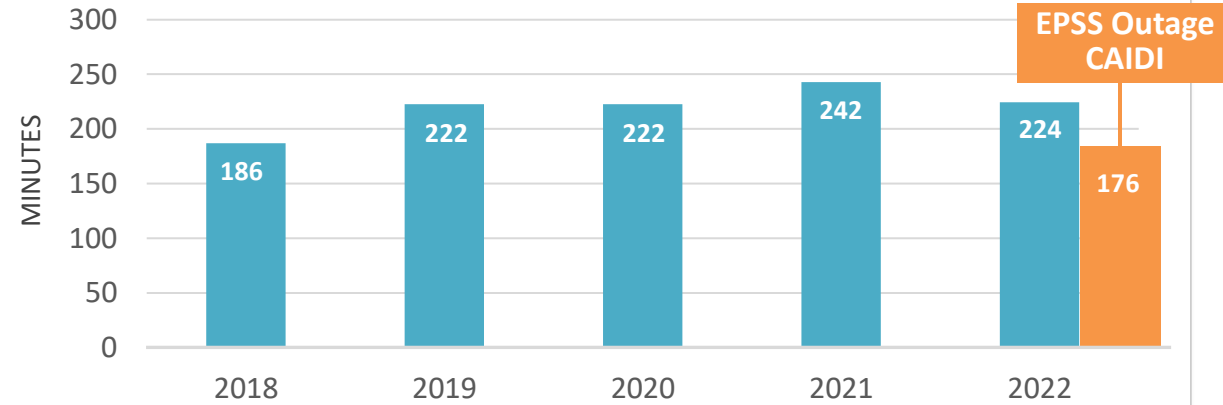


Systemwide Reliability

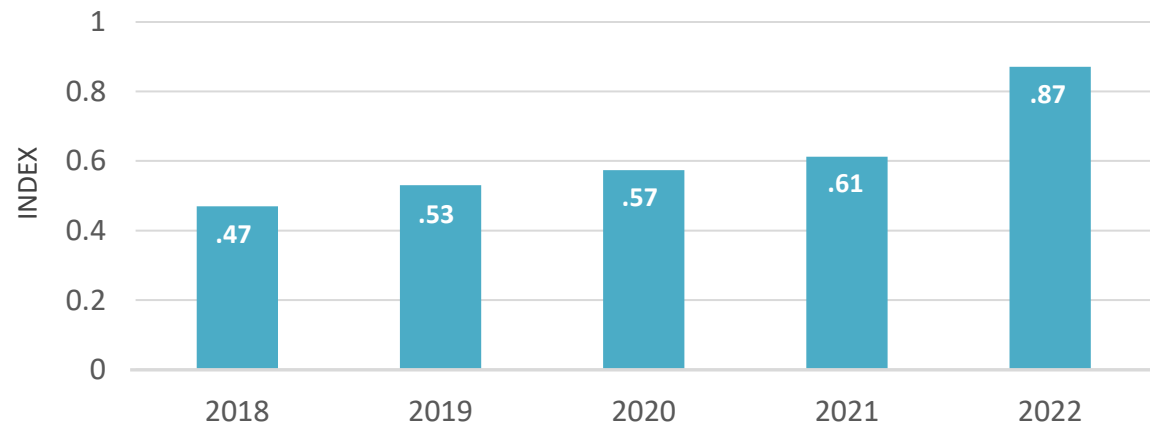
Momentary Average Interruption Frequency Index (MAIFI)



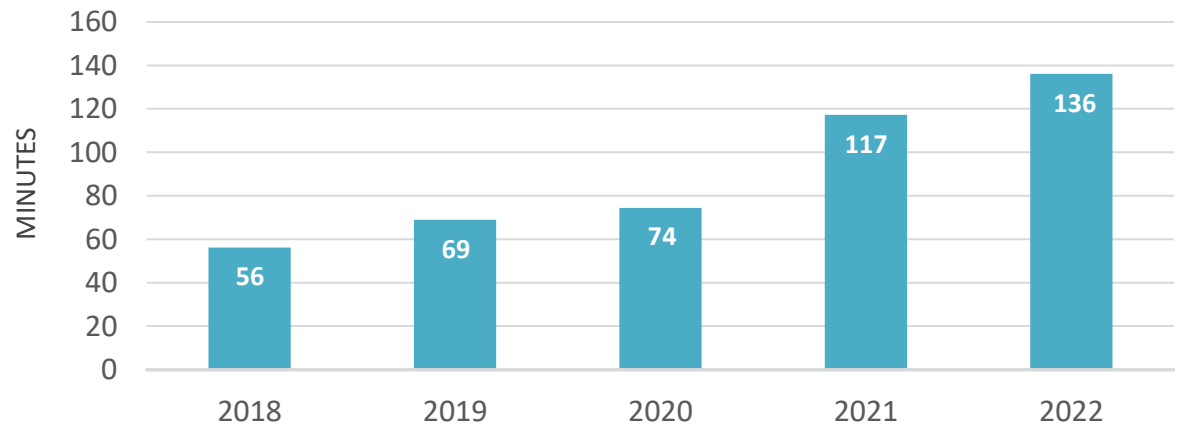
Customers Average Interruption Duration Index (CAIDI)



System Average Interruption Frequency Index (SAIFI)



System Average Interruption Duration Index (SAIDI)

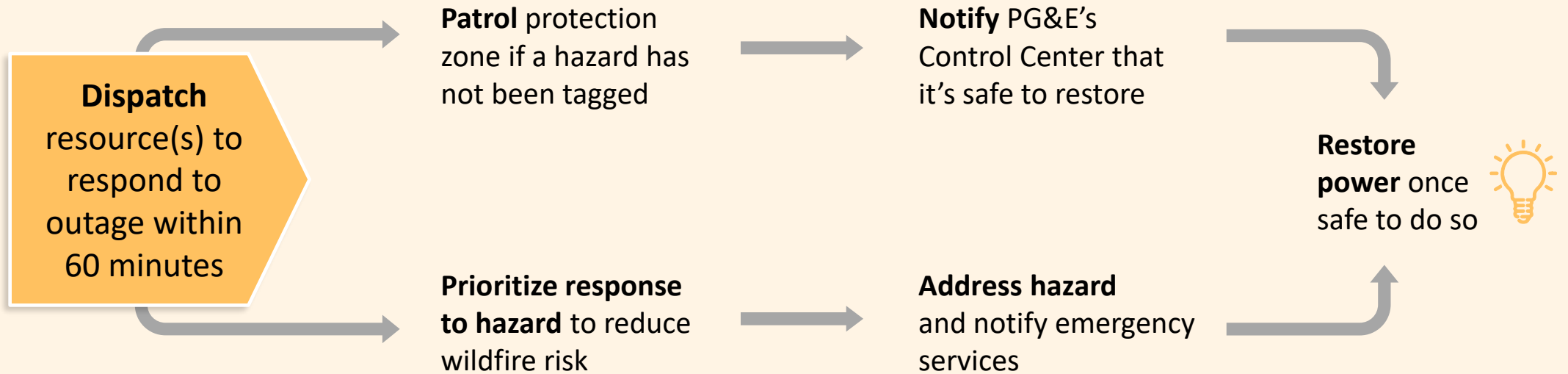


Data is approximate

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

Responding to Outages on EPSS Protected Powerlines

If an outage occurs, we quickly and safely restore power.



We continue to take steps to improve restoration efforts by:

- Installing more fault indicators and line sensors to reduce outage lengths
- Ramping up our fleet of helicopters during wildfire season to expand our overall capabilities and rapidly respond in rough terrain
- Using strategic staffing of Safety and Infrastructure Protection Teams (SIPT) and qualified electric coworkers to enhance response efforts
- Exploring the opportunity to leverage our Grid Data Analytics Tool to streamline response and restoration efforts in real-time

Sharing Information and Updates with Customers





Sharing Outage Information and Updates with Customers

Updates and information for both planned and unplanned outages:

pge.com/outages

PLANNED OUTAGES

With advanced notification

1 Public Safety Power Shutoff

Advanced notification and regular updates

- Phone calls, texts, emails, social media, news releases, local/tribal government and CBO* outreach, PSPS Portal**

2 Rotating Outages (as directed by CAISO)

Advanced notification and regular updates

- Phone calls, texts, emails, social media, news releases, local/tribal government outreach

3 Planned Maintenance

10-day advanced notification

- Phone calls, texts, emails

UNPLANNED OUTAGES

Without advanced notification

1 Emergency Repairs, Active Wildfires, System Damage

Notification during and after

- Phone calls, texts, emails

2 Outages Related to Enhanced Powerline Safety Settings (EPSS)

Notification during and after

- Phone calls, texts, emails, Outage Portal**



Restoring Power, Quickly and Safely

Public Safety Power Shutoff

- **Patrol** powerline by foot, vehicle and air for damage
- **Isolate** hazard
- **Repair** any damage by isolating the area
- **Restore** power once it is safe to do so

Efforts That Can Help Shorten Restoration Times

- Strategically staging dedicated helicopters

Wildfire Safety Work and Maintenance

- **Complete** necessary work
- **Restore** power by PG&E crews*

**For clearance jobs, crews will coordinate restoration with PG&E's Control Center*

Efforts That Can Help Shorten Restoration Times

- Exploring opportunities to further bundle work

Outages Related to Enhanced Powerline Safety Settings

- **Patrol** powerline by foot, vehicle and air for damage
- **Isolate** hazard
- **Repair** any damage by isolating the area
- **Restore** power once it is safe to do so

Efforts That Can Help Shorten Restoration Times

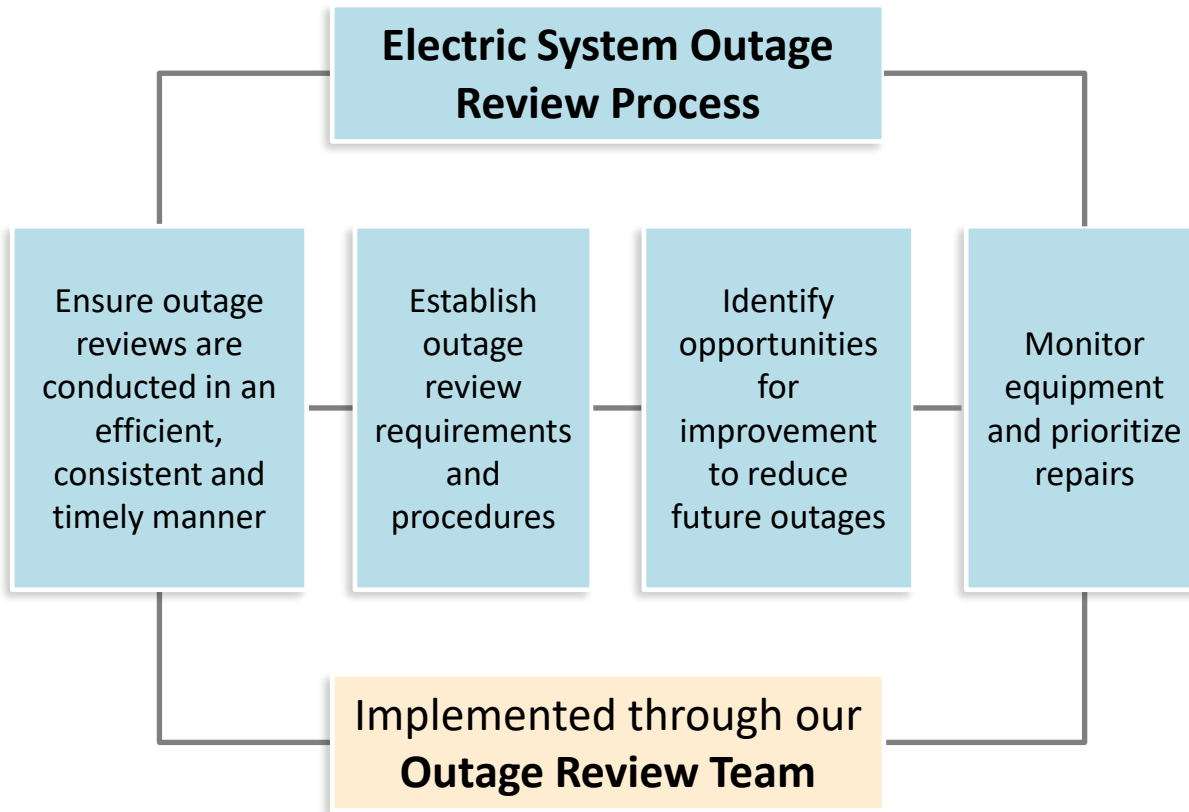
- Utilizing existing fault indicators and installing additional devices
- Strategically staging dedicated helicopters

Emergency Repairs, System Damage and Active Wildfires

- **Patrol** powerline by foot, vehicle and air for damage
- **Isolate** hazard
- **Repair** any damage by isolating the area
- **Restore** power once it is safe to do so



We have a longstanding outage review process to help drive reliability improvements...



...and we've built on this to create an enhanced Multi-Outage Review for EPSS (MORE) process.

MORE Process

- 1 Monitor outage volumes
- 2 If multiple outages on the same circuit, perform MORE
- 3 Identify causes and potential actions
- 4 Make reliability improvements
- 5 Notify customers of actions

Supporting Customers with Resources and Backup Power Options





Providing More Information and Tools for Customers to Prepare

EPSS & PSPS Support

- **Portable Battery Program**
No-cost portable backup battery solutions, mini-fridges, and insulin cooler wallets
- **Self-Generation Incentive Program**
Rebates to help customers purchase permanent battery storage
- **Generator and Battery Rebate Program**
Rebates with purchase of a portable generator or battery
- **Disability Disaster Access and Resources**
Emergency preparedness planning, portable batteries, and support for Access and Functional Needs customers
- **Fixed Power Solutions**
Permanent, long-term backup power solutions for the most impacted customers
- **Backup Power Transfer Meter**
Devices that automatically connect a home to generator power during an outage

General Wildfire Safety Support

safetyactioncenter.pge.com

211ca.org

pge.com/wildfiresafety

pge.com/epss

pge.com/psps



Helping More Customers Access Support

Program	2022 Qualifications	2023 Qualifications	Customer Offerings
Portable Battery Program (PBP)	<ul style="list-style-type: none"> Enrolled in PG&E’s Medical Baseline Program (MBL) and Located in a Tier 2/3 HFTD or have experienced 2+ PSPS outages since 2020 	<ul style="list-style-type: none"> Enrolled in MBL or Self-Identified as Vulnerable and have assistive technology or durable medical equipment Must have experienced at least one PSPS outage in 2021 or 5 or more EPSS outages in 2022 	No-cost portable battery, mini-fridge, and insulin cooler wallet
Disability Disaster Access and Resources (DDAR)	<ul style="list-style-type: none"> Must be an electricity-dependent individual with Access and Functional Needs (AFN*) and Located in a Tier 2/3 HFTD and experienced 2 or more PSPS outages since 2020 		No-cost portable battery, in-event support such as accessible hotel rooms, transportation, fuel cards for generators and food vouchers
Self-Generation Incentive Program (SGIP)	<ul style="list-style-type: none"> General market funds available to all customers, offsetting 15% - 20% of home battery cost 		\$1,500 Incentive on permanent battery
	<ul style="list-style-type: none"> Equity Resiliency Budget incentives are available for customers who: <ul style="list-style-type: none"> Live in Tier 2/3 HFTD or have experienced 2+ PSPS outages and Are a MBL, Low Income, SASH, DAC-SASH, MASH, SOMAH, or electric well pump customer 		100% Incentive offsetting full cost of permanent battery
Fixed Power Solutions: Residential Storage Initiative	<ul style="list-style-type: none"> Must be enrolled in CARE and meet eligibility 		No-cost permanent battery and installation
Generator and Battery Rebate Program (GBRP)	<ul style="list-style-type: none"> Have a residential/business PG&E electric account and Located in a Tier 2/3 HFTD, served by an EPSS-capable line and experienced 2+ PSPS outages and Products purchased must be on the qualified products list 	<ul style="list-style-type: none"> Have a residential or business PG&E electric account and Located in a Tier 2/3 HFTD or served by an EPSS-protected circuit and Products purchased must be on the qualified products list 	\$300 rebate to offset cost of a portable generator or battery and \$200 rebate (or \$500 total) if customer is CARE/FERA
Backup Power Transfer Meter Program	<ul style="list-style-type: none"> Focused on Tier 2 or Tier 3 HFTD and/or served by an EPSS-protected circuit Participant must be the PG&E customer of record Participant is the owner of the site or has the owner’s permission for the site’s participation 		No-cost meter and installation

**Individuals who are at an increased risk of harm to their health, safety and independence during a PSPS)
Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.*



Support Provided

Program	2020	2021	2022	2023 Year-To-Date	Total Inception-To-Date	2023 Target
Portable Battery Program (PBP)	5,569	5,135	7,780	132*	18,616	4,700 batteries
Disability Disaster Access and Resources (DDAR)	<ul style="list-style-type: none"> • 1,004 batteries • 1,650 assessments • 550 hotels • 900 food vouchers • 50 gas cards • 30 transportation 	<ul style="list-style-type: none"> • 1,371 batteries • 2,405 assessments • 348 hotels • 348 food vouchers • 36 gas cards • 2 transportation 	<ul style="list-style-type: none"> • 1,667 batteries • 2,472 assessments • 0 other in-event support (no PSPS in 2022) 	<ul style="list-style-type: none"> • 158 batteries* • 574 assessments • As needed in-event support 	<ul style="list-style-type: none"> • 4,200 batteries • 7,400 assessments • 898 hotels • 1,248 food vouchers • 86 gas cards • 32 transportation 	800 batteries
Self-Generation Incentive Program (SGIP) Interconnections	<ul style="list-style-type: none"> • 608 ERB • 3,790 other SGIP 	<ul style="list-style-type: none"> • 1,785 ERB • 3,813 other SGIP 	<ul style="list-style-type: none"> • 1,816 ERB • 3,591 other SGIP 	<ul style="list-style-type: none"> • 198 ERB* • 301 other SGIP 	<ul style="list-style-type: none"> • 4,407 ERB • 11,495 other SGIP 	<ul style="list-style-type: none"> • 950 ERB • 1,850 other SGIP
Fixed Power Solutions: Residential Storage Initiative	N/A	N/A	29 permanent battery storage installations	29 permanent battery storage installations	58 permanent battery storage installations	600 – 650 permanent battery storage installations
Generator and Battery Rebate Program (GBRP)	108	1,200	2,244	412*	3,964	1,300 rebates
Backup Power Transfer Meter Program	N/A	84	1,344	200*	1,628	3,000 installations

*As of February 2023, YTD

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



Providing Support Where It's Needed

Resource and support offerings are available to all customers, dependent on eligibility, and we are doing even more for our more frequently impacted and vulnerable customers who have not previously participated in resiliency offerings.



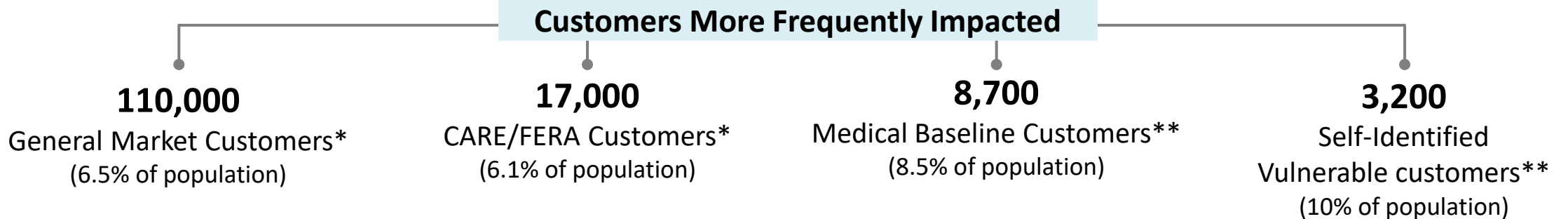
Broad Support For All Customers

Resource and support offerings are available to all customers, dependent on eligibility



Additional, Targeted Support

In addition, we provide targeted outreach, enhanced offerings and have expanded eligibility for our more frequently impacted customers



More Frequently Impacted Customers: *Customers who experienced 2+ PSPS or 5+ EPSS outages in 2022 **Customers who experienced a PSPS outage in 2021 or 5+ EPSS outages in 2022
Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Thank You



Appendix

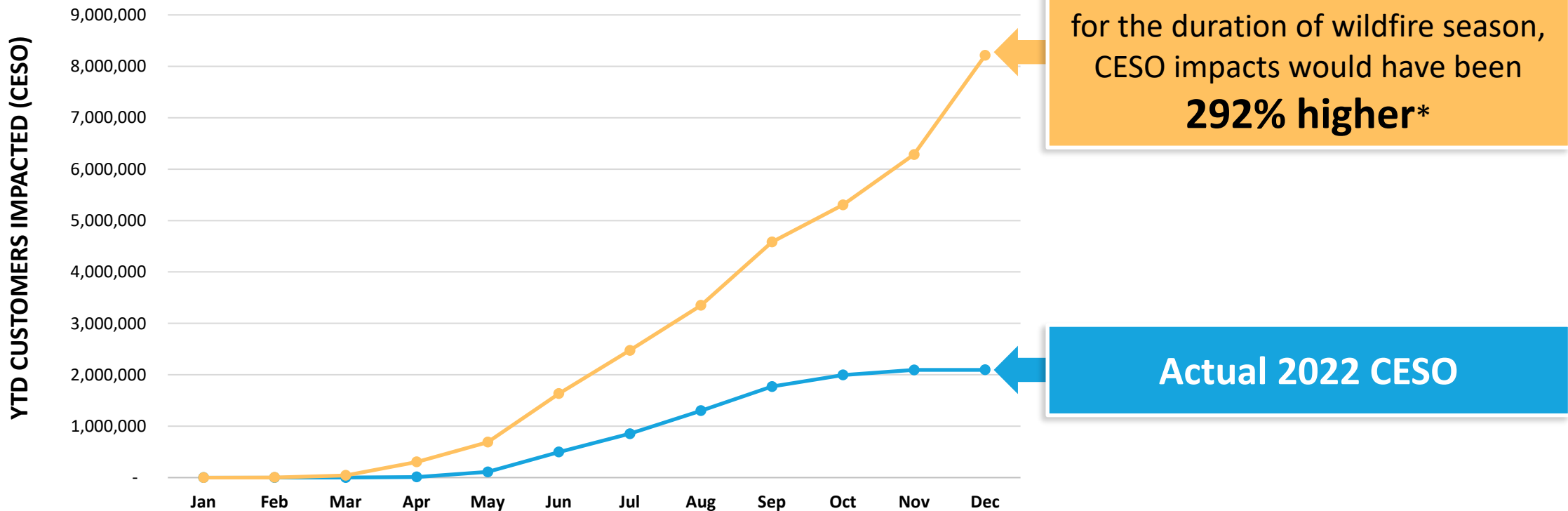




Refined Daily Enablement Process

Improvements to operational capabilities, allowed us to enable EPSS only during elevated wildfire risk and return to normal when safe to do so.

Avoided Customer Impact by Projected CESO*



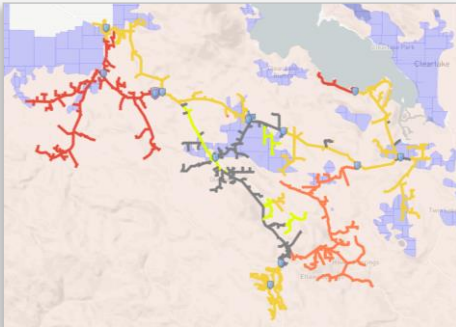
CESO: Customers Experiencing a Sustained Outage

*Data through 2/13/2023. "Avoided Outages" aggregates increased customer impact based on presumed upstream EPSS device operation for unplanned outages on downstream fuses, trip savers and reclosers when EPSS was not enabled. Some of the measures included in this presentation are contemplated as additional precautionary measures intended to further reduce the risk of wildfires.

Based on outage review findings, specific improvements were made to circuits to improve reliability.

Sample Improvements

60+ days without an outage after MORE

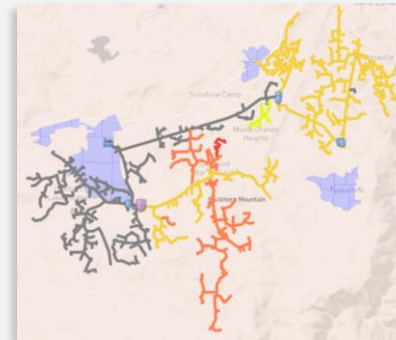


Data as of 12/21/22

Konocti 1102

- Fault indicators installed to improve restoration times
- Refinements to settings to limit outages

65+ days without an outage after MORE

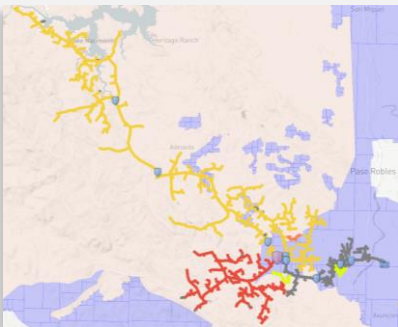


Data as of 12/5/22

Curtis 1705

- Switch and line recloser replacements identified based on fault origins
- Adjusted line recloser sensitivity to reduce outages

36+ days without an outage after MORE

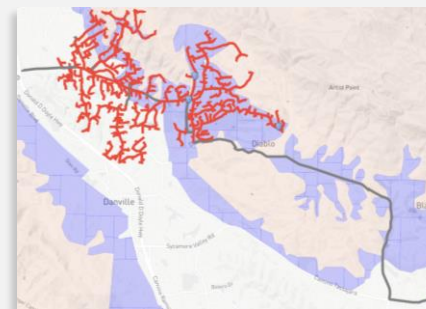


Data as of 12/5/22

Templeton 2110

- Adjusted line recloser settings to better identify faults
- Installed 15 fault indicators to improve restoration times

60+ days without an outage after MORE



Data as of 12/5/22

Tassajara 2103

- Installed fault indicators to improve restoration times
- Implemented new circuit configuration to reduce frequency of EPSS enablement
- Completed load transfer to limit outages



Identifying and Addressing More Wildfire Risk

To improve EPSS and further enhance wildfire risk reduction, we have implemented two innovative solutions.

47% of ignitions in high fire-risk areas while EPSS were enabled resulted from **low-current, high-impedance faults**

Because these faults occur at a low-current, they may not be caught with existing EPSS protection

Solutions to mitigate this risk:

Down Conductor Detection (DCD)

- Uses sophisticated harmonic analysis to detect arcing during high-impedance faults and provides enhanced ground fault protection

Partial Voltage Force Out (PVFO)

- Leverages our existing SmartMeter network to support the identification and response to low- and very-low high-impedance faults



Improved Communications with Customers

We improved customer communications through expanded engagement and implementation of a Community Outreach and Support Program last year.

Community Outreach and Support Program

Implemented for circuits experiencing multiple interruptions on EPSS-enabled zones.

- 1 Planning Prioritization**
Circuits identified for review based on five reliability criteria
- 2 Operations Review**
Operations initiates a cross-functional review of the circuit
- 3 Customer Outreach**
We conduct community outreach to communicate findings and mitigating actions

Outreach and Engagement

- 114** local government forums with cities and counties
- 70** customer IVRs
- 53** social media posts across channels
- 44** county-specific EPSS maps
- 43** public webinars and town halls
- 15** emails/direct mail items to customers
- 12** local government agency emails
- 9** community-focused EPSS webinars



Efforts To Improve Reliability and the Customer Experience

We are continuing to engage and provide resources to all customers and increasing our efforts with those customers most impacted. This includes:

- **TARGETING** additional outreach and engagement to the most impacted customers
- **EXPANDING** backup power support for vulnerable and highly impacted customers
- **INSTALLING** more fault indicators and line sensors to reduce outage lengths
- **IMPROVING** outage notifications so they are clearer and more accurate
- **CONDUCTING** targeted vegetation management and animal mitigation work
- **IMPROVING** reliability using our Multi-Outage Review for EPSS process
- **SUPPORTING** customers through our partnerships with community-based organizations

