



# An Inside Look at Electric Reliability

2022 PG&E Electric Reliability Virtual Town Hall



Online Presentation  
Dec. 15, 2023



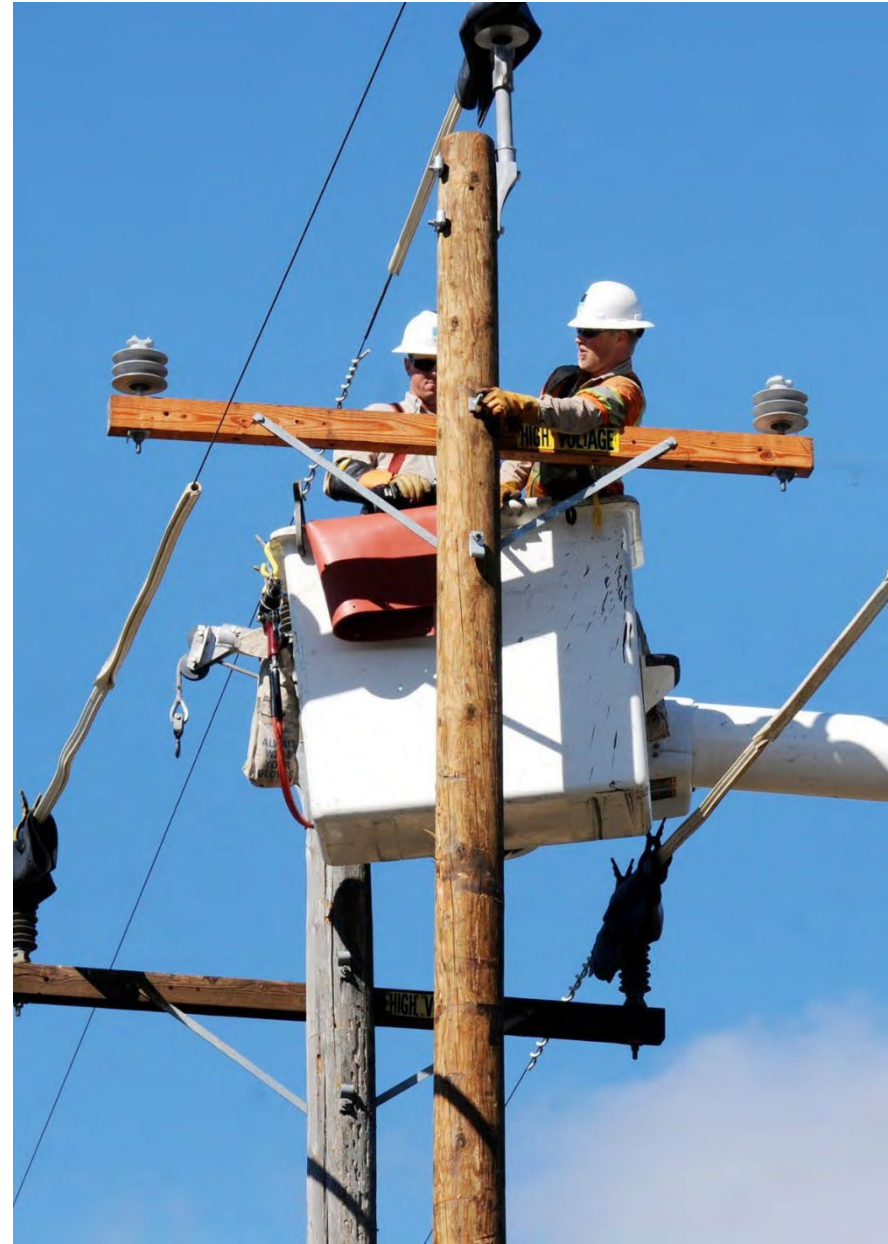
# Safety and Welcome

**Matt Nauman**

**Director, PG&E**

**Operations Communications**

- Safety and Welcome
- Overview of our electric system
- Power outages and interruptions
- System-wide and local reliability statistics
- What we're doing in your community to improve reliability
- Questions



# Safety

## General Safety Tips



**Identify two exit routes** from your current work area in the event of a fire or other emergency.



**“Drop, cover and hold”** in the event of an earthquake.



**Notify emergency services** if you are in danger. You can also ask for help by putting a message in the chat function of this meeting.



# About PG&E

## **Monica Tell**

**Regional Senior Manager,**

**Bay Area Region**

**Diablo/East Bay/Mission Divisions**



# About us

## Energizing California for over 150 years

Provides electric service to  
 **16 million** people

 Spans our diverse  
**70,000** square-mile  
service territory

 **20,000+** employees

 Regulated by the California  
Public Utilities Commission



Delivering for our hometowns



# Delivering for our hometowns

## Diablo Division:

PG&E's Diablo Division is located east of Oakland and in between Sacramento and Stockton. Lafayette, Concord, Walnut Creek, Danville, Brentwood, Bay Point, Antioch and Martinez are among the cities in the Diablo Division, which includes central and east Contra Costa County (CCC). West CCC is currently within the East Bay Division; likewise, the southern-most tip of CCC is within the Mission Division. The area is mostly suburban, with some business centers in the larger cities and designated open space. The Division is generally affluent with some pockets of low-income households.

- **Area:** 552 square mile
- **Population:** 1,165,900
- **Customers:**
  - Total Electric Service Agreements** 321,548 customers
  - Total: Gas Service Agreements** 272,533 customers
- **PG&E workforce:** 3,356
- **Infrastructure:** powerlines, 4,637 miles; gas lines, 2,897 miles
- **PG&E facilities:** Major industries in this Division include refineries, chemical, steel, science/technology, real estate, health and public works. The power plant in the central portion of this Division supports electric demand not only for Diablo Division but for the entire Greater Bay Area Region.



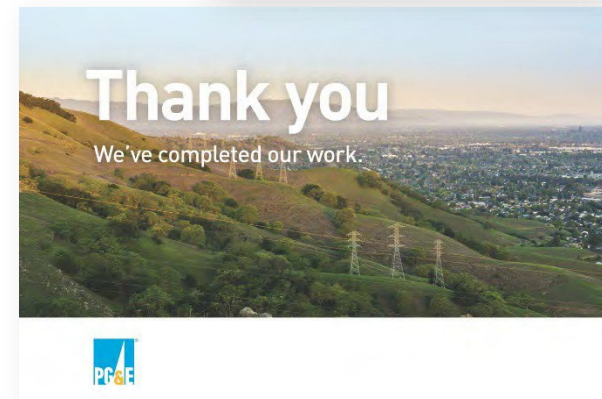
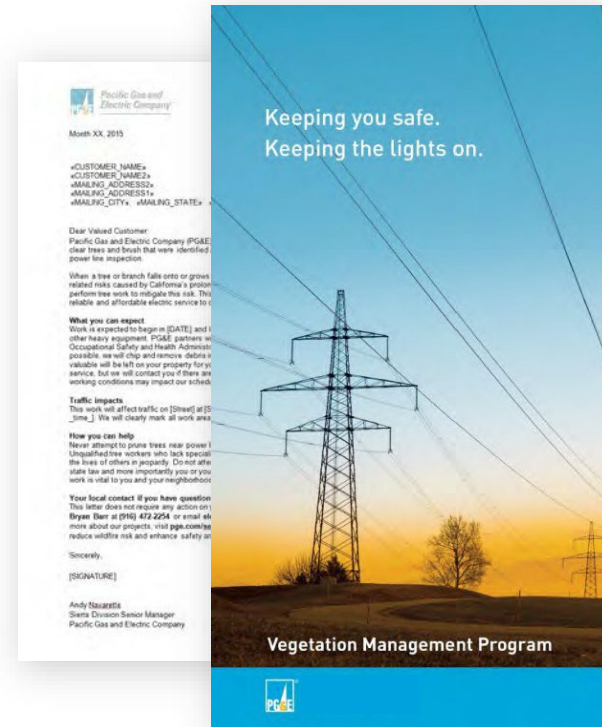
# Keeping our customers informed

## Public safety

The safety of our customers and the communities we serve is PG&E's primary responsibility. We engage our customers with a robust communication process.

### Personal notifications include:

- In person conversations
- Door hangers
- Letters
- Phone calls
- Bill inserts







**Delivering safe and reliable electric service**

**Tom Huynh**

**Manager, Electric  
Distribution Reliability**



# Our electric system



**We are committed to delivering safe, reliable, affordable and clean energy.**



operates and maintains  
**107,460 Miles**  
of distribution lines



**18,330 Miles**  
of interconnected transmission lines  
focused on clean energy





# Our electric system



**Power Generated at**  
13–25 kV

**Transmission Line**  
60, 115, 230 or 500 kV

**Distribution Line**  
4, 12, 17 or 21 kV  
**Home or Business**  
120–480 Volts

# Why are there outages and interruptions?



**Weather**



**Vegetation** (trees contacting power lines)



**Animals**



**Equipment failure**



**Vehicle accidents**



**Digging into underground electric lines**

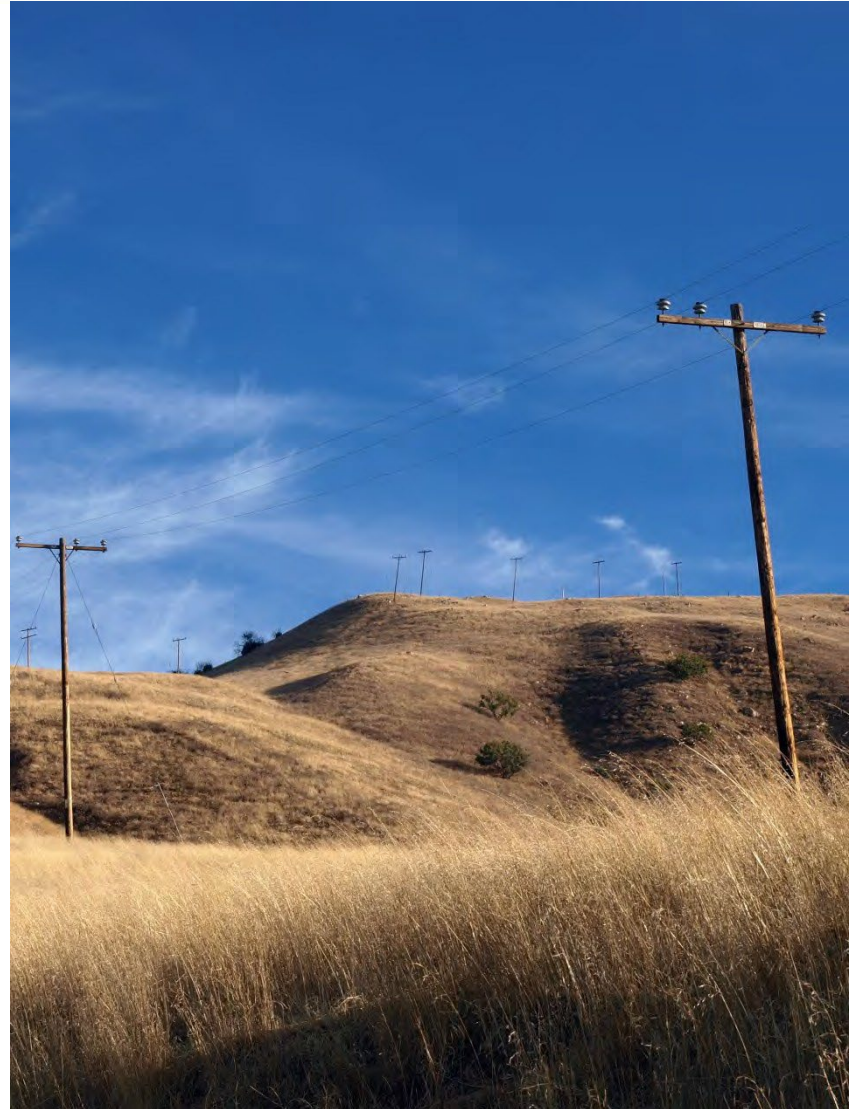


# What is a Public Safety Power Shutoff?

High winds and dangerous conditions can cause branches to contact powerlines. This could damage our equipment and cause a wildfire.

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**To prevent such fires, we may need to turn off power as a last resort.**





# Enhanced Powerline Safety Settings (EPSS) A Technology To Prevent Wildfires

## How It Works

PG&E powerlines have equipment that allows power to automatically turn off within one-tenth of a second if there is a wildfire risk, like a tree branch or other object striking the line.

## Why We Do It

Quickly and automatically shutting off power when a hazard is detected can help stop wildfires before they have a chance to start.

## Preventing Wildfires

65% decrease in CPUC-reportable ignitions in 2022 on EPSS-enabled circuits.

Compared to previous three years 2018-2020



### **SAFETY SETTINGS IN ACTION**

An example of these settings preventing a potential ignition in Napa County. When a tree branch fell into a powerline, power was quickly and automatically turned off.



# Differences Between PSPS and Safety Settings

## Public Safety Power Shutoffs (PSPS)

Turning off power to prevent tree branches and debris from contacting energized lines



### WHEN

During times of high winds, low humidity and dry vegetation



### NOTIFICATIONS

In advance through automated calls, texts, and emails along with real-time updates



### 2022 FOCUS

Continuing to refine the program and reducing impacts in the areas at highest risk

## Enhanced Powerline Safety Settings

Settings quickly and automatically turn off power if a problem is detected on the line.



### WHEN

Elevated wildfire risk is present, most likely from May to November, but can occur year-round.



### NOTIFICATIONS

Customers receive notifications at the start of an outage, and regular updates; Since power is automatically shut off within one-tenth of a second, we are unable to provide advanced notice.



### 2023 FOCUS

Optimizing protective settings and reducing unknown outages

# Outage Classifications

The company classifies outages according to industry definitions specified in the institute of Electrical and Electronic (IEEE) standards.



## Momentary Outage

An outage of 5 minutes or less in duration.



## Sustained Outage

An outage greater than 5 minutes in duration.



## Planned Outage

Outages which are customer or public official-requested or where the company has provided notice to the customer.



## Major Event

A set of outages which occurred during a specific time and location and which combined, exceeds historically expected outage duration (SAIDI) for at least one day (as defined in IEEE 1366-2012)





# Reliability

## How we measure reliability:

SmartMeter data

Information from customer calls

Information from PG&E's automated systems

## How we track outages:

Outages are logged in PG&E's outage databases

Some data is stored automatically

Detailed data is gathered by PG&E's first responders and field crews

## What we do with the data:

Data is grouped into various metrics -- SAIDI, SAIFI, CAIDI, MAIFI -- so we can learn more about our reliability and how best to improve



# How We Manage Reliability

## Immediate Response

Restoration crews make repairs and improvements to the electric system due to an outage

## Daily Reviews

Previous day's outages are reviewed and near-term system improvement projects are identified

## Weekly and Monthly Reviews

Trends in electric reliability are reviewed and action items are developed for both near- and long-term system improvement projects

## Annual Reviews

Long-term (one year or greater) system improvement projects are identified and planned



# Reliability is consistently delivering power to our customers

## How we define and measure this

$$\text{SAIDI} = \frac{\text{Total minutes every customer was without power due to sustained outages}}{\text{Total number of customers}}$$

Average cumulative minutes of sustained power interruptions during the year

$$\text{SAIFI} = \frac{\text{Number of sustained customer outages experienced by all PG&E customers}}{\text{Total number of customers}}$$

Average number of sustained power interruptions during the year

$$\text{CAIDI} = \frac{\text{System Average Interruption Duration Index (SAIDI)}}{\text{System Average Interruption Frequency Index (SAIFI)}}$$

Average duration of each sustained power interruptions during the year

$$\text{MAIFI} = \frac{\text{Number of customers who experience Momentary Outages}}{\text{Total number of customers}}$$

Average number of momentary power interruptions during the year

\***AIDI** – Average cumulative minutes of sustained power interruptions during the year on a specific circuit.

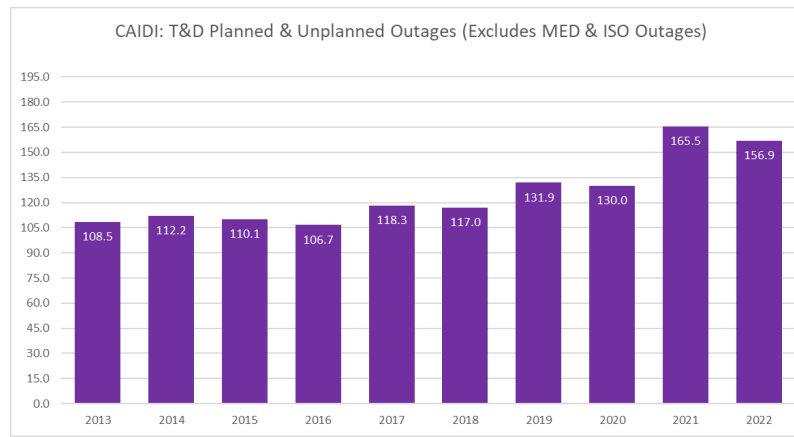
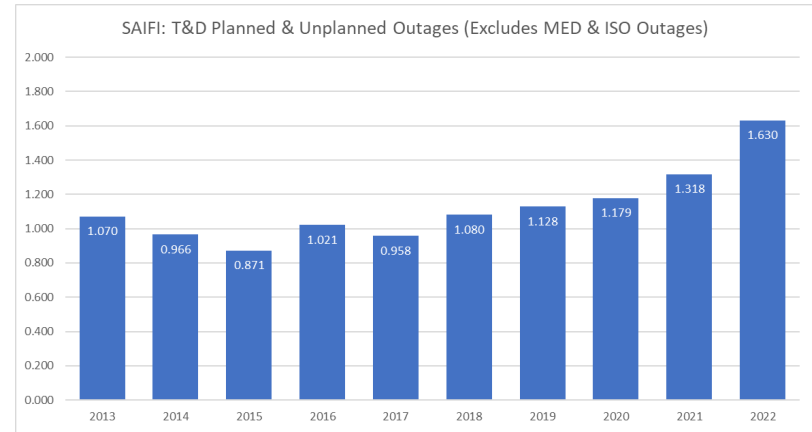
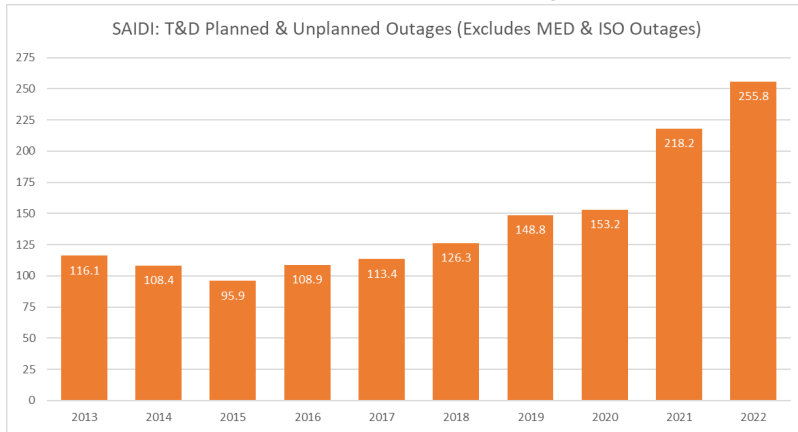
\***AIFI** – Average number of sustained power interruptions during the year on a specific circuit.

## What is PG&E's system-wide reliability story?

- Reliability performance continue to be impacted by severe storms, wildfire events and mitigations
- **120% increase** in the amount of time customers experience outages since 2013 - SAIDI
- **52% increase** in customer outages since 2013 - SAIFI

## How will PG&E's reliability improve?

- Significant infrastructure and system hardening investments
- New technology implementation
- Circuit-hardening programs

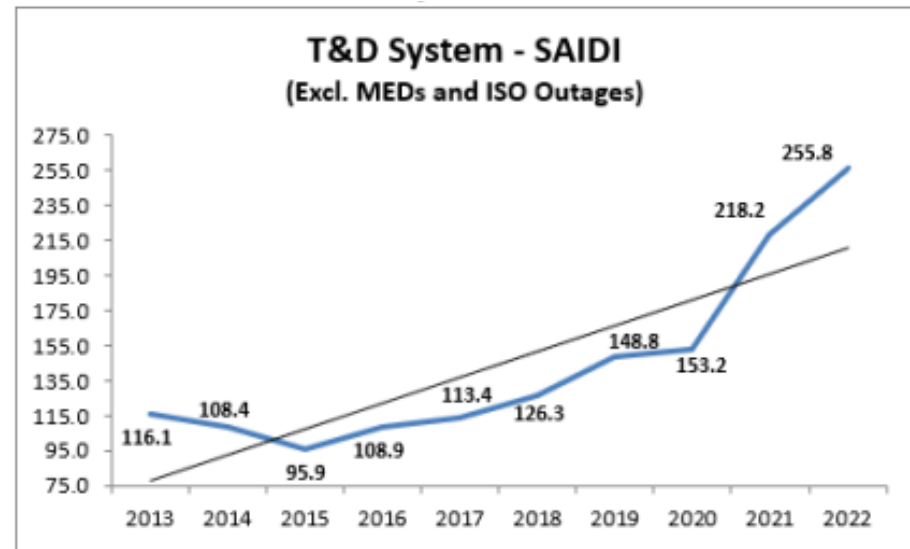




# Combined Transmission and Distribution System Indices (2013-2022)

(Excludes MED and Independent System Operator ISO outages, and includes planned outages)

Year	Major Events Excluded			
	SAIDI	SAIFI	MAIFI	CAIDI
2013	116.1	1.070	1.527	108.5
2014	108.4	0.966	1.396	112.2
2015	95.9	0.871	1.594	110.1
2016	108.9	1.021	1.494	106.7
2017	113.4	0.958	1.489	118.3
2018	126.3	1.080	1.361	117.0
2019	148.8	1.128	1.282	131.9
2020	153.2	1.179	1.316	130.0
2021	218.2	1.318	1.327	165.5
2022	255.8	1.630	1.320	156.9



**2013-2022 Transmission and Distribution System SAIDI Performance**  
(Includes Planned Outages, Excludes Major Event Days and ISO Outages)

# Poorly Performing Electric Circuits - AIDI

PG&E's poorly performing electric circuits in 2022, calculated by *the duration of time* the average PG&E customer experienced a sustained outage (an outage that lasts more than five minutes).

AIDI Worst Performing Circuit for 2022

#	DIVISION	SUBSTATION	CIRCUITNAME	TOTAL CUSTOMERS	CIRCUIT MILES	% OH	% UG	HFTD	3 YR AVG MAINLINE OUTAGES	3 YR AVG AIDI
1	NORTH VALLEY	CRESCENT MILLS	CRESCENT MILLS-2101	881	85	93	7	1 & 2	7	3445
2	FRESNO	BALCH NO 1	BALCH NO 1-1101	28	15	100	0	2	2	3129
3	DE ANZA	LOS GATOS	LOS GATOS-1106	1618	74	96	4	2 & 3	15	2457
4	NORTH VALLEY	CHALLENGE	CHALLENGE-1101*	705	49	98	2	2 & 3	8	2188
5	NORTH VALLEY	PIT NO 5	PIT NO 5-1101*	120	27	89	11	2	6	2035
6	HUMBOLDT	GARBERVILLE	GARBERVILLE-1102	1816	142	94	6	1 & 2	22	1891
7	HUMBOLDT	HOOPA	HOOPA-1101	2086	142	92	8	1, 2, & 3	13	1645
8	SIERRA	ALLEGHANY	ALLEGHANY-1101*	1079	79	97	3	1, 2, & 3	10	1627
9	CENTRAL COAST	BENLOMOND	BENLOMOND-0401	884	24	96	4	3	10	1523
10	SIERRA	ALLEGHANY	ALLEGHANY-1102	165	18	94	6	3	3	1519
11	SIERRA	EL DORADO PH	EL DORADO PH-2101*	3952	144	96	4	1, 2, & 3	17	1509
12	HUMBOLDT	WILLOW CREEK	WILLOW CREEK-1103	1519	77	99	1	2 & 3	8	1422
13	CENTRAL COAST	LOS OSITOS	LOS OSITOS-2103	1058	177	96	4	1 & 2	11	1410
14	SIERRA	PLACERVILLE	PLACERVILLE-2106	5281	286	95	5	1, 2, & 3	15	1372
15	NORTH VALLEY	ELK CREEK	ELK CREEK-1101*	903	173	99	1	1 & 2	9	1328
16	KERN	POSO MOUNTAIN	POSO MOUNTAIN-2101	142	59	100	0	1 & 2	8	1293
17	CENTRAL COAST	OTTER	OTTER-1102*	527	64	84	16	2 & 3	5	1284
18	NORTH BAY	SILVERADO	SILVERADO-2104	3833	156	88	12	1, 2, & 3	18	1277
19	NORTH VALLEY	CEDAR CREEK	CEDAR CREEK-1101*	776	111	99	1	2 & 3	4	1147
20	YOSEMITE	SPRING GAP	SPRING GAP-1702	1495	47	91	9	1, 2, & 3	7	1126
21	SIERRA	APPLE HILL	APPLE HILL-2102	4902	377	97	3	1, 2, & 3	19	1119
22	CENTRAL COAST	CASSERLY	CASSERLY-0401	215	3	100	0	1	7	1094

\* Highlighted circuits are poor performing on both SAIDI and SAIFI metrics

# Poorly Performing Electric Circuits - AIFI

PG&E's poorly performing electric circuits in 2022, calculated by *the number of times* the average PG&E customer experienced a sustained outage (an outage that lasts more than five minutes).

AIFI Worst Performing Circuit for 2022

#	DIVISION	SUBSTATION	CIRCUIT NAME	TOTAL CUSTOMERS	CIRCUIT MILES	% OH	% UG	HFTD	3YR AVG MAINLINE OUTAGES	3YR AVG AIFI
1	CENTRAL COAST	BEN LOMOND	BEN LOMOND-0401*	884	24	96	4	3	10	7.78
2	DE ANZA	LOS GATOS	LOS GATOS-1106*	1618	74	96	4	2 & 3	15	7.27
3	CENTRAL COAST	CASSERLY	CASSERLY-0401	215	3	100	0	1	7	6.67
4	HUMBOLDT	GARBERVILLE	GARBERVILLE-1102	1816	142	94	6	1 & 2	22	5.32
5	HUMBOLDT	FRUITLAND	FRUITLAND-1141	386	26	100	0	1 & 2	7	5.26
6	HUMBOLDT	GARBERVILLE	GARBERVILLE-1101*	1275	164	98	2	1 & 2	15	5.22
7	CENTRAL COAST	LOS OSITOS	LOS OSITOS-2103	1058	177	96	4	1 & 2	11	4.98
8	STOCKTON	ALPINE	ALPINE-1101*	281	8	12	88	1	5	4.94
9	CENTRAL COAST	BIG TREES	BIG TREES-0402	868	17	100	0	1, 2, & 3	4	4.89
10	NORTH VALLEY	CHALLENGE	CHALLENGE-1101	705	49	98	2	2 & 3	8	4.83
11	SIERRA	EL DORADO PH	EL DORADO PH-2101*	3952	144	96	4	1, 2, & 3	17	4.80
12	YOSEMITE	CURTIS	CURTIS-1702	4449	124	94	6	1, 2, & 3	10	4.75
13	LOS PADRES	TEMPLETON	TEMPLETON-2113*	5521	352	92	8	1, 2, & 3	18	4.60
14	SIERRA	ALLEGHANY	ALLEGHANY-1101*	1079	79	97	3	1, 2, & 3	10	4.39
15	CENTRAL COAST	GREEN VALLEY	GREEN VALLEY-2101	3130	167	93	7	1, 2, & 3	17	4.34
16	SIERRA	PLACERVILLE	PLACERVILLE-2106	5281	286	95	5	1, 2, & 3	15	4.33
17	SIERRA	SHINGLE SPRINGS	SHINGLE SPRINGS-2108	2903	40	70	30	1, 2, & 3	6	4.22
18	HUMBOLDT	HOOPA	HOOPA-1101	2086	142	92	8	1, 2, & 3	13	4.17
19	DE ANZA	CAMP EVERS	CAMP EVERS-2106*	6111	166	88	12	1, 2, & 3	22	4.16
20	YOSEMITE	MARIPOSA	MARIPOSA-2102	3324	262	98	2	1, 2, & 3	10	4.06
21	NORTH VALLEY	CRESCENT MILLS	CRESCENT MILLS-2101	881	85	93	7	1 & 2	7	3.95
22	SACRAMENTO	GRAND ISLAND	GRAND ISLAND-2227	1124	159	99	1	1	9	3.94

\*Highlighted circuits are poor performing on both SAIDI and SAIFI metrics

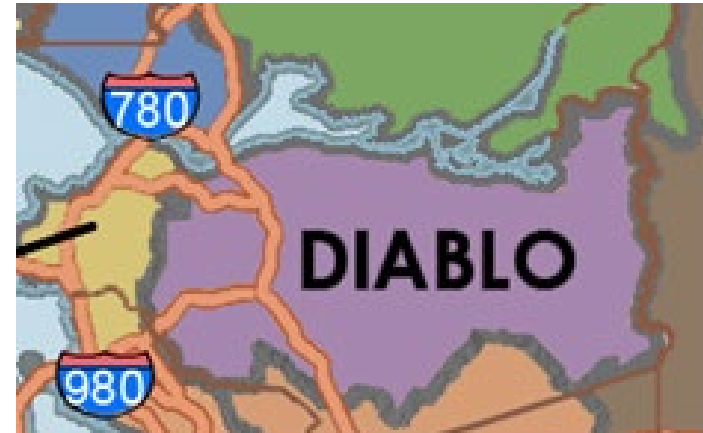


# PG&E's Electric Circuit Geography

## System Map



## Diablo Division







# Reliability in Diablo Division (Unplanned Outages)

## Declined reliability over the last 10 years.

- In 2013, the average customer experienced **80.3 minutes** of sustained power interruptions
- In 2022, customers experienced **114.4 minutes**
- An increase of over **42%** largely due to implementation of EPSS settings

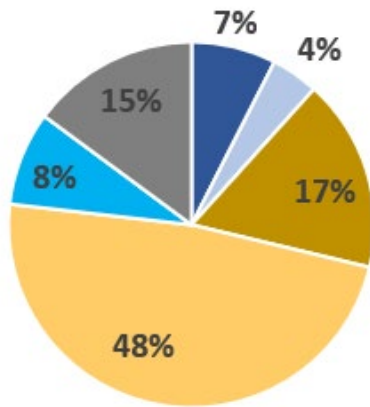
## More outage interruptions.

- In 2013, the average customer experienced **1.001** sustained power interruptions in a year
- In 2022, the average customer experienced **1.566** interruptions
- An increase of over **56%** largely due to implementation of EPSS settings

Power was on  
**99.95%**  
of the time

## Power Outages in Your County

- Average Customers Impacted per Outage: **240 customers**
- Average Outage Length: **2.2 hours**



## Types of Outages

- Third-party incident
- Weather/vegetation
- PG&E operations and maintenance
- Animal interacted with equipment
- Equipment issue
- Unknown

Data from July-September 2022

County- and city-level versions of this report were shared with all electric customers in November 2022 and are available [here](#).

**Learn about safety and reliability where you live**

**Service Reliability in San Luis Obispo County**  
Power was on **99.91%** of the time

**Steps PG&E is Taking to Better Serve You**

**Wildfire Safety in Your County**  
We are working hard every day to keep you safe and improve our electric system.

PROGRAM	TODAY	2022 PLAN	2023 PROJECTIONS
Undergrounding distribution powerlines	0 miles	0 miles	0 miles
Installing stronger equipment	15 miles	18 miles	7 miles
Keeping lines away from powerlines	194 miles	<1 mile	<1 mile

**High Fire-Risk Areas**  
San Luis Obispo County

**Enhanced Powerline Safety Settings (EPSS) In Your County**  
If a hazard is detected, like a tree branch on the line, power is automatically turned off within one-tenth of a second on certain powerlines.

**123,582** Customers with EPSS Protection

**2 hours** Average Outage Length

**51%** Reduction in Average Outage Length\*

**80%** Reduction in CRUC-reparable outages\*\*

**Steps we are taking to reduce customer impact:**

- Adjusting the sensitivity settings on powerlines
- Installing technology to quickly identify outage causes
- Improving our patrol to turn power back on faster

\*Data is based on overall customer outage length for 2021  
\*\*The actual number of days the risk area powerlines with safety settings installed compared to the prior three-year average (the difference is 1,201)

DATA AS OF SEPTEMBER 2022



# Reliability Projects in Diablo Division

## Wildfire Hardening Projects

- In 2023, PG&E completed a wildfire undergrounding project near Walnut Creek in Contra Costa County that made the electric distribution system more resilient to extreme weather events and EPSS outages. This project included the removal of overhead lines and installation of approximately 10,000 feet of cable and protection devices.
- Installed 5 SCADA switches, installed over 20 line sensors, and replaced over 40 non-exempt fuses as part of Wildfire Mitigation program.

## Reliability Improvements

- Improved operational flexibility for Danville customers by installing 7 SCADA devices, restoring ties to two adjacent circuits, and offloading customers.
- Installed multiple Fault Indicators to narrow down future outage locations and reduce future patrol times.
- Replaced over 100 poles and completed hundreds of maintenance tags.
- Repaired Rossmoor 1107 underground main line cable.
- Completed bird retrofits on the Rossmoor 1105 and 1107 circuits.
- Completed refinements to EPSS settings on PG&E protection devices and continued making refinements to EPSS Planning Processes.



# The Future of PG&E Reliability

## **PG&E plans to continue to explore and deploy smart grid technology, including:**

- Continue to make refinements to EPSS settings on PG&E protection devices and continue making refinements to EPSS Planning Processes
- Eight reliability improvement projects are in-scope for 2024\*

### EPSS reliability enhancement

- Install 2 Line Reclosures on Willow Pass 1101\*
- Install 1 Line Reclosure on Meadow Lane 2106\*
- Install 1 Interrupter on Willow Pass 2108\*

### Continue integrating clean and renewable energy on the grid, such as:

- Solar
- Electric vehicles
- Battery storage technology
- Energy efficiency improvement
- Microgrids

\*Subject to change based on year-to-year budgetary constraints



# Thank you

**Annual report and a copy of this presentation**

**[pge.com/ertownhall](http://pge.com/ertownhall)**

**Contact us**

**800-743-5000**

**Questions?**