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Date: February 25, 2022
Witness(es): Various

PACIFIC GAS AND ELECTRIC COMPANY

2023 GENERAL RATE CASE

EXHIBIT (PG&E-4)

ELECTRIC DISTRIBUTION

CHAPTERS 1-6

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

VOLUME 1 OF 3

(PUBLIC VERSION)

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[1] New witness from the June 30, 2021 submission.

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PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 1

ELECTRIC DISTRIBUTION POLICY AND INTRODUCTION

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 1
ELECTRIC DISTRIBUTION POLICY AND INTRODUCTION

A. Introduction

This chapter introduces Pacific Gas and Electric Company's (PG&E) Electric Distribution Operations (Electric Operations or EO) line of business exhibit in PG&E's 2023 General Rate Case (GRC). Electric Operations is responsible for safely and reliably delivering electricity to PG&E's customers over a large and diverse service area through efficient and cost-effective planning, engineering, constructing, maintaining, and restoring of electric distribution assets.

EO is focused on achieving its core mission to deliver affordable and clean energy safely and reliably to our customers every single day, while building the energy network of tomorrow, and meeting the challenge of climate change by integrating renewable and clean energy technologies. In addition, we are committed to improving the customer experience by delivering on our commitments. EO's expense and capital forecasts represent a risk-informed portfolio that puts safety first while delivering on customer commitments and supporting California's clean energy goals.

As directed by Commission President Batjer in the October 1, 2021 Scoping Memo, PG&E presents this testimony to update our 2023 GRC forecast to reflect changes in wildfire mitigation strategies. For those chapters where we have updates to make, we have provided new versions of those chapters in today's submission.

With respect to this introductory chapter, Sections B and C below remain relatively unchanged from the prior submission. Section D, which is new, provides a roadmap to the updated testimony, identifying what material is new and what topics have been updated.

B. Key Developments Since the 2020 GRC

Since the 2020 GRC, PG&E has focused on addressing wildfire risk, advanced its risk assessment and risk management, continued to pursue operational excellence, adapted its operations during a global pandemic, and emerged from bankruptcy.

1. Focus on Reducing Wildfire Risk

In 2019 and 2020, California continued to experience devastating wildfires due to climate change. Five of the six largest wildfires in California's history occurred in 2020, all in PG&E's service territory, including the first fire to ever impact more than one million acres. The unprecedented weather patterns (including late-summer dry lightning storms) that drove the 2020 wildfire season continued to present significant wildfire risk and necessitated Public Safety Power Shutoff (PSPS) events into January 2021.

PG&E is committed to further reducing wildfire risk to keep customers and communities safe. In 2020, PG&E completed several important wildfire-related safety enhancements and investments to continue progress on this vital objective, consistent with state policy. This included work that:

- Reduced Wildfire Potential – Pruned or removed trees with a higher potential for wildfire risk along distribution lines in High Fire Threat District (HFTD) areas[1] (Enhanced Vegetation Management (EVM)); installed stronger, more resilient poles and covered conductors on some overhead lines and undergrounded other lines in HFTD areas (System Hardening); and completed inspections of the entire electrical infrastructure in Tier 3 HFTD areas, and accelerated inspections in other HFTD areas;
- Improved Situational Awareness – Installed additional weather stations to more precisely forecast weather that could lead to PSPS events and installed additional high-definition cameras to help monitor real-time conditions; and
- Improved PSPS – Reduced the scope and impact of PSPS events compared to events in 2019 under similar weather conditions, and restored power faster after severe weather passed.

[1] HFTD areas were defined and identified by the California Public Utilities Commission (CPUC or the Commission) in 2018. The CPUC adopted the final CPUC Fire-Threat Map via disposition of Advice Letters 5211-E/3172-E, filed January 5, 2018, and approved January 19, 2018.

2. Advancing Risk Assessment and Risk Management

Since PG&E filed its 2020 GRC, EO has advanced its risk modeling and risk management capabilities. EO evaluated its top safety risks in the 2020 Risk Assessment and Mitigation Phase (RAMP) Report using updated enterprise risk models.[2] Since PG&E filed the RAMP Report, EO has continued to improve the enterprise risk models based on feedback from Safety Policy Division and other parties, and additional information learned internally at PG&E. The models and improvements are described in the Electric Distribution Risk Management Chapter (Exhibit (PG&E-4), Chapter 3).

In addition to updating enterprise risk models, EO developed a planning model for its top safety risk – wildfire. The Wildfire Distribution Risk Model (2021 WDRM) was implemented for 2021 planning and provides a bottom-up view of asset and risk conditions. The 2021 WDRM identifies specific circuit segments with the greatest risk of wildfire due to vegetation contact or conductor equipment failure. The 2021 WDRM then comprehensively assesses and prioritizes wildfire risk mitigation work, including system hardening and enhanced vegetation management activities. Building upon previous modeling, the 2021 WDRM uses advanced software and machine learning to predict fire ignitions and improve fire spread simulations to determine potential wildfire impacts. The 2021 WDRM allows EO to prioritize operations within the highest fire-threat areas. In the spirit of continuous improvement, EO will continue to refine the 2021 WDRM with updated inputs and adoption of more advanced modelling techniques.

3. Pursuing Operational Excellence

PG&E's asset management vision is to attain the optimum balance of asset risk, performance, and cost. Accordingly, EO has continued to pursue Publicly Available Specification (PAS) 55 and ISO 55001 asset management

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[2] PG&E's RAMP Report, A.20-06-012 (June 30, 2020).

certifications.[3] By achieving these certifications, EO will establish a foundation for continuous improvement and support our commitment to the safe and effective management of our electric assets on behalf of customers.

Since 2018, EO has taken several steps towards achieving its PAS 55 and ISO 55001 certifications, including:

- Establishing and maintaining an EO Asset Management Policy, which describes EO's asset management framework;
- Establishing and maintaining a Strategic Asset Management Plan, which specifies: (1) how organizational objectives translate to asset management objectives; (2) how to develop asset management plans; and (3) how the asset management system supports achievement of the asset management objectives;
- Establishing and maintaining Asset Management Plans, which provide an overview of risks, performance, costs, and efforts underway to reduce risk and maintain reliability for each of EO's asset families; and
- Instituting training sessions for EO employees to introduce and reinforce a comprehensive asset management framework.

In 2020, EO completed the Stage One assessment in support of our goal of achieving ISO 55001 and PAS 55 asset management certifications. EO is working towards completing its Stage Two assessment, which requires that auditors visit worksites.

4. Coronavirus Pandemic

On March 12, 2020, the World Health Organization declared the coronavirus (COVID-19) outbreak a pandemic. Shortly thereafter, the Commission directed electric utility companies in California to follow customer protection measures including a moratorium on service disconnections. In addition, the state, counties, and cities instituted various shelter-in-place measures. As the pandemic continued, these entities

[3] PAS 55 and ISO 55001 are internationally recognized asset management standards that cover end to end lifecycle aspects of a business' asset management system, and provide a common framework for the Utility to take a comprehensive view of how it manages assets in an effective and sustainable manner and to implement continuous improvement.

periodically relaxed and increased shelter-in-place measures, depending on the severity of COVID-19 within each area.

The COVID-19 pandemic impacted EO in different ways, including workforce safety and the ability to perform some scheduled work. During the pandemic, PG&E has sought to prioritize the health and safety of the public and employees, while ensuring the ability to continue to provide safe and reliable electric service to customers.

To protect the health and safety of employees, contractors, and the public, EO issued COVID-19 work plan guidelines describing work activities that should continue[4] and work types that should be paused.[5] Work that paused later resumed as shelter-in-place orders allowed. EO will continue to work throughout this GRC cycle on the backlog of work paused due to the pandemic.

EO also took actions to ensure safe and reliable electricity service would continue during the pandemic. EO established and activated the COVID-19 Emergency Operations Center for over 100 operational periods to monitor and respond to the impacts of the pandemic, confirming business capabilities as government policies evolved. Additionally, EO set up full distribution and transmission control rooms at the San Ramon Valley Conference Center, where operators were sequestered as an additional precaution.

5. Emergence from Bankruptcy

In 2020, PG&E emerged from Chapter 11 bankruptcy after successfully completing its restructuring process and implementing its Plan of Reorganization (POR). As part of its POR, PG&E made a series of commitments regarding governance, operations, and financial structure, all designed to further prioritize safety. PG&E made these commitments working with the Governor's Office and incorporating guidance from CPUC

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4 Work that should continue was defined as work identified as critical during shelter-in-place, including emergency response, critical societal needs, PSPS and wildfire mitigation work, critical/essential new business needs, essential regulatory compliance work, and critical operating equipment work.

5 Non-critical work that was paused included: new business and work requested by others; non-essential compliance and critical operating equipment work; and, capacity, reliability, and asset replacement work.

President Batjer, which was included in the full Commission's approval of the POR.[6]

Some of the commitments impacting EO include:

- Introducing a 6-step Enhanced Oversight and Enforcement Process[7] to ensure that PG&E meets safety and operational commitments, and promptly corrects any issues that may arise;
- Achieving PAS 55 and ISO 55001 certifications; and
- Setting financial targets for EO forecasts that will help position PG&E to deliver cost-effective service to customers while actively managing costs within budgets to improve long-term costs and financing plans.

C. Areas of Focus in the 2023 GRC

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

EO's expense and capital forecasts represent a risk-informed work portfolio that addresses top safety risks, delivers on customer commitments, and supports California's clean energy goals. The Electric Distribution Forecast and Investment Planning chapter (Chapter 2 of this exhibit) provides additional detail on the methods used to develop the forecast as well as information about the alignment with POR targets.

Table 1-1 in Section D below provides a roadmap to the updated testimony chapters.

1. Continued Focus on Wildfire Risk Mitigation Work

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

Over half of PG&E's service territory lies in Tier 2 and Tier 3 HFTD areas. The wildfire threat in these areas has increased significantly over the past decade due to climate change and other factors.[8] Approximately 25,500 line-miles, or nearly one-third, of PG&E's electric distribution assets

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6 Decision (D.) 20-05-053.

7 D.20-05-053, p. 111, Ordering Paragraph 4 and Appendix A.

8 For example, the U.S. Forest Service estimates that 147 million trees died in California from drought and invasive beetles from 2010-2018, which is just one of the factors that has contributed to the significant increase in the size of the HFTDs within PG&E's service territory.

lie within HFTD areas. Many of these assets include long lines that serve low-density, non-urban customers and communities located within the "wildland-urban interface," who face an increased fire risk. Approximately 10 percent of PG&E's electric customers reside within HFTD areas, and the number of customers living in wildland-urban interfaces or HFTD areas may increase in the future. PG&E is continuing to evaluate its wildfire risk and may expand wildfire risk mitigations to include additional areas. In 2021, in furtherance of our commitment to continuously work to reduce wildfire risk associated with our electric equipment, PG&E announced a plan to underground 10,000 miles of electric distribution lines in and near HFTD areas and implemented its Enhanced Powerline Safety Setting (EPSS) program.

Using the 2021 WDRM, EO identified the highest risk circuit segments and prioritized risk mitigation activities within those segments. This work builds on progress from previous years:

- Enhanced Vegetation Management – Conducting additional miles of EVM work focused on the highest risk circuit protection zones;
- System Hardening – Targeting high wildfire risk miles and applying various mitigation activities, including: (1) line removal, (2) conversion from overhead to underground, (3) application of Remote Grid alternatives, (4) mitigation of exposure through relocation of overhead facilities, and (5) in-place overhead system hardening;
- PSPS and PSPS Impact Reduction Initiatives – Executing PSPS events to reduce wildfire risk while also working to reduce: (1) the scope of PSPS events by installing sectionalizing devices to include only the customers who need to be de-energized and deploying temporary generation to serve customers who can safely receive power, and (2) the impact of PSPS events to customers by providing back up power for critical customer facilities and providing essential services to impacted customers;
- Enhanced Powerline Safety Settings – Enabling the adjustment of settings on electric equipment to automatically turn off power when the system detects a problem or anomaly.

- Situational Awareness and Forecasting Initiatives – Continuing installation of a variety of weather and fire monitoring devices, including weather stations and high-definition cameras, across HFTD areas to enable early warning of high-risk fire conditions and real-time identification of emerging wildfires; and
- Additional System Automation and Protection – Implementing and exploring various emergent system protection technologies that may reduce wildfire risk. Two examples include Rapid Earth Fault Current Limiter (technology that automatically and rapidly reduces the flow of current and risk of ignition in single phase to ground faults) and Distribution Transmission Substation – Fire Action Scheme and Technology (technology that detects objects approaching an energized power line and responds quickly to shut off power before objects impact the line).

PG&E's wildfire mitigation programs and activities are discussed in Chapter 4. In addition to reducing wildfire risk to keep customers and communities safe, some wildfire mitigation work, such as EVM and System Hardening, is expected increase reliability.

PG&E is continuing to evaluate and assess wildfire risk. As additional data and modeling capabilities expand, the most efficient suite of mitigations for a particular circuit segment may change. EO's mitigation work will be aligned and updated to reflect the initiatives outlined in annual Wildfire Mitigation Plans.

2. Increasing Customer Focus by Delivering on Customer Commitments

As PG&E increases its customer focus by putting the customer at the center of operations, EO is committed to providing customers with a positive customer experience by supporting several customer commitments. Key customer commitments in this GRC forecast include Electric Distribution Capacity, Community Rebuild, Field Metering, and New Business/Work at the Request of Others (NB/WRO).

EO's Electric Distribution Capacity forecast includes expenditures to address an increase in new applications for service and added loads to serve industrial, agricultural, high-tech facilities, as well as state and local infrastructure. EO also anticipates additional capacity needed to support a

substantial increase in electric vehicle (EV) fast charging and fleet charging applications. Chapter 17 in this exhibit provides additional information on these issues.

Following the devastating Camp Fire in 2018, PG&E initiated the Community Rebuild Program to rebuild PG&E's distribution electric and gas system infrastructure in the areas damaged by the fire. EO's GRC forecast includes expenditures associated with undergrounding electric distribution assets in the Town of Paradise and adjacent parts of Butte County. PG&E is committed to completing the rebuild in a safe and reliable manner. Chapter 23 in this exhibit describes the Community Rebuild Program.

Since the 2020 GRC, the Field Metering Program transitioned to the EO organization. In this GRC forecast, EO has included expenditures for replacing defective SmartMeter™ gas modules with newer, functioning endpoint devices. Replacing these modules will ensure customer usage is accurately recorded and reliably delivered to PG&E's billing systems. Chapter 8 discusses this program in greater detail.

The NB/WRO Program supports new customers and existing customers connected to our distribution system, as well as requests from customers and governmental agencies to relocate existing PG&E facilities. In this GRC forecast, EO has included expenditures to support an increased demand for residential customer connections and EV charging infrastructure costs. Chapter 18 in this exhibit provides additional information on the NB/WRO Program.

3. Supporting California's Clean Energy Goals

PG&E is committed to supporting California's greenhouse gas emissions reductions goals. Widespread transportation electrification and increased adoption of distributed energy resources (DER) will help achieve the state's greenhouse gas emissions reductions goals. EO's GRC forecast includes programs associated with supporting DERs, EVs, and energy storage.

To support DER growth, PG&E continues to improve existing technology infrastructure to enable a more dynamic grid through PG&E's Integrated Grid Platform (IGP). Ultimately, PG&E's IGP aims to facilitate DER enablement and safe and reliable operation of the electric grid. The IGP will

modernize PG&E's grid with improved situational awareness, operational efficiency, cybersecurity, and DER integration capabilities to meet today's challenges while also positioning the grid to meet the demands of a dynamic energy future. In this GRC, PG&E continues its multi-year effort to build and implement its IGP, which includes: developing advanced distribution planning tools, facilitating the development of multi-customer microgrids, continuing implementation of an Advanced Distribution Management System (ADMS), and beginning implementation of a Distributed Energy Resource Management System to complement the ADMS program. Chapter 21 provides additional information on PG&E's IGP.

Widespread transportation electrification will require a grid that can support charging needs. PG&E's GRC forecast includes expenditures to support electrification in two areas: Capacity (Chapter 17) and New Business (Chapter 18). In support of California's EV public and shared charging infrastructure goals, PG&E's Capacity program forecasts expenditures associated with system upgrades necessary to support EV fast charging and EV fleet charging stations. Additionally, PG&E's New Business Program forecast includes costs associated with upgrading electric distribution infrastructure to support new EVs in PG&E's service territory. These service upgrade costs now include both infrastructure upgrades on the utility side of the meter and upgrades to the meter itself.

Energy storage will play a crucial role in renewable resource integration, helping balance the intermittency of renewable generation and low customer demand during peak generation. EO's GRC forecast includes two energy storage projects. First, PG&E's Electric Distribution Capacity forecast includes the Renz Energy Storage project, which is designed to address capacity deficiencies. Second, PG&E's IGP forecast includes the Elkhorn Battery Energy Storage System (Elkhorn BESS), which is being constructed in partnership with Tesla, Inc. The Elkhorn BESS will store and dispatch energy to the electrical grid during periods of high demand, enhancing reliability by addressing capacity deficiencies without adding new fossil fuel resources to the grid. The system will also participate in the California Independent System Operator (CAISO) markets, providing energy and ancillary services to the CAISO-controlled grid.

4. Improving Public and Workforce Safety

PG&E remains committed to delivering on our planned work safely; it is our most important responsibility. While EO remains focused on reducing wildfire risk, EO's GRC forecast contains planned investments that are intended to further reduce system safety risk.

The planned investments include:

- Programs that address asset-related safety risk: (1) continuing to replace manhole covers in areas of high pedestrian foot traffic with hinged venting manhole covers designed to stay in place in the event of a vault explosion; and (2) continuously improving detailed inspections of assets to enable proactive identification of any potential equipment issues that may lead to failures;
- Public awareness programs that educate third-party workers and the public about power line safety and the hazards associated with wire down events; and,
- Programs that facilitate a more data-driven, risk-based asset management strategy by: (1) improving EO's ability to capture outage and failure information; and (2) continuing to improve risk modeling.

PG&E is also committed to improving workforce safety. Workforce safety is focused on improvements in three key areas: motor vehicle safety, contractor safety, and employee safety.

To improve motor vehicle safety, PG&E developed a Motor Vehicle Safety program, which includes resources for all things related to motor vehicle safety. Some of these resources include web-based training for employees on defensive driving and ways to reduce driving-related risks.

EO continues to incorporate lessons learned to improve contractor safety. For example, PG&E has improved processes related to Vegetation Management work, which relies on contractors to perform tree trimming. PG&E developed a procedure requiring contractors to provide a list of subcontractors for PG&E approval prior to arriving at a job location. PG&E also added Vegetation Management Inspectors focused on the safety and quality of tree crews; the Inspectors provide field oversight and real time feedback in an effort to reduce serious incidents.

To improve employee safety, EO has developed an office ergonomics plan to prevent, evaluate, and manage office-based ergonomic issues.

5. Continued Focus on Operational Excellence

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

In alignment with the organizations across the Company, EO will implement a Lean Operating System as further described in Exhibit (PG&E-1), Chapter 1. This new management approach will improve safety and operational outcomes by providing clear visibility into performance, creating a daily dialog about results, reinforcing a consistent problem-solving approach, and standardizing ways of working across the Company. The Lean Operating System will standardize a culture of continuous improvement.

In addition to implementing the Lean Operating System, continuous improvement and innovation remain a key focus of EO. Accordingly, as discussed above, EO is committed to obtaining PAS 55 and ISO 55001 certifications in 2021. Obtaining these certifications will build on existing asset management advances and help further develop asset-centered decisions, plans and activities using a risk-based approach.

EO is also focused on continuing to improve its asset knowledge management. High quality asset data enhances business intelligence and enables the operation of a safer, more reliable, and more affordable system. In 2020, EO developed a Data Management and Analytics organization to guide electric data strategy, data quality, and data management efforts. This organization will help align data strategies across EO and the enterprise to improve PG&E's ability to make data-driven decisions around asset-related risk management. EO will be integrating an Enterprise Data Platform that will establish key connections between disparate data systems. Chapter 20 provides additional information regarding these initiatives.

Identifying, developing, and demonstrating emerging technologies also contributes to operational excellence. Demonstrating emerging technologies, for example, can be critical in finding new ways to support operations in areas such as wildfire risk mitigation and clean energy goals.

~~In this GRC forecast, EO will continue exploring emerging technologies through the Electric Program Investment Charge (EPIC) Program. Chapter 21 includes a forecast to continue Technology Demonstration and Deployment work in the event that EPIC does not continue beyond the current cycle.~~

D. Overview of the Electric Distribution Exhibit and Roadmap of February 25, 2022 Updates

This section has been added to reflect PG&E's updated forecast as of February 25, 2022.

As described above, EO's 2023 GRC forecast contains expenditures for various programs that reduce wildfire risk, deliver on customer commitments, support California's clean energy goals, improve safety, and pursue operational excellence. This includes new forecasts for PG&E's 10,000-mile undergrounding program, Vegetation Management program, and EPSS program. The Electric Distribution Exhibit is organized as follows, and includes the updates described below in this February 25, 2022 update:

TABLE 1-1
ELECTRIC DISTRIBUTION EXHIBIT CHAPTERS AND SUMMARY OF FEBRUARY 25, 2022 UPDATES

Chapter No.	Chapter Title	February 25, 2022 Updates
1	Electric Distribution Policy and Introduction	Provides updated testimony and roadmap of Exhibit (PG&E-4) changes.
2	Electric Distribution Forecast and Investment Planning	Provides summary of forecast changes and summary tables reflecting changes to PG&E's Exhibit (PG&E-4) forecasts, and testimony and workpaper errata.
3	Electric Distribution Risk Management	Introduces new integrated wildfire risk strategy and provides updated wildfire risk analysis, including a new wildfire risk mitigation and testimony errata.
4	Wildfire Risk Mitigations	Provides revised wildfire mitigation forecasts for System Hardening, including supplemental testimony explaining key aspects about PG&E's 10,000 mile undergrounding program announced in July 2021. • Chapter 4.0 provides summary tables for PG&E's updated wildfire mitigation forecasts and includes in workpapers a comparison of PG&E's updated forecast to the 2022 Wildfire Mitigation Plan. • Chapter 4.3 provides revised wildfire mitigation forecasts for System Hardening, including supplemental testimony explaining key aspects about PG&E's 10,000 mile undergrounding program announced in July 2021 and testimony non-forecast errata. • Chapter 4.6 is a new chapter providing a forecast and supplemental testimony regarding PG&E's EPSS program.
5	Emergency Preparedness and Response	Includes testimony non-forecast errata.

TABLE 1-1
ELECTRIC DISTRIBUTION EXHIBIT CHAPTERS AND SUMMARY OF FEBRUARY 25, 2022 UPDATES
(CONTINUED)

Chapter No.	Chapter Title	February 25, 2022 Updates
6	Electric Emergency Recovery	None
7	Distribution System Operations	Includes workpaper non-forecast errata.
8	Field Metering	None
9	Vegetation Management	Provides PG&E's updated scope of work and forecast for vegetation management and errata to correct 2020 recorded costs in testimony and workpapers.
10	Overhead and Underground Electric Asset Inspections	Includes testimony and workpaper non-forecast errata.
11	Overhead and Underground Electric Distribution Maintenance	Includes workpaper non-forecast errata.
12	Pole Asset Management	Includes workpaper non-forecast errata.
13	Overhead and Underground Asset Management and Reliability	Includes testimony and workpaper non-forecast errata.
14	Network Asset Management	None
15	Substation Asset Management	None
16	Distribution System Automation and Protection	None
17	Electric Distribution Capacity, Engineering and Planning	None
18	New Business and Work at the Request of Others	Includes workpaper non-forecast errata.
19	Rule 20A	None
20	Electric Distribution Data Management and Technology	Includes testimony and workpaper forecast errata.
21	Integrated Grid Platform and Grid Modernization Plan	Removes PG&E's forecast for Technology Demonstration and Deployment work associated with the EPIC program. The removal impacts both testimony and workpapers.
22	Electric Distribution Support Activities	Includes workpaper non-forecast errata.
23	Community Rebuild Program	Provides revised unit costs and forecast for undergrounding and non-forecast workpaper errata.

Details of the forecast and changes in the exhibit organization from the 2020 GRC are provided in Chapter 2.

E. Conclusion

Since the 2020 GRC, PG&E has implemented programs to reduce wildfire risk, improved risk management, and pursued operational excellence during unprecedented times all while striving to serve customers safely and reliably. The forecasts in this exhibit will enable EO to balance addressing our top safety risks, delivering on customer commitments, supporting California's clean energy goals, improving safety, and continuing to focus on operational excellence.

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PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 2

ELECTRIC DISTRIBUTION FORECAST AND INVESTMENT PLANNING

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

PACIFIC GAS AND ELECTRIC COMPANY
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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 2
ELECTRIC DISTRIBUTION FORECAST AND INVESTMENT PLANNING

A. Introduction

In this chapter, Pacific Gas and Electric Company (PG&E or the Company) describes its cost forecasting methodology used to develop the operation and maintenance (O&M) expense and capital expenditure forecasts for the Electric Distribution work presented in the 2023 GRC.

This chapter provides an overview of the following: (1) the Electric Distribution forecast; (2) key changes in the presentation of the forecast compared to the 2020 General Rate Case (GRC); (3) Electric Distribution's funding prioritization and cost forecasting approach; (4) compliance with the 2020 GRC Settlement Agreement Principles for Deferred Work; and (5) a summary of the forecast by GRC chapter and program area.

This chapter was updated as part of PG&E's February 25, 2022 update to reflect its revised Wildfire risk management strategy.

The remainder of this chapter is organized as follows:

- Section B – Overview of Forecast;
- Section C – Exhibit Changes Since the 2020 GRC;
- Section D – Managing Electric Operations Funding;
- Section E – Cost Forecasting Approach;
- Section F – Compliance with Section 5.2 of the 2020 GRC Settlement "Deferred Work Principles"; and
- Section G – Forecast by Chapter and Program Area.
- ~~Attachment A: Incrementality of Memorandum Account Recorded Costs.~~

B. Overview of Forecast

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

PG&E's annual enterprise-wide strategic planning and budgeting process sets the foundation for the work in Electric Operations (EO). The process brings a systematic approach to PG&E's planning by: (1) identifying top compliance, enterprise, and operational risks; (2) developing a 5-year Operating Plan,

including specific goals and strategies; and, (3) establishing PG&E's execution and financial plan.

A fundamental part of EO's business is to proactively manage risk and comply with applicable rules and regulations. EO must continuously evaluate its priorities, consider new data, leverage its risk management processes, and incorporate regulatory direction, including feedback from its annual Wildfire Mitigation Plan (WMP) report. The forecasts in this exhibit reflect that process, incorporate changes since the 2020 GRC was filed, and represent the most risk-informed plan right now.

PG&E requests that the Commission adopt its 2023 expense forecast of $2.2 billion for EO. PG&E's 2023 expense forecast for EO is $39.7 million or 2 percent lower than 2020 recorded costs of $2.2 billion.[1]

PG&E further requests that the Commission adopt its capital forecast of $3.4 billion in 2021, $4.0 billion in 2022, $4.5 billion in 2023, $5.7 billion in 2024, $6.2 billion in 2025, and $6.6 billion in 2026. The 2023 capital forecast for EO is $1.4 billion or 45 percent higher than 2020 recorded expenditures of $3.1 billion.[2] PG&E discusses the changes driving these increases relative to 2020 later in this chapter.

PG&E categorizes its EO expense and capital forecasts into six program areas:

1) Risk Reduction;
2) Emergency Preparedness and Response;
3) Customer Requested and Load Growth;
4) Maintenance and Compliance;
5) Asset Management and Reliability;[3] and
6) Operational Coordination.

PG&E provides further details regarding the expense and capital expenditure forecasts for EO below.

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1 Exhibit (PG&E-4), WP 2-1. Amounts in this chapter do not include confidential forecast amounts for Elkhorn energy storage project shown in Appendix A.

2 Exhibit (PG&E-4), WP 2-4. Amounts in this chapter do not include confidential forecast amounts for Elkhorn energy storage project shown in Appendix A.

3 Asset Management and Reliability are typically capital expenditures only.

1. Summary of February 25, 2022 Forecast Updates

This section has been added as of February 25, 2022.

As directed by Commission President Batjer, PG&E has updated its 2023 GRC forecast to reflect changes in its wildfire mitigation strategies. This supplemental testimony includes the following changes to PG&E's 2023 forecast:

Expense:

- Addition of $151.1 million for new wildfire mitigation Enhanced Powerline Safety Settings (EPSS). This mitigation is described in Chapter 3, and new Chapter 4.6.
- Overall reduction of $137.6 million to the Vegetation Management (VM) programs, which reflect a change in scope commensurate with PG&E's increased system hardening undergrounding work in the High Fire Threat District (HFTD) areas, application of EPSS across its HFTD distribution circuits, and PG&E's commitment to reducing the costs of its VM programs. The changes include a decrease in the Enhanced VM wildfire mitigation, and an increase to Routine VM. These changes are detailed in Chapter 9.
- Removal of $15.1 million of PG&E's forecast for the Electric Emerging Technology Program. The California Public Utilities Commission (Commission) authorized continuation of the Electric Program Investment Charge (EPIC) to fund development of emerging but unproven technologies, so funding in the GRC is no longer required. See Chapter 21 for details on this updated forecast.

Capital:

- Addition of $603.1 million to reflect PG&E's plan to underground additional miles at a lower unit cost as part of its System Hardening Program. Chapter 4.3 describes these changes.
- Reduction of $0.2 million to correct errata as noted in Chapter 20.
- Reduction of $25.9 million in the Community Rebuild Program to reflect lower unit costs for undergrounding, as described in Chapter 23.

A summary of the forecast changes, including capital changes through 2026, are provided in Tables 2-6 through 2-9 at the end of this chapter. The remainder of this chapter shows PG&E's updated forecast as compared to

2020 recorded amounts, as well as minor updates to Table 2.2 in PG&E's deferred work showing in Section F to reflect system hardening forecast changes in 2022.

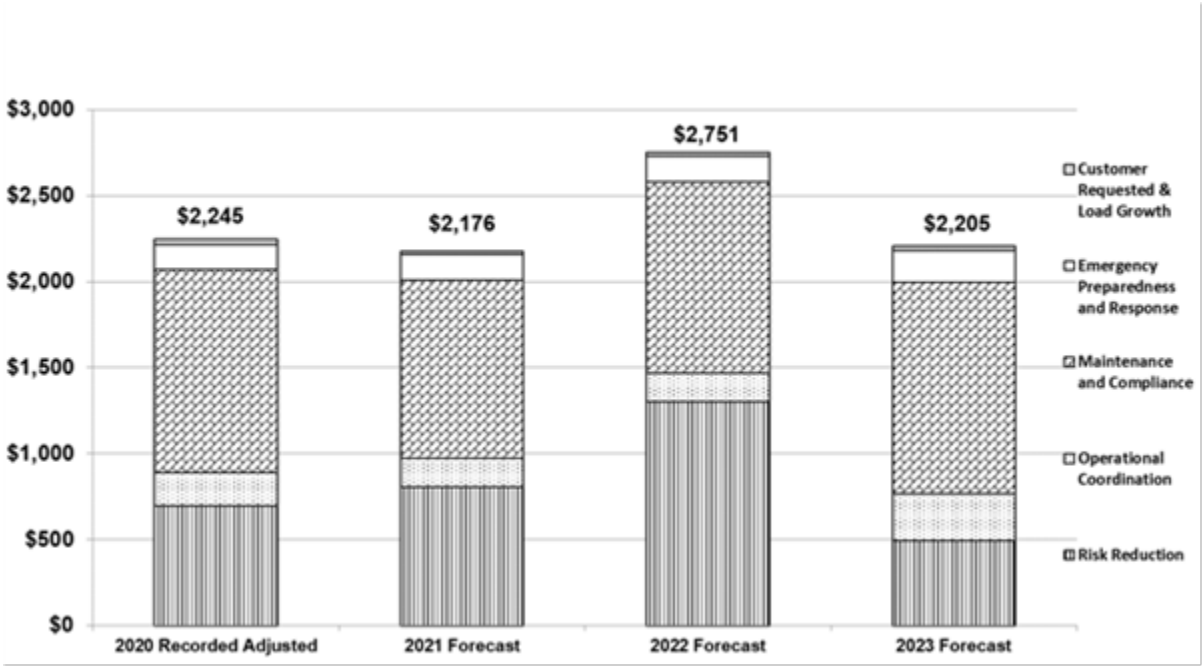
2. Expense Forecast

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

Figure 2-1 shows the 2020 recorded and 2021-2023 forecast expenses for EO by program area.[4] PG&E's forecast for 2023 electric distribution expenses is 2 percent lower than 2020 recorded adjusted expenditures.

[4] Amounts for 2020-2022 include work tracked in memorandum accounts and other separately funded programs which will be rolled into the GRC starting in 2023, shown for trending purposes. See Exhibit (PG&E-4), WP 2-2.

FIGURE 2-1
EXPENSE FORECAST BY PROGRAM AREA 2020-2023
(MILLIONS OF NOMINAL DOLLARS)



Note These amounts included in testimony and workpapers in the operational chapters may vary from the values in the Results of Operations (RO) model previously provided to the Public Advocates Office at the California Public Utilities Commission (Cal Advocates). The RO will be updated to incorporate this February 25, 2022 update and additional errata.

Figure 2-2 shows the changes from 2020 recorded to 2023 forecast expense by program area.[5] The largest changes in the EO expense forecasts are:

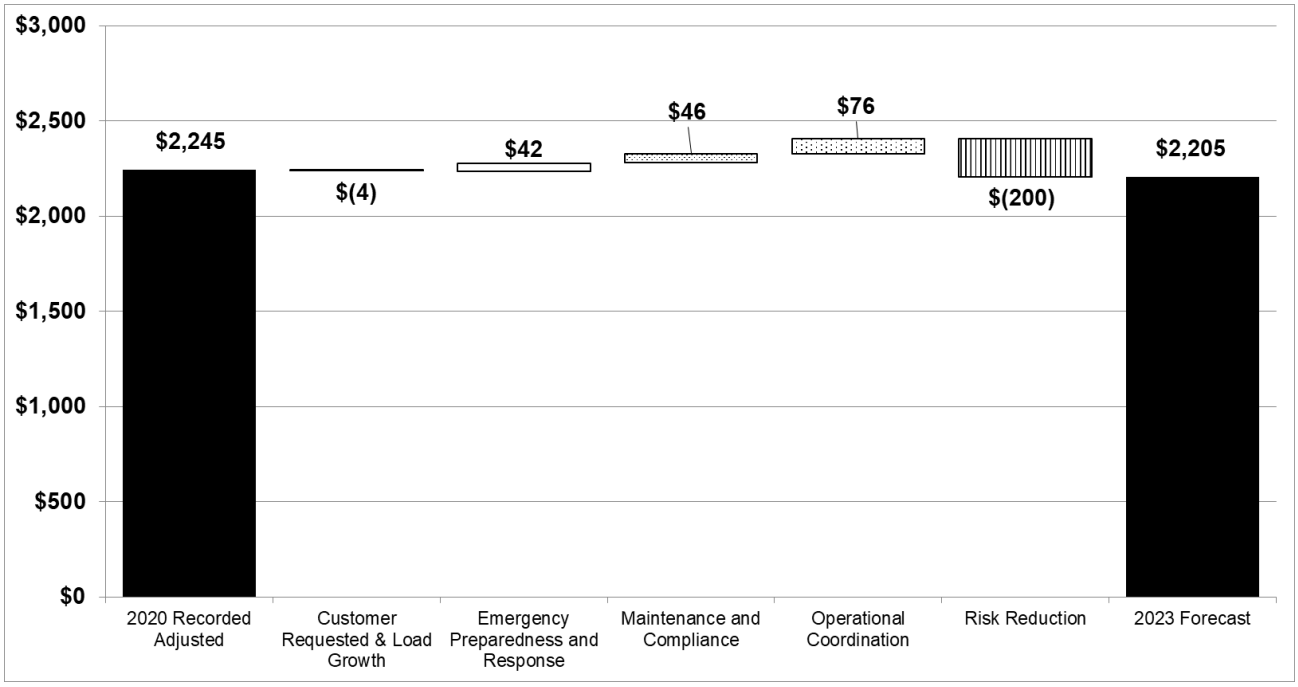
- Maintenance and Compliance ($46 million increase) – Driven primarily by increased scope in PG&E's Routine VM Program during this GRC period in order to reduce potential vegetation contact with overhead electric lines and other equipment while the undergrounding of electric distribution assets takes place; offset by reductions in detailed overhead asset inspections as a result of moving to a risk-informed approach for scheduling inspections;
- Risk Reduction ($200 million decrease) – Driven primarily by reduced scope of the Enhanced VM Program, lower costs for Utility Defensible Space and Wood Management; and fewer additional staff for safety

5 See Exhibit (PG&E-4), WP 2-3.

oversight and quality work verification, offset by costs for the new EPSS wildfire mitigation, additional technology investments to support wildfire mitigations; and expanding PG&E's Safety and Infrastructure Protection Team;

- Operational Coordination ($76 million increase) – Driven by increased work in Integrated Grid Platform and Grid Modernization; the inclusion of a new Data Management and Analytics program, and increased headcount to support the Regulatory Compliance and Quality Assurance group and other EO work; and
- Emergency Preparedness and Response ($42 million increase) – Driven by wildfire mitigation activities such as the Wildfire Safety Operations Center moving out of the Wildfire Mitigation Balancing Account starting in 2023, and a new forecast for straight time labor costs associated with Catastrophic Event Memorandum Account (CEMA)-eligible events in the GRC.

FIGURE 2-2
EXPENSE WALK BY PROGRAM AREA 2020-2023
(MILLIONS OF NOMINAL DOLLARS)



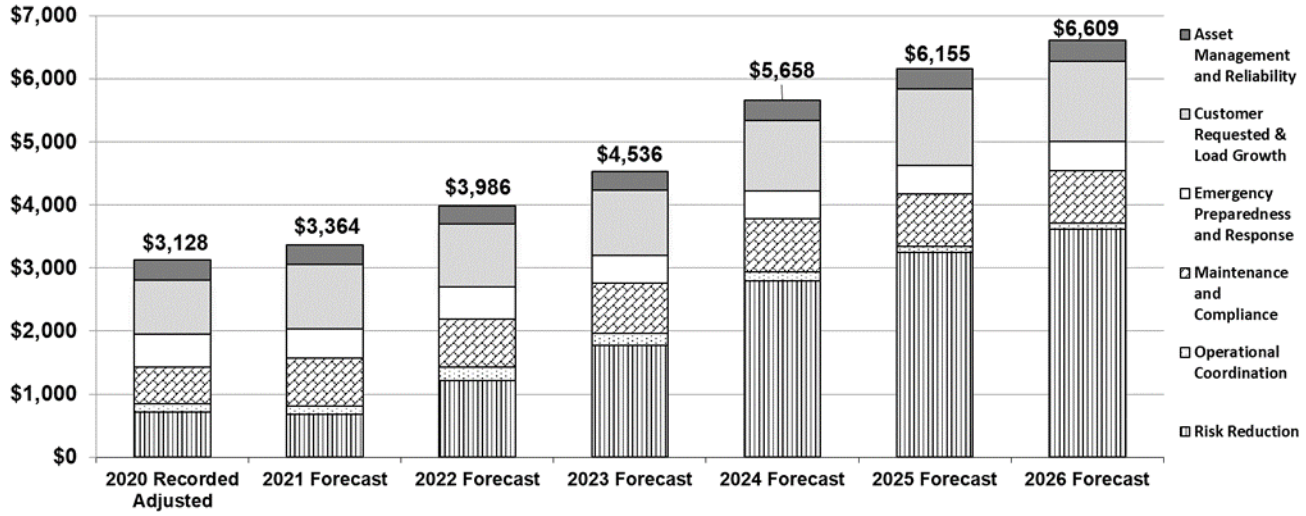
Note These amounts included in testimony and workpapers in the operational chapters may vary from the values in the RO model previously provided to Cal Advocates. The RO will be updated to incorporate this February 25, 2022 update and additional errata.

3. Capital Expenditures Forecast

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

Figure 2-3 shows the 2020 recorded and 2021-2026 forecast capital expenditures for EO by program area.[6] EO's forecast 2023 capital expenditures reflect an approximately 45 percent increase relative to 2020 recorded expenditures.

FIGURE 2-3
CAPITAL FORECAST BY PROGRAM AREA 2020-2026
(MILLIONS OF NOMINAL DOLLARS)



Note These amounts included in testimony and workpapers in the operational chapters may vary from the values in the RO model previously provided to Cal Advocates. The RO will be updated to incorporate this February 25, 2022 update and additional errata.

Figure 2-4 shows the changes from 2020 recorded to 2023 forecast capital by program area.[7] The largest changes in the EO capital forecasts are:

- Risk Reduction ($1,064 million increase) – Driven primarily by PG&E's plans to underground additional miles as part of the System Hardening

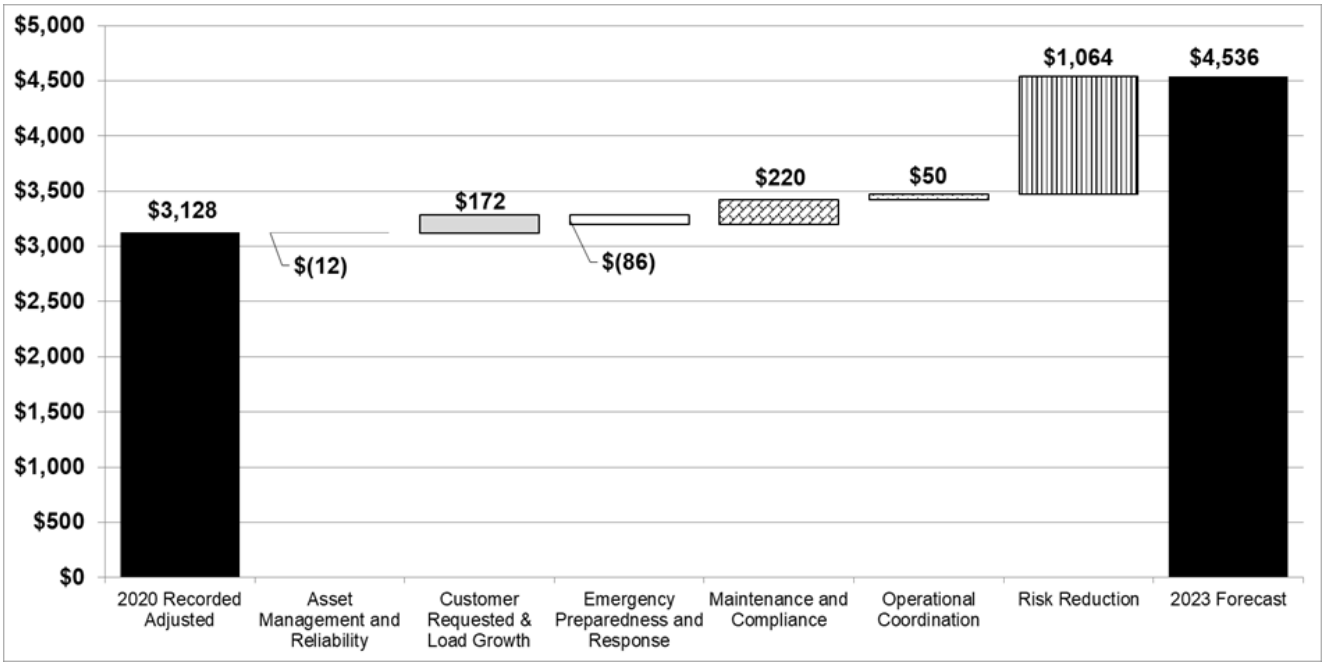
[6] Amounts for 2020-2022 include work tracked in memorandum accounts and other separately funded programs which will be rolled into the GRC starting in 2023, shown for trending purposes. See Exhibit (PG&E-4), WP 2-5.

[7] See Exhibit (PG&E-4), WP 2-6.

Program and also costs for the Community Rebuild Program in Butte County;

- Maintenance and Compliance ($220 million increase) – Driven by a significant increase in the volume of pole replacements resulting from the enhanced inspection criteria initiated in 2019 and an increase in the number of non-communicating gas SmartMeter™ modules that need to be replaced;
- Customer Requested and Load Growth ($172 million increase) – Driven by a projected increase in demand for new residential customer connections and the inclusion in the GRC forecast of some Electric Vehicle (EV) charging infrastructure costs that were historically covered by customers or recovered in other proceedings, and capacity upgrades driven by the new applications for service and EV charging applications;
- Operational Coordination ($50 million increase) – Driven by investments in the Advanced Distribution Management System to support PG&E's Integrated Grid Platform;
- Emergency Preparedness and Response ($86 million decrease) – Driven by lower costs for the Distribution Substation Emergency Equipment Replacement Program due to the completion of capital wildfire-related projects, and decrease in emergency costs for the Community Rebuild Program; and
- Asset Management and Reliability ($12 million decrease) – Driven by decreased costs related to the conclusion of milestone payments to the Elkhorn Battery Energy Storage System Engineering, Procurement, and Construction vendor. This decrease is offset by increased replacement rates in overhead conductor, underground cable, and substation circuit breakers.

FIGURE 2-4
CAPITAL EXPENDITURES WALK BY PROGRAM AREA 2020-2023
(MILLIONS OF NOMINAL DOLLARS)



Note These amounts included in testimony and workpapers in the operational chapters may vary from the values in the RO model previously provided to Cal Advocates. The RO will be updated to incorporate this February 25, 2022 update and additional errata.

Tables 2-6 and 2-7 at the end of this chapter show the forecasts by chapter and program areas.

4. Balancing Accounts

a. Wildfire Mitigation Balancing Account

PG&E proposes to continue the two-way Wildfire Mitigation Balancing Account (WMBA) for its capital and expense costs incurred for wildfire mitigations, with modifications to increase the reasonableness review threshold.[8] The WMBA will be used for Community Wildfire Safety Program (CWSP) wildfire mitigation expenditures, including the work in the System Hardening Program and other wildfire mitigations described in this application as well as new risk mitigation activities that PG&E may develop in future years.

[8] See Exhibit (PG&E-4), Ch. 4 for the discussion on the WMBA.

b. Vegetation Management Balancing Account

PG&E proposes continuing its two-way Vegetation Management Balancing Account (VMBA) through the 2023 GRC period, with modifications to increase the reasonableness review threshold.[9] The VMBA is used to record PG&E's routine and EVM activities, and also includes VM costs for dead and dying trees previously recorded in the CEMA. To the extent that other lines of business (LOB) have similar drought-related VM activities in the future that were previously booked to CEMA, those expenses will also be booked to the VMBA.

c. Major Emergency Balancing Account

PG&E proposes to continue the two-way Major Emergency Balancing Account (MEBA) for its capital and expense costs incurred for major emergencies.

The purpose of the MEBA is to recover actual expenses and capital revenue requirements resulting from responding to major emergencies and catastrophic events not eligible for recovery through CEMA.[10]

d. Catastrophic Events Straight Time Labor Balancing Account

PG&E proposes to recover straight-time (ST) labor costs associated with CEMA-eligible events through a new two-way balancing account referred to as the Catastrophic Events Straight-Time Labor Balancing Account (CESTLBA). If this proposal is approved, PG&E would stop recording catastrophic event straight-time labor costs to the CEMA. PG&E is proposing this change to simplify cost recovery in future CEMA applications beginning in 2023.[11]

e. Rule 20A Balancing Account

PG&E proposes to continue the one-way balancing account for its capital and expense costs incurred for the Rule 20A Program, and will modify its proposal as needed to comply with the final decision on

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9 See Exhibit (PG&E-4), Ch. 9 for the discussion on the VMBA.

10 See Exhibit (PG&E-4), Ch. 6 for more on MEBA.

11 See Exhibit (PG&E-4), Ch. 6 for more details on the proposed CESTLBA.

Rulemaking (R.) 17-05-010, *Order Instituting Rulemaking (OIR) to Consider Revisions to Electric Rule 20 and Related Matters.*[12]

~~**5. Reasonableness Review of 2020 Recorded Costs in Wildfire Memorandum Accounts**~~

~~In this GRC, PG&E is also requesting recovery of 2020 recorded costs incremental to funding approved in the 2020 GRC for activities associated with wildfire risk reduction. These costs were recorded in the Fire Risk Mitigation Memorandum Account (FRMMA) and the Wildfire Mitigation Plan Memorandum Account (WMPMA). Attachment A to this chapter provides a description of how PG&E determined the incrementality of these costs and which costs are excluded because they were subject to the Wildfire Order Instituting Investigation penalty reduction. The following chapters in the electric exhibit have reasonableness review testimony on 2020 memorandum account costs:~~

- ~~Chapter 4, "Wildfire Risk Mitigations";~~
- ~~Chapter 6, "Electric Emergency Recovery";~~
- ~~Chapter 10, "Overhead and Underground Electric Asset Inspections";~~
- ~~Chapter 11, "Overhead and Underground Electric Distribution Maintenance";~~
- ~~Chapter 12, "Pole Asset Management"; and~~
- ~~Chapter 15, "Substation Asset Management."~~

C. Exhibit Changes Since the 2020 GRC

PG&E reorganized the Electric Distribution exhibit as compared to the 2020 GRC exhibit by adding new chapters and reorganizing the way work is presented. The most notable changes are listed below.

1. Testimony on Electric Distribution Forecast and Investment Planning

PG&E presents this chapter to provide testimony on the following: (1) an overview of the Electric Distribution forecast; (2) key changes compared to the 2020 GRC; (3) a demonstration of compliance with the 2020 GRC Settlement Agreement Principles for Deferred Work; (4) a

[12] See Exhibit (PG&E-4), Ch. 21 for more details on the Rule 20A balancing account.

description of the Electric Operations Investment Planning process; and (5) a summary of the forecast by program area.

2. Reorganization of Wildfire Risk Mitigation Testimony

This section has been revised to reflect PG&E's updated expense forecast as of February 25, 2022.

PG&E consolidated most of its discussion of Wildfire Risk Mitigations into one chapter (Chapter 4), which includes the following sub-chapters:

- Chapter 4.0 – "Wildfire Mitigations";
- Chapter 4.1 - "Situational Awareness and Forecasting";
- Chapter 4.2 – "Public Safety Power Shutoff (PSPS) Operations";
- Chapter 4.3 – "System Hardening, Enhanced Automation, and PSPS Impact Mitigations";
- Chapter 4.4 – "Community Wildfire Safety Program (CWSP) Program Management Office (PMO)";
- Chapter 4.5 – "Information Technology for Wildfire Mitigations"; and
- Chapter 4.6 – "Enhanced Powerline Safety Settings."

3. Testimony on Community Rebuild Program

PG&E presents new testimony as Chapter 23 to describe the work being done to rebuild, in a safe and cost-effective manner, utility infrastructure required to serve the Town of Paradise and surrounding areas.

4. Other Organizational Changes

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

In this GRC, PG&E is presenting inspections and maintenance programs that in previous GRCs were all included in the Electric Distribution Maintenance chapter in three chapters: "Overhead and Underground Electric Asset Inspections" (Chapter 10),"Overhead and Underground Electric Distribution Maintenance" (Chapter 11), and "Network Asset Management" (Chapter 14). These chapters were separated to allow for a more focused evaluation of their respective programs.

Field Metering Operations has moved from Exhibit (PG&E-6), "Customer Care," Chapter 6, to Chapter 8 of Exhibit (PG&E-4).

Table 2-1 below compares the 2020 GRC presentation to the 2023 GRC presentation by chapter name and the MWCs presented in each chapter.

TABLE 2-1
COMPARING THE 2020 GRC TO 2023 GRC CHAPTERS

Line No.	2020 GRC		2023 GRC	
	Chapter Number and Title	MWCs	Chapter Number and Title	MWCs
1	Chapter 1: Electric Distribution Operations Policy and Introduction	All	Chapter 1: Electric Distribution Policy and Introduction	None
2			Chapter 2: Electric Distribution Forecast and Investment Planning	All
3	Chapter 2: Electric Distribution Risk Management	None	Chapter 3: Electric Distribution Risk Management	None
4	Chapter 2A: Wildfire Risk Policy and Overview	None		
5	Multiple Chapters (2A, 3, 5, 6, 9, 10, 18)	AB, BA, HG, 2A, 08, 09, 21, 49	Chapter 4: Wildfire Risk Mitigations	Exp: AB, BA, BH, FZ, GC GE, IG, JV Cap: 21, 2F, 08, 48, 49
6	Chapter 3: Emergency Preparedness and Response	Exp: AB Cap: 21	Chapter 5: Emergency Preparedness and Response	Exp: AB Cap: 21
7	Chapter 4: Electric Emergency Recovery	Exp: IF, BH Cap: 17, 95	Chapter 6: Electric Emergency Recovery	Exp: IF, BH Cap: 17, 95
8	Chapter 5: Distribution System Operations	Exp: BA, DD, HG Cap: 63	Chapter 7: Distribution System Operations	Exp: BA, DD, HG Cap: 63
9	Exhibit (PG&E-6), Chapter 6: Metering	Exp: AR, DD, EY, EZ, HY, IG, IU, JV Cap: 01, 05, 21, 25, 74, 97, 2F, 3J	Chapter 8: Field Metering	Exp: AR, DD, EY, EZ, HY, IU Cap: 25, 74
10	Chapter 7: Vegetation Management	Exp: HN, IG Cap: None	Chapter 9: Vegetation Management	Exp: HN, IG Cap: None
11	Chapter 6: Electric Distribution Maintenance	Exp: BF, BK, KA, KB, KC Cap: 2A, 2B, 2C	Chapter 10: Overhead and Underground Electric Asset Inspections	Exp: BF Cap: None
12			Chapter 11: Overhead and Underground Electric Distribution Maintenance	Exp: BK, KA, KB Cap: 2A, 2B
13			Chapter 14: Network Asset Management	Exp: KC Cap:2C, 56

TABLE 2-1
COMPARING THE 2020 GRC TO 2023 GRC CHAPTERS
(CONTINUED)

Line No.	2020 GRC		2023 GRC	
	Chapter Number and Title	MWCs	Chapter Number and Title	MWCs
14	Chapter 8: Pole Asset Management	Exp: GA Cap: 07	Chapter 12: Pole Asset Management	Exp. GA Cap: 07
15	Chapter 9: Distribution Overhead System Hardening and Reliability	Exp: None Cap: 08, 49	Chapter 13: Overhead and Underground Asset Management and Reliability	Exp: None Cap: 08, 49, 56 (Wildfire mitigations moved to Ch 4)
16	Chapter 11: Underground Asset Management	Exp: None Cap: 56		
17	Chapter 10: Distribution Automation and System Protection	Exp: HX Cap:09	Chapter 16: Distribution System Automation and Protection	Exp. HX Cap: 09
18	Chapter 12: Substation Asset Management	Exp: GC Cap: 48, 54, 58, 59	Chapter 15: Substation Asset Management	Exp: GC Cap: 48, 54, 58, 59
19	Chapter 13: Electric Distribution Capacity	Exp: None Cap: 06, 46	Chapter 17: Electric Distribution Capacity, Engineering and Planning	Exp: FZ Cap: 06, 46
20	Chapter 14: Electric Distribution Engineering and Planning	Exp: FZ Cap: None		
21	Chapter 15: Electric Distribution Technology	Exp: JV Cap: 2F	Chapter 20: Electric Distribution Data Management and Technology	Exp. GE, JV Cap: 21, 2F
22	Chapter 16: New Business and Work at the Request of Others	Exp: EV, EW Cap: 10. 16	Chapter 18: New Business and Work at the Request of Others	Exp: EV, EW Cap: 10. 16
23	Chapter 17: Rule 20A	Exp: None Cap: 30	Chapter 19: Rule 20A	Exp. IG Cap: 30
24	Chapter 18: Electric Distribution Support Activities	Exp: AB, GE, IS, OM, OS Cap: 05, 21	Chapter 22: Electric Distribution Support Activities	Exp: AB, IS, OM, OS Cap: 05, 21
25	Chapter 19: Integrated Grid Platform Program and Grid Modernization Plan	Exp: HG, JV Cap: 63, 2F	Chapter 21: Integrated Grid Platform and Grid Modernization Plan	Exp: AB, AT, HG, IG, JV Cap: 21, 2F, 3M, 3R, 63, 82
26	None	N/A	Chapter 23: Community Rebuild Program	Exp: IF Cap: 95

D. Managing Electric Operations Funding

1. Operating Rhythm

The 2023 GRC forecast includes funding for a risk-informed portfolio of work that puts safety first while delivering on customer commitments and supporting California's clean energy goals. In developing this portfolio, EO must consider such factors as risk reduction, cost, efficiencies, overall authorized GRC funding, the availability of PG&E and contractor resources, synergies with other work, and dependencies and requirements such as permitting and the different rules for working with California's counties and cities.

When it emerged from its Chapter 11 proceeding, PG&E adopted a new framework called the Operating Rhythm[13] to run the business. This framework provides a forum for reviewing Key Performance Indicators, setting 5-year plans, developing more detailed shorter term plans, reviewing work execution, and authorizing changes as needed to the annual work plan.

The main decision-making entity within Electric Operations is the Work, Resource and Financial Review (WRFR) Committee, a governing body comprised of EO's Senior Vice President, Sr. Vice President Electric Engineering, Vice President Asset Risk Management, Vice President Major Projects and Programs, Sr. Director Electric Compliance, Sr. Director of Electric Business Operations, and Director EO Business Finance. The WRFR Committee approves the 5-year project/program targets and the associated annual work plans. The committee meets monthly to review the execution of the work plan from a units, dollars, and resources viewpoint. When appropriate, the committee also authorizes changes to the annual work plan, submittal into the Enterprise Operating Rhythm, and incremental funding requests. The committee also provides guidance over resource allocation decisions to ensure support of the work and financial plan.

Once an annual budget is established, managing it entails evaluating the budget against planned and executed work and adjusting funding levels on a monthly basis through change control and WRFR Committee meetings.

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[13] Exhibit (PG&E-2), Ch. 3.

The change control process encompasses the review and approval by the WRFR Committee of funding level changes and proposed emergent work to the work plan. These approved funding adjustments enable the Electric Operations organization to execute a balanced portfolio of work.

The prioritization process PG&E followed in developing its forecast for this GRC builds on this Operating Rhythm framework. Electric Operations is continuing to refine its risk-prioritized spending methods and tools. This may lead to spending on specific projects or programs to align with PG&E's WMP and to address emerging issues. As in previous years, management will exercise its judgment in determining how best to allocate funds.

2. Funding the 2020-2022 Workplan

PG&E's 2020 GRC presented a forecast which included significant investments for wildfire risk reduction. The WMBA, which was authorized in the 2020 GRC, provides funding for the wildfire mitigation activities described in the 2020 GRC. Wildfire mitigations not eligible for recovery in the WMBA are recorded in the WMPMA if approved as part of the WMP and recorded in the FRMMA if not yet approved as part of the WMP.

As discussed in PG&E's 2020 GRC rebuttal testimony, the 2020 GRC forecast did not include a forecast for the Wildfire Safety Inspection Program (WSIP) and related repairs and replacements.[14] Because the WSIP costs and related repair and replacement costs exceeded PG&E's imputed adopted amounts for maintenance tags, pole replacements, and other identified work, those excess amounts have been recorded in the WMPMA.

~~Attachment A to this chapter describes the methodology used for determining incrementality to the 2020 GRC imputed adopted amounts and provides a summary of work recorded in the wildfire memorandum accounts in 2020 for which PG&E is requesting reasonableness review in this application.~~

While PG&E has other cost recovery mechanisms available for incremental wildfire mitigation work, most of its work portfolio must be prioritized within the 2020 GRC authorized revenue requirements. Exhibit (PG&E-2), Chapter 3, "Operating Rhythm," describes the Company's Plan of

[14] A.18-12-009, HE-20: Exhibit (PG&E-18), p. 2A-8, lines 11-31.

Reorganization (POR), which included 5-year LOB forecast targets from 2020-2025. The POR targets were anchored in the then-known/then-current regulatory adopted amounts at the LOB level. For EO, given the increased amount of work identified since the 2020 GRC was filed, Investment Planning worked to develop an investment plan which funded necessary work and was aligned with the POR targets. For 2021 and 2022, the bottom up expense forecasts exceeded the POR targets, so the GRC forecast for those years includes an expense challenge for many programs. The forecast presented in the workpapers shows the costs expected for the work, and an adjustment which represents unidentified work efficiencies to align to the POR targets. The Electric Operations Performance Improvement team is exploring opportunities for EO's organizations to work more efficiently to achieve these cost savings. Also as discussed in Chapter 1 of this exhibit, EO is implementing a Lean Operating System to help achieve these goals.

3. Prioritizing Funding in the 2023 GRC

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

At the time EO developed its forecast for the 2023 GRC, the Company was in the process of retiring the Risk-Informed Budget Allocation (RIBA) standard. During this transition period, EO applied a risk-based approach for prioritizing its GRC portfolio. This approach centered around its Loading Order, Circuit Protection Zone Ranking, work execution analyses, and other considerations.

The Loading Order is a prioritization framework specific to the EO portfolio that ranks funding priorities by work type. Funding priorities act as guidance for allocating funds to the highest risk areas for electric operations. The top tier loading order assignments are aligned with electric operations RAMP risks. The top priorities in the Loading Order are to fund work that addresses immediate safety emergencies and work that prevents wildfire ignitions such as system hardening and VM. Other priorities include: overhead work that addresses known safety risks such as conductor replacement; work that prevents wires down and repair tags; and emergency preparedness activities such as installing cameras and weather

stations and PSPS events. Work in the middle tier of the Loading Order includes underground and network activities and compliance work with a strong safety link; work that mitigates system-wide failure; and New Business and Work at the Request of Others (NB/WRO). The lower priority work addresses compliance and reliability work representing a low safety risk.

The Circuit Protection Zone Ranking supplements the Loading Order by incorporating risk ranking prioritization and additional risk and value analyses. The Circuit Protection Zone Ranking: incorporates enhanced wildfire spread modeling; addresses PSPS impact mitigations; assesses the pace, scope, and combination of planned risk mitigations; and updates risk ranking and prioritization for circuits in non-High Fire Threat District (HFTD) areas.

Work Execution analyses centered around evaluating the number of hours available to execute work based on current staffing levels and the volume and type of work forecast in the GRC. Work Execution also evaluated precursor and dependent work, such as the number of project estimators needed and material availability, to support the GRC forecast.

Along with the frameworks and analyses described above, other issues considered during the prioritization process included: funding for preferred mitigation and control portfolios described in PG&E's 2020 RAMP Report;[15] eliminating or reducing deferred work; and continued funding to complete work in progress. EO also built into its portfolio affordability initiatives such as reducing costs through aggressive contract pricing. The EO Investment Planning team worked closely with program owners, asset managers and EO leadership in finalizing the balanced GRC portfolio.

Finally, in developing its GRC portfolio, EO was constrained by the targets established in the POR when PG&E emerged from bankruptcy on July 1, 2020.[16] While the EO forecast was anchored to the POR, PG&E recognized the need to increase its forecast above POR targets in certain

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15 PG&E's RAMP Report, A.20-06-012 (June 30, 2020).

16 PG&E discusses the POR financial targets in Exhibit (PG&E-2), Ch. 3.

key areas. The primary increases to EO's POR targets as approved by PG&E's Operating Plan Committee (OPC)[17] are:

- Field Metering added additional funding to address gas meter module failures;
- EO Operational Management and Operational Support had increases for wildfire mitigation costs;
- Acceleration of the rebuild of Butte County in the Community Rebuild Program;
- EO NB/WRO added additional funding to align with updated economic models and comply with a Commission-approved settlement; and
- Undergrounding of additional miles as part of the System Hardening Program.

E. Cost Forecasting Approach

1. Cost Forecasting Methods

The forecast costs presented in Chapters 4 to 23 of this Electric Distribution exhibit generally include four cost types:

a) Unit costs for work that is recorded and forecast by unit (e.g., miles of conductor hardened, number of poles inspected);

b) Non-unitized costs for work that does not lend itself to unit cost estimation and, therefore, is recorded and forecast at a total MWC/MAT level (e.g., emergency response work, new programs for which there are no historical costs);

c) Project based forecasts for work that is forecast at the individual project level; and

d) Costs that are calculated by other methods (e.g., IT projects, work at the request of others).

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[17] PG&E's OPC is responsible for governance of the Operating Rhythm, an integrated enterprise-wide structure focused on planning, performance management and governance in order to provide clear line of sight to performance execution and accountability. The OPC is comprised of PG&E's senior leaders including the Chief Executive Officer, Chief Financial Officer, Chief Risk Officer, and Chief Operating Officer. See Exhibit (PG&E-2), Ch. 3 for more information about the Operating Rhythm and OPC.

The forecasting method for each of these cost types is described below.[18] Additional information is provided in the individual forecast chapters.

The 2021 forecast amounts in PG&E's 2023 GRC presentation are based on EO's approved 2021 budget. The budget represents a balanced portfolio that prioritizes risk mitigation work, compliance work, and regulatory and other commitments while staying within corporate capital and expense targets.

a. Method for Forecasting Unit Cost Work

Much of the work forecast in Electric Distribution is based on the costs to complete a unit of work. The unit cost forecasts are mostly presented at the MAT code level where there is a single unit cost for each MAT. For certain types of work the unit costs are presented at MWC level (e.g., field metering). In other cases, there are very different types of work in a single MAT that cannot be represented by a single unit cost. In these cases, PG&E develops a unit cost for each unique type of work, based on historical averages and incorporating planned changes to the way the work will be conducted and opportunities to reduce unit costs.

b. Method for Forecasting Non-Unitized Work

Certain MWCs and MAT codes in the Electric Distribution portfolio are not tracked at a unit-cost level. For example, the costs recorded to MAT code 05 (Tools and Equipment) are for miscellaneous capital tools and equipment used on Electric Distribution projects across PG&E's service area. Capital tools and equipment are purchased as needed based on the different types of work occurring, and to replace tools and equipment that are worn or broken. The costs forecast in this MAT code do not lend themselves to the unit-cost forecasting methodology because tools and equipment are considered more of a commodity type

[18] PG&E's 2022 forecast for base electric distribution expense work (work that is not included in balancing memorandum accounts) is, for the most part, equal to the 2021 forecast. The 2022 forecast for non-base expense and capital work was developed as described in Section E.

item as opposed to specific numbers and types of tools and equipment that can be reasonably forecast.

PG&E forecasts non-unitized work, also referred to as program work, based on historic costs. Since the work in the program is generally the same from year-to-year, PG&E uses the historic spend as a basis for the forecast program work. Generally, program cost forecasts are based on two prior years of historic spend, adjusted for known program changes, and escalates the forecast using the approved GRC forecast rates.

c. Method for Forecasting Project Based Work

PG&E's forecast includes individual projects such as adding capacity in strategic locations to improve system flexibility and limit the number of customers on a circuit. These individual project forecasts are based on individual project estimates using historic cost data from similar projects, vendor quotes, and/or engineering estimates.

d. Methods for Forecasting Other Work

The following three types of cost forecasts in PG&E's Electric Distribution portfolio are calculated using different forecasting methods because the type of work does not lend itself to any of the methods described above.

1) Information Technology (IT) Projects – The IT cost forecast for Electric Distribution is developed as a bottom-up forecast for each IT project forecast in the rate case. PG&E uses its Project Estimating Tool (PET) to develop each project forecast. The PET and IT forecasting methodology are discussed in Exhibit (PG&E-7), Chapter 8.
2) NB/WRO – The NB and WRO forecasts for Electric Distribution are based on economic and government spending indices and historic PG&E cost data. PG&E also works with a leading independent real estate economics consulting firm which has developed a model to forecast certain portions of the NB/WRO portfolio. More information about the NB/WRO forecasting methodology is included in Exhibit (PG&E-4), Chapter 18.

3) NB/WRO – State Infrastructure Projects – PG&E forecasts costs for large-scale projects with schedules and scope dictated by third parties, typically state and local governments. An individual forecast for each project is developed based on the best information available at the time and includes varying levels of cost assumptions. More information about the NB/WRO State Infrastructure Projects is included in Exhibit (PG&E-4), Chapter 18.

2. Escalation Calculation

Forecasts in this exhibit are escalated. For expense, PG&E developed a blended escalation rate between Labor and Non-Labor, using escalation rates developed by Global Insight,[19] and applied it to all electric distribution expense forecasts (with exceptions noted below). For capital, PG&E used a combined Labor and Non-Labor escalation rate developed by Global Insight and applied it to all electric distribution capital forecasts (again with exceptions).

Two program areas, Emergency Preparedness and Response (EP&R) and VM, have a significantly different mix of work from other programs and their escalation rates were calculated accordingly.

EP&R work is considered Administrative and General (A&G) work and is primarily labor, so PG&E used Global Insight's A&G-related escalation factors to calculate a blended escalation rate for this work. For capital components of EP&R costs, PG&E used a combined Labor and Non-Labor common plant escalation rate instead of the Labor and Non-Labor electric distribution only escalation rate.

Most VM work is performed by contractors, who are treated as a Non-Labor expense. Therefore, PG&E calculated a blended escalation rate for VM based on a Labor and Non-Labor split specific to the expense forecast for the VM Program.

Details of PG&E's methodology for calculation of escalation rates are provided in workpapers.[20] For a description of escalation calculations for IT projects included in this exhibit, see Exhibit (PG&E-7), Chapter 8.

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19 See Exhibit (PG&E-12), Chapter 3.

20 See Exhibit (PG&E-4), WP 2-37.

F. Compliance With Section 5.2 of the 2020 GRC Settlement "Deferred Work Principles"

The purpose of this Section is to describe how Electric Operations manages its budget and balances its portfolio of rate case funded work over the rate case period to ensure that all safety and reliability work is performed. The Section also presents the results of Electric Operations' deferred work analysis as required by Section 5.2 of the 2020 GRC Settlement "Deferred Work Principles." The section is organized as follows:

- Section F.1 – Balancing Electric Operations Portfolio of Work;
- Section F.2 – Addressing Changing Priorities;
- Section F.3 – Analysis of "Deferred Work";
- Section F.4 – Showing Required for Deferred Work; and
- Section F.5 – Consistency of EO's Funding Request with the Six Principles of Deferred Work.

1. Balancing Electric Operations Portfolio of Work

In Section D, PG&E describes the Electric Operations Investment Planning process which leads to an annual Electric Operations budget that is approved by the executive leadership team before the budget year begins. Balancing the Electric Operations portfolio includes allocating funding to the highest priority work, mandatory work, and new work by identifying programs with available funding. Higher priority work is determined through the processes described in Section D above and/or addressing changing priorities across the Electric Operations portfolio.

2. Addressing Changing Priorities

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

PG&E's 2020 GRC presented forecasts for a portfolio of work which included substantial investments for the Community Wildfire Safety Program and the foundation of an Integrated Grid Platform, while continuing to help connect customers to the grid and maintain reliability. In late 2018, after the 2020 GRC was filed, PG&E began implementing the WSIP, a risk-based approach to inspections of overhead distribution assets and substations in high fire risk areas of its service territory. As described in PG&E's Updated

Progress Report – Wildfire Mitigation Plan,[21] the WSIP resulted in essential findings about components in HFTD areas that could pose a risk of fire ignition. These enhanced inspections and resulting maintenance tags, which were not included in the 2020 GRC forecast or imputed adopted amounts, required PG&E to reprioritize some investments planned in the 2020 GRC period in order to complete this higher priority risk mitigation work. Additionally, building on the WSIP foundation, PG&E is incorporating the enhanced inspection processes and tools into routine compliance inspection and maintenance and using risk-informed maintenance cycles going forward.

2020 presented additional challenges for work execution due to the global COVID-19 pandemic. In order to protect the health and safety of our employees, contractors and the general public, Electric Operations developed COVID-19 work plan guidelines describing work that should continue and work types that should be paused during shelter-in-place protocols. These work plan guidelines prioritized critical work such as emergency response, PSPS and wildfire mitigation work, critical new business needs, and critical operating equipment work. As noted in Chapter 1, EO will continue to work throughout this GRC cycle to complete the work that was paused due to shelter-in-place guidelines.

As has been common in the last few years, 2020 had a devastating fire season. In 2020, PG&E conducted six PSPS events. While PG&E succeeded in making PSPS events shorter by reducing the average time to restore power once the severe weather cleared, these events required crews to inspect lines for damage prior to restoring power.

This mix of factors during the first year of the 2020 GRC cycle affected the planned work for 2020 and subsequent years. As shown in Table 2-2 below, between 2020 and 2022, across the entire Electric Distribution portfolio of work, PG&E expects to spend:

- Approximately $7.1billion in expense, which is $4.0 billion more than the imputed amount for expense projects and programs;[22] and

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21 Rulemaking (R.) 18-10-007, PG&E's Updated Progress Report – Wildfire Mitigation Plan (Jan. 15, 2020), pp. 3, 12, 13.

22 See Exhibit (PG&E-4), WP 2-35, line 64.

- Approximately $10.1 billion in capital expenditures, which is $2.4 billion more than the imputed amount for capital projects and programs.[23]

TABLE 2-2
ELECTRIC DISTRIBUTION INCURRED AND RECORDED/FORECAST COSTS 2020-2022
(MILLIONS OF NOMINAL DOLLARS)

Line No.	Type	2023 GRC (2020 Recorded Adjusted and 2021-2022 Forecast)	2020 GRC (2020-2022 Imputed Regulatory Values)	Difference
1	Expense Total	$7,055	$3,099	$3,956
2	Capital Total	$10,054	$7,700	$2,354

The numbers in the table above include amounts recorded in balancing accounts (WMBA, VMBA, MEBA, Rule 20A) and wildfire memorandum accounts (FRMMA and WMPMA). Amounts for separately-funded programs rolling into the GRC starting in 2023[24] are excluded to provide an "apples to apples" comparison with the 2020 GRC imputed adopted amounts.

For expense, the primary reasons for the higher than imputed spending include: (1) higher costs for Routine VM and Enhanced VM; (2) a new requirement to record Tree Mortality Program costs in the VMBA (these costs were not included in PG&E's 2020 GRC forecast as PG&E had been tracking these costs in the CEMA); (3) PSPS event costs that were not forecast in the 2020 GRC; (4) implementation of a new enhanced inspection process; and (5) WSIP-related equipment repairs.

Electric Operations' 2020-2022 capital expenditures are forecast to be higher than imputed in numerous programs including: (1) pole replacements, (2) overhead maintenance, (3) new customer connections, (4) capacity, (5) response to routine emergencies; (6) substation emergency replacements, and (7) gas meter module replacements.

Some of the overspend shown above is subject to reasonableness review through the wildfire memorandum accounts. ~~See Attachment A of~~

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23 See Exhibit (PG&E-4), WP 2-36, line 55.

24 These include amounts recovered in the CEMA, and the Distribution Resources Plan memorandum accounts~~, and the EPIC~~.

~~this chapter for a summary of the 2020 recorded wildfire memorandum account amounts included in PG&E's reasonableness review request.~~ Forecast amounts in 2021 and 2022 include what PG&E currently expects to record to the wildfire memorandum accounts. PG&E will determine the incrementality of future year costs when recorded amounts are available.

3. Analysis of "Deferred Work"

Section 5.2 of the 2020 GRC Settlement Agreement (Principles for Deferred Work) requires PG&E to include testimony in this GRC where the following criteria are met:

a) The work was requested and authorized based on representations that it was needed to provide safe and reliable service (Check 1);

b) PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work (Check 2); and

c) PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service (Check 3).

The results from EO review to determine if any work was deferred are summarized in the Deferred Work Analysis Summary workpaper.[25] Each EO witness reviewed all of the MAT codes that are included in their 2023 GRC chapter and answered each of the three questions listed above to determine if work meets the 2020 GRC Settlement deferred work criteria. The three questions are shown as Check 1, Check 2, and Check 3 in the workpaper. For purposes of the deferred work analysis, Check 2 is divided into two Checks (2a and 2b). The answers to each Check are listed in Columns G through J by MAT. After answering the three deferred work questions, the witness provided the reason that work meets or does not meet the deferred work criteria in Column K.

To analyze whether "the work was requested and authorized based on representations that it was needed to provide safe and reliable service" (Check 1), EO answered "Yes" for the following work: (1) any MAT codes identified as safety, reliability, or maintenance (SRM)-related in the 2020

25 See Exhibit (PG&E-4), WP 2-15.

Risk Spend Accountability Report (RSAR);[26] and (2) any activities not captured in the 2020 RSAR under (1), but where some or all of the work was requested in the 2020 GRC based on representations that the work was "needed to provide safe and reliable service."

Next, to analyze whether "PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work" (Check 2), EO first evaluated whether units were imputed for the work based on the 2020 GRC decision. For GRC work, EO then compared 2020 recorded units, and 2021 and 2022 forecasts to the units imputed for the period 2020-2022. Under this analysis, Check 2 applies where 2020 actuals and the 2021 and 2022 forecast indicate that the imputed units of work will not be completed by the end of 2022.

Finally, to analyze whether "PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service" (Check 3), EO reviewed its 2020 GRC testimony to establish whether it is again proposing the same work for safety and reliability in the 2023 GRC. The response to Check 3 is "No" for work even if the expected units are fewer than the imputed units if the work is: demand-driven work conducted on an "as-needed" basis; compliance work where PG&E expects to complete all compliance work regardless of the number of units imputed and forecast; work where the type or scope of work forecast under a particular MAT changed from the type or scope of work originally forecast; work no longer needed to improve safety and reliability; or if the difference is due to other types of change such as revised work methods, changes in strategy or approach, or a material difference in forecast assumptions.

For those areas of work where one or more of the three checks were not met, PG&E determined that the area of work did not qualify as "deferred work" as this term is used in the 2020 GRC Settlement.

If the checks all applied, EO determined that the work qualified as "deferred work" as this term is used in the 2020 GRC Settlement.

Table 2-3 summarizes the deferred work identified by PG&E's analysis for Electric Operations by program and chapter.

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26 See PG&E's 2020 Risk Spend Accountability Report (March 31,2021).

TABLE 2-3
LIST OF ELECTRIC DISTRIBUTION DEFERRED WORK PROGRAMS

Line No.	Program, Chapter and Witness	Reason for Deferring Work	Volume and Cost of Work (Thousands of Dollars)
1	Overhead Notifications – Expense (MAT KAA) Chapter 11 – Electric Distribution Overhead and Underground Maintenance Witness: Mark Esguerra	PG&E does not expect to complete 11,617 notifications out of the imputed units of 93,673. The program will be overspent by $140 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority maintenance tags.	Imputed Volume and Cost of Work (MAT KAA) 2020 GRC (2020-2022) 93,674 notifications $56,886 Recorded/Forecast Volume and Cost of Work 2020-2022: 82,057 notifications $196,945
2	Underground Notifications – Expense (MAT KBA) Chapter 11 – Electric Distribution Overhead and Underground Maintenance Witness: Mark Esguerra	PG&E does not expect to complete 5,240 notifications out of the imputed units of 18,479. The program will be overspent by $8.1 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority maintenance tags.	Imputed Volume and Cost of Work (MAT KBA) 2020 GRC (2020-2022) 18,479 notifications $33,027 Recorded/Forecast Volume and Cost of Work 2020-2022: 13,239 notifications $41,092
3	Overhead Idle Facility Removal – Capital (MAT 2AF) Chapter 11 – Electric Distribution Overhead and Underground Maintenance Witness: Mark Esguerra	PG&E does not expect to complete 1,783 removals out of the imputed units of 5,346. The program will be overspent by $4.1 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority maintenance tags.	Imputed Volume and Cost of Work (MAT 2AF) 2020 GRC (2020-2022) 5,346 removals $24,124 Recorded/Forecast Volume and Cost of Work 2020-2022: 3,563 removals $28,198

TABLE 2-3
LIST OF ELECTRIC DISTRIBUTION DEFERRED WORK PROGRAMS
(CONTINUED)

Line No.	Program, Chapter and Witness	Reason for Deferring Work	Volume and Cost of Work (Thousands of Dollars)
4	Underground Notifications – Capital (MAT 2BA) Chapter 11 – Electric Distribution Overhead and Underground Maintenance Witness: Mark Esguerra	PG&E does not expect to complete 2,632 notifications out of the imputed units of 7,676. The program will be underspent by $8.9 million. Reasons: Reprioritization/higher risk work: Resources and funding were reprioritized to complete higher priority maintenance tags.	Imputed Volume and Cost of Work (MAT 2BA) 2020 GRC (2020-2022) 7,676 notifications $139,851 Recorded/Forecast Volume and Cost of Work 2020-2022: 5,044 notifications $130,936
5	Underground Idle Facility Removals – Capital (MAT 2BF) Chapter 11 – Electric Distribution Overhead and Underground Maintenance Witness: Mark Esguerra	PG&E does not expect to complete 37 removals out of the imputed units of 51. The program will be underspent by $0.4 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority maintenance tags.	Imputed Volume and Cost of Work (MAT 2BF) 2020 GRC (2020-2022) 51 removals $583 Recorded/Forecast Volume and Cost of Work 2020-2022: 14 removals $230

TABLE 2-3
LIST OF ELECTRIC DISTRIBUTION DEFERRED WORK PROGRAMS
(CONTINUED)

Line No.	Program, Chapter and Witness	Reason for Deferring Work	Volume and Cost of Work (Thousands of Dollars)
6	Overhead Conductor Replacement Program – Capital (MAT 08J) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 128 miles out of the imputed units of 289. The program will be underspent by $67 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority work based on time dependency. Funding was used to support routine emergency and higher priority maintenance tags COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 08J) 2020 GRC (2020-2022) 289 miles $157,550 Recorded/Forecast Volume and Cost of Work 2020-2022: 161 miles $90,459
7	Grasshopper Switch Replacements – Capital (MAT 08S) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 26 switches out of the imputed units of 90. The program will be underspent by $0.9 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority work based on time dependency. Funding was used to support routine emergency and higher priority maintenance tags COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 08S) 2020 GRC (2020-2022) 90 switches $3,372 Recorded/Forecast Volume and Cost of Work 2020-2022: 64 switches $2,410

TABLE 2-3
LIST OF ELECTRIC DISTRIBUTION DEFERRED WORK PROGRAMS
(CONTINUED)

Line No.	Program, Chapter and Witness	Reason for Deferring Work	Volume and Cost of Work (Thousands of Dollars)
8	Overhead Fuses – Capital (MAT 49C) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 66 fuses out of the imputed units of 297. The program will be underspent by $0.6 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority work based on time dependency. Funding was used to support routine emergency and higher priority maintenance tags COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 49C) 2020 GRC (2020-2022) 297 fuses $3,285 Recorded/Forecast Volume and Cost of Work 2020-2022: 231 fuses $2,713
9	Trip Savers – Capital (MAT 49T) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 92 units out of the imputed units of 239. The program will be underspent by $0.9 million. Reasons: Reprioritization/higher risk work: Resources were reprioritized to complete higher priority work based on time dependency. Funding was used to support routine emergency and higher priority maintenance tags COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 49T) 2020 GRC (2020-2022) 239 units $3,290 Recorded/Forecast Volume and Cost of Work 2020-2022: 147 units $2,403

TABLE 2-3
LIST OF ELECTRIC DISTRIBUTION DEFERRED WORK PROGRAMS
(CONTINUED)

Line No.	Program, Chapter and Witness	Reason for Deferring Work	Volume and Cost of Work (Thousands of Dollars)
10	Reliability Cable Replacement – Capital (MAT 56A) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 5 miles out of the imputed units of 60. The program will be underspent by $5.0 million. Reasons: Reprioritization/higher risk work: Resources and funding were reprioritized to complete higher priority underground asset replacement work. COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 56A) 2020 GRC (2020-2022) 60 miles $100,539 Recorded/Forecast Volume and Cost of Work 2020-2022: 55 miles $95,556
11	COE Cable Replacement – Capital (MAT 56C) Chapter 13 Overhead and Underground Asset Management and Reliability Witness: Mark Esguerra	PG&E does not expect to complete 164 units out of the imputed units of 662. The program will be underspent by $11.9 million. Reasons: Reprioritization/higher risk work: Resources and funding were reprioritized to complete higher priority underground asset replacement work. COVID-19 delays: Project delays occurred in 2020 due to COVID-19 related work stoppages	Imputed Volume and Cost of Work (MAT 56C) 2020 GRC (2020-2022) 662 units $100,250 Recorded/Forecast Volume and Cost of Work 2020-2022: 498 units $88,331
12	Battery Replacement – Capital (MAT 48C) Chapter 15 – Substation Asset Management Witness: Maria Ly	PG&E does not expect to complete 17 units out of the imputed units of 30. The program will be underspent by $3.3 million. Reasons: Reprioritization/higher risk work: Resources and funding were reprioritized to complete higher priority substation work.	Imputed Volume and Cost of Work (MAT 48C) 2020 GRC (2020-2022) 30 units $6,779 Recorded/Forecast Volume and Cost of Work 2020-2022: 13 units $3,488

4. Showing Required for Identified Deferred Work

For each work area identified as “deferred work” the Settlement requires that PG&E address the following:

a) Why the authorized work was not performed in the time forecasted;

b) Whether the deferral of the authorized work resulted in lower than authorized spending for the authorized work;

c) How the funding was reallocated and whether such reallocation related to the provision of safe and reliable service;

d) The reasonableness of the alternative work for the purpose of evaluating the appropriateness of the new funding request; and

e) How the specific funding request is consistent with the deferred work principles.

For the areas of deferred work identified by EO, elements (a) through (d) are addressed for each deferred work area by the witnesses in the chapters referenced in the table. Element (c) is addressed generally for EO below. Item (e), EO compliance with the six principles of deferred work for all the 12 electric operations deferred work areas, is addressed below.

The reasonableness of the alternative work is addressed below as part of responding to Question (c).

a. Response to Question (c) for Electric Distribution Expense Programs

Table 2-4 summarizes the recorded and forecast expense spend compared to imputed adopted for the areas identified as deferred work.[27]

TABLE 2-4
ELECTRIC DISTRIBUTION EXPENSE DEFERRED WORK PROGRAMS SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	2023 GRC Chapter	Description	2020 Rec. Adj. + 2021 to 2022 Forecast	2020-2022 Imputed	Difference
1	11	Overhead Notifications (MAT KAA)	$196,945	$56,886	$140,059
2	11	Underground Notifications (MAT KBA)	41,092	33,027	8,064
3		Total	$238,037	$89,914	$148,123

[27] See Exhibit (PG&E-4), WP 2-20, line 81 and WP 2-21, line 93.

PG&E expects to spend more than the imputed adopted amounts in the MAT codes where all units will not be completed, so no funding was reallocated to other programs.

b. Response to Question (c) for Electric Distribution Capital Programs

Table 2-5 summarizes the recorded and forecast capital expenditures spend compared to imputed adopted for the areas identified as deferred work.[28]

TABLE 2-5
ELECTRIC DISTRIBUTION CAPITAL DEFERRED WORK PROGRAMS SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	2023 GRC Chapter	Description	2020 Rec. Adj. + 2021 to 2022 Forecast	2020-2022 Imputed	Difference
1	11	Overhead Idle Facility Removal (MAT 2AF)	$28,198	$24,124	$4,073
2	11	Underground Notifications (MAT 2BA)	130,936	139,851	(8,916)
3	11	Underground Idle Facility Removals (MAT 2BF)	230	583	(353)
4	13	Overhead Conductor Replacement Program (MAT 08J)	90,459	157,550	(67,092)
5	13	Grasshopper Switch Replacements (MAT 08S)	2,410	3,372	(962)
6	13	Overhead Fuses (MAT 49C)	2,713	3,285	(572)
7	13	Trip Savers (MAT 49T)	2,403	3,290	(887)
8	13	Reliability Cable Replacement (MAT 56A)	95,556	100,539	(4,983)
9	13	COE Cable Replacement (MAT 56C)	88,331	100,250	(11,919)
10	15	Battery Replacement (MAT 48C)	3,488	6,779	(3,291)
11		Total	$444,724	$539,625	$(94,902)

For capital work identified as deferred, PG&E expects to spend approximately $94.9 million less than imputed adopted amounts. For overhead and underground maintenance, underground asset replacement, and substation batteries, funding was reprioritized to address other work within the overall respective programs. For overhead asset replacement and reliability work, funding was reprioritized using the Loading Order framework discussed in Section D above.

The overhead asset replacement work (MATs 08J and 08S), while categorized as Loading Order 2 (Overhead work with a strong safety

28 See Exhibit (PG&E-4), WP 2-19, line 62; WP 2-20, lines 71 and 74; WP 2-21, lines 116, 117; WP 2-22, lines 122, 129, and 132; WP 2-23, line 134, WP 2-24, line 154.

link), was determined to be a lower near-term priority than: (1) other more time-dependent Loading Order 2 work such as poles, OH tags, and (2) time-dependent Loading Order 6 (Customer Commitment work) capacity work needed to serve customers. Reliability work in MATs 49C and 49T are lower down in the Loading Order. These programs, while effective at mitigating overhead safety and reliability risk, are "proactive" replacement and equipment installation programs. When overhead resources and funding are needed for higher risk wildfire mitigation work, and time-dependent work such as emergency replacement and high risk time-dependent maintenance work, PG&E's prioritization weighs this time dependency against the risks associated with not completing the full annually forecasted proactive replacement and equipment installation work. PG&E's patrols and inspections programs are aimed at finding imminent failure potential to somewhat mitigate the near-term risk of a reduced amount of proactive work.

5. Consistency of EO's Funding Request With the Six Principles of Deferred Work

Section 5.2 of the 2020 GRC Settlement lists six principles. The Settlement requires that for all work meeting the definition of deferred work:

> PG&E's direct showing in support of the reasonableness of its forecast in the rate case shall provide at a minimum, a demonstration of how the specific funding request is consistent with the principles…

PG&E's deferred work for EO is consistent with the six principles as discussed below. In addition to being addressed below with respect to deferred work identified by EO, the six principles are also discussed in the context of PG&E's overall, enterprise-level planning and budgeting processes in Section F of Exhibit (PG&E-2), Chapter 3.

As stated in Section 5.2 of the GRC Settlement, the six principles below should be viewed "in totality" and not in isolation. PG&E describes each principle and its key element(s) in order to provide additional structure for this discussion; these should be considered when determining whether PG&E's decisions are reasonable for the operation of its systems.

Overall, EO's re-request for funding of part of the work identified as "deferred work" under the Settlement, is reasonable, justified, and consistent

with the six principles because as summarized in Table 2-3 above, in all cases resources and funding (where there was underspending of authorized amounts) were reprioritized to complete higher priority work. In certain cases, project delays occurred in 2020 due to COVID 19 related work stoppages, contributing to deferred work. EO's deferred work represents prudent management of risks and resources, and is consistent with PG&E's obligation to provide safe and reliable service.

Principle 1 – Where funds are originally collected from ratepayers based on representations that the work is necessary to provide safe and reliable service and, yet, PG&E does not perform all of the designated work, the fact that PG&E must pay for a higher priority activity or program does not nullify or extinguish its responsibilities to fund forecasted and authorized work unless such work is no longer deemed necessary for safe and reliable service.

PG&E believes that the intention of this principle is to require funding by PG&E of all work needed to deliver safe and reliable service regardless of other funding demands.

EO has met, or will meet, the requirement to provide safe and reliable service in 2020-2022. As discussed in Exhibit (PG&E-2) Chapter 3, the Company's enterprise-wide planning and budgeting process ensures that necessary work is funded. The Operating Rhythm and OPC process provides an enterprise-level forum for LOBs to seek additional funding to address changing conditions and emergent high priority work. Following the Company's enterprise-wide planning and budgeting process, and consistent with its "responsibility and its discretion to adjust priorities to accommodate changing conditions" (see Principle 5 below), EO manages and reprioritizes its spending as described in Section D above. These processes—the Operating Rhythm and OPC process and EO's management of its portfolio—align spending to meet all of PG&E's operational obligations and provide safe and reliable service.

Each of EO's deferred work items are consistent with the obligation to provide safe and reliable service. The reasons for deferral, reprioritization of funding, and the alternative work are summarized in Table 2-3 and addressed in detail by the witnesses in the chapters referenced in the table.

In sum, for all EO's "deferred work" items, PG&E's actions were reasonable, did not compromise safety and reliability, and in the cases where authorized funding was not spent, it was reprioritized to higher priority work. For these reasons, PG&E believes that EO's deferred work decisions as described in this chapter were consistent with the obligation to provide safe and reliable service as required by Principle 1.

Principle 2 – PG&E is responsible for providing safe and reliable customer service whether or not its overall spending matches funding levels authorized or imputed in rates.

PG&E understands this principle to mean that PG&E's responsibility to provide safe and reliable service is independent of PG&E's overall spending level. PG&E discusses this principle at an enterprise level in Exhibit (PG&E-2), Chapter 3.

As discussed under Principle 1, Electric Operations demonstrates compliance with this principle and with its responsibility to provide safe and reliable service by following its budget planning and management process described in Section D. above. Furthermore, as explained under Principle 1, the specific deferred work described in this exhibit will not compromise system safety or near-term reliability.

Finally, while mindful of authorized funding levels, Electric Operations does not limit its spending to authorized levels if greater expenditures are needed to address safety concerns and meet reliability targets. As discussed above, Electric Operations expects to spend more than the imputed amounts on both expense and capital programs and projects between 2020 and 2022. This increase in spending above imputed was necessary to address findings from the WSIP, execute PSPS events, complete VM work, and to address cost increases, emerging work, and other conditions not forecast in the 2020 GRC. These decisions to spend above imputed funding on both the portfolio level and the individual MAT level are all reasonable and consistent with this principle, and with Principle 5 below which requires PG&E to adjust spending to meet changing conditions.

Principle 3 – PG&E bears the risk that, as a result of meeting spending obligations necessary to provide safe and reliable service, the earned rate of return may be less than the authorized return.

PG&E understands that under this principle PG&E is not guaranteed its authorized rate of return and PG&E's obligation to provide safe and reliable service may cause PG&E's earnings to be less than authorized.

PG&E discusses this principle at an enterprise level in Exhibit (PG&E-2), Chapter 3.

Principle 4 – While PG&E has finite funds to meet capital and operational needs, PG&E is not restricted to spending only up to the forecast adopted in a GRC.

PG&E understands this principle to be closely related to Principle 2, with the important additional acknowledgment that PG&E has finite funds to meet its capital and operational needs.

PG&E discusses this principle at an enterprise level in Exhibit (PG&E-2), Chapter 3. With respect to Electric Operations, please see the discussion regarding Principle 2.

Principle 5 – PG&E bears the responsibility—and has discretion—to adjust priorities to accommodate changing conditions after test year forecasts are adopted. Readjusting spending priorities, however, only involves the ranking and sequence of spending. Reprioritizing spending for new projects does not automatically justify postponing projects previously deemed necessary for safe and reliable service.

PG&E understands this principle to be very similar to Principles 1-3, adding the explicit acknowledgment of PG&E's responsibility and discretion to readjust its spending priorities.

PG&E discusses this principle at an enterprise level in Exhibit (PG&E-2), Chapter 3. With respect to Electric Operations, as explained in Section D above, spending is managed to deliver system safety and reliability; meet compliance, regulatory and public commitments; and perform mandatory work (including new and emergent work). Electric Operations considers factors such as risk reduction, cost, efficiencies, the availability of PG&E and contractor resources, synergies with other work, and dependencies and requirements such as permitting and the different rules for working with

California's counties and cities. As a result of this risk-informed planning and budgeting process, no project or program is "automatically" postponed. As previously discussed under Principle 1, with respect to the specific areas of deferred work identified by Electric Operations, the deferrals were operationally reasonable and will not degrade system safety or near-term reliability.

<u>Principle 6</u> – The GRC process is a tool in supporting PG&E's ongoing ability to provide safe and reliable service while affording a reasonable opportunity to earn its rate of return and thereby attract capital to fund its infrastructure needs. Adopted revenue requirements and the disposition of disputed ratemaking issues should be consistent with the goal of supporting PG&E's ability to provide safe and reliable service while maintaining its financial health and ability to raise capital.

PG&E understands this principle to add important financial counterweights to the operational points covered in Principles 1-5. PG&E discusses this principle at an enterprise level in Exhibit (PG&E-2), Chapter 3.

G. Forecast by Chapter and Program Area

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

Tables 2-6 and 2-7 summarize the 2023 expense and capital forecasts for Electric Operations by chapter and program area, showing the walk to the February 25, 2022 forecasts.[29] Specifically, Tables 2-6A and 2-7A show PG&E's forecast as of November 5, 2021; Tables 2-6B and 2-7B show the forecast changes with the February 25, 2022 forecast update; and Tables 2-6C and 2-7C show PG&E's updated forecast as of February 25, 2022.

Tables 2-8 and 2-9 provide a summary of the February 25, 2022 updates for all forecast years.

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29 See Exhibit (PG&E-4), WP 2-12 and WP 2-13 for 2020 expense and capital recorded amounts and 2021-2026 forecast.

TABLE 2-6A
2023 EXPENSE FORECAST BY CHAPTER AND PROGRAM AREA – NOVEMBER 5, 2021 FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Chapter	Chapter Title	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.1	Situational Awareness and Forecasting	–	–	–	–	$43,416	$43,416
2	4.2	PSPS Operations	–	–	–	–	115,266	115,266
3	4.3	System Hardening, Enhanced Automation and PSPS Impact Mitigations	–	–	–	–	11,595	11,595
4	4.4	CWSP PMO	–	–	–	–	13,460	13,460
5	4.5	Information Technology for Wildfire Mitigation	–	–	–	–	35,700	35,700
6	5	Emergency Preparedness & Response	–	$22,275	–	–	4,176	26,451
7	6	Electric Emergency Recovery	–	136,466	–	–	–	136,466
8	7	Distribution System Operations	–	–	–	$58,646	–	58,646
9	8	Field Metering	–	–	$21,574	–	–	21,574
10	9	Vegetation Management	-	-	645,996	-	550,686	1,196,683
11	10	Overhead and Underground Electric Asset Inspections	–	–	89,464	–	–	89,464
12	11	Overhead and Underground Electric Distribution Maintenance	–	–	94,985	–	–	94,985
13	12	Pole Asset Management	–	–	39,340	–	–	39,340
14	14	Network Asset Management	–	–	5,021	–	–	5,021
15	15	Substation Asset Management	–	14,069	36,871	–	–	50,940
16	16	Distribution System Automation and Protection	–	–	–	3,008	–	3,008
17	17	Electric Distribution Capacity, Engineering and Planning	–	–	–	19,943	–	19,943
18	18	NB/WRO	$24,161	–	–	–	–	24,161
19	19	Rule 20A	–	–	–	–	–	–
20	20	Electric Distribution Data Management and Technology	–	–	–	26,026	–	26,026
21	21	Integrated Grid Platform and Grid Modernization Plan	–	–	–	49,065	–	49,065
22	22	Electric Distribution Support Activities	–	–	–	128,784	2,810	131,594
23	23	Community Rebuild Program	–	13,781	–	–	–	13,781
24		Total Expense	$24,161	$186,591	$933,252	$285,472	$777,109	$2,206,585

TABLE 2-6B
DIFFERENCE: FEBRUARY 25, 2022 FORECAST – NOVEMBER 5, 2021 FORECAST
2023 EXPENSE FORECAST BY CHAPTER AND PROGRAM AREA
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Chapter	Chapter Title	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.6	Enhanced Powerline Safety Settings	–	–	–	–	$151,129	$151,129
2	9	Vegetation Management	–	–	$295,054	–	(432,664)	(137,610)
3	21	Integrated Grid Platform and Grid Modernization Plan	–	–		$(15,118)	–	(15,118)
4		Total Forecast Difference	–	–	$295,054	$(15,118)	$(281,535)	$(1,600)

TABLE 2-6C
2023 EXPENSE FORECAST BY CHAPTER AND PROGRAM AREA – FEBRUARY 25, 2022 FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Chapter	Chapter Title	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.1	Situational Awareness and Forecasting	–	–	–	–	$43,416	$43,416
2	4.2	PSPS Operations	–	–	–	–	115,266	115,266
3	4.3	System Hardening, Enhanced Automation and PSPS Impact Mitigations	–	–	–	–	11,595	11,595
4	4.4	CWSP PMO	–	–	–	–	13,460	13,460
5	4.5	Information Technology for Wildfire Mitigation	–	–	–	–	35,700	35,700
6	4.6	Enhanced Powerline Safety Settings	–	–	–	–	151,129	151,129
7	5	Emergency Preparedness & Response	–	$22,275	–	–	4,176	26,451
8	6	Electric Emergency Recovery	–	136,466	–	–	–	136,466
9	7	Distribution System Operations	–	–	–	$58,646	–	58,646
10	8	Field Metering	–	–	$21,574	–	–	21,574
11	9	Vegetation Management	-	-	941,050	-	118,022	1,059,072
12	10	Overhead and Underground Electric Asset Inspections	–	–	89,464	–	–	89,464
13	11	Overhead and Underground Electric Distribution Maintenance	–	–	94,985	–	–	94,985
14	12	Pole Asset Management	–	–	39,340	–	–	39,340
15	14	Network Asset Management	–	–	5,021	–	–	5,021
16	15	Substation Asset Management	–	14,069	36,871	–	–	50,940
17	16	Distribution System Automation and Protection	–	–	–	3,008	–	3,008
18	17	Electric Distribution Capacity, Engineering and Planning	–	–	–	19,943	–	19,943
19	18	NB/WRO	$24,161	–	–	–	–	24,161
20	19	Rule 20A	–	–	–	–	–	–
21	20	Electric Distribution Data Management and Technology	–	–	–	26,026	–	26,026
22	21	Integrated Grid Platform and Grid Modernization Plan	–	–	–	33,947	–	33,947
23	22	Electric Distribution Support Activities	–	–	–	128,784	2,810	131,594
24	23	Community Rebuild Program	–	13,781	–	–	–	13,781
25		Total Expense	$24,161	$186,591	$1,228,306	$270,355	$495,573	$2,204,986

TABLE 2-7A
2023 CAPITAL EXPENDITURE FORECAST BY CHAPTER AND PROGRAM AREA – NOVEMBER 5, 2021 FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Ch.	Chapter Title	Asset Management and Reliability	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.1	Situational Awareness and Forecasting	–	–	–	–	–	$4,601	$4,601
2	4.2	PSPS Operations	–	–	–	–	–	262	262
3	4.3	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	–	–	–	–	–	990,063	990,063
4	4.5	Information Technology for Wildfire Mitigations	–	–	–	–	–	25,300	25,300
5	5	Emergency Preparedness and Response	–	–	$3,359	–	–	2,143	5,502
6	6	Electric Emergency Recovery	–	–	319,184	–	–	–	319,184
7	7	Distribution System Operations	–	–	–	–	$4,333	–	4,333
8	8	Field Metering	–	–	–	$104,455	–	–	104,455
9	11	Overhead and Underground Electric Distribution Maintenance	–	–	–	318,171	–	26,067	344,238
10	12	Pole Asset Management	–	–	–	376,218	–	3,296	379,514
11	13	Overhead and Underground Asset Management and Reliability	$157,223	–	–	–	–	7,214	164,438
12	14	Network Asset Management	25,673	–	-	–	–	18,750	44,423
13	15	Substation Asset Management	119,217	–	82,323	–	–	6,589	208,129
14	16	Distribution System Automation and Protection	–	–	–	–	27,003	–	27,003
15	17	Electric Distribution Capacity, Engineering and Planning	–	$195,738	–	–	–	–	195,738
16	18	NB/WRO	–	799,564	–	–	–	–	799,564
17	19	Rule 20A	–	39,876	–	–	–	–	39,876
18	20	Electric Distribution Data Management and Technology	–	–	–	–	19,941	–	19,941
19	21	Integrated Grid Platform and Grid Modernization Plan	–	–	–	–	131,655	–	131,655
20	22	Electric Distribution Support Activities	–	–	–	–	8,394	–	8,394
21	23	Community Rebuild Program	–	–	28,139	–	–	114,341	142,480
22		Total Capital	$302,113	$1,035,178	$433,006	$798,844	$191,325	$1,198,626	$3,959,093

TABLE 2-7B
DIFFERENCE: FEBRUARY 25, 2022 FORECAST – NOVEMBER 5, 2021 FORECAST
2023 CAPITAL EXPENDITURE FORECAST BY CHAPTER AND PROGRAM AREA
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Ch.	Chapter Title	Asset Management and Reliability	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.3	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	–	–	–	–	–	$603,080	$603,080
2	20	Electric Distribution Data Management and Technology	–	–	–	–	$(241)	–	(241)
3	23	Community Rebuild Program	–	–	–	–	–	(25,891)	(25,891)
4		Total Forecast Difference	–	–	–	–	$(241)	$577,189	$576,948

TABLE 2-7C
2023 CAPITAL EXPENDITURE FORECAST BY CHAPTER AND PROGRAM AREA – FEBRUARY 25, 2022 FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Ch.	Chapter Title	Asset Management and Reliability	Customer Requested and Load Growth	Emergency Preparedness and Response	Maintenance and Compliance	Operational Coordination	Risk Reduction	2023 Forecast Total
1	4.1	Situational Awareness and Forecasting	–	–	–	–	–	$4,601	$4,601
2	4.2	PSPS Operations	–	–	–	–	–	262	262
3	4.3	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	–	–	–	–	–	1,593,142	1,593,142
4	4.5	Information Technology for Wildfire Mitigations	–	–	–	–	–	25,300	25,300
5	4.6	EPSS	–	–	–	–	–	–	–
6	5	Emergency Preparedness and Response	–	–	$3,359	–	–	2,143	5,502
7	6	Electric Emergency Recovery	–	–	319,184	–	–	–	319,184
8	7	Distribution System Operations	–	–	–	–	$4,333	–	4,333
9	8	Field Metering	–	–	–	$104,455	–	–	104,455
10	11	Overhead and Underground Electric Distribution Maintenance	–	–	–	318,171	–	26,067	344,238
11	12	Pole Asset Management	–	–	–	376,218	–	3,296	379,514
12	13	Overhead and Underground Asset Management and Reliability	$157,223	–	–	–	–	7,214	164,438
13	14	Network Asset Management	25,673	–	-	–	–	18,750	44,423
14	15	Substation Asset Management	119,217	–	82,323	–	–	6,589	208,129
15	16	Distribution System Automation and Protection	–	–	–	–	27,003	–	27,003
16	17	Electric Distribution Capacity, Engineering and Planning	–	$195,738	–	–	–	–	195,738
17	18	NB/WRO	–	799,564	–	–	–	–	799,564
18	19	Rule 20A	–	39,876	–	–	–	–	39,876
19	20	Electric Distribution Data Management and Technology	–	–	–	–	19,700	–	19,700
20	21	Integrated Grid Platform and Grid Modernization Plan	–	–	–	–	131,655	–	131,655
21	22	Electric Distribution Support Activities	–	–	–	–	8,394	–	8,394
22	23	Community Rebuild Program	–	–	28,139	–	–	88,450	116,590
23		Total Capital	$302,113	$1,035,178	$433,006	$798,844	$191,084	$1,775,815	$4,536,041

TABLE 2-8
2020-2023 EXPENSE RECORDED AND FORECAST UPDATE SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Description	Recorded Adjusted 2020	Forecast 2021	2022	2023
1	Electric Distribution Nov 5, 2021 Forecast	$2,258,159	$2,174,106	$2,054,929	$2,206,585
2	Chapter 4.6 Forecast Updates	–	18,203	148,921	151,129
3	Chapter 9 Forecast Updates	1,144	–	563,517	(137,610)
4	Chapter 21 Forecast Updates	(14,609)	(16,158)	(16,653)	(15,118)
5	Total February 25, 2022 Forecast	$2,244,694	$2,176,151	$2,750,714	$2,204,986

TABLE 2-9
2020-2026 CAPITAL EXPENDITURE RECORDED AND FORECAST UPDATE SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Description	Recorded Adjusted 2020	Forecast 2021	2022	2023	2024	2025	2026
1	Electric Distribution Nov 5, 2021 Forecast	$3,128,179	$3,364,432	$3,892,954	$3,959,093	$4,030,543	$4,034,995	$4,004,272
2	Chapter 4.3 Forecast Updates	–	–	102,176	603,080	1,661,375	2,154,196	2,606,552
3	Chapter 20 Forecast Updates	–	–	3	(241)	(567)	(990)	(1,534)
4	Chapter 23 Forecast Updates	–	–	(9,037)	(25,891)	(33,474)	(33,076)	–
5	Total February 25, 2022 Forecast	$3,128,179	$3,364,432	$3,986,096	$4,536,041	$5,657,875	$6,155,126	$6,609,290

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony: ☒ **Workpapers:** ☐ **SOQ:** ☐

Exhibit Number: 4 **Chapter Number:** 2

Chapter Title: Electric Distribution Forecast and Investment Planning

Witness Name: Tatjana Rmus

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
2-2	7	2023 vs 2020 EO expense forecast delta	$51 million	$51.6 million
2-2	12	2023 vs 2020 EO capital forecast delta	$833.3 million	$830.9 million
2-6	Figure 2-3	CAPITAL FORECAST BY PROGRAM AREA 2020-2026	2021 - $3,385 2022 - $3,897 2023 - $3,961 2024 - $4,021 2025 - $4,013 2026 - $3,961	2021 - $3,364 2022 - $3,893 2023 - $3,959 2024 - $4,031 2025 - $4,035 2026 - $4,004
2-6	12	Customer Requested and Load Growth increase	$171 million	$172 million
2-7	Figure 2-4	CAPITAL EXPENDITURES WALK BY PROGRAM AREA 2020 2023	$171 (Customer Requested & Load Growth) $3,961 (2023 Forecast)	$172 (Customer Requested & Load Growth) $3,959 (2023 Forecast)
2-24	Table 2-2, line 2	ELECTRIC DISTRIBUTION INCURRED AND RECORDED/FORECAST COSTS 2020 2022 (MILLIONS OF NOMINAL DOLLARS) – Capital	$9,977 (2023 GRC (2020 Recorded Adjusted and 2021 2022 Forecast – Capital Total) $2,277 (Difference – Capital Total)	$9,952 (2023 GRC (2020 Recorded Adjusted and 2021 2022 Forecast – Capital Total) $2,252 (Difference – Capital Total)

Page No.	Line No.	Item	As Filed	As Corrected
2-27, 2-28	Table 2-3, lines 1-5	Witness Names	Trish Fabris	Mark Esguerra
2-28	5	2BF 2020-22 underspend (Deferred Work Analysis)	$0.3 million	$0.4 million
2-28	5	2BF 2020-22 Recorded/Forecast Cost of Work (Deferred Work Analysis)	$263	$230
2-29 to 2-31	Table 2-3, lines 6-11	Witness Names	Jeff Borders	Mark Esguerra
2-33	Table 2-5, Line 11	2020 Rec. Adj. + 2021 to 2022 Forecast, Difference	263 (320)	230 (353)
2-33	Table 2-5, Total	2020 Rec. Adj. + 2021 to 2022 Forecast, Difference	$444,757 $(94,869)	$444,724 $(94,902)
2-39	Table 2-6 lines 6 & 24	2023 EXPENSE FORECAST BY CHAPTER AND PROGRAM AREA – Ch 5 and Total Expense	$22,342 (Emergency Preparedness & Response – Ch 5) $4,192 (Risk Reduction – Ch 5) $26,534 (2023 Forecast Total – Ch 5) $186,659 (Emergency Preparedness & Response – Total Expense) $777,124 (Risk Reduction – Total Expense) $2,206,667 (2023 Forecast Total – Total Expense)	$22,275 (Emergency Preparedness & Response – Ch 5) $4,176 (Risk Reduction – Ch 5) $26,451 (2023 Forecast Total – Ch 5) $186,591 (Emergency Preparedness & Response – Total Expense) $777,109 (Risk Reduction – Total Expense) $2,206,585 (2023 Forecast Total – Total Expense)

Page No.	Line No.	Item	As Filed	As Corrected
2-40	Table 2-7, line 9, 13, 16, 22	2023 CAPITAL EXPENDITURE FORECAST BY CHAPTER AND PROGRAM AREA – Ch 11, 15, 18 and Total Capital	318,467 (Maintenance and Compliance – Ch 11) 344,534 (2023 Forecast Total – Ch 11) 121,500 (Asset Mgmt and Reliability – Ch 15) 210,412 (2023 Forecast Total – Ch 15) 799,328 (Customer Requested and Load Growth – Ch 18) 799,328 (2023 Forecast Total – Ch 18) $304,396 (Asset Management and Reliability – Total Capital) $1,034,942 (Customer Requested and Load Growth – Total Capital) $799,140 (Maintenance and Compliance – Total Capital) $3,961,436 (2023 Forecast Total – Total Capital	318,171 (Maintenance and Compliance – Ch 11) 344,238 (2023 Forecast Total – Ch 11) 119,217 (Asset Mgmt and Reliability – Ch 15) 208,129 (2023 Forecast Total – Ch 15) 799,564 (Customer Requested and Load Growth – Ch 18) 799,564 (2023 Forecast Total – Ch 18) $302,113 (Asset Management and Reliability – Total Capital) $1,035,178 (Customer Requested and Load Growth – Total Capital) $798,844 (Maintenance and Compliance – Total Capital) $3,959,093 (2023 Forecast Total – Total Capital

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of February 25, 2022				
2-3	Figure 2-1	Figure Title	EXPENSE FORECAST BY PROGRAM AREA 2020-2023	EXPENSE FORECAST BY PROGRAM AREA 2020-2023 (MILLIONS OF NOMINAL DOLLARS
2-5	Figure 2-2	Figure Title	EXPENSE WALK BY PROGRAM AREA 2020-2023	EXPENSE WALK BY PROGRAM AREA 2020-2023 (MILLIONS OF NOMINAL DOLLARS
2-6	Figure 2-3	Figure Title	CAPITAL FORECAST BY PROGRAM AREA 2020-2026	CAPITAL FORECAST BY PROGRAM AREA 2020-2026 (MILLIONS OF NOMINAL DOLLARS)
2-7	Figure 2-4	Figure Title	CAPITAL EXPENDITURES WALK BY PROGRAM AREA 2020-2023	CAPITAL EXPENDITURES WALK BY PROGRAM AREA 2020-2023 (MILLIONS OF NOMINAL DOLLARS)
2-7	Figure 2-4	Asset Management and Reliability	$(10)	$(12)
2-32	11	Testimony text	“PG&E also discusses element”	“Element”
2-32	19	Testimony text	“Table 2-4 summarizes expense the recorded and forecast expense…”	“Table 2-4 summarizes the recorded and forecast expense”
2-34	15	Testimony text	“near-term risk of a reduced amount proactive work.”	“near-term risk of a reduced amount of proactive work.”

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 3

ELECTRIC DISTRIBUTION RISK MANAGEMENT

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 3
ELECTRIC DISTRIBUTION RISK MANAGEMENT

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 3
ELECTRIC DISTRIBUTION RISK MANAGEMENT

A. Introduction

This chapter describes how Pacific Gas and Electric Company (PG&E) manages risks associated with its electric facilities.[1] It has been updated to reflect errata and changes associated with PG&E's Electric Operations (EO) update testimony served February 25, 2022.

Section B provides an overview of the EO Risk organization and its management structure. This section also describes the governance process over EO risks.

Section C describes EO's risk management policy, the tools used by EO to manage its risks, and includes a discussion of EO programs that address multiple risks.

Section D describes EO's top three safety risks (Wildfire, Failure of Electric Distribution Overhead Assets, and Failure of Electric Distribution Network Assets) and a cross-cutting factor (Emergency Preparedness and Response (EP&R)),[2] which were included in PG&E's June 2020 Risk Assessment Mitigation Phase (RAMP) filing (2020 RAMP Report). Updates to the assessment of those risks are also included in this section. In this chapter, PG&E presents an updated Wildfire risk analysis to incorporate changes associated with PG&E's new wildfire mitigation strategy in its February 25, 2022 supplemental testimony.

Section E describes the remaining risks that impact electric distribution (Failure of Electric Distribution Underground (UG) Assets and Failure of Electric Distribution Substation Assets), including how the Step 3 Supplemental Analysis stemming from the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement was applied to each risk.

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1 While transmission facilities are not part of PG&E's General Rate Case (GRC) expenditure forecast, references to transmission assets are included to provide a more complete view of risk management within the electric line of business.

2 A cross-cutting factor is an item that is not a risk event itself, but rather impacts either the likelihood or consequence of other items on the Corporate Risk Register.

Attachment A to this chapter provides a list of mitigations and controls by risk, including changes since the 2020 RAMP Report.

1. February 25, 2022 GRC Update – PG&E's Updated Wildfire Mitigation Strategy

This section has been added as of February 25, 2022.

PG&E is committed to the safety of our customers and the communities that we serve. Our commitment to safety includes taking bold actions to reduce wildfire risk. California, along with other western states, continues to experience an increase in wildfire risk and a longer wildfire season. The drought, hotter temperatures, and higher winds have significantly increased the risk of catastrophic wildfires. Because wildfire risks are dynamic, PG&E is continually evolving its risk mitigation programs using data-driven, risk-informed approaches to maximize wildfire risk mitigation.

PG&E's comprehensive wildfire mitigation strategy focuses on increasing the number of miles and pace of undergrounding, expanding the Enhanced Powerline Safety Settings (EPSS) program, and adjusting the scope of Enhanced Vegetation Management (EVM). PG&E's program to underground 10,000 distribution circuit miles in and near High Fire Threat Districts (HFTD)[3] will effectively reduce the ignition risk to zero for lines that have been converted from overhead to underground. The primary objective of the program is to target undergrounding in the areas where the wildfire threat and Public Safety Power Shutoff (PSPS) impacts have been the highest. Increasing the number of undergrounded miles in HFTDs prevents ignition events on those lines. Over time, PG&E will rely less and less on EPSS and PSPS which will become a measure of last resort if wind and weather threaten the safety of the community being served.

PG&E's undergrounding program reduces ignition risk by approximately 99 percent because it eliminates vegetation, animal, and other potential sources of contact with electric lines. Undergrounding electric assets makes the system more reliable in the long-term and leads to lower operations and maintenance costs in the areas of inspections, VM and weather-related

[3] The HFTD consists of Tiers 2 and 3 and Zone 1. Zone 1 includes Tier 1, High Hazard Zones (HHZ) that are in direct proximity to communities, roads, and utility lines, and represent a direct threat to public safety. D.17-12-024, p. 2.

repairs. Undergrounding 10,000 miles of distribution lines in and near HFTDs will meaningfully reduce risk and improve reliability. For undergrounding to have this impact, a significant portion of powerlines in HFTDs must be relocated underground. Over half of PG&E's service territory lies in Tier 2 and Tier 3 HFTDs, and nearly one-third of PG&E's overhead distribution lines lie within HFTDs. This means that nearly 25,500 line miles of distribution assets lie within these HFTDs. Based on PG&E's 2021 risk model, approximately 8,000 – 10,000 miles of overhead miles in HFTDs represents 70 to 80 percent of the wildfire risk.

PG&E's integrated strategy will significantly reduce wildfire risk from 2023 to 2026 and beyond. Figure 3-1 shows the contribution to wildfire risk reduction from the system hardening program, VM, EPSS and PSPS from 2022 to 2031.[4] The graphic shows:

- Implementing the changes in the system hardening program and EVM, along with the other wildfire mitigations and controls in PG&E's portfolio (excluding EPSS and PSPS), will reduce wildfire risk between 60 percent and 80 percent in the HFTD areas by 2031.
- Incorporating PSPS and EPSS will further reduce wildfire risk, resulting in an overall risk reduction of approximately 93 percent.
- Reliance on EPSS and PSPS will have an impact on system reliability but it will decrease over time as the line miles underground increase. Figure 3-2 below shows risk and the reliability impacts in 2023.[5]
- The baseline wildfire risk will continue to increase over time due to climate change.

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4 Wildfire and reliability risk scores after 2026 are projections. The range of wildfire and reliability risk reduction will vary over time.

5 As discussed in Section D.1.c, PSPS Consequence Modeling, below, PG&E also includes safety impacts for PSPS.

FIGURE 3-1
WILDFIRE RISK REDUCTION FROM PG&E'S INTEGRATED MITIGATION STRATEGY

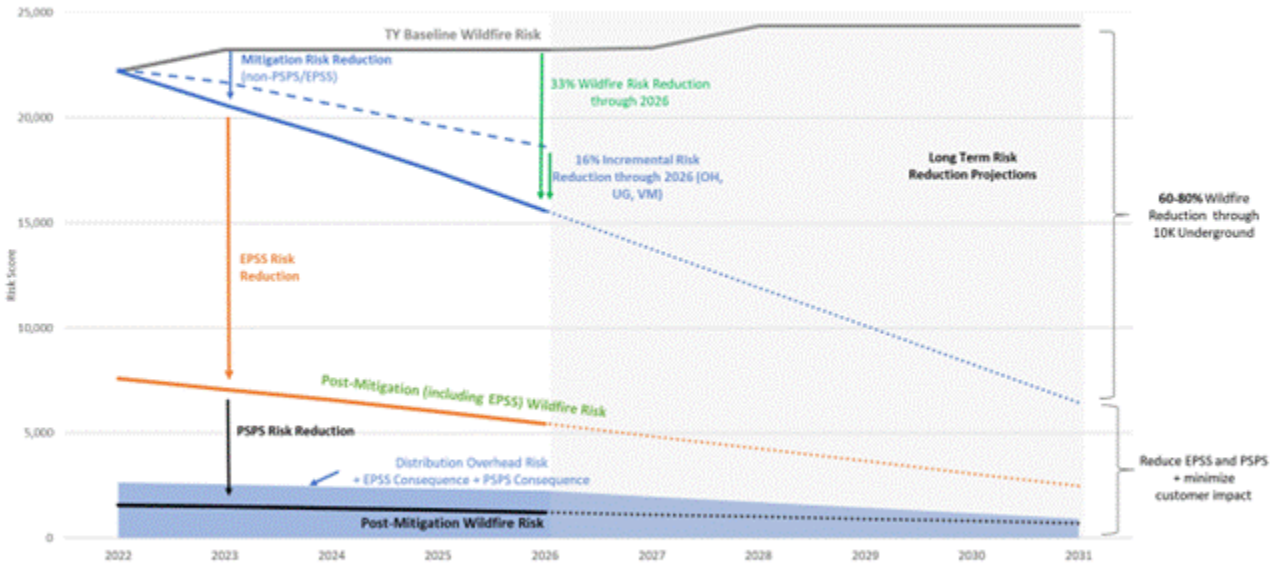
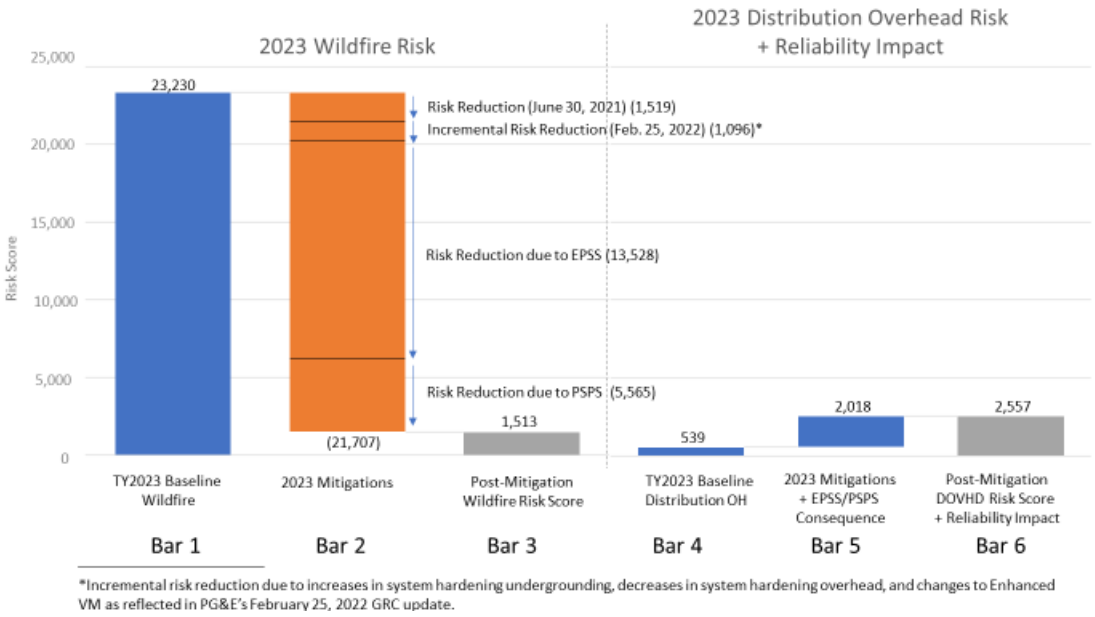


Figure 3-2 shows the net reduction in wildfire risk in 2023. While the mitigations significantly reduce wildfire risk, reliance on EPSS and PSPS will have a negative impact on system reliability, partially offsetting the mitigation benefits.

- Bar 1 – Test year (TY) 2023 baseline wildfire risk score: 23,220;
- Bar 2 – Implementing the integrated mitigation strategy (including all wildfire mitigations and controls in PG&E's portfolio) will reduce wildfire risk by approximately 93 percent;
- Bar 3 – TY2023 post-mitigation Wildfire risk score: 1,513;
- Bar 4 – TY2023 baseline risk score, Failure of Overhead Electric Distribution Assets: 539;
- Bar 5 – Reliability impacts due to EPSS and PSPS: 2,018; and
- Bar 6 – TY2023 post-mitigation risk score, Failure of Overhead Electric Distribution Assets: 2,557.

FIGURE 3-2
NET REDUCTION IN WILDFIRE RISK 2023



*Incremental risk reduction due to increases in system hardening undergrounding, decreases in system hardening overhead, and changes to Enhanced VM as reflected in PG&E's February 25, 2022 GRC update.

PG&E recognizes that outages due to EPSS and PSPS are disruptive to our customers. Nevertheless, the program to underground 10,000 miles of distribution lines will be a multi-year effort and PG&E must continue to mitigate against wildfire risk during this time. Therefore, PG&E will rely on its integrated mitigation strategy to provide near-term risk reduction through EPSS and PSPS while building long-term system resiliency.

Along with overall wildfire risk reduction, the integrated strategy will result in changes in the risk spend efficiency (RSE) for both the system hardening program (WLDFR-M002) and EVM (WLDFR-M001)[6] during the rate case period. The RSE for EVM increases from 3.9 to 14.5. Table 3-1 shows that the RSE for system hardening overhead decreases and the RSE for system hardening underground increases year-over-year as PG&E realizes efficiencies in its undergrounding program.

6 In the February 25, 2022 risk modeling workpapers this mitigation is referred to as WLDFR-M018: Modified EVM.

TABLE 3-1
CHANGES IN SYSTEM HARDENING RSE VALUES 2022-2026

Line No.	Mitigation No.	2022	2023	2024	2025	2026
1	WLDFR-M002 [Overhead]	7.5	6.1	5.9	5.8	5.6
2	WLDFR-M002 [Underground]	4.1	4.8	5.0	5.4	5.9

Not factored into the RSE analysis is the additional cost that PG&E may incur if hardened overhead assets are destroyed in a fire. In areas subject to wildfires, PG&E may harden an overhead asset which could be subsequently destroyed in a wildfire and would need to be replaced. Relocating these assets underground helps to protect them in the event of a fire.

PG&E's plan to underground 10,000 circuit miles of electric distribution assets in and near PG&E's HFTD areas will significantly reduce wildfire risk which will ultimately reduce the need for PSPS and EPSS and provide other long-term benefits. PG&E anticipates undergrounding more than 3,600 miles during this GRC period[7] resulting in a 44 percent increase in RSE driven by the benefits of scaling the undergrounding program and achieving the underground program's proposed unit costs. Hardening overhead assets is approximately 62 percent effective at reducing wildfire risk while undergrounding the assets is 99 percent effective.[8] PG&E describes the changes to its system hardening underground program in Exhibit (PG&E-4), Chapter 4.3.

To address the continuously evolving wildfire risk, PG&E implemented the EPSS program in July 2021 on approximately 11,500 miles of distribution circuits, or 45 percent of the circuit miles in HFTD areas. With EPSS, if an object such as vegetation contacts a distribution line, power is automatically shut off within 1/10th of a second, reducing the potential for an ignition. In 2021, this program reduced CPUC-reportable ignitions from electrical equipment on EPSS enabled circuits by 80 percent compared to a

7 Exhibit (PG&E-4), Table 4.3-2, line 4.

8 PG&E recognizes that there is a minimal ignition risk with underground electric assets.

three-year average.[9] PG&E will expand EPSS to all circuits within the HFTD and High Fire Risk Areas (HFRA), as well as some circuits within Tier 1 buffer zones in 2022. EPSS has an RSE of 106.2 because it is effective at reducing ignitions. However, it is also disruptive to customers. PG&E is actively exploring ways to reduce customer disruptions.[10] PG&E envisions EPSS as part of an integrated wildfire risk mitigation solution that will protect against vegetation and other ignition causes while undergrounding work progresses and as the scope of EVM is reduced. PG&E describes its EPSS program in Exhibit (PG&E-4) Chapter 4.6.

As part of the integrated wildfire mitigation strategy, PG&E is evaluating its Vegetation Management (VM) programs to align to the changes in system hardening undergrounding and the implementation of EPSS. Starting in 2023, and as reflected in the February 25, 2022 updated forecast, the EVM Program will only include overhang clearing. Tree removals and radial clearance will become part of Routine VM. PG&E describes the changes to its VM programs in Exhibit (PG&E-4) Chapter 9.

While PG&E's integrated risk mitigation strategy focuses on system hardening undergrounding, EPSS, and EVM, PG&E continues to employ other mitigations to reduce wildfire risk including installing stronger poles, covered conductor and sectionalizing devices, and implementing PSPS. These additional wildfire mitigations are described in Exhibit (PG&E-4) Chapters 4.1, 4.2, and 4.3.

B. EO Risk Organization Structure and Governance

This section has been modified to reflect changes in the EO Risk organization structure for the February 25, 2022 GRC update.

Exhibit (PG&E-2), Chapter 1 describes PG&E's Enterprise and Operational Risk Management (EORM) organization. EORM works across the enterprise to establish a consistent and repeatable risk management program. This program

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9 See PG&E's November 24, 2021 response to TURN data request 053, question 3 (GRC-2023-Ph_DR_TURN_053-Q03).

10 To address EPSS outages and the corresponding customer impacts, PG&E adjusted sensitivity of devices to reduce the likelihood, size and duration of outages and improved internal coordination of patrol crews for faster restoration times. PG&E is also planning to implement several programs to provide or subsidize back-up generation or battery storage resources to select customers impacted by EPSS outages.

ensures that individual PG&E Lines of Business (LOB) consistently identify, evaluate, respond to, and monitor the risks associated with their LOB functions.

The EO Risk Management Team (EO Risk Team) is responsible for implementing the EORM risk framework for risks related to PG&E's electric assets. These assets include electric distribution and transmission line assets and electric distribution and transmission substations. Transmission assets and transmission substations are not funded through the GRC. Therefore, the discussion in this section will focus on distribution assets and distribution substations. There are five EO risks and one EO cross-cutting factor on PG&E's Corporate Risk Register. PG&E describes each of these in the sections that follow.

The EO Risk Management Team is led by the Director of Risk Management and Analytics. The organization consists of three departments: (1) Risk Management; (2) Risk Data Analytics; and (3) Electric Asset Excellence. Together these departments implement the EORM risk framework for Electric Operations, including managing EO's risk register and working directly with representatives across EO to identify, assess, and monitor mitigation plans for EO's risks. The EO Risk Management and Risk Data Analytics departments focus on supporting data analytics that drive prioritization of major programs for managing and mitigating EO's risks. The Electric Asset Excellence Department focuses on ensuring a path and process for long-term asset management and achieving PAS 55/International Organization for Standardization (ISO) 55001 certification.[11] The EO Risk Management organization reports to the Senior Director of Asset Strategy, which in turn reports to the Vice President, Asset Risk Management.

Given its significant exposure to wildfire risk, PG&E established the Wildfire Risk Organization in March 2021. This organization is focused on preparing for the wildfire season and delivering on PG&E's Wildfire Mitigation Plan (WMP) commitments. This organization is focused on: Governance, Analytics and

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11 The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies. ISO 55001 is an asset management system standard to help organizations manage the lifecycle of its assets more effectively. See, <https://pecb.com/en/education-and-certification-for-individuals/iso-55001#:~:text=ISO%2055001%20is%20an%20asset,lifecycle%20of%20assets%20more%20effectively> (as of June 9, 2021).

Stakeholder Management; Program Management and Execution; and PSPS Planning and Execution. Several members of EO, including the Risk Management and Analytics Director, directly support this organization.

As of the February 25, 2022 GRC update, the Wildfire Risk Organization reports to the Executive Vice President, Chief Safety and Risk Officer, ensuring continued executive oversight over the exposure to wildfire risk. As part of this organizational change, a Senior Director leads the Wildfire Risk Management organization, which oversees the Wildfire Risk Management Vegetation, Analytics and Strategy and Meteorology and Fire Science organizations. The existing Electric Risk Management organization's reporting structure has not changed.

Governance over the EO risk program is supported by multiple committees, both within the EO organization and at the enterprise level. Within EO there is a Risk and Compliance Committee (RCC) that is chaired by the Vice President Asset Risk Management and the Senior Director of Electric Compliance. The direct reports of the two RCC co-chairs are committee members and EORM, Internal Audit, and Compliance and Ethics (C&E) representatives are standing meeting invitees. The RCC meets monthly and serves as the main forum within EO for discussing risk management activities.

At the enterprise level, EO representatives actively participate in other forums that are part of PG&E's overall risk governance structure.[12] The enterprise-level risk committees that EO participates in are:

- Wildfire Risk Governance Steering Committee;
- Safety and Nuclear Oversight Committees;
- Board of Directors and Select Board Committees;
- L1 Key Risk Indicators Review Meeting;
- Public Safety Risk Committee;
- Climate Resilience Officer Coordination Committee; and
- Risk Management Community.

[12] PG&E describes its Enterprise risk governance structure in Exhibit (PG&E-2), Ch. 1.

C. EO Risk Management Policy and Tools

1. Risk Management Policy

The EO Risk Team develops and manages an active list of risks. Each risk is assigned a risk owner who works with the EO Risk Team to document risk analysis and quantification activities; map the risk drivers, controls, and consequences that impact the risk; identify and develop mitigations to promote risk reduction; calculate Risk Spend Efficiencies (RSE);[13] and establish key performance indicators or metrics to monitor risk performance.

EO risk management policy is consistent with the EORM LOB risk management policy as described in Exhibit (PG&E 2), Chapter 1. There are four major steps included in the EO risk management process: (i) Risk Identification; (ii) Risk Evaluation and Quantification; (iii) Risk Response; and (iv) Risk Monitoring and Reporting. A simplified figure below shows the risk management process.

[13] RSE is a metric for representing the benefit to cost ratio of a mitigation, where benefit is described in terms of risk reduction. RSEs are calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate.

FIGURE 3-1
ELECTRIC OPERATIONS RISK MANAGEMENT PROCESS

a. Risk Identification

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

The Risk Identification process involves the EO Risk Team, risk owners, and subject matter experts (SME) who together identify and evaluate EO risks. Risks that are identified by the EO Risk Team are reviewed by the EO RCC. Ultimately, the RCC approves the list of risks that are included on the EO Risk Register. The risks that are on the EO-owned Risk Register are that same as the EO risks that are on the Corporate Risk Register.

Table 3-2 below shows EO's risks on the Corporate Risk Register. Transmission risks are shown in the table for completeness but are not included in the GRC.

TABLE 3-2
ELECTRIC OPERATIONS RISKS

Line No.	Risk Name	Risk Description	Risk Type[a]	2023 Test Year (TY) Risk Score	2026 Mitigated Risk Score
1	Wildfire	PG&E assets or activities may initiate a fire that is not easily contained and endangers the public, private property, sensitive lands or environment	RAMP	23,220	5,514
2	Failure of Electric Distribution Overhead Assets[b]	Failure of distribution overhead assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage or inability to deliver energy.	RAMP	539	496
3	Failure of Electric Distribution Network Assets	Failure of distribution network assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage or inability to deliver energy.	RAMP	17	13
4	Failure of Electric Distribution Underground Assets	Failure of distribution underground assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage or inability to deliver energy.	Non-RAMP	116	114
5	Failure of Electric Distribution Substation Assets	Failure of distribution substation assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage, disruption of major generation sources or inability to deliver energy.	Non-RAMP	42	38
6	Emergency Preparedness and Response	Impact of emergency preparedness and response controls that affect PG&E's risk drivers and consequences.	RAMP Cross Cutting Factor[c]	N/A	N/A
7	Failure of Electric Transmission Overhead Assets	Failure of transmission overhead assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage, disruption of major generation sources and inability to deliver energy.	Outside CPUC Jurisdiction	N/A	N/A

TABLE 3-2
ELECTRIC OPERATIONS RISKS
(CONTINUED)

Line No.	Risk Name	Risk Description	Risk Type[(a)]	2023 Test Year Risk Score	2026 Mitigated Risk Score
8	Failure of Electric Transmission Underground Assets	Failure of transmission underground assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage, reduced operational redundancy in critical urban centers, or large-scale prolonged outages.	Outside CPUC Jurisdiction	N/A	N/A
9	Failure of Electric Transmission Substation Assets	Failure of transmission substation assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage, disruption of major generation sources or inability to deliver energy.	Outside CPUC Jurisdiction	N/A	N/A
10	Electric Transmission System-Wide Blackout	A system-wide disturbance leading to a cascading event that causes a blackout of PG&E's electrical system with the inability to restore the grid in a timely fashion	Outside CPUC Jurisdiction	N/A	N/A

(a) RAMP risk refers to those risks identified in the 2020 RAMP Report as one of PG&E's top safety risks based on the safety score risk ranking of all the risks on PG&E's Corporate Risk Register. Non-RAMP refers to risks that are on the Corporate Risk Register, but were not one of the highest scoring safety risks.

(b) PG&E calculated a preliminary risk score for the Failure of Electric Distribution Assets risk including the impacts from EPSS. See Section 2.a.1 below.

(c) PG&E does not calculate a risk score for the cross-cutting factors.

In addition to the risks on the Corporate Risk Register, EO also assesses the following cross-cutting factors in partnership with other organizations:[14] EP&R, Skilled and Qualified Workforce, Physical Attack, Information Technology Asset Failure, Cyber Attack, Records and Information Management, Seismic, and Climate Change.[15]

14 Exhibit (PG&E-2), Ch. 1, Attachment B maps the cross-cutting factors to the risk events.

15 For Climate Change, EO recognizes that climate can impact the environmental conditions affecting the operations of Electric assets. EO has partnered with the Climate Resilience team to review the Climate Vulnerability Assessment (CVA) across PG&E's service territory. As the CVA is developed, the results of the assessments will be implemented in EO's risk modeling and specific programs that combat the impacts of Climate Change.

b. Risk Evaluation and Quantification

PG&E uses the bow-tie methodology to evaluate risk events, consistent with the S-MAP framework.[16] The bow-ties illustrating the EO risk are provided in each risk section below. The bow-tie methodology provides (1) a high-level visual summary of the risk event, and (2) a detailed process for presenting the risk drivers, the likelihood or frequency of the risk event, the potential consequences of the risk event, and the score for the assessed risk. Developing the bow-tie methodology includes defining exposure, drivers, tranches, and consequences.

- Risk exposure is the scope of the assessment for PG&E to measure the risk. Examples of exposure could include asset types and could be measured in line miles or asset counts. Exposure is supported by records associated with outages, ignitions, and other failure mode data.
- Risk drivers represent various modes or causes that lead to failures. Risk drivers can be broken into sub-drivers. An example of driver/sub-driver is the outages caused by equipment failure driver, where conductor failure is one of the corresponding sub-drivers of the risk.
- Risk tranches include a group of assets, a geographic region or other grouping that is intended to have a similar risk profile such as having the same likelihood or consequence of risk events. Examples of tranches could be circuits with high, moderate, or low reliability performance.

Exposure to the risk is divided into different segments or tranches. More granular tranches allow for a better understanding of risk profiles. For example, for the Wildfire risk on a system level, equipment failure is the largest cause of ignitions. However, when line miles in HFTD areas are considered separately, the largest risk driver becomes vegetation contact instead of equipment failure.

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16 Decision (D.) 18-12-014, Phase Two Decision Adopting S-MAP Settlement Agreement with Modifications (Dec. 20, 2018). This Settlement Agreement achieves steps toward a more uniform and quantitative risk-based decision-making framework in the S-MAP.

The consequences of a risk event are also identified as part of the bow-tie. The separation of consequences into different outcomes allows for a better understanding of the chances of a high frequency/low consequence event or a low frequency/high consequence event. Consequences include safety, reliability, and/or financial damages.

The outcome of the risk assessment is a bow-tie for each risk. The risk bow-ties are presented in the individual risk sections that follow (Section D for RAMP risks and Section E for non-RAMP risks).

c. Risk Response

The EO Risk Team works with SMEs to identify appropriate controls and mitigations to manage the risk. Control programs are ongoing activities that maintain the existing level of risk. Mitigation programs are activities designed to further reduce the level of risk. Control and mitigation programs are associated with risk drivers, risk consequences, and/or risk tranches to accurately quantity the benefits of the program. The outcome of risk quantification is the calculation of an RSE for mitigations and controls.

The mitigations and controls presented herein represent EO's mitigation and control portfolio as of the time of filing this GRC. PG&E continually evaluates its risks, mitigations, and controls and expects that the portfolio will change.

d. Risk Monitoring and Reporting

EO reports on the status of its risks and the performance of its risk response programs through forums such as the Risk and Compliance Committee and enterprise-level governance reporting. Based on the performance of the risk and response programs, PG&E may accelerate or adjust its responses to better manage the risk.

As part of the risk monitoring process, PG&E continues to look for opportunities to improve risk modeling. For example, through the risk assessment process, one gap that PG&E identified in its risk modeling was that its historical data does not fully articulate the level of risk based on condition and age of the existing infrastructure. To address this issue, PG&E added three tranches to the 2023 GRC Enterprise Risk

Model for the Failure of Electric Distribution Network Assets risk and incorporated estimated expected failure rates based on industry failure curves instead of using PG&E historical data. PG&E plans to implement this improved methodology to model other asset types in other EO risks.

2. EO-Specific Risk Management Tools and Quantification Efforts

This section has been modified to reflect changes in risk modeling tools as of February 25, 2022.

The EO Risk Team relies on a combination of enterprise and Electric LOB models to make risk-informed decisions related to mitigation programs, investment planning, and real time operational decisions.

Table 3-3 below lists the key models that the EO Risk Team relies on. Lines 1 and 2 on Table 3-3 both reference the Enterprise Multi-Attribute Value Function (MAVF).

In the June 30, 2021 GRC the MAVF was listed twice in the table because PG&E had updated the model since it filed its 2020 RAMP Report. The two models were referred to as: (1) the 2020 RAMP Enterprise Risk Model; and, (2) the 2023 GRC Enterprise Risk Model. The updates to the 2020 RAMP Enterprise Risk Model are described in Exhibit (PG&E-2), Chapter 1, Section E.5.

In the February 25, 2022 testimony PG&E updates its enterprise risk model again. The model used for the February 25, 2022 GRC update and for the 2022 WMP is referred to as the 2022 Enterprise Risk Model. Updates to the model are described in Section D.1.b.2 below.

TABLE 3-3
EO RISK MANAGEMENT WILDFIRE MODELS

Line No.	Model Name	Abbreviation	Description
1	Enterprise Multi Attribute Value Function Risk Model	2020 RAMP Enterprise Risk Model	• Model used in PG&E's 2020 RAMP • Aligned to the S-MAP requirements. • Assess enterprise risks using a common framework • Used to develop risk scores, safety scores, the risk bow-tie, and RSE values for individual risk events.
2		2023 GRC Enterprise Risk Model	• Model used in PG&E's June 30, 2021 GRC Submittal • Aligned to the S-MAP requirements. • Assess enterprise risks using a common framework • Used to develop risk scores, safety scores, the risk bow-tie, and RSE values for individual risk events.
3		2022 Enterprise Risk Model	• Model used in PG&E's February 25, 2022 GRC update and 2022 WMP
4	2021 Wildfire Distribution Risk Model (WDRM)	2021 WDRM	• Planning model • Calculates wildfire risk probabilities of ignition and consequence scores for the overhead distribution system in the HFTD at the circuit segment level • Informs the development of mitigation programs; and helps to prioritize highest wildfire risk miles on PG&E's distribution system in the HFTD. • Outputs inform PG&E's System Hardening and EVM work planning and scheduling. • Includes three component models (described on lines 4, 5, and 6).
5	Conductor Risk Model	N/A	• One of three 2021 WDRM component models • Quantifies wildfire risk due to conductor failures by calculating a probability of ignition in combination with the Wildfire Consequence Model. • Provides a risk value that is aggregated to the circuit segment level and informs prioritization of system hardening and equipment replacement efforts.

TABLE 3-3
EO RISK MANAGEMENT WILDFIRE MODELS
(CONTINUED)

Line No.	Model Name	Abbreviation	Description
6	Vegetation Risk Model	N/A	• One of three 2021 WDRM component models • Quantifies wildfire risk due to vegetation contact with distribution facilities by calculating a vegetation probability of ignition. • Provides a risk value that is aggregated to the circuit segment level and informs the prioritization of VM efforts. • Used in combination with the EVM Tree-Weighted Prioritization, which takes into account the tree count at the circuit segment level.
7	Wildfire Consequence Model	N/A	• One of three 2021 WDRM component models • The spatial data set based on Technosylva[(a)] fire simulations under elevated fire conditions is calibrated to be compatible with PG&E's MAVF scoring. • Produces the wildfire risk value for each grid location.

(a) Technosylva is a suite of wildfire simulation software applications whose propagation and consequence outcomes are based on available fuels, topography, and weather, as well as building and population locational data.

3. Accounting for Programs That Address Multiple Risks

There are several instances of overlap between programs across risk profiles, where one mitigation or control offsets more than one risk. For example, EVM and the overhead conductor replacement portion of the Wildfire System Hardening Program reduce both the Wildfire risk and the Failure of Electric Distribution Overhead Assets (Failure of DOH Assets) risk.[17] To represent the full benefit of such a program, the risk reduction is aggregated between the program's management of Wildfire and Failure of DOH Assets risk.

[17] The EVM mitigation is described in Exhibit (PG&E-4), Ch. 9. The System Hardening mitigation is described in Exhibit (PG&E-4), Ch. 4.3.

The 2023 GRC Enterprise Risk Model and the 2022 Enterprise Risk Model use the expense and capital forecast by risk to calculate the RSEs. In certain cases, forecast costs for the same program are included in more than one risk model. For example, the activities and costs to proactively replace batteries in substations appear in two risk controls: Substation Proactive Asset Replacement – Batteries (WLDFR-C10C) and Substation Proactive Asset Replacement – Batteries (SUBSTN-C16C).[18] In this example, the same forecast costs are used to calculate the RSEs for WLDFR-C10C and SBSTN-C16C. Even through the same costs are used to calculate the RSEs, PG&E is only requesting recovery for these costs once.

In the Exhibit (PG&E-4) forecast chapters PG&E includes tables showing the 2020-2023 recorded and forecast expense amounts and 2020-2026 recorded and forecast capital costs for mitigations. In supporting workpapers PG&E also provides the 2024, 2025 and 2026 forecast expense amounts for mitigations. The RSE calculations are based on the 2023 through 2026 forecast costs. Recorded and forecast costs for controls are provided in supporting workpapers.

4. Evolving Approaches to Risk Reduction Activities

As PG&E continues to develop more granular planning risk models, it has changed the way it prioritizes its work.

The 2021 WDRM analyzes risk at the circuit segment level for HFTD areas. The 2021 WDRM uses a combination of the probability of failure and the consequence of a failure to generate a risk score at a circuit segment level, as opposed to generating a risk score only at the system level. The ability to calculate a circuit segment risk score is an example of how PG&E is continuing to improve its assessment and management of risk. This new method for calculating a circuit segment risk score was used for developing System Hardening and EVM risk-based work prioritization. PG&E uses the outputs from the 2021 WDRM to prioritize system hardening and EVM work, allowing PG&E to focus its efforts on the highest risk segments.

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[18] Substation Proactive Asset Replacement – Batteries is described in Exhibit (PG&E-4), Ch. 15.

Based on the lessons learned from using the 2021 WDRM, PG&E will expand this approach to other programs. The EO Risk Team and Asset Knowledge organizations are working together to improve data quality at the asset level. Improved data quality will support the modelling of probability and consequence of failure and ultimately lead to more granular asset level risk models.

D. Risk Assessment and Mitigation Phase (RAMP) Risks

PG&E's 2020 RAMP Report included three EO distribution-related risks (Wildfire, Failure of Electric Distribution Overhead Assets, Failure of Electric Distribution Network Assets) and one cross-cutting factor (EP&R). In the sections that follow PG&E describes the three RAMP risks along with any changes to EO's enterprise risk models, mitigations, controls, and RSEs since PG&E filed the 2020 RAMP Report.

1. Wildfire

This section has been modified to reflect risk modeling updates due to changes in PG&E's integrated wildfire mitigation strategy as of February 25, 2022.

a. Risk Overview

Wildfire was identified as a RAMP risk in PG&E's 2020 RAMP Report.

The Wildfire risk is defined as PG&E assets or activities that may initiate a fire that is not easily contained, endangers the public, private property, sensitive lands, or the environment.

The majority of the wildfire risk is in HFTD areas.[19] The HFTD was adopted by the Commission in 2017. The HFTD consists of three areas:

- Zone 1 consists of Tier 1 HHZ on the map of Tree Mortality HHZ prepared jointly by the United States Forecast Service and the California Department of Forestry and Fire Protection (CAL FIRE).

[19] In addition to HFTD areas, PG&E also made incremental changes to reflect HFRAs. The HFRA map builds on the CPUC's HFTD Map by adding regions where the risk of utility triggered catastrophic wildfire from an offshore wind event is high and removing regions where it is not.

Tier 1 HHZs are in direct proximity to communities, roads, and utility lines and represent a direct threat to public safety.

- Tier 2 consists of areas on the CPUC Fire-Threat Map where there is an elevated risk for destructive utility-associated wildfires.
- Tier 3 consists for areas on the CPUC Fire-Threat Map where there is an extreme risk for destructive utility-associated wildfires.[20]

Exposure to the Wildfire risk is modeled based on the approximately 99,000 overhead circuit miles in PG&E's electric distribution and transmission system. Of the total overhead circuit miles, 25,462 miles are associated with HFTD Distribution. The drivers for this risk are Vegetation Contact, Equipment/Facility Failure, Contact from Object, Wire-to-Wire Contact, Unknown, Other, Vandalism/Theft, Utility Work/Operation, Contamination, and Seismic. The drivers for this risk event have been modified since PG&E filed its 2020 RAMP Report to align with the drivers outlined in the 2021 WMP guidelines. The one exception is that in the WMP, Vegetation Contact is a sub-driver of the Contact from Object driver, whereas in the 2023 GRC Enterprise Risk Model and 2022 Enterprise Risk Model, Vegetation Contact is a stand-alone risk driver. The change in risk driver was made to reflect the vegetation contact driver's contribution to the risk.

Wildfire includes approximately 480 risk events (ignitions)[21] each year; 150 (or 31 percent of) risk events occur in HFTD areas each year. Risk events in HFTD areas accounted for 99 percent of the overall risk. The Equipment Failure risk driver accounts for 36 percent of ignitions systemwide and 21 percent of ignitions in HFTD areas.[22] Conductor

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20 D.17-12-024, p. 2.

21 Based on the CPUC's reportable fire ignition definition, fire ignition is defined as an ignition resulting a fire that traveled more than one meter from the ignition point and burnt something other than PG&E facilities. (D.14-02-015, Appendix C, p. C-2, Section 1.A.4.) PG&E's current Wildfire risk model uses all reportable ignitions systemwide; previous versions of the model were limited to high fire risk areas (Fire Index Area's in the 2017 RAMP and HFTD areas in the 2020 GRC). PG&E's forecast of 2023 baseline ignitions is 480, which is based on historical ignitions with certain adjustments.

22 The Equipment Failure risk driver accounts for 21 percent of ignitions in HFTD areas, 20 percent of ignitions in HFTD Distribution, and 32 percent of ignitions in HFTD Transmission.

and connection device failures account for most of these equipment failure incidents. The Vegetation risk driver accounts for 28 percent of ignitions systemwide and 48 percent of ignitions in HFTD areas.[23]

The cross-cutting factors Climate, EP&R, Records and Information Management and Seismic also impact this risk.[24]

PG&E identified 40 tranches in the 2023 GRC Enterprise Risk Model, including 25 tranches related to distribution assets in HFTD areas (HFTD Distribution). Separating HFTD and non-HFTD miles allows for additional focus in the HFTD areas. As discussed in Section D.1.b below, PG&E revised the number of tranches in its 2023 GRC Enterprise Risk Model for Wildfire model based on feedback from Safety Policy Division (SPD).

Wildfire consequences are separated between: (1) red flag warning[25] and non-red flag warning periods; and (2) different magnitudes of wildfire (e.g., catastrophic, destructive, large, and small). 89 percent of the Wildfire risk score is due to the small number of ignitions that result in catastrophic fires (defined as fires that burn 100 or more structures and result in a serious injury or fatality).[26]

PG&E proposed a suite of mitigations and controls in the 2020 RAMP Report. Since filing the 2020 RAMP Report, the suite of mitigations and controls have changed.[27] Tables 3A-1 and 3A-2 in Attachment A lists the mitigations and controls included in the RAMP, those that have been removed from the portfolio, and those forecast in the 2023 GRC.

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23 The Vegetation risk driver accounts for 48 percent of ignitions in HFTD areas, 51 percent for HFTD Distribution, and 5 percent of ignitions in HFTD Transmission.

24 See Exhibit (PG&E-2), Ch. 1, Attachment B.

25 The National Weather Service issues Red Flag Warnings to alert fire departments of the onset, or possible onset, of critical weather and dry conditions that could lead to rapid or dramatic increases in wildfire activity. See <https://www.fire.ca.gov/programs/communications/red-flag-warnings-fire-weather-watches/> (as of June 13, 2021).

26 See PG&E's RAMP Report, A.20-06-012 (June 30, 2020), p. 10-19, lines 2-20 for additional information on how wildfires are categorized.

27 PG&E describes the changes to the mitigations and controls in the forecast chapters to which those mitigations and controls are aligned.

The 2023 TY baseline risk score presented in the 2020 RAMP Report was 25,127[28] and the 2026 post mitigation risk score was 19,192. The 2023 TY baseline risk score and the 2026 post mitigation risk scores updated for the GRC are 23,143 and 18,637 respectively. The 2023 TY baseline risk score and the 2026 post mitigation risk scores as of the February 25, 2022 update filing are 23,220 and 5,449 respectively. These changes in risk scores are due to: (1) the activities described in Section D.1.b below; (2) incorporating 2021 data into the 2022 Enterprise Risk Model, for Wildfire; and (3) changes in the Wildfire risk mitigation strategy described in Section A.1 above.

The 2026 post-mitigation risk score in PG&E's June 30, 2021 filing was 18,637, whereas it is 5,449 in this February 25, 2022 update. The change in risk reduction is driven by the changes in system hardening and EVM and the addition of EPSS to the mitigation portfolio.

Figures 3-2 and 3-3 below show the exposures, drivers, outcomes, and risk score for the Wildfire risk system-wide and in HFTD Distribution.

28 The 2020 RAMP Wildfire baseline risk score was updated in errata. See PG&E's 2020 RAMP Report, Post-Filing Errata, A.20-06-012 (July 17, 2020), p. 2, line 33; and, p. 3, Figure 17-1, Figure B.

FIGURE 3-2
SYSTEM-WIDE (TRANSMISSION AND DISTRIBUTION) WILDFIRE
BOW-TIE ILLUSTRATION

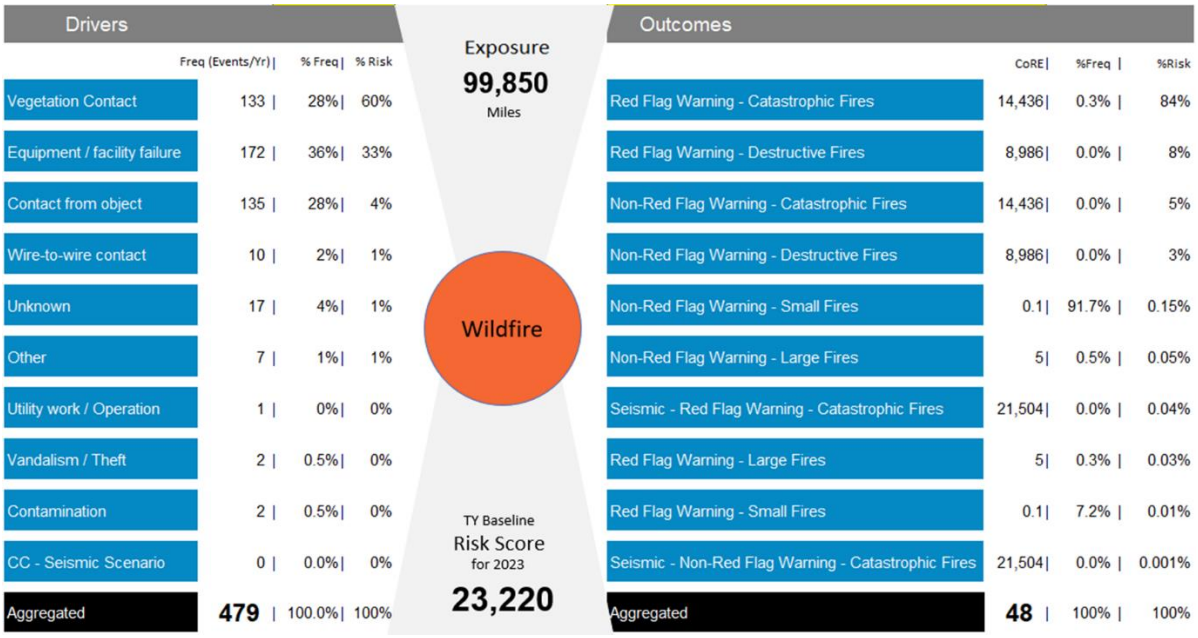
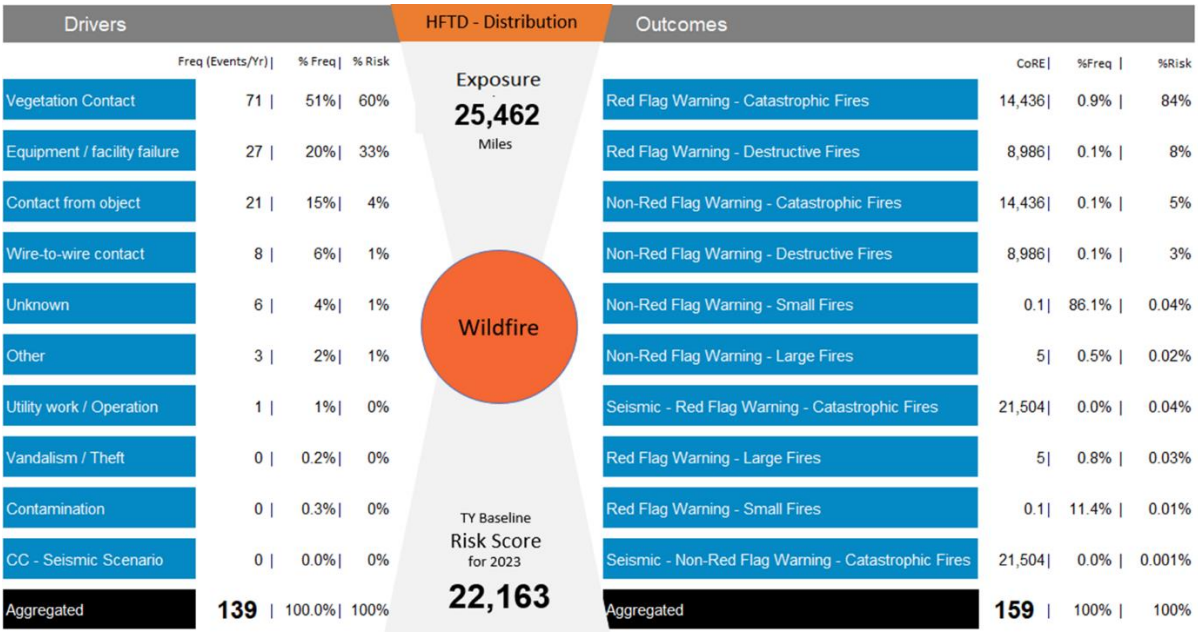


FIGURE 3-3
WILDFIRE – HFTD DISTRIBUTION
BOW-TIE ILLUSTRATION



The 2023 GRC Enterprise Risk Model and accompanying source data used for the June 2021 GRC submittal and the 2022 Enterprise

Risk Model supporting the February 2022 GRC update data are available upon request.

In addition to updating the risk scores, PG&E has updated RSE scores for those mitigations that are included in both the 2020 RAMP Report and this GRC as shown in Table 3-4 in Section D.1.e below.

b. Responding to Feedback on PG&E's 2020 RAMP Report

On November 25, 2020, the SPD issued its Staff Evaluation Report on PG&E's 2020 RAMP Application (A.) 20-06-012. Subsequently on January 15, 2021 and January 29, 2021, other interested parties also provided feedback on PG&E's 2020 RAMP Report. Along with SPD, the Public Advocates Office at the California Public Utilities Commission (Cal Advocates), The Utility Reform Network (TURN), the Mussey Grade Road Alliance (MGRA), and FEITA Bureau of Excellence (FEITA) all provided feedback to PG&E about its Wildfire risk analysis. PG&E appreciates SPD and parties' feedback and, as shown in supporting workpapers, agrees with many of the comments and recommendations received. A listing of the feedback and PG&E's response to each item is provided in workpapers.[29]

SPD identified two key areas for improvement: (1) increased granularity; and (2) the need to provide RSEs for individual to understand the effectiveness and efficiency of each specific control and mitigation.[30] These findings suggest that PG&E should provide more detailed information in its risk analysis to provide the Commission, SPD and other interested parties sufficient information to evaluate PG&E's GRC proposals.[31] PG&E agrees that more granular tranching and more RSEs will improve risk analysis and as such:

- PG&E has increased the number of tranches in its 2023 GRC Enterprise Risk Model for Wildfire. In HFTD Distribution, PG&E

29 See Exhibit (PG&E-2), WP 1-12.

30 SPD Staff Evaluation Report on PG&E's 2020 RAMP, A.20-06-012 (Nov. 25, 2020) (SPD Staff Report), p. 4.

31 PG&E Opening Comments, A.20-06-012, (Jan. 15, 2021), p. 2.

increased the number of tranches from 3 to 25 tranches. More information about tranching is provided in Section b.2 below.

- In the 2020 RAMP Report, PG&E provided RSEs for 6 Wildfire mitigations and no controls whereas in this GRC PG&E is providing RSEs for 17 mitigations and 22 controls.[32]

SPD and parties' comments also included suggestions that PG&E: incorporate additional risk drivers into the wildfire risk analysis; improve focus on weather; and further develop PSPS modeling and incorporate PSPS's consequences to PG&E's customers into the risk model. This feedback is addressed in the Updates to PG&E's Risk Model (Section D.1.b below).

1) Changes in Mitigations and Controls

PG&E described its plans for managing the Wildfire risk in its 2020 RAMP Report. Since filing the 2020 RAMP Report, PG&E has divided certain mitigations into asset-specific mitigations to support a more detailed risk analysis. Changes from the 2020 RAMP Report are highlighted below:

- PSPS Impact Reduction Initiatives mitigation: PSPS impact reduction initiatives were presented as a single mitigation in the 2020 RAMP Report and are now broken down into individual activities. See Chapters 4.2 and 4.3 for additional information.
- Situational Awareness and Forecasting Initiatives mitigation: PG&E presented a single Situational Awareness and Forecasting Initiatives mitigation in the 2020 RAMP Report. This mitigation is now divided into several individual mitigations. See Chapters 4.1 and 4.3 for additional information.
- Additional System Automation and Protection mitigation: PG&E presented one mitigation in the 2020 RAMP Report. In the GRC this mitigation is now divided into subprograms. See Chapter 4.3 for additional information.

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32 In certain instances, PG&E has calculated more than one RSE for a single mitigation or control.

- As part of the February 25, 2022 update PG&E is making changes to three Wildfire mitigation programs.
  (1) PG&E is revising its System Hardening approach. In the June 30, 2021 filing PG&E forecast approximately 1,638 miles of overhead system hardening and 182 miles of underground system hardening between 2023 and 2026.[33] With the February 25, 2022 update PG&E is proposing approximately 3,400 miles of overhead system hardening and 320 miles of overhead system hardening between 2023 and 2026.[34] This change reflects PG&E's plan to increase the number of miles and pace of the system hardening undergrounding program because it is significantly more effective at reducing wildfire risk than hardening overhead assets. See Chapter 4.3 for additional information.
  (2) PG&E is adding a new mitigation, EPSS (WLDFR-M020). PG&E adjusts the sensitivity of its equipment to automatically turn off power faster if the system detects a problem. In 2021, EPSS reduced CPUC-reportable ignitions from electrical equipment on EPSS enabled circuits by 80 percent compared to a three-year average. See Chapter 4.6 for additional information.
  (3) PG&E is revising its EVM program starting in 2023. Key changes to the EVM program reflected in the February 25, 2022 update include reducing the scope of the program in 2023 to include only overhang clearing. This program change aligns to PG&E's strategy to increase system hardening undergrounding and implementing EPSS. With this change in the EVM program, PG&E will conduct tree risk assessments, identify strike trees, and remove hazard trees in the Routine VM program. See Chapter 9 for additional information.

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33 Exhibit (PG&E-4), Page 4.3-28, Table 4.3-7.

34 Cite to 4.3 table

PG&E shows the risk mitigations and controls presented in the 2020 RAMP Report, those forecast in the June 30, 2021 GRC filing and the mitigations and controls as of the February 25, 2022 update in Attachment A, Tables 3A-1 and 3A-2. The updated portfolio of mitigations and controls is more closely aligned to PG&E's current risk management strategy.

Information about the 2020 RAMP Report Wildfire mitigations and controls is provided in Chapter 10 of PG&E's 2020 RAMP Report. Changes to PG&E's forecast mitigations and controls are discussed in the following Chapters in this exhibit.

Mitigations

- Chapter 4.1 – Wildfire Risk Mitigations – Situational Awareness and Forecasting
- Chapter 4.2 – Wildfire Risk Mitigations – PSPS Operations
- Chapter 4.3 – Wildfire Risk Mitigations – System Hardening, Enhanced Automation, and PSPS Impact Mitigations
- Chapter 4.4 – Wildfire Risk Mitigations – Community Wildfire Safety Program (CWSP) Program Management Office (PMO)
- Chapter 4.6 – Enhanced Powerline Safety Settings
- Chapter 9 – Vegetation Management
- Chapter 11 – Overhead and Underground Electric Distribution Maintenance
- Chapter 12 – Pole Asset Management
- Chapter 23 – Community Rebuild Program

Controls

- Chapter 9 – Vegetation Management
- Chapter 10 – Overhead and Underground Electric Distribution Inspections
- Chapter 11 – Overhead and Underground Electric Distribution Maintenance
- Chapter 12 – Pole Asset Management
- Chapter 15 – Substation Asset Management

2) Updates to PG&E's 2020 RAMP Enterprise Risk Model

For the June 30, 2021 GRC submittal PG&E updated its 2020 RAMP Enterprise Risk Model. Since PG&E filed its 2020 RAMP Report it has made changes to its 2020 RAMP Enterprise Risk Model discussed below. Certain changes were made in response to feedback from SPD and parties as noted below, while other changes were made by PG&E as it continues to update and refine its enterprise risk models. PG&E also made many changes to align to the 2021 Wildfire Distribution Risk Model discussed in the 2021 WMP.

PG&E again updated its enterprise risk model for the February 25, 2022 GRC update and the 2022 WMP. This updated model is referred to as the 2022 Enterprise Risk Model. These changes are described in this section, sub-section (g) below.

a) Tranching

SPD and parties recommended that PG&E's risk models incorporate more granular tranching. For example, SPD stated that given the diverse environments and conditions covered by PG&E's electric distribution system it was unreasonable to assume a homogeneous risk profile as PG&E did in the 2020 RAMP Report.[35]

PG&E agrees that the tranches included in the 2020 RAMP Enterprise Risk Model for Wildfire can be improved. In response to SPD and parties' feedback, PG&E revised the tranches in the 2023 GRC Enterprise Risk Model for Wildfire. PG&E expanded its overall tranches from 8 to 40.[36] Transmission tranches were further refined by voltage class and HFTD tier, expanding from 2 to 12. HFTD Distribution tranches were further refined, expanding from 3 to 25. The 25 tranches represent the combination of 5 quintiles of the Likelihood of a

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35 SPD Staff Report, p. 5.

36 There are two substation tranches and one non-HFTD distribution tranche that have not change since the 2020 RAMP Report.

Risk Event (LoRE) and the Consequence of a Risk Event (CoRE). An important aspect of the refinement in HFTD Distribution tranching is the alignment of the 2023 GRC Enterprise Wildfire Risk Model to the 2021 WDRM.

The 2021 WDRM provides support for prioritization of EVM and System Hardening work. The 2023 GRC Enterprise Risk Model assesses enterprise risks (including Wildfire) using a common framework and develops RSEs using the MAVF scoring approach agreed to in the S-MAP Settlement Agreement. PG&E aligned the two models by using the outputs from the 2021 WDRM in the 2023 GRC Enterprise Risk Model. The 2021 WDRM informs the probability of ignition at the circuit segment and the HFTD tiers in the 2023 GRC Enterprise Risk Model, for the equipment/facility failure (conductor damage or failure) and vegetation contact drivers. Further, Technosylva simulation results in the 2021 WDRM inform the Wildfire consequences at the circuit segment level.

b) Drivers

PG&E made three key changes to its risk drivers since the 2020 RAMP Report.

First, in its evaluation of PG&E's 2020 RAMP Report, TURN stated that, "...[a] correct portrait of PG&E's Wildfire Risk requires that the considerable risk resulting from PG&E's operational failures be recognized and that the risk reduction benefits from fixing those problems be quantified."[37] SPD agreed that this was a valid comment and that operational failures should be modeled as a risk driver.[38] PG&E agrees with TURN and SPD's recommendation. To capture operational failure in the 2023 GRC Enterprise Risk Model, PG&E matches ignitions to associated outages, and if the basic cause is

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37 TURN's Opening Comments on PG&E's RAMP Report and the SPD's November 25, 2020 Evaluation Report, A.20-06-012 (Jan. 15, 2021) (TURN Opening Comments), p. 7.

38 SPD Staff Report, p. 71.

Company initiated, additional review is performed to identify if the ignition was caused by human failure. The 2023 GRC Enterprise Risk Model for Wildfire includes Operational Failure as a risk driver, using ignitions associated with PG&E workforce-caused outages. PG&E will continue to explore other ways to represent operational failures in the risk model.[39]

Second, PG&E updated the 2023 GRC Enterprise Risk Model for Wildfire drivers and sub-drivers to align with those presented in the 2021 WMP so that the information is consistent between the two regulatory filings.

Third, PG&E enhanced the substation drivers in the 2023 GRC Enterprise Risk Model for Wildfire. To capture the potential substation failures that could lead to an ignition, substation outages that could cause an ignition were incorporated into the model.

c) Weather

Parties recommended further delineation of weather conditions, for example by using wind speed. MGRA noted that PG&E's risk model should be updated and stated that effectively, risk is a function of the frequency and severity of weather events impacting the PG&E systems.[40] In response to this feedback, PG&E incorporated weather into its risk model. Weather and environmental conditions are included in the Wildfire Consequence Model from Technosylva fire simulations based on the worst weather days.

d) Public Safety Power Shutoff

PG&E describes PSPS modeling updates in Section D.1.c below.

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39 For example, PG&E has introduced a new data entry field as part of its Corrective Action Program to identify and track ignitions that are submitted by PG&E workforce.

40 MGRA Comments on the PG&E 2020 RAMP Report and the SPD Staff Evaluation Report, A.20-06-012 (Jan. 15, 2021), p. 10.

e) Additional Ignitions

PG&E is including more ignitions in its 2023 GRC Enterprise Risk Model for Wildfire than it included in the 2020 RAMP Report. The additional ignitions were identified through two audits: (1) an audit of other PG&E systems of record and (2) an audit resulting from a self-identified data omission regarding fire ignition data.[41] This update to the 2023 GRC Enterprise Risk Model for Wildfire was initiated by PG&E.

f) Power Law Distribution

SPD and Cal Advocates recommended that PG&E consider using a power law[42] distribution to characterize wildfire consequence distribution.[43] PG&E agreed with these recommendations and has incorporated power law into its consequence distribution.

g) Updates to PG&E's 2023 GRC Enterprise Risk Model (Now Referred to as the 2022 Enterprise Risk Model)

PG&E updated the risk model which supported its June 30, 2021 GRC submittal. The updated model is referred to as the 2022 Enterprise Risk Model. Updates to the risk model include:

- PG&E updated its enterprise risk model to include the impact from 2021 recorded work for all mitigations and the updated 2022-2026 forecast units for underground and overhead hardening programs, EPSS, and routine and EVM.[44]

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41 Letter from Lise Jordan, PG&E, to Nika Kjensli, CPUC, Regarding Self-Report Notification Update: Fire Ignition Report (Mar. 31, 2021).

42 "Power law" is a functional relationship between two quantities, where a relative change in one quantity results in a proportional relative change in the other quantity. See Wikipedia, at: <https://en.wikipedia.org/wiki/Power_law> (as of June 9, 2021).

43 See, SPD Staff Report, p. 17, ¶ 5; and, Opening Comments of the Public Advocates Office on PG&E's RAMP Application and the SPD's Report, A.20-06-012, (Jan. 15, 2021), p. 2.

44 Even though the 2023 GRC Enterprise Risk Model has been updated in certain instances to include 2021 recorded costs and revised 2022 forecast units, the cost tables in PG&E's testimony and workpapers still show 2021 forecast costs. PG&E will submit 2021 recorded costs to parties in March 2022.

- PG&E revised the way that the enterprise risk model applies the climate change multiplier. PG&E analyzed 2021 and historic fire data and determined that wildfire risk is increasing on non-Red Flag Warning (RFW)[45] days. Therefore, PG&E adjusted the enterprise risk model and is now applying the climate change multiplier to events that occur during both RFW and non-RFW days.
- PG&E incorporated the effect of 2021 mitigations, including system hardening and EVM, to each circuit segment and refreshed the designation of each circuit segment into the 25 HFTD Distribution tranches.

c. PSPS Consequence Modeling

1) Complying with WSD-002

The CPUC issued Resolution WSD-002[46] to give the electrical corporations regulated by the Commission guidance on their 2020 WMPs. In the decision on PG&E's 2020 GRC, the Commission required that in the next GRC (PG&E's 2023 GRC) PG&E must include testimony that shows or explains how its RSE calculation complies with Resolution WSD-002,[47] specifically the section of Resolution WSD-002 that states:

> RSE is not an appropriate tool for justifying the use of PSPS. When calculating RSE for PSPS, electrical corporations generally assume 100 percent wildfire risk mitigation and very low implementation costs because societal costs and impact are not included. When calculated this way, PSPS will always rise to the top as a wildfire mitigation tool, but it will always fail to account for its true costs to customers. Therefore, electrical corporations shall not rely on RSE calculations as a tool to justify the use of PSPS.[48]

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45 The National Weather Service issues Red Flag Warnings to alert fire departments of the onset, or possible onset, of critical weather and dry conditions that could lead to rapid or dramatic increases in wildfire activity. www.fire.ca.gov/programs/communications/red-flag-warnings-fire-weather-watches/.

46 Res. WSD-002 (June 11, 2020).

47 D.20-12-005, p. 327.

48 Res. WSD-002 (June 11, 2020), Appendix A, p. A-1.

PG&E will not calculate an RSE for the benefits of PSPS as a mitigation to the Wildfire risk per Resolution WSD-002.

2) Complying with the CPUC Ruling Requiring Updated Analysis of PSPS

On June 3, 2021 the CPUC ruled on the joint motion filed by the Public Advocates Office and FEITA Bureau of Excellence (the Joint Motion)[49] requesting that PG&E be required to analyze and address concerns regarding is PSPS program.[50] Specifically, the Joint Motion requested that PG&E should analyze the full safety, health and financial consequences of PSPS on its customers. The CPUC denied the Joint Motion but found it appropriate for PG&E to provide testimony in this GRC concerning updated risk analysis of the estimated consequences of initiating PSPS events and that the testimony must contain analysis and discussion of the consequences of PSPS for customers and how PG&E analyzes those consequences.

In response to party feedback and the Administrative Law Judge's (ALJ) ruling on the Joint Motion, PG&E describes in this section its updated analysis of the consequences of PSPS. PSPS is divided into three components: (1) the frequency of a PSPS event, (2) the scope of the event or customers impacted, and (3) the duration of the customer impact.

The frequency of PSPS is represented as the LoRE. In the 2020 RAMP Report, PG&E estimated 5.4 PSPS events based on PG&E's 2019 PSPS protocols. To estimate the frequency of a PSPS event for the 2023 GRC Enterprise Risk Model, PG&E used a 10-year historical review based on PG&E's 2020 PSPS protocols and estimated the number of expected events that would have occurred between 2010 to 2019. The historical review estimated

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49 A.20-06-012, *ALJ Lirag E-Mail Ruling Denying Joint Motion by Cal Advocates and FEITA* (June 3, 2021).

50 Joint Motion of the Public Advocates Office and FEITA Bureau of Excellence, LLC, A.20-06-012 (Mar. 30, 2021).

that there would have been 29 events over the 10 years,[51] roughly 2.9 events per year. In addition, given the uncertainty around the borderline weather events PG&E estimates 1 extra event per year, totaling a LoRE of 3.9.[52]

As part of the February 2022 GRC update, PG&E incorporated the historical lookback from 2010-2021 based off the 2021 PSPS protocols. Given the variability in weather events and the number of PSPS events customers have seen in more recent years, PG&E focused its representation of PSPS on the last 4 years, 2018-2021. The historical review estimated that there were 19 events over the 2018-2021, roughly 4.75 events per year. This represents an increase in the number events than was originally forecast.

The PSPS scope and duration is represented as the Consequence of a Risk Event. PG&E also uses the 10-year historical lookback based on PG&E's 2020 PSPS Protocols to estimate the number of customers impacted and the average duration of each event to develop its reliability consequence distribution. Based on the number of customers impacted by each event, PG&E evaluated the safety, reliability and financial consequences.

Safety consequences are evaluated based on equivalent fatalities. In the 2020 RAMP Report, PG&E only included PG&E's historical PSPS events in the PSPS safety consequence analysis. When evaluating the safety consequence, PG&E did not identify any serious injury or fatalities associated with PG&E's historical PSPS events, so there were no safety consequences for PSPS in the 2020 RAMP Report. The safety risk to customers has been mitigated by customer notifications and education on PSPS events.

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51 Variations in the number of events due to potential overlapping weather events being combined.

52 PG&E has recently modified its 2021 WMP to reflect an estimate of five PSPS events per year. The forecast in this GRC is based on three events plus one additional borderline event. (see Ch. 4.2, Section C.1). See PG&E's 2021 Wildfire Mitigation Plan Report, R.18-10-007 (Feb. 5, 2021).

For the 2023 GRC Enterprise Risk Model, PG&E used both PG&E's historical PSPS events data and the data from large-scale unplanned outages across the United States to represent safety. The unplanned outages data PG&E used include the 2003 Northeast Blackout, 2011 Southwest Blackout, 2012 Superstorm Sandy, 2017 Hurricane Irma, and the 2012 Derecho Windstorms. The unplanned outage events do not provide customers with notification of upcoming de-energization, and therefore, are not comparable to PG&E's PSPS events, which are preceded by extensive customer notifications and involve numerous mitigation steps. However, to be responsive to party comments, in the 2023 GRC Enterprise Risk Model, PG&E combines the data of planned PSPS outages with the unplanned outages across the industry to provide an illustration of potential safety consequence for our customers. A review of this data should keep in mind the differences between planned PSPS outages and unplanned outages.

The reliability consequences are based on customer minutes interrupted. To estimate this impact, PG&E used historical PSPS events. PG&E updated the 2023 GRC Enterprise Risk Model to include 2020 PSPS events.

Financial consequences to customers are represented by estimated ratepayer costs for a PSPS event. In the 2020 RAMP Report, PG&E did not include any financial consequences. For the 2023 GRC Enterprise Risk Model, PG&E added the financial costs of executing PSPS to the financial consequence.

While PG&E added both safety and financial consequences to the 2023 Enterprise Risk Model, and updated additional data from the 2020 RAMP Report, the reliability consequence is still the predominant component of the overall consequence of PSPS.

After incorporating updated data and additional consequences, PG&E calculated an RSE for its PSPS Impact Reduction Initiative

(referred to as WLDFR-M006 mitigations) so it could be assessed against other Wildfire initiatives.[53]

EO is also undertaking more comprehensive and granular risk analysis and modelling at the circuit level to help prioritize mitigation activities at targeted locations. The output from this circuit-level PSPS consequence analysis will help PG&E target PSPS impact reduction programs to locations that may experience a high frequency of PSPS events or where a PSPS event would have considerable customer impact.

d. Aligning the GRC Wildfire Risk Modeling to the Wildfire Mitigation Plan

PG&E submitted its 2021 WMP on February 5, 2021 and its 2022 WMP on February 25, 2022. The 2021 WMP details PG&E's plans for mitigating wildfire risk, with a focus on work planned for 2021. The 2022 WMP details PG&E's plans for mitigating wildfire risk, with a focus on work planned for 2022. PG&E has incorporated many of the improvements it made to the 2021 WDRM into the 2023 GRC Enterprise Risk Model for Wildfire. It is also including in the GRC forecast many of the mitigation programs described in the WMPs. There are, however, certain elements in PG&E's 2023 GRC Wildfire risk analysis that do not align to the WMPs for the reasons noted below.

1) There is a difference in the forecast periods covered by the 2023 GRC and 2021 WMP and 2022 WMP. The GRC covers the expense forecast for 2023 and the capital forecasts for 2021-2026 whereas the 2021 WMP period includes capital and expense estimates for 2021-2022 and the 2022 WMP period includes capital and expense estimates for 2022-2023.
2) The GRC does not include mitigation or control programs related to transmission assets, whereas the WMP does.

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53 Other PSPS impact reduction initiatives, such as those that are related to Electric Transmission, are not discussed in the GRC. Please refer to PG&E's annual WMP to review for more information about how PG&E is mitigating the impact of PSPS. PG&E's 2021 Wildfire Mitigation Plan Report, R.18-10-007 (Feb. 5, 2021).

3) GRC controls and mitigations are aligned to how PG&E views its programs. PG&E's forecasts and recorded costs are aligned accordingly. The WMP initiatives are prescribed by the Office of Energy Infrastructure Safety (Energy Safety); the forecast and recorded costs, when aligned to the WMP initiatives, may not line up with the way the program is tracked and managed by PG&E. This difference between GRC and WMP programs and costs can also impact the RSE calculations.

PG&E uses the same enterprise risk model for both the February 25, 2022 GRC update and the 2022 WMP. This model is referred to as the 2022 Enterprise Risk Model. Using the same model ensures consistency between the updated February 2022 GRC and the 2022 WMP.

e. Comparing RSEs from the 2020 RAMP Report to the 2023 GRC

Table 3-4 below lists the mitigations that PG&E included in its 2020 RAMP Report and that are also included in the 2023 GRC. The table shows the RSE from the 2020 RAMP Report compared to the June 30, 2023 GRC filing and the February 25, 2022 update.[54] Following the table, PG&E describes reasons that RSEs for mitigations have changed significantly between the time they were calculated for the 2020 RAMP Report for the GRC.

[54] Certain RSEs that are not associated with the February 25, 2022 GRC update changed since PG&E filed its June 30, 2021 testimony and/or November 5, 2021 errata. These updated RSEs are shown in Tables 3-4 (Wildfire), Table 3-5 (Failure of Electric) Distribution Overhead Assets), Table 3-6, (Failures of Electric Distribution Network Assets), and Table 3-7 (Emergency Preparedness and Response) in the "2023 GRC RSE Feb. 25, 2022 Update" column and in the workpapers supporting this chapter. The February 25, 2022 updated RSEs are not also shown in the individual Exhibit (PG&E-4) testimony chapters (see for example Line 5 in Table 3-4) but will be updated in a future errata.

TABLE 3-4
WILDFIRE
COMPARING MITIGATION RSES IN THE 2020 RAMP REPORT AND THE 2023 GRC

Line No.	Mitigation No.	Mitigation Name (2023 GRC)	2020 RAMP RSE[a]	2023 GRC RSE Nov. 5, 2021 Errata	2023 GRC RSE Feb. 25, 2022 Update
1	WLDFR-M001[o]	Enhanced Vegetation Management	2.7[b]	3.9 [b]	14.5
2	WLDFR-M002	System Hardening Overhead	7.8 [b],[c]	6.2[b]	5.9[n]
3	WLDFR-M002	System Hardening Underground	5.0[c]	4.5[b]	5.4[n]
4	WLDFR-M003	Non-Exempt Surge Arrester Replacement	[d]	0.1	0.1
5	WLDFR-M004	Expulsion Fuse Replacement	1.0[b]	3.6	3.8
6	WLDFR-M005	PSPS Event	15.0[e]	(h)	(h)
7	WLDFR-M006	PSPS Program	(e)	(h) (m)	(h) (m)
8	–	–	–	–	–
9	WLDFR-M006	PSPS Impact Reduction Initiatives – Sectionalizer Device Install/Replace	–	12.3	12.1
10	WLDFR-M007	Situational Awareness and Forecasting Initiatives (SA&FI)	(f)	(g)	(g)
11	WLDFR-M07A	SA&FI - Line Sensors	–	17.6	17.9
12	WLDFR-M07B	SA&FI – Weather Stations	–	(f)	(f)
13	WLDFR-M07C	SA&FI – Wildfire Safety Operations Center (WSOC)	–	(f)	(f)
14	WLDFR-M07D	SA&FI – Cameras	–	19.5	19.5
15	WLDFR-M07E	SA&FI – Satellite Fire Detection	–	154.7	160.9
16	WLDFR-M07F	SA&FI – Sensor IQ	–	(f)	(f)
17	WLDFR-M07G	SA&FI – Partial Voltage Detection	–	283.0	291.4
18	WLDFR-M07H	SA&FI – SOPP Improvements	–	(f)	(f)
19	WLDFR-M07I	SA&FI – Advance Fire Modeling	–	(f)	(f)
20	WLDFR-M07J	SA&FI – Meteorology	–	(f)	(f)
21	WLDFR-M07K	SA&FI - Fire Potential Index	–	(f)	(f)
22	WLDFR-M008	Safety and Infrastructure Protection Team (SIPT)	(f)	1.0[k]	1.0
23	WLDFR-M009	Community Wildfire Safety Program PMO	(f)	(f)	(f)
24	WLDFR-M010	Additional System Automation and Protection	(f)	(i)	(f)

TABLE 3-4
WILDFIRE
COMPARING MITIGATION RSES IN THE 2020 RAMP AND 2023 GRC
(CONTINUED)

Line No.	Mitigation No.	Mitigation Name (2023 GRC)	2020 RAMP RSE[(a)]	2023 GRC RSE Nov. 5, 2021 Errata	2023 GRC RSE Feb. 25, 2022 Update
25	WLDFR-M10B	Additional System Automation and Protection – FuseSaver	–	19.4	18.9
26	WLDFR-M10C	Additional System Automation and Protection – REFCL	–	23.0	23.1
27	WLDFR-M011	SA&FI -EFD	–	71.0	71.5
28	WLDFR-M012	SA&FI -DFA	–	[(l)]	
29	WLDFR-M017	System Hardening - Remote Grid	17.8[(b),(j)]	32.2	32.8
30	WLDFR-M019	Enhanced Power Line Safety Settings	–	–	105.7

(a) See PG&E's 2020 RAMP Report, WP 3-2, lines 44-47. For the RSE for Remote Grid see PG&E's 2020 RAMP Report, p. 10-66.

(b) The RSE includes the risk reduction for both the Wildfire and Failure of Distribution Overhead Assets risks.

(c) PG&E did not calculate separate RSEs for System Hardening Overhead and System Hardening UG in the 2020 RAMP Report. PG&E presented separate RSEs for System Hardening Overhead and System Hardening UG during the post-RAMP filing scenario analysis meetings held with SPD and interested parties. http://pgera.azurewebsites.net/Regulation/ValidateDocAccess?docID=629535. See workbook tab called "SH RSE," workbook rows 13 and 14.

(d) PG&E assumed in its 2020 RAMP Report that work in this program would be complete before 2023 and, therefore, did not calculate an RSE.

(e) The RSE PG&E calculated in the 2020 RAMP for mitigation WLDFR-M005, PSPS, included the combined WLDFR-M005 (PSPS Event) and WLDFR-M006 (PSPS Impact Reduction Initiatives) mitigations.

(f) PG&E considers this a foundational mitigation and did not calculate an RSE.

(g) For this GRC, WLDFR-M007 was further divided into individual initiatives in order to analyze risk reduction at a more granular level.

(h) To comply with guidance from the Safety Policy Division (SPD), PG&E is not calculating an RSE for the Wildfire risk mitigation benefits of PSPS, per Resolution (Res.) WSD-002 (June 11, 2020), Appendix A, p. A-1. PSPS is discussed on Section D.1.c above.

(i) For GRC, Additional System Automation and Protection (WLDFR-M10) was divided into three individual initiatives in order to analyze risk reduction at a more granular level.

(j) See PG&E's 2020 RAMP Report Post-Filing Errata, line 37.

(k) The RSE shown represents only the elements of the SIPT program that can be quantified. Other elements of the SIPT program are considered foundational.

(l) The RSE for Situational Awareness and Forecasting Initiative – DFA (WLDFR-M012) is incorporated into the Situational Awareness and Forecasting Initiative – Line Sensors program (WLDFR-M07A) because the two devices work in tandem and the risk reduction is combined.

(m) PSPS Program elements are listed in Chapter 4.2.

(n) See discussion regarding system hardening RSEs in Section A.1 and Table 3-1 above.

(o) Referred to as WLDFR-M018: Modified EVM in the risk modeling workpapers (February 25, 2022 update).

Some of the variability in RSE scores is due to changes in the MAVF, RSE methodology, and Enterprise Risk Model as discussed in

PG&E's Enterprise Operational and Risk Management testimony,[55] in response to SPD and party feedback on PG&E's 2020 RAMP Report,[56] and due to updates to the enterprise risk model.[57] Other changes to the RSEs are described below.

System Hardening (WLDFR-M002)

- Overhead: The change in RSE between the 2020 RAMP Report and the June 30, 2021 GRC filing is due to the addition of the Present Value Rate of Return (PVRR) factor into the 2023 Enterprise Risk Model.[58] The change in RSE between the June 30, 2021 GRC filing and the February 25, 2022 update is based on the forecast change in unit costs.
- Underground: The change in RSE between the 2020 RAMP Report and the June 30, 2021 GRC filing is due to the model accounting for decreasing the incremental Operations and Maintenance costs due to undergrounding as compared to overhead lines. The change in RSE between the June 30, 2021 GRC filing and the February 25, 2022 update is based on the forecast change in unit costs.

System Hardening – Remote Grid (WLDFR-M011)

Since filing the 2020 RAMP Report, PG&E has better estimates of the cost of the program. Despite the higher cost of the program, PG&E also shifted the focus of the remote grid locations to the high-risk miles as identified through the system hardening program, providing higher risk reduction per project.

Safety and Infrastructure Protection Team (WLDFR-M008)

In the 2020 RAMP Report, PG&E considered this a foundational activity and did not calculate an RSE for it. Since filing the 2020 RAMP Report PG&E has identified quantifiable data and is now able to analyze some of the risk reduction related to the SIPT Program. Some elements

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55 See Exhibit (PG&E-2), Ch. 1, Section E.5.

56 See Exhibit (PG&E-2), WP 1-12.

57 See Section D.2.g.

58 See Exhibit (PG&E-2), Ch. 1, Section E.5.

of the SIPT Program are still considered foundational and cannot be quantified.

Enhanced Vegetation Management (WLDFR-M001)

The change in RSE between the June 30, 2021 GRC filing and the February 25, 2022 update is due to a change in the scope of work focused on higher risk reduction for dollar spent.

2. Failure of Electric Distribution Overhead Assets

This section has been modified to reflect risk modeling updates due to changes in PG&E's integrated wildfire mitigation strategy as of February 25, 2022.

a. Risk Overview

Failure of Electric Distribution Overhead Assets was identified as a RAMP risk in PG&E's 2020 RAMP Report.

The Failure of DOH Assets risk is defined as failure of electric distribution overhead assets or lack of remote operational functionality that may result in public or employee safety issues, property damage, environmental damage, or inability to deliver energy. The drivers for this risk event are: Distribution Line Equipment Failure; Other; Vegetation; Seismic Scenario; Animal; Natural Hazard; Other PG&E Assets or Processes; Human Performance; Physical Attack; Skilled and Qualified Workforce; and Records and Information Management. The cross-cutting factors Information Technology Asset Failure, Climate Change, and EP&R also impact this risk.[59]

Exposure to this risk is based on the 80,715 circuit miles of primary overhead distribution lines in PG&E's electric system. The 2023 GRC Enterprise risk model estimates approximately 24,852 risk events (outages) each year. The Distribution Line Equipment Failure and Vegetation drivers together account for 55 percent of the risk events. The Other driver accounts for 30 percent of the risk events. The mitigations PG&E is forecasting in this GRC are designed to address these key risk drivers.

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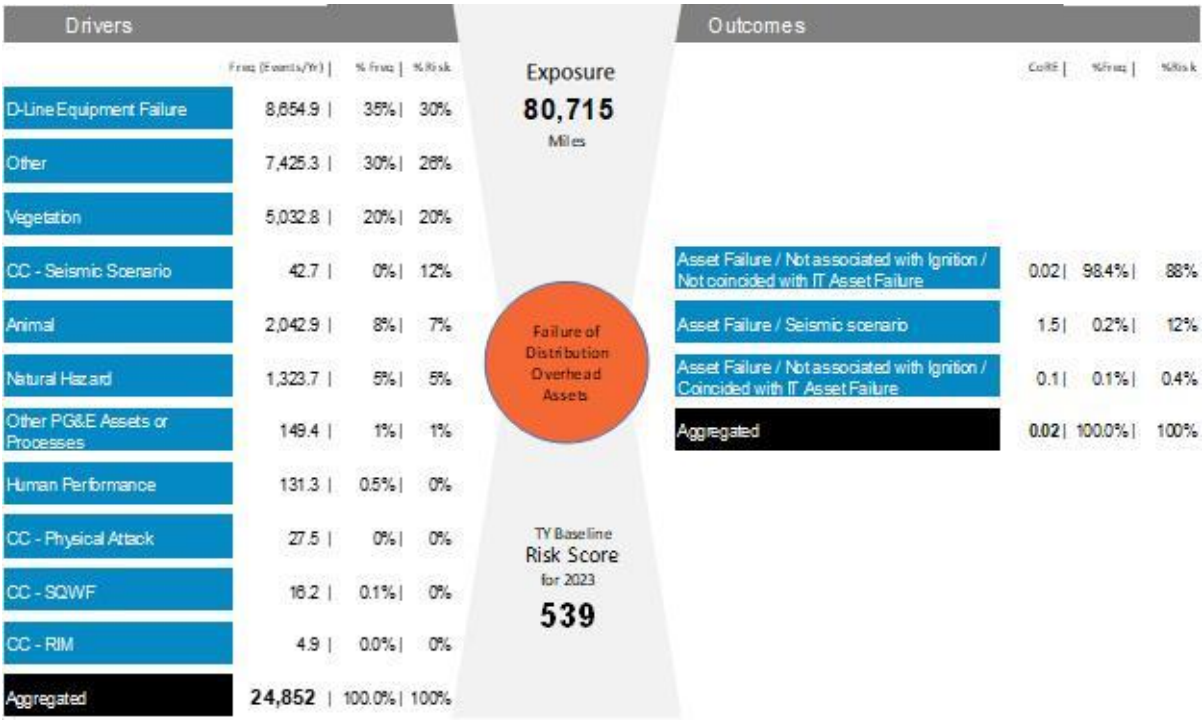
59 See Exhibit (PG&E-2), Ch. 1, Attachment B.

In terms of consequence, asset failures not coincident with IT Asset Failure account for 98 percent of the risk events and 88 percent of the risk score. Asset failures associated with seismic events account for less than 1 percent of the risk events but 12 percent of the risk score. The risk of ignitions associated with asset failures is modeled as part of the Wildfire risk rather than the Failure of DOH Assets risk.

PG&E identified six tranches for this risk event: one tranche for HFTD areas; two tranches for groups of circuits with issues historically identified as carrying an increased risk for asset failure; and three tranches based on circuits' reliability performance. The highest tranche-level risk is associated with circuits in HFTD areas (39 percent of the risk) and circuits with poor reliability performance (31 percent of the risk).

The 2023 TY baseline risk score presented in the 2020 RAMP Report was 525 and the 2026 post mitigation risk score was 500. The 2023 TY baseline risk score and the 2026 post mitigation risk scores updated for the GRC are 539 and 496 respectively. The change in risk score is due to including 2020 data in the risk assessment.

FIGURE 3-4
FAILURE OF DISTRIBUTION OVERHEAD ASSETS
BOW-TIE ILLUSTRATION



PG&E proposed a suite of mitigations and controls in the 2020 RAMP Report. Tables 3A-3 and 3A-4 in Attachment A list the mitigations and controls included in the 2020 RAMP Report, those that have been removed from the portfolio, and those forecast in this GRC.

PG&E's risk models and accompanying source data are available upon request.

1) February 25, 2022 Update

As discussed in Section A.1 above, PG&E implemented its EPSS program in July 2021 as part of its integrated wildfire risk management strategy. At the end of 2021, PG&E had implemented EPSS on approximately 45 percent of the HFTD distribution circuit miles and plans to expand EPSS to the remainder of the HFTD distribution circuit miles in 2022. PG&E recognizes that while EPSS provides significant wildfire risk reduction, it also impacts reliability resulting in customer outages.

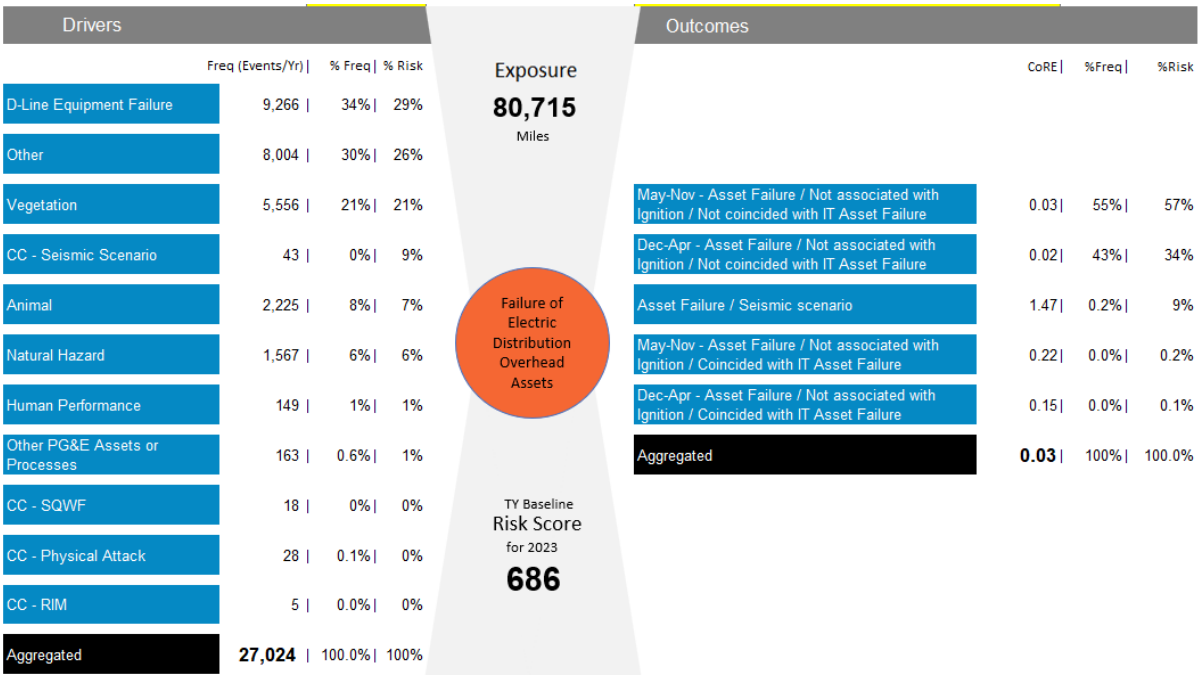
PG&E incorporated the impacts of EPSS into the Failure of Electric Distribution Overhead Assets risk model to analyze the

impacts of EPSS events and the consequences of those events. The model compared data from August through December of 2021 (during which time EPSS was activated) to historical data from 2015-2020 – before PG&E implemented the EPSS program.

The risk modeling PG&E conducted is preliminary in nature: only limited EPSS data is available since the program was initiated in July 2021; EPSS has been implemented on less than half the HFTD distribution circuit miles; and PG&E continues to refine EPSS settings as it gains experience with the program. More data, wider program execution, and changes to system settings will, over time, change the risk reduction and the program's reliability impacts.

When EPSS is incorporated into the model, the 2023 TY baseline risk is 686 and the 2026 post mitigation risk score is 614. The 2023 TY baseline risk score and the 2026 post mitigation risk scores excluding EPSS are 539 and 496 respectively. Figure 3-4.1 below shows the Failure of Electric Distribution Overhead Assets bowtie updated to include the impacts from the preliminary EPSS analysis, separating outcomes for May-November because that is the timeframe during which EPSS is more likely to be activated and have an adverse impact on reliability.

FIGURE 3-4.1
FAILURE OF DISTRIBUTION OVERHEAD ASSETS
BOW-TIE ILLUSTRATION



b. Responding to Feedback on PG&E's 2020 RAMP Report

Below PG&E addresses comments from SPD and parties that resulted in a change to the 2020 Enterprise RAMP risk model or other changes in the 2023 GRC. PG&E appreciates SPD feedback and, as shown in supporting workpapers, agrees with many of the comments and recommendations received. A listing of the feedback and PG&E's response to each item is provided in workpapers.[60]

SPD recommended that PG&E provide increased granularity and more RSE calculations to provide the Commission, SPD and other interested parties sufficient information to evaluate PG&E's GRC proposals.[61] PG&E agrees with these recommendations and has made changes based on this feedback in this GRC.

- SPD recommended that PG&E include risk analysis based on outage and wire-down data, including whether that latter is

60 Exhibit (PG&E-2), WP 1-12.

61 PG&E Opening Comments, A.20-06-012 (Jan. 15, 2021), p. 2.

energized versus non-energized.[62] PG&E agrees with SPD's concern and, in response, PG&E is evaluating adding additional tranches based on areas with elevated public safety risk. In the interim, PG&E has added one tranche to its Failure of Electric DOH risk analysis.

- In the 2020 RAMP Report, PG&E provided RSEs for 6 mitigations and 1 control whereas in this GRC, PG&E is providing RSEs for 13 mitigations and 15 controls.

SPD also recommended that PG&E more accurately identify the causes of undetermined outages in the "other" risk driver category.[63] PG&E agrees that "other" is not an ideal risk driver category and has included Additional Asset Data Capture (DOVHD-M005) as a mitigation to address this gap. This mitigation consists of various efforts to improve PG&E's ability to capture information about the location and cause of outages, and about the reasons for equipment failures.

1) Changes in Mitigations and Controls

PG&E described its plans for managing the Failure of Electric Distribution Overhead Assets risk in Chapter 11 of its 2020 RAMP Report. PG&E has not modified its mitigations since filing the 2020 RAMP Report. However, PG&E added two controls:

- DOVHD-C09A – Overloaded Transformers Replacement; and
- DOVHD-C014 – Additional System Automation and Protection – FuseSaver

Forecast mitigations and controls are discussed in the following Chapters in this exhibit.

<u>Mitigations</u>

- Chapter 3 – Two mitigations are described in Section D.5 below
- Chapter 4.1 – Wildfire Risk Mitigations – Situational Awareness and Forecasting
- Chapter 4.3 – Wildfire Risk Mitigations – System Hardening, Enhanced Automation, and PSPS Impact Mitigations

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62 SPD Staff Report, p. 145.

63 SPD Staff Report, p. 83.

- Chapter 4.6 – Enhanced Powerline Safety Settings
- Chapter 9 – Vegetation Management
- Chapter 11 – Overhead and Underground Electric Distribution Maintenance

Controls

- Chapter 9 – Vegetation Management
- Chapter 10 – Overhead and Underground Electric Distribution Inspections
- Chapter 11 – Overhead and Underground Electric Distribution Maintenance
- Chapter 12 – Pole Asset Management
- Chapter 13 – Overhead and Underground Asset Management and Reliability
- Chapter 16 – Distribution Automation and System Protection
- Chapter 17 – Electric Distribution Capacity, Engineering, and Planning

2) Updates to PG&E's 2020 RAMP Enterprise Risk Model

For the 2023 GRC, PG&E updated its 2020 RAMP Enterprise Risk Model. Since filing its 2020 RAMP Report, PG&E updated its 2023 GRC Enterprise Risk Model for the Failure of Electric Distribution Overhead Assets risk to address SPD and party feedback by adding an additional HFTD tranche. In addition, PG&E is pursuing development of more granular tranching based on areas with elevated public safety risk such as wire down energized lines. These areas may include major transportation infrastructure, public assembly areas, and public safety entities.

c. Comparing RSEs from the 2020 RAMP Report to the 2023 GRC

Table 3-5 below lists the mitigations and pilot control that PG&E included in its 2020 RAMP Report and that are included in the 2023 GRC. The table shows the RSE from the 2020 RAMP Report compared to the GRC RSE. PG&E describes the reasons that RSEs for mitigations and pilot control have changed significantly between the time they were calculated for the 2020 RAMP Report and for the GRC.

PG&E conducted a preliminary analysis to evaluate the impacts of EPSS on the Failure of Electric Distribution Overhead Assets risk. The output from this preliminary analysis included changes in the RSEs that are shown in Table 3-5.

TABLE 3-5
FAILURE OF ELECTRIC DISTRIBUTION OVERHEAD ASSETS
COMPARING MITIGATION AND CONTROL RSES IN THE 2020 RAMP AND 2023 GRC

Line No.	Mitigation No.	Mitigation Name (2023 GRC)	2020 RAMP RSE[a]	2023 GRC RSE Nov. 5, 2021 Errata	2023 GRC RSE Feb. 25, 2022 Update
1	DOVHD-M001	Enhanced Vegetation Management	(b)	(d)	(d)
2	DOVHD-M002	System Hardening	(b)	(d)	(d)
3	DOVHD-M003	Non-Exempt Surge Arrester Replacement	0.02	0.1	0.1
4	DOVHD-M004	Expulsion Fuse Replacement	(b)	(d)	(d)
5	DOVHD-M005	Additional Asset Data Capture	(c)	(c)	(c)
6	DOVHD-M006	Grasshopper and KPF Switch Replacement	3.69	7.9	12.3
7	DOVHD-M007	Regulated Output Streetlight Replacement	<0.01	<0.01	0
.38	DOVHD-M008	Ceramic Post Insulator Replacement	0.72	0.3	0.1
9	DOVHD-M009	Improved Distribution Risk Model	(c)	(c)	(c)
10	DOVHD-M010	3A and 4C Line Recloser Replacement	1.39 (e)	(f)	(f)
11	DOVHD-M011	System Hardening - Remote Grid	(b)	(d)	(d)
12	DOVHD-C005	Inspections – Distribution Overhead	0.37	85.0 (d)	(d)

(a) See PG&E's 2020 RAMP Report, WP 3-1, lines 17-21. The RSE for Enhanced Inspections is provided in PG&E's 2020 RAMP Report, p. 11-34.

(b) The costs for this work was aligned to the Wildfire risk in the RAMP Report and, therefore, the RSE is aligned to Wildfire and shown in Table 3.3 above.

(c) PG&E considers this a foundational mitigation and did not calculate an RSE.

(d) RSE represents the combined benefit of Wildfire and Failure of Distribution Overhead Asset.

(e) See PG&E's 2020 RAMP Report, Post-Filing Errata, line 8.

(f) PG&E calculated two RSEs for this mitigation:3A and 4C Line Recloser Replacement [3A], RSE 0.7; and, 3A and 4C Line Recloser Replacement [4C], RSE 2.0.

Some of the variability in RSE scores is due to changes in the MAVF, RSE methodology and Enterprise Risk Model and in response to SPD and party feedback on PG&E's 2020 RAMP Report.[64] Other changes to the RSEs are described below.

Non-Exempt Surge Arrester Replacement (WLDFR-M003)

The contribution to risk reduction in the Failure of Distribution Overhead Assets in the GRC remains consistent with the 2020 RAMP Report. The difference is due to the increased contribution to risk reduction for the Wildfire risk.

Grasshopper and KPF Switch Replacement (DOVHD-M006)

The change in RSE between the 2020 RAMP Report and the GRC is due to: a decrease in the unit cost for replacing switches; allocating more switches to a higher risk tranche in the GRC (in the 2020 RAMP Report more switches were allocated to the elevated wire down tranche and in the GRC more switches are allocated to the higher risk HFTD tranche); and prioritizing the replacement of switches with higher customer counts.

Inspections - Distribution Overhead (DOVHD-C005)[65]

The change in RSE is driven by the lowered unit costs[66] and the inclusion of risk reduction benefits of inspections as a control to Wildfire. In the 2020 RAMP Report PG&E did not include the benefits to Wildfire in the RSE calculation.

3. Failure of Electric Distribution Network Assets

a. Risk Overview

Failure of Electric Distribution Network Assets was identified as a RAMP risk in PG&E's 2020 RAMP Report.

The Failure of Electric Distribution Network Assets risk is defined as the failure of distribution network assets or lack of remote operation functionality that may result in public or employee safety issues,

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64 Exhibit (PG&E-2), WP 1-12.

65 This control was identified as C13 in PG&E's RAMP Report, A.20-06-032 (June 30, 2020), p. 11-16, line 25.

66 See MAT BFB, Exhibit (PG&E-4), WP 10-8, lines 15 and 18.

property damage, environmental damage, or inability to deliver energy. The drivers for this risk event are: Underground Network Equipment Failure; Human Performance; Skilled and Qualified Workforce; Seismic Scenario; Physical Attack; and Records and information Management. The cross-cutting factors EP&R, Climate Change, and Cyber Attack, also impact this risk.[67]

Exposure to this risk is based on the 188 circuit miles of networked circuits and 73 pieces of equipment targeted for replacement in downtown areas of San Francisco and Oakland. The risk model estimates approximately 15 risk events each year where network equipment fails resulting in an outage. Equipment failure, human performance, and the Skilled and Qualified Workforce cross-cutting factor together account for 99 percent of the risk events. Catastrophic asset failures (defined as failures that result in a vault explosion, manhole cover displacement, and/or a fire) unrelated to a seismic scenario account for 97 percent of the risk and 17 percent of the risk events; asset failures associated with a seismic scenario account for 1 percent of risk and 1 percent of the risk events. The mitigations PG&E is forecasting in this GRC are designed to address these key risk drivers.

PG&E identified six tranches for this risk event. Three tranches are based on differences in the network asset replacement strategy: circuits with a high failure rate that are a current priority for replacement; circuits where older network cable has already been replaced; and all other circuits. PG&E added three additional asset-specific tranches (CMD-type network protector, high-rise dry type transformers, and high-rise dry type network protectors) to provide more granularity for risk analysis.

The 2023 TY baseline risk score presented in the 2020 RAMP was 7 and the 2026 post mitigation risk score was 6. The 2023 TY baseline risk score and the 2026 post mitigation risk scores updated for the GRC are 17 and 13 respectively. This change in risk score is due to factoring

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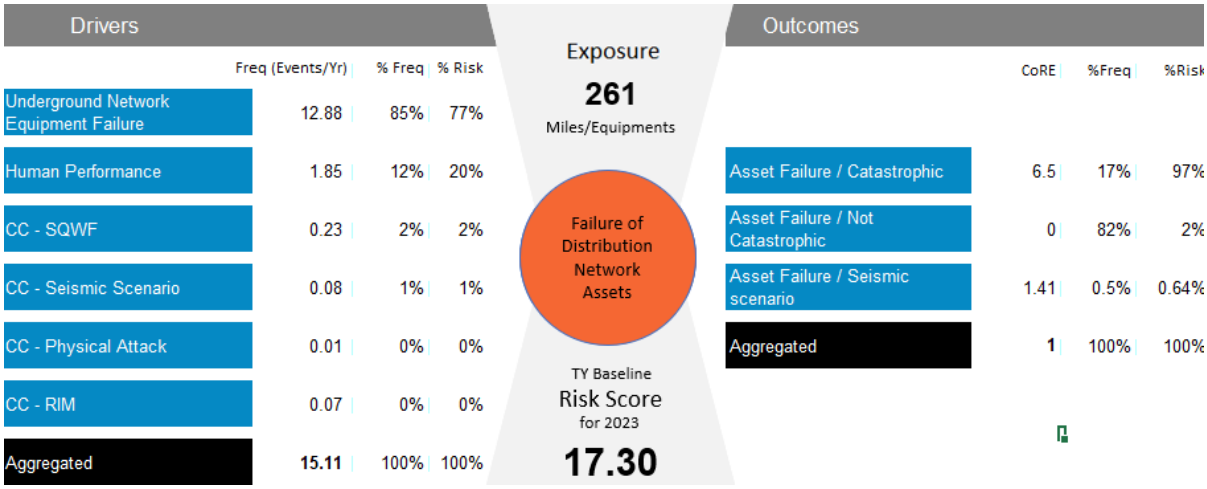
67 See Exhibit (PG&E-2), Ch. 1, Attachment B.

in the additional risk associated with the new CMD-type network protector, high-rise dry type transformer, and high-rise dry type network protector tranches. The change in risk score is also impacted by changes in frequency modeling. In the 2020 RAMP Report, PG&E used historical failure rates as the measure of frequency whereas in the GRC PG&E uses an expected estimated failure rate based on a failure curve.

FIGURE 3-5
FAILURE OF ELECTRIC UNDERGROUND NETWORK ASSETS
BOW-TIE ILLUSTRATION



Additional details about the risk model, mitigations and controls are in PG&E's 2020 RAMP Report.[68]

PG&E proposed a suite of mitigations and controls in the 2020 RAMP Report. Since the 2020 RAMP filing, the suite of mitigations has stayed the same but the control programs have changed. Tables 3A-5 and 3A-6 in Attachment A lists the mitigations and controls included in the 2020 RAMP Report, those that have been removed from the portfolio and those forecast in the GRC.

b. Responding to Feedback on PG&E's 2020 RAMP Report

On November 25, 2020, the SPD issued its Staff Evaluation Report on PG&E's 2020 RAMP Report (A.20-06-012). Subsequently on

68 PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 12.

January 15, 2021, other interested parties also provided feedback on PG&E's 2020 RAMP Report.

SPD's key recommendations were that PG&E provide increased granularity and more RSE calculations to provide the Commission, SPD and other interested parties sufficient information to evaluate PG&E's GRC proposals.[69] SPD found that the tranches in PG&E's risk model not only allowed for evaluation and assessment of the risks but also enabled prioritization of high failure rate secondary network assets to mitigate this high-risk tranche.[70] After filing the 2020 RAMP Report PG&E further refined its 2023 GRC Risk Model by adding three additional tranches.

In the 2020 RAMP Report, PG&E provided RSEs for 3 mitigations and no controls. In the GRC, PG&E has updated the 4 mitigation RSEs and is also providing RSEs for 4 controls.

PG&E lists the feedback received from SPD and parties' and PG&E's response to each in workpapers.[71]

1) Changes Mitigations and Controls

PG&E described its plans for managing the Failure of Electric Distribution Network Assets risk in its 2020 RAMP Report. PG&E has not modified its proposed mitigations. Controls C004 (Asset Information Improvements/Asset Data Comparison and Updates), C005 (Network Health Reports), and C006 (Standards, Processes and Training) were included in the 2020 RAMP Report but are not included in the 2023 GRC. PG&E determined that these controls did not reduce risk.

Information about the RAMP mitigations and controls is provided in Chapter 12 of PG&E's 2020 RAMP Report. Changes to PG&E's forecast mitigations and controls are discussed in Chapter 14, Network Asset Management, in this exhibit.

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69 PG&E's Opening Comments, A.20-06-012 (Jan. 15, 2021), p. 2.

70 SPD Staff Report, p. 91.

71 Exhibit (PG&E-2), WP 1-12.

2) Updates to PG&E's Risk Model

For the 2023 GRC PG&E updated its 2020 RAMP Enterprise Risk Model. PG&E changed its risk modeling approach by: (1) adding three new tranches; and (2) updating frequency data by estimating expected failure rate for some equipment based on failure curves and age. In addition, PG&E incorporated 2020 data into the risk model.

PG&E's risk models and accompanying source data are available upon request.

c. Comparing RSEs from the 2020 RAMP Report to the 2023 GRC

Table 3-6 below lists the mitigations that PG&E included in its 2020 RAMP Report and that are included in the 2023 GRC. The table shows the RSE from the 2020 RAMP Report compared to the GRC RSE. PG&E describes reasons that RSEs for mitigations have changed significantly between the time they were calculated for the 2020 RAMP Report and for the GRC.

TABLE 3-6
FAILURE OF ELECTRIC DISTRIBUTION NETWORK ASSETS
COMPARING MITIGATION RSEs IN THE 2020 RAMP AND 2023 GRC

Line No.	Mitigation No.	Mitigation Name (2023 GRC)	2020 RAMP RSE[(a)]	2023 GRC RSE Nov. 5, 2021 Errata	2023 GRC RSE Feb. 25, 2022 Update
1	DNTWK-M001	Network Component Replacements – Targeted Replacement of Oil-Filled Transformers in High-Rise Buildings	(b)	(b)	(b)
2	DNTWK-M002	Venting Manhole Cover Replacements	(b)	(b)	(b)
3	DNTWK-M003	Installation of SCADA Equipment for Safety Monitoring	(c)	(c)	(c)
4	DNTWK-M004	Incremental Primary Network Cable Replacements	0.07	0.05	0.1
5	DNTWK-M005	Network Component Replacements - Targeted Replacement of Dry-Type Transformers in High-Rise Buildings	<0.01	(d)	(d)
6	DNTWK-M006	Network Component Replacements - Targeted Replacement of CMD-Type Network Protectors	0.37	5.2	5.2

(a) See PG&E's 2020 RAMP Report, WP 3-1, lines 14-16.
(b) PG&E assumed in its 2020 RAMP Report that work in this program would be complete before 2023 and, therefore, did not calculate an RSE.
(c) PG&E considers this a foundational mitigation and did not calculate an RSE.
(d) PG&E calculated two RSEs for this mitigation: Network Component Replacements – High-Rise Dry-Type Transformers [Protector], RSE 5.6; and Network Component Replacements – High-Rise Dry-Type Transformers [Transformer], RSE 0.6. PG&E calculated separate RSEs in order to better understand the benefits of these specific asset replacement programs.

Some of the variability in RSE scores is due to changes in the MAVF, RSE methodology and Enterprise Risk Model and in response to SPD and party feedback on PG&E's 2020 RAMP Report.[72]

Changes in the RSEs are due to changes in frequency modeling on the additional tranches PG&E added to the 2023 Enterprise Risk Model that are discussed above.

4. Emergency Preparedness and Response

a. Cross-Cutting Factor Overview

The EP&R cross-cutting factor examines the drivers and consequences of inadequate planning or response to catastrophic emergencies. Inadequate emergency planning or response could have significant safety, reliability, and regulatory impacts. EP&R advances

72 Exhibit (PG&E-2), WP 1-12.

PG&E's response to emergencies by improving governance, strengthening coordination among LOBs, and improving collaboration with external partners such as the Federal Emergency Management Agency and the California Governor's Office of Emergency Services.

EP&R is a cross-cutting factor that is aligned to several risk events. PG&E provides a mapping of cross-cutting factors to risk events in Exhibit (GP&E-2), Chapter 1, Attachment B.

b. Responding to Feedback on PG&E's 2020 RAMP Report

Parties did not have any specific recommendations related to the EP&R cross-cutting factor.

1) Changes in Mitigations and Controls

PG&E described its plans for managing the EP&R risk in its 2020 RAMP Report. PG&E has modified its portfolio of controls and mitigations. In the 2020 RAMP Report, PG&E presented several individual mitigations and controls. In the GRC, PG&E is presenting a single mitigation that consists of many of the 2020 RAMP Report mitigations and a single control that includes both 2020 RAMP Report controls and new controls.

Starting in 2023, certain Wildfire controls transition to All Hazard controls aligned to EP&R. PG&E considers that this work controls several risks, not just Wildfire. For example, the WSOC (Chapter 4.2, Section C.1.a) is a Wildfire mitigation through 2022 and then becomes an all hazards center aligned to EP&R starting in 2023, where it will be referred to as the Hazard Awareness and Warning Center.

PG&E describes its EP&R mitigations and controls in Chapter 5 of this exhibit. A list of mitigations and controls is provided in Tables 3A-7 and 3A-8.

2) Updates to PG&E's 2020 RAMP Enterprise Risk Model

For the 2023 GRC PG&E updated its 2020 RAMP Enterprise Risk Model. Since filing the 2020 RAMP Report, PG&E updated its 2023 GRC Enterprise Risk Model for EP&R by refreshing the mapping of the EP&R benefits to risk outcomes. PG&E made

updates to the risk events on the Corporate Risk Register and the outcomes related to those risks. In response, EP&R refreshed its analysis and remapped the EP&R program to those updated outcomes. PG&E also incorporated 2020 data into the model.

PG&E's risk models and accompanying source data are available upon request.

c. Comparing RSEs from the 2020 RAMP Report to the 2023 GRC

In the 2020 RAMP Report PG&E calculated two RSEs for EP&R: one RSE for mitigations associated with Emergency Operations Center Enhancements and a second RSE for mitigations associated with Mutual Assistance. In this GRC, PG&E is forecasting one mitigation that consists of several programs.[73] Table 3-7 below compares the RSEs calculated in the 2020 RAMP Report to the GRC RSEs for those same programs.

TABLE 3-7
EMERGENCY PREPAREDNESS AND RESPONSE
COMPARING MITIGATION RSES IN THE 2020 RAMP AND 2023 GRC

Line No.	Mitigation No.	Mitigation Name (2023 GRC)	2020 RAMP RSE[(a)]	2023 GRC RSE Nov. 5, 2021 Errata	2023 GRC RSE Feb. 25, 2022 Update
1	EPNDR-M000	EP&R Mitigations – Emergency Operations Center Enhancements Program	440	308.2	307.8
2	EPNDR-M000	EP&R Mitigations – Mutual Aid Enhancements Program	14,918	21,346	21,343.9

(a) A.20-06-012, p. 20-AtchA-35, Tables 14 and 15.

5. Other Electric Distribution Risk Mitigations and Controls

a. Mitigations

In the 2020 RAMP Report, PG&E described the mitigations listed in Table 3-8 below and associated them with the Failure of DOH Assets

[73] See Exhibit (PG&E-4), Chapter 5, Table 5-3.

risk. Both mitigations are presented in this chapter because they apply to all distribution assets, not just the Failure of DOH Assets risk.

TABLE 3-8
MITIGATIONS THAT APPLY TO ALL ELECTRIC DISTRIBUTION ASSETS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	DOVHD-M005	Additional Asset Data Capture – Outage Information Reporting, Outage Cause, and Failure Analysis	This mitigation consists of various efforts to improve PG&E's ability to capture information about the location and cause of outages, and about the reasons for equipment failures. It may include facilitating asset data capture on mobile devices in the field or automatically, efforts to improve PG&E's outage database, and changes in standards and procedures to expand the amount of asset failure information gathered by field personnel. These improvements will facilitate PG&E's move towards a more data-driven, risk-based asset management strategy. PG&E considers this to be a foundational activity because it supports other controls and mitigations rather than directly reducing risk. As a result, PG&E is not calculating a risk reduction score or an RSE for this mitigation.	Foundational	Forecast included in Exhibit PG&E-4, Chapter 22 See WP 3-26	AB#
2	DOVHD-M009	Improved Distribution Risk Model	PG&E continues development of an improved distribution risk model that when fully implemented will provide a more risk-based framework for decisions about asset inspection, maintenance, and replacement of all overhead electric distribution assets. Each asset will receive a risk score, in line with the Multi-Attribute Value Function Framework, that considers the probability of failure (based on asset health factors) and the resulting consequences (based on the function and location of the assets). PG&E believes this risk-based approach will address drivers of asset failure more effectively than the traditional, compliance-based approach. In 2020 PG&E implemented the Conductor Failure Risk Model and Vegetation Risk Model that focus on two of the largest drivers of distribution overhead risk specifically focused on ignition risk for wildfire. PG&E will be continually evolving this improved model through at least 2026. PG&E considers this to be a foundational activity because it supports other controls and mitigations rather than directly reducing risk. As a result, PG&E is not calculating a risk reduction score or an RSE for this mitigation.	Foundational	Forecast included in Exhibit PG&E-4, Chapter 22 See WP 3-27	AB#

b. Controls

In the 2020 RAMP Report, PG&E presented two controls as part of the Human Resources (HR) LOB. Since the 2020 RAMP Report, PG&E has re-evaluated the controls and transferred the controls to Electric Operations. EO and HR will partner to deliver both trainings, as appropriate.

TABLE 3-9
CONTROLS MANAGED BY HUMAN RESOURCES AND ELECTRIC OPERATIONS

Line No.	Control Number	Control Name	Description	Risk Drivers Addressed	Additional Information
1	WLDFR-C016	Design Standards Training	This control relates to training on general standards that describe the proper application of equipment to ensure safe and reliable operation in high fire-threat areas.	Foundational	Forecast is included in Exhibit (PG&E-8), Chapter 5
2	WLDFR-C017	Operational Procedures Training	This control relates to training associated with work standards for high fire-threat areas.	Foundational	Forecast is included in Exhibit (PG&E-8), Chapter 5

Additionally, in the 2020 RAMP Report, PG&E presented three controls associated with the Third-Party Safety Incident Risk[74] that are executed by EO. These controls have not changed.

- TPTSI-C011 Design Pole Locations is part of work completed in pole design and estimating, tracked in Major Work Category (MWC) 07.
- TPTSI-C012 Visibility Strips on Electric Distribution Poles and Guy Markers is part of routine inspections, tracked in MWC BF.[75]
- TPTSI-C013 Anti-Climbing Guard Assemblies for Steel Towers is part of PG&E's transmission portfolio and is not discussed here.

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74 See Exhibit (PG&E-7), Ch. 1 for more information about this risk.

75 Costs for TPTSI-C011 and TPTSI-C012 are not tracked separately.

c. Cost Tables

Table 3-10 below shows the recorded and forecast costs for mitigations. Tables showing the GRC costs compared to the costs estimated in the 2020 RAMP Report are provided in workpapers.[76]

76 See Exhibit (PG&E-4), WP 3-20 to WP 3-24.

TABLE 3-10
FAILURE OF ELECTRIC DISTRIBUTION OVERHEAD ASSETS
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 –EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total	RSE
1	DOVHD-M005	Additional Asset Data Capture	AB#	–	–	$1,269	$1,297	$2,566	(a)
2	DOVHD-M009	Improved Distribution Risk Model	AB#	–	–	1,473	1,513	2,986	(a)
3		Total		–	–	$2,742	$2,810	$5,552	

(a) PG&E considers this a foundational mitigation and, as such, does not calculate an RSE for it.

E. Non-RAMP Risks

1. Failure of Electric Distribution Underground Assets Risk

a. Risk Overview

Failure of Electric Distribution UG Assets was not a 2020 RAMP risk.

The Failure of Electric Distribution UG Assets risk is defined as a failure of distribution UG assets or lack of remote operation functionality that may result in public or employee safety issues, property damage, environmental damage or an inability for PG&E to deliver power to its customers.

PG&E manages its UG distribution assets in its UG Asset Management Program. PG&E's UG assets include over 26,000 circuit miles of UG primary distribution cable. Most UG cable is installed in urban and suburban areas.

The scope of this risk includes a failure of assets associated with the UG electrical distribution system including primary and secondary UG cables, line equipment, and subsurface and pad-mount transformers.

PG&E models its exposure to the Failure of Electric Distribution UG Assets risk based on population density (high/low) and the following: primary and secondary cable circuit length, transformers, and line equipment – these categories equate to the eight asset categories shown in the bow-tie illustration (Figure 3-6 below). The risk model estimates approximately 2,312 outages, or risk events, each year. The model includes eight tranches: primary and secondary cable length (4 tranches); transformers (2 tranches); and, line equipment (2 tranches). The cross-cutting factors that impact the Failure of Electric Distribution UG risk are: Climate Change, Seismic, Information Technology Asset Failure, Cyber Attack, Physical Attack, Skilled & Qualified Workforce, Records and Information Management, and Emergency Preparedness & Response.[77]

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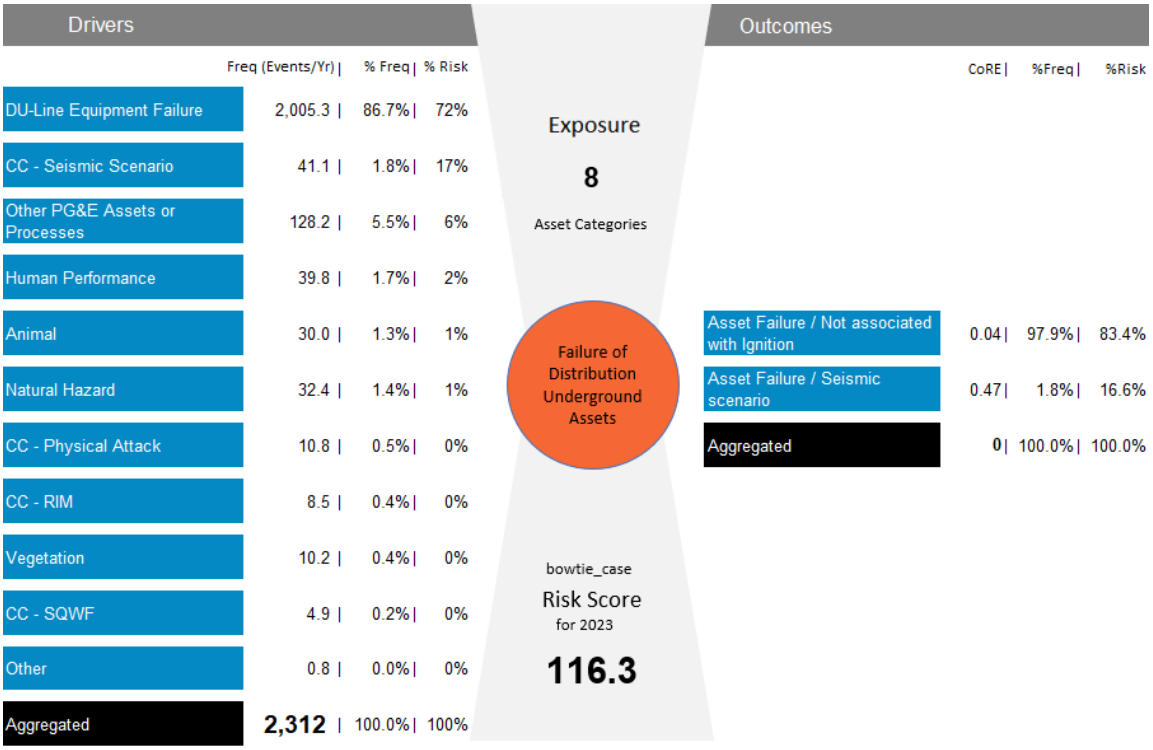
[77] Exhibit (PG&E-2), Ch. 1, Attachment B.

The risk drivers include: Distribution UG Line Equipment Failure; Seismic Scenario; Other PG&E Assets or Processes; Human Performance; Animal; Natural Hazard; Physical Attack; Records and Information Management; Skilled and Qualified Workforce; Vegetation and Other.

The 2023 TY baseline risk score for Failure of Electric Distribution UG Assets is 116 and the 2026 post mitigation risk score is 114.

FIGURE 3-6
FAILURE OF ELECTRIC UNDERGROUND ASSETS
BOW-TIE ILLUSTRATION



PG&E's risk models and accompanying source data are available upon request.

b. Risk Management – Mitigations and Controls

In this GRC, PG&E is proposing no mitigations and eight controls to manage this risk.[78] PG&E describes these mitigations and controls in the following chapters. A list of the controls is provided in Table 3A-11.

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78 See Exhibit (PG&E-4), WP 3-16 (DUNGD controls, expense); and, WP 3-17 (DUNGD controls, capital).

Controls

- Chapter 10 – Overhead and Underground Electric Distribution Inspections
- Chapter 11 – Overhead and Underground Electric Distribution Maintenance
- Chapter 13 – Overhead and Underground Asset Management

c. S-MAP Settlement Agreement, Step 3 Supplemental Analysis

PG&E has calculated RSEs for its mitigations for both RAMP and non-RAMP risks (excluding foundational mitigations). PG&E has also calculated RSEs for its controls for RAMP risks. To determine whether to calculate an RSE for non-RAMP risk controls, PG&E performed the "Step-3 Supplemental Analysis" (Step-3 Analysis) from the S-MAP Settlement Agreement.[79]

The Step-3 Analysis requires PG&E to calculate an RSE for any control: (1) that was not part of the 2020 RAMP Report; (2) that is for a program that PG&E justifies primarily on the basis of reducing a safety or reliability risk; and (3) that is for a program is associated with the Electric Distribution or Gas Distribution, Transmission or Storage Facilities.[80]

The Failure of Electric Distribution UG Assets risk is subject to the Step-3 Analysis. Based on the outcome of the analysis, PG&E is required to provide RSEs for the following control programs:

- DUNGD-C001: Underground Patrols and Inspections;
- DUNGD-C002: Underground Notifications;
- DUNGD-C003: Underground General Replacements;
- DUNGD-C06A: Primary Cable Replacement Program; and
- DUNGD-C007: LBOR Switch Replacement.

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79 D.18-12-014.

80 D.18-12-014, Appendix A, Row 28(1), p. A-14 to p. A-15.

The results of the Step-3 analysis, the recorded and forecast costs for control programs and the RSEs for control programs are included in workpapers.[81]

2. Failure of Electric Distribution Substation Assets Risk

a. Risk Overview

The Failure of Electric Distribution Substation Assets was not a 2020 RAMP risk.

Failure of Electric Distribution Substation Assets is defined as the failure of distribution substation assets or lack of remote operation functionality that may result in public or employee safety issues, property damage, environmental damage, or inability to deliver energy.

PG&E has 758 distribution substations, consisting of power transformers, circuit breakers, switchgears, protective relays, bus structures, voltage regulation equipment, disconnect switches, motor operated air switches, station batteries, battery energy storage systems, reactive equipment, and grounding systems. Each substation transforms high voltage electricity from PG&E's electric transmission system to lower voltage for delivery to PG&E's customers. Exposure to this risk is based on 21 total unique combinations in the categories of HFTD, criticality, and asset type. The 2023 GRC Enterprise risk model estimates approximately 66 substation outages each year. The substation model includes 21 tranches divided among asset types, HFTD, and criticality. The cross-cutting factors that impact the Failure of Electric Distribution Substation Assets risk are: Climate Change, Cyber Attack, EP&R, Physical Attack, Records and Information Management, Seismic, and Skilled and Qualified Workforce.[82]

The drivers of the Failure of Electric Distribution Substation risk are: Substation Equipment Failure; Animal; Human Performance; Other; Natural Hazard; Physical Attack; Skilled and Qualified Workforce;

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81 Exhibit (PG&E-4), WP 3-16 and 3-17 (recorded and forecast costs and RSEs for control programs); and, WP 3-26 (Step-3 Analysis).

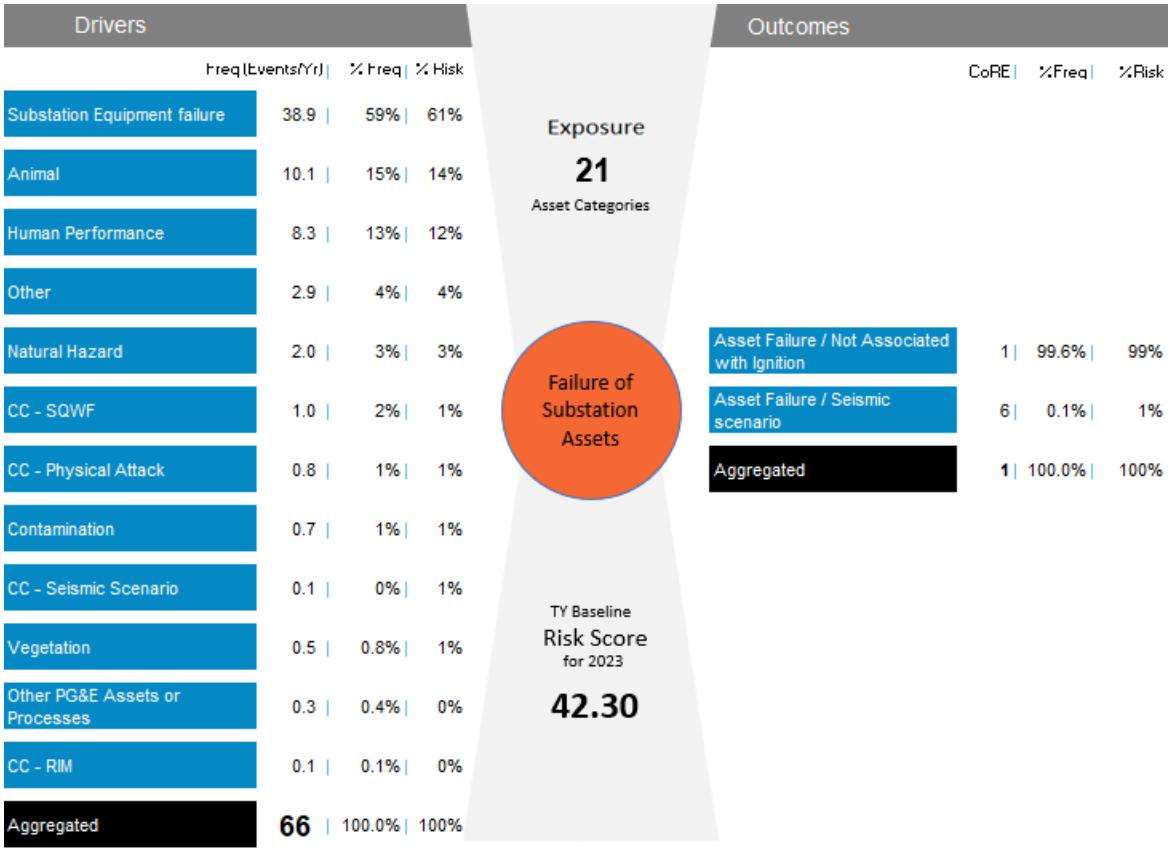
82 Exhibit (PG&E-2), Ch. 1, Attachment B.

Contamination; Seismic Scenario; Vegetation; and Other PG&E Assets or Processes.

Through the risk assessment process, one gap that PG&E identified in its risk modeling was that historical data does not fully articulate the level of risk based on condition and age of the existing infrastructure. PG&E will continue to look for opportunities to reflect the impacts of an aging infrastructure in future risk model iterations.

The 2023 TY baseline risk score for Failure of Electric Distribution Substation Assets is 42 and the 2026 post mitigation risk score is 38.

FIGURE 3-7
FAILURE OF ELECTRIC DISTRIBUTION SUBSTATION ASSETS
BOW-TIE ILLUSTRATION



PG&E's risk models and accompanying source data are available upon request.

b. Risk Management – Mitigations and Controls

While PG&E did not receive feedback from parties specifically on its Failure of Electric Distribution Substation Assets risk as part of the 2020 RAMP process, PG&E integrated some feedback received more broadly into this risk model. In response to feedback recommending more granular tranches in risk models, PG&E added an asset type tranche into the Distribution Substation risk model to capture the unique risk profiles of the various asset types within the risk. In addition, PG&E divided its substation risk model into two separate substation risk models – one for the Failure of Electric Transmission Substation Assets and one for the Failure of Electric Distribution Substation Assets – because the drivers, controls, mitigations, and consequences of these two risks are distinct.

In this GRC PG&E is proposing several mitigations and controls to manage this risk as shown in Attachment A, Tables 3A-9 and 3A-10. PG&E describes these mitigations and controls in Chapter 15 – Substation Asset Management and Maintenance.

c. S-MAP Settlement Agreement, Step 3 Supplemental Analysis

The Failure of Electric Distribution Substation Assets risk is subject to the Step-3 Analysis. Based on the outcome of the analysis, PG&E is required to provide RSEs for the following control programs:

- SBSTN-C003: Patrols and Inspections – Substation;
- SBSTN-C16D: Substation Proactive Asset Replacement – Circuit Breakers;
- SBSTN-C16F: Substation Proactive Asset Replacement – Switchgear;
- SBSTN-C16K: Substation Proactive Asset Replacement – Transformer; and
- SBSTN-C017: Substation Proactive Maintenance.

The results of the Step-3 analysis are included in workpapers along with the RSEs for these control programs.[83]

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83 Exhibit (PG&E-4), WP 3-13 to 3-15 (recorded and forecast costs and RSEs for mitigations and controls); and, WP 3-25 (Step-3 Analysis).

F. Additional Information Supporting PG&E's Electric Operations Risk Testimony

The workpapers associated with this chapter include the Electric Operations Risk Placemat.[84] The placemat is divided into mitigations and controls and shows where the costs for all the mitigations and controls PG&E is forecasting in this GRC is included in PG&E's testimony.

The forecast amounts shown on the placemat are the 2023-2026 costs used to calculate the RSE values. Additional workpapers in this chapter are provided that include the forecasts for each risk mitigation and control from 2020-2026.[85] While the recorded and forecast costs are provided in the Chapter 3 workpapers for completeness, the forecast chapter witnesses are responsible for those recorded and forecast costs.

PG&E's 2020 RAMP Report included estimated costs to implement the mitigations and one pilot control (Enhanced Inspections addressing the Failure of Electric Distribution Overhead Assets risk). Workpapers associated with this chapter compare the estimated costs from the 2020 RAMP Report for mitigations and the pilot control to the forecast costs for the mitigations and pilot control included in this GRC.[86]

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84 Exhibit (PG&E-4), WP 3-1.

85 Exhibit (PG&E-4), WP 3-2 to WP 3-19.

86 Exhibit (PG&E-4), WP 3-20 to WP 3-24.

G. Attachment A: Electric Operations Mitigations and Controls

The tables below list the mitigations and controls PG&E is forecasting in this GRC for each of the Electric Operations risk events and the cross-cutting factor. For the RAMP risks the tables also include the associated RAMP mitigation or control.

TABLE 3A-1
WILDFIRE MITIGATIONS

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	M1	Enhanced Vegetation Management	WLDFR-M001[(a)]	Enhanced Vegetation Management	9		IGJ
2	M2	System Hardening	WLDFR-M002	System Hardening[(b)]	4.3	08W	
3	M3	Non-Exempt Surge Arrester Replacement	WLDFR-M003	Non-Exempt Surge Arrester Replacement	11	2AR	
4	M4	Expulsion Fuse Replacement	WLDFR-M004	Expulsion Fuse Replacement	4.3	2AP	
5	M5	PSPS	WLDFR-M005	Public Safety Power Shutoff – PSPS Event Distribution	4.2		AB6
6	M6	PSPS Impact Reduction Initiatives	WLDFR-M006	EP&R Field Operations	4.2		AB6
7			WLDFR-M006	EP&R Field Ops Tech Expense	4.2		AB6
8			WLDFR-M006	CRC Preparedness	4.2	21A	AB6
9			WLDFR-M006	PSPS - EP&R Field Ops Tech Expense	4.2		AB6
10			WLDFR-M006	PSPS Collateral/Segment Creations Exp	4.2		AB6
11			WLDFR-M006	PSPS EP&R Field Ops Misc.	4.2		AB6
12			WLDFR-M006	PSPS Field Exercise Dist. Exp	4.2		AB6
13			WLDFR-M006	PSPS Increased Helicopter EU (Dist)	4.2		AB6
14			WLDFR-M006	PSPS PMO	4.2		AB6
15			WLDFR-M006	PSPS PMO Projects	4.2		AB6
16			WLDFR-M006	PSPS Pre-flights Expense	4.2		AB6
17			WLDFR-M006	Wildfire Public Engagement Team	4.2		AB6
18			WLDFR-M006	PSPS Field Ops Tech Capital	4.2	21A	
19			WLDFR-M006	EP&R Field Operations (Includes Tech, Training, and Other Misc)	4.2		AB6
20			WLDFR-M006	PSPS Reduction Initiatives - Sectionalizer Device Install/Replace	4.3	49H	
21			WLDFR-M006	PSPS Reduction Initiatives - Temporary Distribution Microgrids	4.3	49M	

TABLE 3A-1
WILDFIRE MITIGATIONS
(CONTINUED)

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
22			WLDFR-M006	Generation Enablement and Deployment PMO	4.3		AB#, IG#
23	M7	SA&FI	WLDFR-M07A	SA&FI – Line Sensors	4.3	49I	FZA, HG#
24			WLDFR-M07B	SA&FI – Weather Station	4.1	21A	AB6
25			WLDFR-M07C	SA&FI –WSOC	4.1	21A	AB6
26			WLDFR-M07D	SA&FI – Cameras	4.1		AB6
27			WLDFR-M07E	SA&FI – Satellite Fire Detection	4.1		AB6
28			WLDFR-M07F	SA&FI – Sensor IQ	4.3	21A	AB#
29			WLDFR-M07G	SA&FI – Partial Voltage Detection	4.1	21A	AB6
30			WLDFR-M07H	SA&FI – Storm Outage Prediction Project (SOPP) Improvements	4.1		AB6
31			WLDFR-M07I	SA&FI – Advance Fire Modeling	4.1	21A	AB6
32			WLDFR-M07J	SA&FI – Meteorology	4.1	21A	AB6
33			WLDFR-M07K	SA&FI – Fire Potential Index	4.1		AB6
34	M8	SIPT	WLDFR-M008	SIPT	4.2	21A	AB6
35	M9	CWSP PMO	WLDFR-M009	Community Wildfire Safety Program Project Management Office	4.4	21#	AB#
36	M10	Additional System Automation and Protection	WLDFR-M10A	Additional System Automation and Protection	4.3	49A	
37			WLDFR-M10B	Additional System Automation and Protection – FuseSaver	4.3	49T	

TABLE 3A-1
WILDFIRE MITIGATIONS
(CONTINUED)

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
38			WLDFR-M10C	Additional System Automation and Protection - REFCL	4.3	49R	
39			WLDFR-M011	Situational Awareness – Early Fault Detection (EFD)	4.3	49I	
40			WLDFR-M012	Situational Awareness – Distribution Fault Anticipation (DFA)	4.3	49I	
41			WLDFR-M013	Pole Programs – Replace Tree Attachments	12	07C	
42			WLDFR-M014	Butte County Rebuild	23	95F	
43	M11	Remote Grid (2020-2022)	WLDFR-M017	Alternative Mitigation – Remote Grid	4.3	08W	KAT, AB#
44			WLDFR-M020	Enhanced Power Line Safety Settings	4.6		Various

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(a) Referred to as WLDFR-M018: Modified EVM in the February 25, 2022 risk modeling workpapers.

(b) System Hardening 08W includes: System Hardening – Overhead, System Hardening Underground, and System Hardening – Butte County Rebuild.

TABLE 3A-2
WILDFIRE CONTROLS

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	C1	Patrols and Inspections – Distribution Overhead	WLDFR-C001	Patrols – Distribution Overhead	10		BFA
2			WLDFR-C01A	Inspections – Distribution Overhead	10		BFB
3			WLDFR-C01B	Infrared Inspections – Distribution Overhead	10		BFC
4			WLDFR-C01E	Inspections	10		BFH
5	C2	Patrols and Inspections – Transmission Overhead					
6	C3	Patrols and Inspections - Substations	WLDFR-C003	Proactive Maintenance	15		GCD
7	C4	Vegetation Management – Distribution Overhead	WLDFR-C004	Vegetation Management – Distribution Overhead	9		HN#, HNA
8			WLDFR-C04i	Incremental Routine Vegetation Management	9		HNA
9	C5	Vegetation Management – Transmission Overhead					
10	C6	Vegetation Management – Substation	WLDFR-C006	Vegetation Management – Substation	15		GCG
11	C7	Vegetation Management – Catastrophic Event Memorandum Account (CEMA)	WLDFR-C007	Vegetation Management – CEMA/Tree Mortality	9		IGI
12	C8	Equipment Maintenance and Replacement – Distribution Overhead	WLDFR-C008	Equipment Maintenance and Replacement – Distribution Overhead	11	2AA, 2AF	KAA, KAF, KAQ
13	C9	Equipment Maintenance and Replacement – Transmission Overhead					
14	C10	Equipment Maintenance and Replacement – Substation					

TABLE 3A-2
WILDFIRE CONTROLS
(CONTINUED)

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
15			WLDFR-C10A	Substation Proactive Asset Replacement – Ground Grid	15	48A	
16			WLDFR-C10C	Substation Proactive Asset Replacement - Batteries	15	48C	
17			WLDFR-C10D	Substation Proactive Asset Replacement – Circuit Breakers	15	48D	
18			WLDFR-C10E	Substation Proactive Asset Replacement – Switches	15	48E	
19			WLDFR-C10F	Substation Proactive Asset Replacement – Switchgear	15	48F	
20			WLDFR-C10H	Substation Proactive Asset Replacement – Line Support Work	15	48L	
21			WLDFR-C10I	Substation Proactive Asset Replacement – Insulators	15	48N	
22			WLDFR-C10K	Substation Proactive Asset Replacement – Transformer	15	54A	
23			WLDFR-C10M	Substation Security Enhancements	15	58S	
24							
25	C11	Animal Abatement	WLDFR-C011	Animal Abatement	11	2AB, 2AC	KAC, KAD
26	C12	Pole Programs					
27			WLDFR-C12A	Wood Pole Inspection Program	12		GAA
28			WLDFR-C12B	Pole Analyze Loading	12		GAC
29			WLDFR-C12C	Pole Replacement	12	07D	
30			WLDFR-C12D	Overloaded Pole Replacement	12	07O	

TABLE 3A-2
WILDFIRE CONTROLS
(CONTINUED)

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
31			WLDFR-C12E	Pole Programs – Pole Reinforcements	12		GAD
32	C13	Transmission Structure Maintenance and Replacement					
33	C14	System Automation and Protection					
34	C15	Reclose Blocking					
35	C16	Design Standards	WLDFR-C016	Design Standards Training	3		Tracked in HR
36	C17	Restoration, Operational Procedures, and Training	WLDFR-C017	Operational Procedures Training	3		Tracked in HR
37			WLDFR-C018	Fire Protection/Suppression Systems	15	58A	

TABLE 3A-3
FAILURE OF ELECTRIC DISTRIBUTION OVERHEAD ASSETS
MITIGATIONS

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	M1	Enhanced Vegetation Management	DOVHD-M001[(a)]	Enhanced Vegetation Management	9		IGJ
2	M2	System Hardening	DOVHD-M002	System Hardening	4.3	08W	
3	M3	Non-Exempt Surge Arrester Replacement	DOVHD-M003	Non-Exempt Surge Arrester Replacement	11	2AR	
4	M4	Expulsion Fuse Replacement	DOVHD-M004	Expulsion Fuse Replacement	4.3	2AP	
5	M5	Additional Asset Data Capture – Outage Information Reporting, Outage Cause, and Failure Analysis	DOVHD-M005	Additional Asset Data Captures	3		AB#
6	M6	Grasshopper/KPF Switch Replacement	DOVHD-M006	Grasshopper and KPF Switch Replacement	13	08S	
7	M7	Regulated Output Streetlight Replacement	DOVHD-M007	Regulated Output Streetlight Replacement	11	2AG	
8	M8	Ceramic Post Insulator Replacement	DOVHD-M008	Ceramic Post Insulator Replacement	11	2AQ	
9	M9	Improved Distribution Risk Model	DOVHD-M009	Improved Distribution Risk Model	3		AB#
10	M10	3A and 4C Line Recloser Controller Replacement	DOVHD-M010	3A and 4C Line Recloser Replacement	4.3, 13	49A, 49B	
11	M11	Remote Grid	DOVHD-M011	Remote Grid	4.3		AB#, KAT
12			DOVHD-M020	Enhanced Power Line Safety Settings	4.6		Various

TABLE 3A-4
FAILURE OF ELECTRIC DISTRIBUTION OVERHEAD ASSETS
CONTROLS

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	C1	Vegetation Management	DOVHD-C001	Vegetation Management	9		HN#, HNA
2			DOVHD-C04i	Incremental Routine Vegetation Management	9		HNA
3	C2	CEMA Vegetation Management	DOVHD-C002	Vegetation Management – CEMA/Tree Mortality	9		IGI
4	C3	Overhead Electric Distribution Preventive Maintenance	DOVHD-C003	Equipment Maintenance and Replacement – Distribution Overhead	11, 13	2AA, 2AB, 2AE, 2AF, 2AH, 2AI, 2AS, 49C	KAA, KAC, KAH, KAM, KAO, KAP, KAS
5	C4	Overhead Conductor Replacement	DOVHD-C004	Overhead Conductor Replacement	13	08J	
6	C5	Overhead Patrols and Inspections	DOVHD-C005	Inspections – Distribution Overhead	10		BFB
7	C6	Overhead Infrared Inspections	DOVHD-C006	Infrared Inspections – Distribution Overhead	10		BFC
8	C7	Supervisor Control and Data Acquisition	DOVHD-C007	Supervisory Control and Data Acquisition	16	09B, 09D, 09E, 09F	HX#, HXA
9	C8	Annual Protection Reviews	DOVHD-C008	Annual Protection Reviews	17		FZA
10	C9	Electric Distribution Line and Equipment Capacity					
11			DOVHD-C09A	Overloaded Transformers Replacement	17	06B	
12	C10	Design Standards					
13	C11	Pole Programs	DOVHD-C011	Pole Programs	11, 12	07D, 07O	GAA, GAD, GAF, GAH, KAC
14	C12	Targeted Circuits Program	DOVHD-C012	Targeted Reliability Programs	13	49X	
15			DOVHD-C013	Patrols – Distribution Overhead	10		BFA
16			DOVHD-C014	Additional Automation and System Protection – Fusesavers	13	49T	

(a) Referred to as WLDFR-M018: Modified EVM in the February 25, 2022 risk modeling workpapers.

TABLE 3A-5
FAILURE OF ELECTRIC DISTRIBUTION NETWORK ASSETS
MITIGATIONS

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	M1	Network Component Replacements – Targeted Replacement of Oil Filled Transformers in High-Rise Buildings	DNTWK-M001	Network Component Replacements - Targeted Replacement of Oil Filled Transformers in High-Rise Buildings	14	2CC	
2	M2	Venting Manhole Cover Replacements	DNTWK-M002	Venting Manhole Cover Replacements	14	2CD	
3	M3	Installation of SCADA Equipment for Safety Monitoring	DNTWK-M003	Installation of SCADA Equipment for Safety Monitoring	14	2CE	
4	M4	Incremental Primary Network Cable Replacements	DNTWK-M004	Incremental Primary Network Cable Replacements	14	56N	
5	M5	Network Component Replacements - Targeted Replacement of Dry-Type Transformers in High-Rise Buildings	DNTWK-M005	Network Component Replacements - High-Rise Dry-Type Transformers	14	2CC	
6	M6	Network Component Replacements – Targeted Replacement of CMD-Type Network Protectors	DNTWK-M006	Network Component Replacements - Targeted Network Protector Replacement	14	2CC	

TABLE 3A-6
FAILURE OF ELECTRIC DISTRIBUTION NETWORK ASSETS
CONTROLS

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	C1	Network Cable Replacement and Switch Installations	DNTWK-C001	Network Cable Replacement	14	56N	
2	C2	Network Maintenance and Corrective Work	DNTWK-C002	Maintenance and Corrective Work	14		KCA, KCB, KCC, KCD, KCE, KCF
3	C3	Network Component (Transformer, Protector) Replacements Condition Based	DNTWK-C003	Network Component (Transformer, Protector) Replacements - Condition Based	14	2CA, 2CC	
4	C4	Asset Information Improvements/Asset Data Comparison and Updates	N/A				
5	C5	Network Health Report (Units Offline)	N/A				
6	C6	Standards, Processes, and Training	N/A				

TABLE 3A-7
EMERGENCY PREPAREDNESS AND RESPONSE
MITIGATIONS

Line No.	RAMP RISK ID	RAMP Mitigation Name	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1			EPNDR-M000	EP&R Mitigations	5	21A	AB6
2	M1	Base Camp Project (a)					
3	M2	Check In/Check Out with Salesforce[(a)]					
4	M3	Secondary Emergency Roles, Enterprise-Wide[(a)]					
5	M4	Mutual Assistance Tools and Equipment					
6	M5	Mutual Assistance Improvement[(a)]					
7	M6	New Incident Specific Annexes					
8	M7	EOC/ICS Training Program Enhancements					
9	M8	Early Earthquake Warning Enhancements					

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(a) In the GRC PG&E consolidated certain individual mitigations from RAMP into a single mitigation (EPNDR-M000).

TABLE 3A-8
EMERGENCY PREPAREDNESS AND RESPONSE
CONTROLS

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1			EPNDR-C000	EP&R Controls	5		AB6
2	C1	Company Emergency Operations Plans and Standards for Response[(a)]					
3	C2	Emergency Response Technology[(a)]					
4	C3	EOC/Incident Command System Training Program[(a)]					
5	C4	EOC Response[(a)]					
6	C5	EOC Exercises[(a)])					
7	C6	Weekly Situational Awareness Calls and Enhancements					
8	C7	Early Earthquake Warning[(a)]					
9	C8	Debris Flow Modeling[(a)]					
10	C9	Gas Systems Operations Temperature Forecasting					
11	C10	Power Generation Hydro Management Forecasting					
12	C11	Short-Term Electric Supply Forecasting					
13	C12	Diablo Canyon Power Plant Emergency Response Organization Support					

TABLE 3A-8
EMERGENCY PREPAREDNESS AND RESPONSE
CONTROLS
(CONTINUED)

Line No.	RAMP RISK ID	RAMP Control Name	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
14			EPNDR-C001	Situational Awareness and Forecasting Initiatives – SOPP Improvements	5		AB6
15			EPNDR-C002	Situational Awareness and Forecasting Initiatives – WSOC	5	21A	AB6
16			EPNDR-C003	EP&R Field Operations Misc.	5		(b)
17			EPNDR-C004	EP&R Field Operations Technology	5	21A	
18			EPNDR-C005	EP&R Field Operations (Includes Tech, Training and Other Misc.)	5		AB6
19			EPNDR-C006	EP&R Field Operations (Support Headcount)	5		AB6

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(a) In the GRC PG&E consolidated certain individual controls from RAMP into a single control (EPNDR-C000).

(b) Costs for this work are not separately tracked.

TABLE 3A-9
FAILURE OF ELECTRIC DISTRIBUTION SUBSTATION ASSETS
MITIGATIONS

Line No.	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	SBSTN-M001	Transformer Life Extension	15	54L	
2	SBSTN-M002	Increase Capitalized Emergency Material (CEM) Stock for Transformers, Emergency Mobile Transformers.	15	54A	
3	SBSTN-M006	Minimize Wood in Substations	15	48H	

TABLE 3A-10
FAILURE OF ELECTRIC DISTRIBUTION SUBSTATION ASSETS
CONTROLS

Line No.	GRC RISK ID	GRC Control Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	SBSTN-C001	Substation Security Enhancements	15	58S	
2	SBSTN-C002	Animal Abatement Substation	15	48X	
3	SBSTN-C005	Civil Structures Replacement	15	48H	
4	SBSTN-C007	Substation Seismic Retrofit	15	58B	
5	SBSTN-C008	Design Criteria	15		GC1
6	SBSTN-C009	Fire Protection/Suppression Systems	15	58A	
7	SBSTN-C16A	Substation Proactive Asset Replacement - Ground Grid	15	48A	
8	SBSTN-C16C	Substation Proactive Asset Replacement - Batteries	15	48C	
9	SBSTN-C16D	Substation Proactive Asset Replacement - Circuit Breakers	15	48D	
10	SBSTN-C16E	Substation Proactive Asset Replacement - Switches	15	48E	
11	SBSTN-C16F	Substation Proactive Asset Replacement - Switchgear	15	48F	
12	SBSTN-C16G	Substation Proactive Asset Replacement - Line Support Work	15	48L	
13	SBSTN-C16H	Substation Proactive Asset Replacement - Insulators	15	48N	
14	SBSTN-C16J	Substation Proactive Asset Replacement - Transformer	15	54A	
15	SBSTN-C017	Substation Proactive Maintenance	15		GC1, GCA, GCB, GCC, GCD, GCE, GCF, GCH, GCI, GCM, GCO, GCS, GCV, GCW
16	SBSTN-C021	Vegetation Management	15		GCG

TABLE 3A-11
FAILURE OF ELECTRIC DISTRIBUTION UNDERGROUND ASSETS
CONTROLS

Line No.	GRC RISK ID	GRC Mitigation Name	GRC Chapter	GRC Capital MAT	GRC Expense MAT
1	DUNGD-C001	Patrols	10		BF3, BF4, BFD, BFE
2	DUNGD-C002	UG Notifications	11		KBA
3	DUNGD-C003	Equipment Maintenance and Replacement	11, 13	2BA, 2BB, 2BD, 56C	KBC, KBD, KBE
4	DUNGD-C004	Planned Major Projects	11	2BP	KBP
5	DUNGD-C005	UG Idle Facility Removal	11	2BF	
6	DUNGD-C06A	Primary Cable Replacement Program	13	56A	
7	DUNGD-C06B	Primary Cable Rejuvenation Program	13	56B	
8	DUNGD-C007	Load Break Oil Rotary Switch Replacement	13	56S	
9	DUNGD-C008	UG Transformers Temperature Sensor	13	56T	

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony: ☒ **Workpapers:** ☐ **SOQ:** ☐

Exhibit Number: 4 **Chapter Number:** 3

Chapter Title: Electric Distribution Risk Management

Witness Name: Paul McGregor

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
3-6, Table 3-1	1	Wildfire 2023 TY Risk Score, 2026 Mitigated Risk Score	23,033 18,449	23,143 18,637
3-6, Table 3-1	4	Failure of Electric Distribution Underground Assets 2023 TY baseline Risk Score, 2026 Mitigated Risk Score	117 115	116 114
3-6, Table 3-1	5	Failure of Electric Distribution Assets Substation 2023 TY baseline Risk Score, 2026 Mitigated Risk Score	44 39	42 38
3-15	21-22	Systemwide Wildfire ignitions	Wildfire includes approximately 481 risk events (ignitions) each year	Wildfire includes approximately 484 risk events (ignitions) each year
3-15	Footnote 13	Forecast of 2023 ignitions	PG&E's forecast of 2023 ignitions is 481 which is based on historical ignitions with certain adjustments	PG&E's forecast of 2023 ignitions is 484, which is based on historical ignitions with certain adjustments
3-17	3-4	Systemwide Wildfire risk scores	The 2023 TY baseline risk score and the 2026 post mitigation risk scores updated for the GRC are 23,033 and 18,449 respectively.	The 2023 TY baseline risk score and the 2026 post mitigation risk scores updated for the GRC are 23,143 and 18,637 respectively.

Page No.	Line No.	Item	As Filed	As Corrected
3-17	Figure 3-2	Systemwide Wildfire bowtie		Replaced in its entirety
3-18	Figure 3-3	HFTD Distribution Wildfire bowtie		Replaced in its entirety
3-30, Table 3-3	1	WLDFR-M001 2023 GRC RSE	2.5	3.9
3-30, Table 3-3	2	WLDFR-M002 2023 GRC RSE	5.6	6.2
3-30, Table 3-3	3	WLDFR-M002 2023 GRC RSE	4.5	4.5
3-30, Table 3-3	5	WLDFR-M004 2023 GRC RSE	1.2	3.6
3-30, Table 3-3	7	WLDFR-M006 PSPS Program 2023 GRC RSE note	(h)	(h) (m)
3-30, Table 3-3	8	The mitigation on Line 8 was inadvertently included as a separate line item; it should be removed because it is an element of the PSPS program shown in Line No. 7	Line 8: WLDFR-M006 PSPS Impact Reduction Initiatives – CRC Preparedness	Line 8: –
3-30, Table 3-3	9	WLDFR-M006 2023 GRC RSE	12.7	12.3
3-30, Table 3-3	11	WLDFR-M07A 2023 GRC RSE	16.9	17.6
3-30, Table 3-3	14	WLDFR-M07D 2023 GRC RSE	19.4	19.5
3-30, Table 3-3	15	WLDFR-M07E 2023 GRC RSE	154.0	154.7
3-30, Table 3-3	17	WLDFR-M07G 2023 GRC RSE	281.9	283.0
3-31, Table 3-3	25	WLDFR-M10B 2023 GRC RSE	20.0	19.4
3-31, Table 3-3	27	WLDFR-M011 2023 GRC RSE	60.7	71.0
3-31, Table 3-3	29	WLDFR-M017 2023 GRC RSE	30.0	32.2
3-31 Table 3-3		New note (m)	blank	(m) PSPS Program elements are listed in Chapter 4.2
3-37, Table 3-4	8	DOVHD-M008 2023 GRC RSE	0.4	0.3
3-37, Table 3-4	12	DOVHD-C005 2023 GRC RSE	48.0	85.0

Page No.	Line No.	Item	As Filed	As Corrected
3-40	Figure 3-5	Failure of Electric Underground Network Assets Bowtie		Replaced in its entirety
3-42, Table 3-5	4	DNTWK-M004 2023 GRC RSE	0.08	0.05
3-45, Table 3-6	1	EPNDR-M000 2023 GRC RSE	360	308.2
3-45, Table 3-6	2	EPNDR-M000 2023 GRC RSE	21,219	21,334.0
3-52	Figure 3-6	Failure of Electric Underground Assets bowtie		Replaced in its entirety
3-52	6-7	Failure of Electric Underground Assets risk score	The 2023 TY baseline risk score for Failure of Electric Distribution UG Assets is 117 and the 2026 post mitigation risk score is 115.	The 2023 TY baseline risk score for Failure of Electric Distribution UG Assets is 116 and the 2026 post mitigation risk score is 114.
3-55	8-9	Failure of Electric Distribution Substation Assets risk score	The 2023 TY baseline risk score for Failure of Electric Distribution Substation Assets is 44 and the 2026 post mitigation risk score is 39.	The 2023 TY baseline risk score for Failure of Electric Distribution Substation Assets is 42 and the 2026 post mitigation risk score is 38.
3-55	Figure 3-7	Failure of Electric Distribution Substation Assets bowtie		Replaced in its entirety
3-63, Table 3A-2	22	WLDFR-C10M GRC Capital MAT	54S	58S
3-68, Table 3A-6	2	DNTWK-C002 GRC Control Name	Network Component (Transformer, Protector) Replacements - Condition Based	Maintenance and Corrective Work
3-68, Table 3A-6	3	DNTWK-C003 GRC Control Name	Maintenance and Corrective Work	Network Component (Transformer, Protector) Replacements – Condition Based
Errata as of February 25, 2022				
3-57, Table 3-8	2	EPNDR-M000	2023 GRC RSE: 21,334	2023 GRC RSE: 21,346

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4

WILDFIRE RISK MITIGATIONS

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4
WILDFIRE RISK MITIGATIONS

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4
WILDFIRE RISK MITIGATIONS

A. Introduction

1. Scope and Purpose

This chapter introduces Pacific Gas and Electric Company's (PG&E) wildfire risk mitigation activities and provides an overview of the expenditure forecasts for this work discussed in subsequent chapters. PG&E's wildfire risk mitigation activities are managed by our Community Wildfire Safety Program (CWSP). The purpose of the CWSP is to reduce the risk of catastrophic wildfires from electric utility infrastructure in PG&E's service territory through a number of programs and activities that have been presented and explained in PG&E's Wildfire Mitigation Plan (WMP).[1] The WMP is submitted to the Office of Energy Infrastructure Safety (OEIS) and comprehensively addresses PG&E's activities to reduce wildfire risk.

As outlined in the WMP, some of PG&E's key wildfire risk reduction activities include hardening of our electric system, installing enhanced automation technologies, Vegetation Management (VM), Public Safety Power Shutoffs (PSPS), Enhanced Powerline Safety Settings (EPSS), situational awareness and emergency response, community engagement, and enhanced safety measures. All these activities are directed and supported by PG&E's robust wildfire risk modeling to identify where wildfire risk is highest and inform our programs in reducing wildfire risk. PG&E's WMP and CWSP continue to improve and evolve in response to new information, lessons learned, and evolving conditions and policies, including those of the Commission.

PG&E served its 2023 General Rate Case (GRC) testimony on June 30, 2021. Subsequently, PG&E revised its comprehensive wildfire mitigation strategy by prioritizing system hardening undergrounding, implementing EPSS and revising the scope of the Enhanced VM (EVM) Program. PG&E

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[1] PG&E's 2021 WMP – Revised Report, Rulemaking 18-10-007 (June 3, 2021) (Revised 2021 WMP), available at: <www.pge.com/wildfiremitigationplan> (as of June 21, 2021).

is submitting this February 25, 2022 updated GRC testimony to explain the new wildfire mitigation strategy, describe the risk reduction benefits it provides and to update PG&E's 2023-2026 forecasts for wildfire mitigation work impacted by the updated strategy.

The costs associated with our wildfire risk mitigation activities are primarily recorded to the Wildfire Mitigation Balancing Account (WMBA). Certain incremental wildfire costs not included in PG&E's revenue requirement for the WMBA authorized in the 2020 GRC decision are recorded to the Fire Risk Mitigation Memorandum Account (FRMMA) or the Wildfire Mitigation Plan Memorandum Account (WMPMA).

This chapter introduces PG&E's wildfire mitigation efforts, particularly, for:

- Situational Awareness and Forecasting (Chapter 4.1);
- PSPS Operations (Chapter 4.2);
- System Hardening, Enhanced Automation, and PSPS Impact Mitigations (Chapter 4.3);
- CWSP Program Management Office (PMO) (Chapter 4.4);
- Information Technology (IT) for Wildfire Mitigations (Chapter 4.5); and
- Enhanced Powerline Safety Settings (Chapter 4.6).

Additional wildfire mitigations are discussed in Chapters 9, 11, 12, and 23 of this exhibit. PG&E is presenting the mitigations in this chapter because they make up the bulk of what was approved in the 2020 GRC for recovery through the WMBA.[2] The alignment of this chapter with other chapters is further discussed in Section A.5.

2. Summary of Request

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

PG&E's updated 2023 expense forecast for wildfire mitigation activities in Chapters 4.1 through 4.6 is $370.6 million, which is $142.9 million more than 2020 recorded amounts.[3] PG&E's February 25, 2022 expense forecast for 2023 is $151.1 million more than its June 30, 2021 forecast for

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2 See Exhibit (PG&E-4), WP 4-34 and 4-35.

3 See Exhibit (PG&E-4), WP 4-1, line 10.

2023. This difference is due to adding the EPSS program to PG&E's wildfire mitigation portfolio.

PG&E's updated capital forecasts for wildfire mitigation activities in Chapters 4.1 through 4.6 are: $557.8 million for 2021, $1,160.6 million for 2022, $1,623.3 million for 2023, $2,641.3 million for 2024, $3,121.1 million for 2025, and $3,529.6 million for 2026.[4] PG&E's 2023 forecast is $1,012.1 million more than 2020 recorded amounts. PG&E's February 25, 2022 capital forecast for 2023 is $603.1 million more than its June 30, 2021 forecast. This difference is due to PG&E's plan to increase the number of system hardening underground miles in 2023.

PG&E proposes to continue the WMBA with minor modifications to adjust the reasonableness review threshold. As described in Section D.1 below, the variability associated with PG&E's wildfire workstreams, which are continuously evolving to address the growing and changing wildfire risk in our service territory, continues to support the need for a two-way balancing account.

3. Overview of Recorded and Forecast Costs

This section has been revised to reflect PG&E's updated forecast as of February 25, 2022.

Figure 4-1 shows the walk from 2020 recorded wildfire mitigation expense costs to the February 25, 2022 updated expense forecast for 2023.[5]

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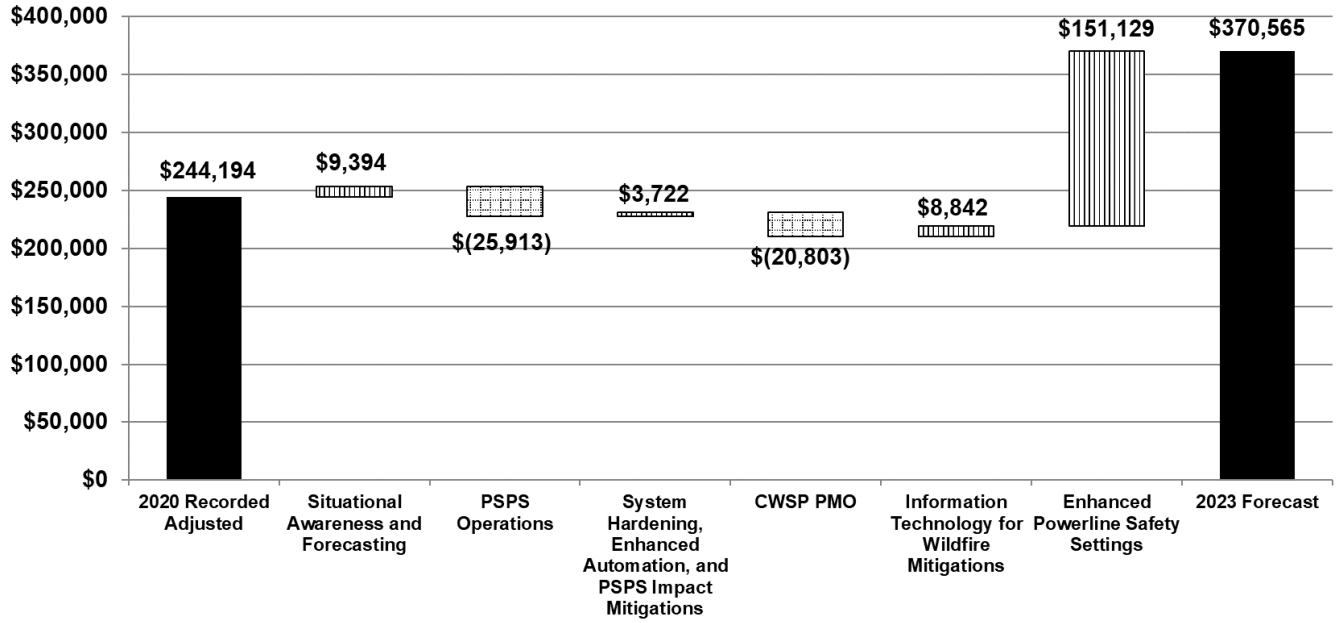
4 See Exhibit (PG&E-4), WP 4-11, line 8.

5 Values vary from the values in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the California Public Utilities Commission (Cal Advocates) at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal. See Exhibit (PG&E-4) WP 4-1

FIGURE 4-1
FEBRUARY 25, 2022 EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



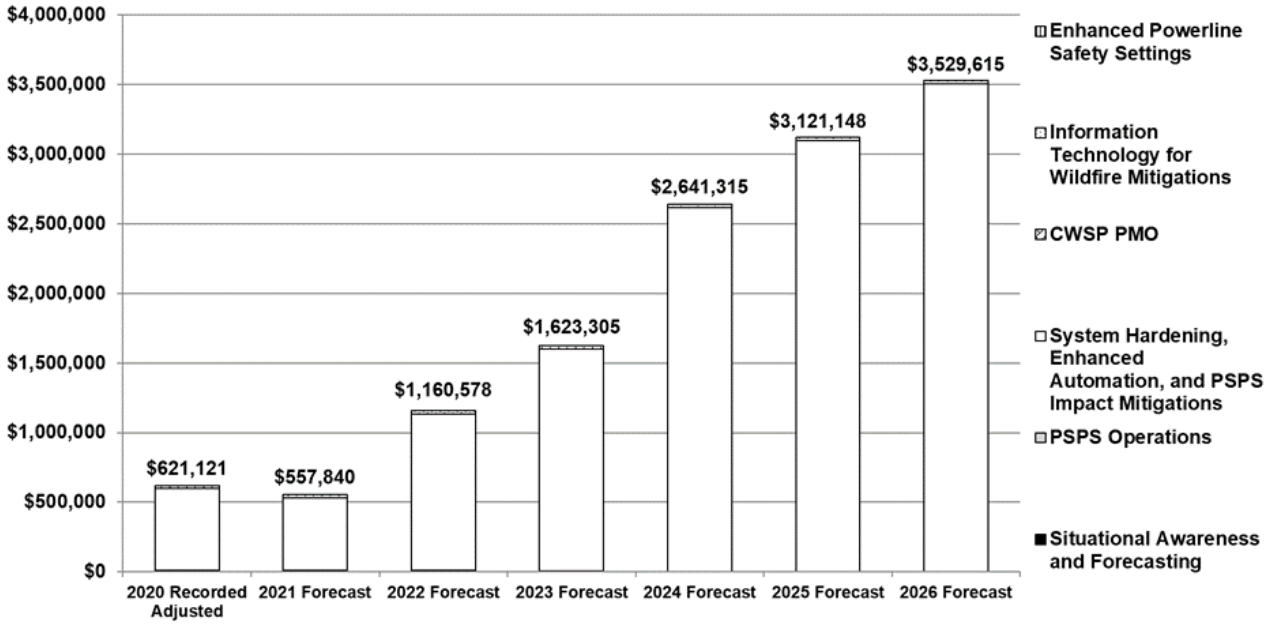
With the updated GRC forecast, wildfire mitigation expense costs are forecast to increase in 2023 relative to 2020 recorded costs. This increase is due to:

- Costs for the EPSS mitigation that were not included in the June 30, 2021 testimony.

Figure 4-2 shows the wildfire mitigation capital 2020 recorded expenditures and 2021-2026 forecasts.[6]

[6] Values vary from the values in the RO Model due to errata. These amounts do not align to the RO Model provided to Cal Advocates at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal. See Exhibit (PG&E-4) WP 4-11

FIGURE 4-2
FEBRUARY 25, 2022 CAPITAL RECORDED AND FORECAST COSTS 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



With the updated GRC forecast, wildfire mitigation capital expenditures are forecast to increase in 2023, relative to 2020 recorded costs. This increase is primarily driven by the change in PG&E's system hardening program beginning in 2022. From 2023 to 2026, capital expenditures will increase due to continued expansion of the system hardening underground program.

Forecasts in Chapter 4 are shown with escalation at the Major Work Category (MWC) level and escalation is included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

4. Support for Request

This section has been revised as part of PG&E's February 25, 2022 update.

Over half of PG&E's service territory lies in High Fire Threat District (HFTD) Tier 2 and 3 areas as identified by the CPUC in 2018.[7] The wildfire threat in these areas has increased significantly over the past decade.

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7 CPUC, Fire Threat Maps & the High Fire Threat District (HFTD), at: <www.cpuc.ca.gov/firethreatmaps> (as of May 24, 2021).

Unfortunately, 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, including the first fire to ever impact over 1 million acres.[8] The unprecedented weather patterns, including late-summer dry lightning storms, that drove the 2020 wildfire season and continued to present significant wildfire risk and the need for PSPS events into January 2021 further indicate the unpredictable, dynamic, and growing nature of the wildfire risk we all face.

Approximately 25,500 line-miles of distribution assets lie within these HFTDs, roughly one-third of PG&E's total overhead assets. Many of these are long lines that serve low-density, non-urban customers and communities located within the "wildland-urban interface," who face increased fire risk. Approximately 10 percent of PG&E's electric customers[9] reside within HFTD areas, and with population migration brought on by COVID-19 and other causes, the number of customers living in wildland-urban interfaces or HFTD areas may increase in coming years.

PG&E has continually evaluated wildfire risk given the dynamic nature of this risk as a result of climate change. In 2020 and 2021, California had its 5th and 2nd driest water years, respectively, in the last century.[10] Climate scientists at the University of California, Los Angeles recently concluded that for the Western United States "2000-2021 [was] the driest 22-year period since 800 A.D., which is as far as the data goes back."[11] PG&E's entire service area experienced extreme and severe drought conditions through much of 2021 prior to the rainstorms that occurred in the latter part of the year.

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8 California Department of Forestry and Fire Protection (CAL FIRE), Top 20 Largest California Wildfires (Apr. 28, 2021), at: <https://www.fire.ca.gov/media/4jandlhh/top20_acres.pdf> (as of May 24, 2021).

9 With a "customer" defined as an electric meter or service point, each of which generally represents at least one household or business.

10 Water years run from October 1 to September 30. See Water Year 2021: An Extreme Year (ca.gov).

11 How Bad Is the Western Drought? Worst in 12 Centuries, Study Finds. - The New York Times (nytimes.com).

California experienced unprecedented increases in the wildfire risk as a result of drought and the ongoing impacts of climate change. For example, on non-Red Flag Warning (RFW)[12] days in 2021, there was a more than 500 percent increase in acreage burned as compared to the average acreage in the prior four years. Simply put, the wildfire threat is growing, and it is PG&E's mission to reduce the risk of this threat to keep our customers and communities safe. This means our programs must evolve commensurate with the risks.

Because wildfire risks are dynamic, PG&E is constantly evolving its risk mitigation programs and initiatives using a data-driven, risk-informed approach. PG&E's integrated wildfire strategy takes a holistic approach to reducing wildfire risks and to provide for the continued safety of our customers and communities.

As a result of this continuing evolution in wildfire risk mitigation, PG&E announced it was revising its comprehensive wildfire mitigation strategy by changing the focus of the system hardening program and more closely aligning system hardening, EPSS, and Enhanced VM. The wildfire mitigation programs described in PG&E's WMP and this chapter are necessary to address the growing wildfire risk associated with PG&E's electric distribution facilities.

5. Alignment and Organization of This Chapter

This section has been revised as part of PG&E's February 25, 2022 update.

The remainder of this chapter is organized as follows:

- Section B – Wildfire Mitigation Program and Risk Overview;
- Section C – Compliance with Prior Commission Decisions;
- Section D – Balancing and Memorandum Accounts; and
- Section E – Cost Tables.

The discussion of PG&E wildfire mitigation programs in this exhibit is organized so that most programs included in the WMBA are discussed in detail in Chapters 4.1 through 4.6 of this exhibit:

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12 A RFW indicates a level of wildfire risk from weather conditions, as declared by the National Weather Service.

- Chapter 4.1 – Situational Awareness and Forecasting;
- Chapter 4.2 – PSPS Operations;
- Chapter 4.3 – System Hardening, Enhanced Automation, and PSPS Impact Mitigations;
- Chapter 4.4 – Community Wildfire Safety Program PMO;
- Chapter 4.5 – Information Technology for Wildfire Mitigations; and
- Chapter 4.6 – Enhanced Powerline Safety Settings.

Outside of Chapter 4 there are a few additional programs which are currently included or will be included in the WMBA starting in 2023.[13] Table 4.5 in Section E below summarizes the forecast for the WMBA for all PG&E exhibits and chapters.

To better align with the overall structure of the Electric Distribution exhibit, certain wildfire mitigation programs are discussed outside of Chapters 4.1 through 4.6. These include Vegetation Management (Chapter 9),[14] Overhead and Underground Electric Distribution Maintenance (Chapter 11),[15] Pole Asset Management (Chapter 12),[16] and Community Rebuild Program (Chapter 23).[17]

B. Wildfire Mitigation Program and Risk Overview

This section has been revised as part of PG&E's February 25, 2022 update.

1. Program Description

a. Program Overview and Goals of PG&E's Wildfire Mitigation Activities

As described above, the wildfire mitigation programs described in this chapter serve three overarching goals: reducing wildfire ignition potential, enhancing situational awareness, and reducing the impact of

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13 See Exhibit (PG&E-4), WP 4-34 and 4-35 for the complete list of programs in Chapter 4 included the WMBA.

14 See Enhanced Vegetation Management, Ch. 9, Section C.2 of this exhibit.

15 See Non-Exempt Surge Arrester Replacement Program in Ch. 11, Section C.1.e of this exhibit.

16 See Tree Attachments, Ch. 12, Section C.2.c. of this exhibit.

17 See Electric Underground Main-Line Construction, Ch. 23, Section C.2.a of this exhibit.

PSPS events. Below is a discussion of the primary mitigations that support these goals.

1) Reducing Wildfire Ignition Potential – System Hardening

To reduce the risk of ignition in our service territory, we are continuing to expand our System Hardening Program. System hardening entails replacing or eliminating existing distribution lines in HFTD areas and installing stronger and more resilient equipment. Hardening methods include undergrounding and replacing bare overhead conductor with covered conductor and installing stronger poles. Some lines can be eliminated entirely if the energy needs of customers or a community can be supplied through some other means, including permanent remote grids.

Consistent with PG&E's updated wildfire mitigation strategy, the System Hardening Program will focus on undergrounding electric assets. PG&E plans to complete 10,000 miles of undergrounding over the next several years.

In addition to the wholesale hardening of the highest priority circuit segments, PG&E is also continuing to replace specific, individual assets on other circuit segments to reduce wildfire risk including replacing nonexempt fuses and surge arresters with CAL FIRE approved "exempt" equipment that is less likely to create a spark during operations. PG&E's System Hardening, Enhanced Automation, and PSPS Impact Mitigations are discussed in detail in Chapter 4.3.

2) Enhancing Wildfire Situational Awareness – Situational Awareness and Forecasting

PG&E is continuing to invest in tools, equipment, resources, and a skilled workforce to improve our understanding of upcoming and real-time weather and fire conditions, so we can act proactively reduce fire ignitions and mitigate the potential spread of a fire if one were to start. As part of our Situational Awareness and Forecasting Program, PG&E is installing a variety of weather and fire monitoring devices across HFTD areas. These monitoring devices allow early

warning of high fire risk conditions and real-time identification of emerging wildfires, which in turn enable faster action by first responders and more proactive system operations to avert fire ignition and spread. In addition, PG&E's situational awareness tools in the HFTD areas include weather stations, high-definition cameras, enhanced abnormal condition or wire-down detection tools, and satellite fire-detection monitoring of the PG&E service territory. PG&E's Situational Awareness and Forecasting activities are discussed in detail in Chapter 4.1.

3) Reducing the Impact of PSPS Events – PSPS Operations

In 2018, the CPUC ordered utilities to present plans and protocols to deenergize portions of their electric distribution system in the interest of public safety. Significant wildfires are most likely to occur under the highest-risk conditions of high winds, low humidity, and where there is a high level of dry fuel—as in the late summer or fall in the heavily forested mountain areas of Northern California, where many of our distribution and transmission assets are located. Under extremely high-risk conditions, it is necessary to deenergize some transmission or distribution lines to reduce the risk of equipment failures or vegetation or other items contacting live wires.

PG&E's focus is on continuing to improve our PSPS Program to reduce the impact of PSPS on our customers by working to make future PSPS events smaller in scope, shorter in duration, and smarter in performance while safeguarding customers and communities from wildfire risk during times of severe weather. PG&E's PSPS Operations activities are discussed in detail in Chapter 4.2. Further, programs for mitigating the impacts of PSPS on customers are discussed in Chapter 4.3.

4) Enhanced Powerline Safety Settings (EPSS)

This section has been revised as part of PG&E's February 25, 2022 update.

As part of the February 25, 2022 GRC update, PG&E is introducing EPSS, a new wildfire mitigation. EPSS minimizes the

probability of an ignition event when a fault occurs on a distribution line in certain high fire-risk areas.

As described in Section A.4 above, PG&E experienced unprecedented changes in wildfire risk in 2021 as a result of drought and ongoing climate change impacts. The risk of an ignition event occurs every time there is a fault of any magnitude that can cause overhead lines to emit sparks. These incidents occur when: vegetation contacts distribution lines and structures; when small animals and birds touch or traverse the lines and structures; and when a component fails on the circuit. By moving to more sensitive safety settings in EPSS, the line shuts off power more quickly, thus, the amount of energy that gets converted into sparks is greatly reduced. PG&E describes its EPSS Program in further detail in Chapter 4.6.

In addition to these overarching goals, PG&E's wildfire mitigation efforts include key programs that support the coordination, logistics and technical needs required to effectively execute our wildfire mitigation programs. These programs include the CWSP PMO (described in Chapter 4.4) and Information Technology for Wildfire Mitigations (described in Chapter 4.5).

PG&E does not anticipate significant changes to wildfire mitigation programs due to EPSS or the new undergrounding program, with the exception of vegetation management. Since EPSS does stop equipment-related ignitions and PG&E's undergrounding initiative is a long-term effort, the near-term risk of ignition due to lines still persists. Therefore, PG&E will continue its wildfire mitigation activities in HFTD areas to significantly reduce wildfire risk, as discussed in this and other chapters. These activities include overhead conductor replacement, VM activities, EPSS, and PSPS as a last-resort measure.

5) Management Structure

This section has been revised as part of PG&E's February 25, 2022 update.

As described in the June 2021 GRC testimony, Wildfire mitigation planning and implementation is conducted by employees, and contractors throughout multiple PG&E teams and organizations. Currently, wildfire mitigation programs are primarily managed and implemented by two teams: Electric Operations (EO) and the Wildfire Risk Organization. EO consists of the departments that manage Electric Transmission and Distribution Operations, Asset Management, Major Projects and Programs, and Compliance.

As a result of a change in organization structure in January 2022, the departments in EO have been revised to: Electric Transmission and Distribution Operations; System Operations; Projects and Construction; Electric Quality Management; and Power Generation. Consequently, Asset Management moved to Engineering and the Wildfire Work Delivery team was created in Projects and Construction.

The EO team, in collaboration with the Wildfire Risk Organization, executes several of the major wildfire programs like the System Hardening, Enhanced Automation and PSPS Impact Mitigation programs described in Chapter 4.3.

The Wildfire Risk Organization manages many of the wildfire risk mitigation programs including PSPS Execution and the Operations and the CWSP PMO that are described in Chapter 4.2 and Chapter 4.4, respectively. Further, the Situational Awareness functions described in Chapter 4.1 are managed within the PSPS Execution and Operations organization within the Wildfire Risk department. In the June 2021 GRC testimony PG&E explained that the Wildfire Risk Organization managed other wildfire safety programs like: VM, System Inspections, and External Engagement, which are described in other chapters in Exhibit PG&E-4.

As of February 2022, VM and System Inspections is its own organization reporting to the Executive Vice President (EVP), Operations and Chief Operating Officer.

EO reports into PG&E's Chief Operating Officer. As of the February 2022 update, the Wildfire Risk Organization reports to the EVP, Chief Risk and Safety Officer.

The Wildfire Risk Governance Steering Committee (WRGSC) governs our wildfire risk modelling and wildfire mitigation workplans. The WRGSC reviews and approves the workplans for the most critical wildfire risk mitigation programs to ensure they are in alignment with the latest wildfire risk model and monitors regular reporting of work completed and quality results so that we are accountable and effective in reducing the most risk through these workstreams.

The WRGSC is chaired by the EVP – Chief Risk and Safety Office and the voting members are: SVP – Electric Operations, SVP – Electric Engineering, VP and Chief Audit Officer, VP – Transmission and Distribution System Operations, SVP – VM and System Inspections, and VP – Customer Care North Coast Region. Representatives from PG&E's Federal Monitor, as well as the Operational Observers from the Governor of California's office also participate in WRGSC meetings.

Chapter 4.5 describes IT investment associated with wildfire mitigation programs. The management structure of the IT Department is described in Exhibit (PG&E-7), Section B.1.d.

Management of Wildfire Mitigation departments continue to evolve to serve PG&E's wildfire mitigation strategy. PG&E will continue to look for opportunities to improve performance by continuing to improve and adjust management structure when applicable.

6) Key Metrics and Other Performance Measures

This section has been revised as part of PG&E's February 25, 2022 update.

PG&E's wildfire mitigation strategy is structured around the three strategic imperatives outlined above: (1) reducing wildfire ignition potential; (2) enhancing situational awareness; and (3) reducing the impact of PSPS events. PG&E's WMP includes

initiative targets and OEIS-established metrics. Sections 5 and 6 and Attachment 1[18] of the Revised 2021 WMP provide a complete overview of key metrics and performance measures to meet PG&E's wildfire mitigation strategy. Examples include the list of annual work and performance commitments provided in Table PG&E-5.2-1.[19] These metrics, targets, and performance against them will continue to be updated in future WMP submissions. PG&E's annual WMPs and associated, CPUC-directed reports like the Quarterly Initiative Update[20] and Quarterly Data Report (QDR)[21] are the best resources for metrics and performance measures for the wildfire mitigation programs in this chapter and other chapters of Exhibit (PG&E-4).

7) Emerging Technology for Wildfire Mitigation

This section provides a summary of emerging technologies that may prove instrumental in mitigating wildfire risk in the future. There are no costs associated with these projects in this application, and they are provided here for transparency into technologies that are currently being explored as potential mitigations which could emerge during the 2023 GRC period.

As detailed in Section 7.1.D of the 2021 WMP,[22] PG&E is conducting ongoing projects to evaluate or pilot new or emerging technologies that may have wildfire risk mitigation potential. These

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18 PG&E's Revised 2021 WMP. See PG&E's 2021 WMP website, at: <www.pge.com/wildfiremitigationplan> (as of June 21, 2021).

19 See PG&E's Revised 2021 WMP, starting on p. 258, at PG&E's 2021 WMP website, at: <www.pge.com/wildfiremitigationplan> (as of June 21, 2021).

20 PG&E's quarterly reports on wildfire mitigation activities are posted on PG&E's 2021 WMP website (see fn 1 link), including the Q1 2021 Quarterly Initiative Update, available at: <https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-2021-Q1-QIU.xlsx> (as of June 10, 2021).

21 PG&E's quarterly reports on wildfire mitigation activities are posted on PG&E's 2021 WMP website (see fn 1 link), including our Q1 2021 QDR, available at: <https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-Q1-2021-WMP-Quarterly-Data-Report.zip> (as of June 10, 2021).

22 PG&E's Revised 2021 WMP, starting at p. 336.

projects aim to further reduce wildfire risk by improving upon existing approaches including vegetation and asset management, system inspections, and grid design and system hardening. As these projects are being conducted at limited scope and scale, subsequent funding will be required to deploy successful technologies at a broader scale across PG&E's service territory.

While the activities and funding required for production deployment of most of these technologies are already accounted for in this GRC, there are six projects for which these follow-on activities and funding have not been included. High-level descriptions of five of these projects and the expected follow-on work are provided below. The sixth project, DTS-FAST, is discussed in Chapter 4.3, Section C.3.f. For these six projects, either the technologies have not yet been sufficiently proven, or there is still too much uncertainty in the production requirements to include in this GRC. If these projects prove to be effective in mitigating wildfire risk, then PG&E will plan to deploy them in production and will appropriately record the associated costs in wildfire-mitigation related balancing or memorandum accounts.

TABLE 4-1
EMERGING TECHNOLOGIES FOR WILDFIRE MITIGATION

Line No.	Project Name	Project Description
1	Electric Program Investment Charge (EPIC) 3.13 Transformer Temperature Monitoring	This project will design and build an overhead transformer temperature sensor and associated analytical tools to identify transformer issues and risk of failures. Post-project funding would be required to scale the devices and analytics by purchasing and more broadly deploying temperature sensors across PG&E's service territory.
2	EPIC 3.32 System Harmonics	This project will collect harmonics data using modern Smart Meter™ devices and develop an algorithm engine that will proactively detect, investigate, and mitigate harmonics issues. Post-project funding would be required to scale analytics by purchasing and deploying additional meters for data collection in targeted locations across PG&E's service territory.
3	EPIC 3.41 Drone Enablement	This project will demonstrate the effectiveness of automated and Beyond Visual Line-of-Sight drone operation for system inspection and asset alert investigation use cases. Post-project funding would be required to scale drone operations by purchasing and deploying additional drone systems across PG&E's service territory.
4	EPIC 3.43 Momentary Outage	This project will demonstrate new approaches for proactively identifying potential system or asset issues related to locations with frequent momentary outages. Post-project funding would be required to purchase and deploy more high-fidelity Smart Meter™ devices to scale analytics for predictive equipment failure.
5	Mobile Laser Illuminated Detection and Ranging (LiDAR)	This project will demonstrate the effectiveness of vehicle and backpack-mounted LiDAR and imagery units to reduce fire risk and improve the effectiveness and compliance of PG&E's VM processes. Post-project funding would be required for the execution of expanded mobile LiDAR scanning, particularly in HFTDs, to support and validate wildfire risk mitigation activities.

2. Risk Integration

This section has been revised as part of PG&E's February 25, 2022 update.

Chapter 3 of this exhibit describes how EO uses the Enterprise and Operational Risk Management Program to manage electric system risks. Table 4-2 below shows the EO risks associated with the forecasts discussed in the Wildfire Mitigations chapters in this exhibit.

TABLE 4-2
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	Chapter Reference
1	Failure of Electric Distribution Overhead Assets	DOVHD	Risk Assessment Mitigation Phase (RAMP)	4.3
2	Wildfire	WLDFR	RAMP	4.1, 4.2, 4.3, 4.4, 4.6[(a)]

(a) Chapter 4.6 added as part of the February 25, 2022 update.

A risk overview is provided for each applicable risk in each chapter. Each chapter also describes the mitigations and controls presented in the GRC, including a description of any changes since filing PG&E's 2020 RAMP Report. PG&E's mitigations and controls presented in the GRC are very similar to the ones proposed in the 2020 RAMP Report, with the exception of changes to the system hardening program and the vegetation management program and the addition of EPSS.

Costs and Risk Spend Efficiencies (RSE) for mitigations are presented in each chapter. Costs and RSEs for controls are presented in workpapers.

Chapter 4.1 mitigation categories include:

- Situational Awareness and Forecasting Initiatives; and
- Safety and Infrastructure Protection Team.

Chapter 4.2 mitigation categories include:

- PSPS Event; and
- PSPS Program.

Chapter 4.3 mitigation categories include:

- System Hardening –Underground, Overhead, and Remote Grid (addresses both Wildfire and the Failure of Electric Distribution Overhead Assets risks);
- Expulsion Fuse Replacements (addresses both Wildfire and the Failure of Electric Distribution Overhead Assets risks);
- PSPS Impact Reduction Initiatives;
- Situational Awareness and Forecasting Initiatives; and
- Automation System and Protection Initiatives.

Chapter 4.4 mitigation categories include:

- The CWSP PMO.

Chapter 4.6 mitigation categories include:

- Enhanced Powerline Safety Settings

Table 4-3 and 4-4 below show the expense and capital forecasts for the mitigations discussed in each wildfire mitigation chapter.

TABLE 4-3
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Chapter	Chapter Name (2023 GRC)	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total
1	Chapter 4.1	Situational Awareness and Forecasting	$34,022	$59,348	$54,559	$43,416	$191,345
2	Chapter 4.2	PSPS Operations	141,178	127,920	119,254	115,266	503,618
3	Chapter 4.3	System Hardening, Enhanced Automation and PSPS Impact Mitigations	7,872	6,902	6,679	11,595	33,048
4	Chapter 4.4	CWSP PMO	17,724	15,438	14,994	13,460	61,616
5	Chapter 4.6	Enhanced Powerline Safety Settings	–	18,203	148,921	151,129	318,254
6		Total	$200,797	$227,811	$344,407	$334,865	$1,107,882

TABLE 4-4
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Chapter	Chapter Name (2023 GRC)	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total
1	Chapter 4.1	Situational Awareness and Forecasting	$11,649	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446	$45,153
2	Chapter 4.2	PSPS Operations	2,397	3,084	3,237	262	269	277	284	9,809
3	Chapter 4.3	System Hardening, Enhanced Automation and PSPS Impact Mitigations	574,476	520,005	1,122,667	1,593,142	2,612,456	3,092,230	3,500,584	13,015,560
4		Total[(a)]	$588,522	$532,540	$1,135,278	$1,598,005	$2,616,015	$3,095,848	$3,504,315	$13,070,523

(a) The 2020 recorded adjusted total includes $287 associated with Chapter 4.4 that is not shown on this table because costs are rounded to the nearest thousand.

C. Compliance With Prior Commission Decisions

1. Compliance With Section 5.2 of the 2020 GRC Settlement Agreement ("Deferred Work Principles")

The 2020 GRC Settlement Agreement requires PG&E to include testimony in this GRC on deferred work if the following criteria are met:

a) The work was requested and authorized based on representations that it was needed to provide safe and reliable service (Check 1);

b) PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work (Check 2); and

c) PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service (Check 3).

Work that was authorized in the 2020 GRC for MWCs in the wildfire mitigation chapters is needed to provide safe and reliable service; however, there was not work that met the criteria for deferred work as described in the Settlement Agreement. This analysis is presented in the workpapers in Chapter 2 of this exhibit.[23]

2. Compliance With the WMP

This section has been revised as part of PG&E's February 25, 2022 update.

In 2018, the Legislature, recognizing the need for bold and immediate action to reduce the risk of catastrophic wildfires, provided utilities with several mechanisms to facilitate urgent wildfire mitigation efforts. Senate Bill (SB) 901, enacted in September 2018, requires utilities to submit annual WMPs. The WMP must identify and prioritize wildfire risks and the drivers of those risks. It must also describe plans for VM, system hardening, preparation for and response to wildfire events, and protocols for disabling reclosers and deenergizing the electric system.[24] Subsequent bills, including Assembly Bill (AB) 1054, AB 111, SB 70, SB 167, SB 247, and SB 560, modified the WMP requirements. Through AB 1054, the

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[23] Exhibit (PG&E-4), WP 2-13.

[24] Public Utilities Code (Pub. Util. Code) § 8386 (describing elements of the WMP).

Legislature expanded the plan coverage to three years, adding requirements, and transferred review of the plans to the OEIS.[25]

The intent in this application is to support compliance with the WMP goals and objectives, completion of forecasted work to fulfill WMP commitments, and manage cost recovery as applicable. The Wildfire Risk Mitigation in Chapter 4, as well as some of the work presented in Chapters 9 – Vegetation Management, 10 – Overhead and Underground Electric Asset Inspections, 11 – Overhead and Underground Electric Distribution Maintenance, 12 – Pole Asset Management, 15 – Substation Asset Management, 20 – Technology Mapping and Asset Data Management, and 23 – Community Rebuild, all represent work activities and programs that were submitted, reviewed and approved in the 2019, 2020, and 2021 WMP.

As a means of demonstrating compliance with the WMP goals and objectives, PG&E developed a workpaper that lists each of the mitigations forecast in the GRC and compares them to the corresponding 2022 WMP initiative(s). The workpaper includes the forecast 2022 and 2023 GRC amounts (updated to account for errata and the February 25, 2022 forecast changes) compared to the costs presented in the 2022 WMP. With certain exceptions, the forecast costs for mitigations in the GRC align to the costs presented for the corresponding initiative(s) in the WMP. Along with minor changes due to timing, scope adjustments, or the alignment between WMP initiatives and GRC mitigations, differences between the GRC and 2022 WMP include the following.

- Non-Exempt Surge Arresters – The GRC forecast does not include forecast amounts for 2023 because in 2023 the work will transition from HFTD to non-HFTD areas. The 2022 WMP shows the costs for both 2022 and 2023.[26]
- Expulsion Fuse Replacement – Since filing the June 2021 GRC, PG&E has increased the number of expulsion fuses it plans to replace in 2022

[25] Pub. Util. Code, § 8386.3(a).

[26] See WP 4-166, line 13.

and 2023. This change in scope results in higher costs in the 2022 WMP compared to the GRC forecast.[27]

- PSPS Impact Reduction Initiatives – The PSPS impact reduction initiatives in the GRC include several different activities. Some of these activities transition from a wildfire only mitigation to an all hazards mitigation in 2023 and are no longer considered a wildfire mitigation and, therefore, not included as part of the GRC wildfire mitigation forecast.[28]
- Additional System Automation and Protection-Rapid Earth Fault Current Limiter (REFCL) – PG&E is re-evaluating its plans for deploying this mitigation. The 2022 WMP does not include costs for it.[29]
- Additional System Automation and Protection – The costs for this mitigation are included in the WMP but are aligned to the Failure of Distribution Overhead risk in the GRC. Therefore, the forecast costs for this work are not included as part of the GRC wildfire mitigation forecast.[30]
- Pole Programs-Replace Tree Attachments – While this mitigation is listed separately in the GRC, it is not specifically referenced in the 2022 WMP.[31]

D. Balancing and Memorandum Accounts

1. Wildfire Mitigation Balancing Account

This section has been revised as part of PG&E's February 25, 2022 update.

The Commission authorized the WMBA in the 2020 GRC Decision (D.) 20-12-005[32] (2020 GRC Decision). The WMBA is a two-way balancing account used to track CWSP expenses beginning January 1, 2020. The primary CWSP expenses recorded to the WMBA include both operations

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27 See WP 4-166, line 14.

28 For example, see WP 4-166, lines 31 and 39.

29 See WP 4-167, line 67.

30 See WP 4-167, line 64.

31 See WP 4-167, line 69.

32 D.20-12-005, p. 396, Conclusion of Law (COL) 29: Authority to establish a two-way WMBA to record CWSP O&M and capital expenditures is supported by the record and should be authorized.

and maintenance (O&M) and capital wildfire mitigation costs incurred by Electric Distribution. Additionally, other CWSP costs include O&M expenses and capital expenditures for Shared Services and Human Resources support for CWSP activities. PG&E proposes continued use of the two-way WMBA to record wildfire mitigation related activities, including those activities described in this application, as well as new activities in PG&E's 2022 WMP.

While PG&E now has more experience with these programs than we did when the two-way WMBA was established, there continues to be significant uncertainty and variability associated with wildfire mitigation activities and their associated costs. As an example, the exact scope of PG&E's System Hardening Program will continue to evolve as PG&E performs detailed planning and engineering for the remaining circuit miles to be hardened. For this reason, there is some uncertainty regarding the exact number of miles of overhead system hardening versus undergrounding PG&E will complete. PG&E's forecast is based on its current assumptions about the number of overhead system hardening miles and underground miles it will complete. To the extent PG&E undergrounds more miles in HFTDs to further reduce risk as compared to overhead system hardening, PG&E's capital expenditures will increase.

There are similar adjustments PG&E may make to other components of the CWSP, based on further planning and engineering, field conditions, and PG&E's understanding of evolving wildfire risks. Consequently, there is uncertainty regarding the wildfire mitigation costs PG&E ultimately will incur versus forecast in this GRC. The continuation of the two-way WMBA ensures that customers only pay for the actual work performed and if our forecast is higher than the actual costs, the difference is returned to customers.

Given the growing and evolving wildfire risk that PG&E, first responders, regulators, and others are battling, a two-way balancing account remains the appropriate tool to ensure that important wildfire risk mitigation work is adequately funded while also ensuring that rates collected from customers for this work are solely spent on wildfire risk mitigation.

The 2020 GRC Decision ordered PG&E to file a Tier 3 Advice Letter (AL) if its total spending is above 115 percent of the approved CWSP amounts or if its recorded average per mile unit costs for system hardening exceed 115 percent of the authorized unit costs.[33] PG&E proposes that the WMBA reasonableness review threshold for total spending and recorded average per mile for the various types of unit costs[34] be raised from 115 percent to 125 percent. As noted above, wildfire risk presents significant uncertainty due to drought, wind patterns, vegetation growth and other factors beyond PG&E's control. In addition, based on these factors and further planning and engineering of the specific locations where PG&E will be performing wildfire mitigation activities, PG&E may adjust its planned mix of wildfire mitigation activities as necessary to address evolving wildfire risks. Increasing the reasonableness review threshold provides a slight reduction in administrative burden for the Commission and parties in the case of a limited variation in the wildfire risk mitigation spend (up to 125 percent) while still protecting customers through a transparent reasonableness review process should the costs exceed the authorized amounts by more than 25 percent.

The forecasts for Wildfire Mitigations tracked in the WMBA are in Section E, Table 4-5, below. In the February 25, 2022 filing PG&E added to Table 4-5 the costs associated with EPSS in Chapter 4.6.

In addition to authorizing the WMBA and setting thresholds for the review of costs, the 2020 GRC Decision also provides that PG&E cannot earn an equity return on the first $3.21 billion of capital expenditures it spends on wildfire mitigation measures included in its approved WMP.[35] Costs requested in Chapter 4 are in excess of the $3.21 billion as discussed in Exhibit (PG&E-10), Ch. 15, Section D.

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33 D.20-12-005, p. 397, COL 32: PG&E should be required to file an application for recovery of CWSP costs recorded in the WMBA if CWSP expenditures are in excess of 115 percent of the authorized amount or if recorded per mile unit costs are in excess of 115 percent of the authorized unit costs.

34 The unit costs for each type of system hardening work are shown in Chapter 4.3, Table 4.3-5 in this exhibit.

35 D.20-12-005, p. 397, COL 33.

2. Wildfire Memorandum Accounts ~~Reasonableness Review~~

In addition to the WMBA, PG&E has established two memorandum accounts where certain wildfire-related costs can be recorded—the FRMMA and the WMPMA.

The purpose of the FRMMA is to record incremental costs of fire risk mitigation work that are not otherwise recovered in PG&E's adopted revenue requirements.[36] Such costs include wildfire mitigation activities that were not contemplated as part of the prior GRCs or WMPs. Costs to be recovered through the FRMMA do not include costs approved for recovery in PG&E's GRCs or through other cost recovery mechanisms, including WMPMA.

The purpose of the WMPMA is to record incremental costs incurred to implement an approved WMP that are not otherwise recovered in PG&E's adopted revenue requirements.[37] Such costs include expense and capital expenditures for wildfire risk mitigation activities outlined in PG&E's WMP, including enhanced inspection activities in excess of what was authorized in PG&E's existing GRC, incremental IT costs to support wildfire mitigation workstreams, and deployment of line sensors and other system monitoring technologies that can help identify potential wildfire risks. Costs in the WMPMA are subject to reasonableness review.

~~In this proceeding PG&E requests recovery of certain costs for wildfire risk mitigation work that are recorded in the FRMMA and WMPMA.~~

~~Attachments A of Chapters 4.3, 4.4, and 4.5 are PG&E's prepared testimony which demonstrates the reasonableness of incremental 2020 costs incurred for wildfire mitigations recorded in the WMPMA and FRMMA.~~ ~~Attachment A of Chapter 2 summarizes the amounts recorded in the~~

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36 On November 1, 2018, PG&E submitted AL 5419-E to establish the FRMMA to track costs incurred for fire risk reduction that are not otherwise encompassed in the Company's revenue requirement. The Commission approved AL 5419-E on March 12, 2019, effective January 1, 2019.

37 D.19-05-037, p. 64, OP 21, authorized PG&E to open the WMPMA to track incremental wildfire-related costs incurred while implementing approved programs within the 2019 WMP. On June 5, 2019, PG&E submitted AL 5555-E to establish the WMPMA. The AL was approved by the Commission on August 8, 2019 with an effective date of June 5, 2019.

~~WMPMA and FRMMA in 2020 and requested in this application.[38] For Chapters 4.3, 4.4, and 4.5, PG&E is seeking recovery of $29.7 million of capital expenditures and $22.7 million of expense costs recorded in the WMPMA and $5.3 million of expense costs recorded in the FRMMA.[39] PG&E seeks a determination that these costs were reasonably incurred and that recovery of these costs in rates is appropriate as further described in these attachments.~~

E. Cost Tables

This section has been revised as part of PG&E's February 25, 2022 update.

Table 4-5 below summarizes the forecast costs for the wildfire mitigations for which PG&E will record in the WMBA or the Vegetation Management Balancing Account. Most of the work included in Table 4-5 is described in Chapters 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6, but there is also work in a few other Exhibit (PG&E-4) chapters. In addition to the wildfire mitigation work in this exhibit, PG&E is forecasting Wildfire Safety and Customer Communications activities in the Customer Care exhibit.[40]

Tables 4-6 and 4-7 show the expense and capital forecasts for the individual Wildfire mitigations described in chapters 4.1, 4.2, 4.3, and 4.4. The IT work described in Chapter 4.5 of this exhibit enables the wildfire mitigations described in the other EO chapters. The wildfire mitigations presented in the other EO chapters are not included on Tables 4-8 and 4-9 but are included in the sponsoring chapter.[41]

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38 ~~Requests for amounts recorded in the WMPMA and FRMMA in 2020 are found in Exhibits (PG&E-4), (PG&E-5), (PG&E-6), (PG&E-7).~~

39 ~~Exhibit (PG&E-4), Ch. 2, Attachment A, Tables 2A-3 and 2A-4, p. 2-AtchA-10, and p. 2-AtchA-11.~~

40 Exhibit (PG&E-6), Ch. 11, Section B.2.c. This work is associated with the PSPS mitigation (WLDFR-M006).

41 See Ch. 11, Section B.2.d; Chapter 12, Section B.2.c; and Chapter 23, Section B.2.a.4.

TABLE 4-5
FORECASTED COSTS 2021-2026
WILDFIRE MITIGATION FORECAST SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)
NOVEMBER 5, 2021 ERRATA

Line No.	Chapter Name	Ex.	Ch.	Expense Forecast 2021	Expense Forecast 2022	Expense Forecast 2023	Capital Forecast 2021	Capital Forecast 2022	Capital Forecast 2023	Capital Forecast 2024	Capital Forecast 2025	Capital Forecast 2026
1	Situational Awareness and Forecasting	4	4.1	$59,348	$54,559	$43,416	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446
2	PSPS Operations	4	4.2	127,920	119,254	115,266	3,084	3,237	262	269	277	284
3	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	4	4.3	6,903	6,679	11,595	520,005	1,020,491	990,063	951,082	938,034	894,031
4	CWSP PMO	4	4.4	27,801	14,994	13,460	–	–	–	–	–	–
5	Information Technology for Wildfire Mitigations	4	4.5	35,700	35,700	35,700	25,300	25,300	25,300	25,300	25,300	25,300
6	Enhanced Powerline Safety Settings	4	4.6	-								
7	Overhead and Underground ED Maintenance	4	11	–	–	–	88,859	16,804	–	–	–	–
8	Pole Asset Management	4	12	–	–	–	–	3,303	3,296	3,500	3,709	3,924
9	Community Rebuild Program	4	23	–	–	–	–	–	114,341	104,985	77,163	-
10	Communications	6	11	15,700	15,700	9,550	–	–	–	–	–	–
11	Total WMBA[(a)]			$273,372	$246,886	$228,987	$646,699	$1,078,510	$1,137,863	$1,088,426	$1,047,824	$926,985
12	Enhanced VM	4	9	$535,952	$553,916	$550,686						
13	Total Wildfire Mitigations[(b)]			$809,324	$800,802	$779,673						

(a) Certain 2021 and 2022 costs shown in this table are tracked in the FRMMA and/or the WMPMA. All 2023 and later forecast amounts shown on line 10 will be tracked in the WMBA.

(b) Differences due to rounding.

TABLE 4-6
FORECASTED COSTS 2021-2026
WILDFIRE MITIGATION FORECAST SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)
FEBRUARY 25, 2022 SUPPLEMENTAL FORECAST CHANGES AND ERRATA

Line No.	Chapter Name	Ex.	Ch.	Expense Forecast			Capital Forecast					
				2021	2022	2023	2021	2022	2023	2024	2025	2026
1	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	4	4.3	–	–	–	–	$102,176	$603,079	$1,661,374	$2,154,196	$2,606,553
2	Enhanced Powerline Safety Settings	4	4.6	$18,203	$148,921	$151,129	–	–	–	–	–	–
3	Community Rebuild Program	4	23	–	–	–	–	–	($25,891)	($33,474)	($33,076)	–
4	Customer Outreach[a]	6	2	16,402	16,826	17,057	–	–	–	–	–	–
5	Customer Resiliency[a]	6	2	–	–	7,330	–	–	–	–	–	–
6	Total WMBA[a]			$34,606	$165,747	$175,516	–	$102,176	$577,188	$1,627,900	$2,121,120	$2,606,553
7	Enhanced VM	4	9	$0	$362,684	($432,684)	–	–	–	–	–	–
8	Total Wildfire Mitigations[b]			$34,606	$528,431	($257,168)	–	–	–	–	–	–

(a) Forecast costs for Customer Outreach and Customer Resiliency are errata and not related to PG&E's February 2022 supplemental forecast.

(b) Differences due to rounding.

TABLE 4-7
FORECASTED COSTS 2021-2026
WILDFIRE MITIGATION FORECAST SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)
FEBRUARY 25, 2022 FORECAST

Line No.	Chapter Name	Ex.	Ch.	February 25, 2022 Forecast								
				Expense Forecast			Capital Forecast					
				2021	2022	2023	2021	2022	2023	2024	2025	2026
1	Situational Awareness and Forecasting	4	4.1	$59,348	$54,559	$43,416	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446
2	PSPS Operations	4	4.2	127,920	119,254	115,266	3,084	3,237	262	269	277	284
3	System Hardening, Enhanced Automation, and PSPS Impact Mitigations	4	4.3	6,903	6,679	11,595	520,005	1,122,667	1,593,142	2,612,456	3,092,230	3,500,584
4	CWSP PMO	4	4.4	27,802	14,994	13,460	–	–	–	–	–	–
5	Information Technology for Wildfire Mitigations	4	4.5	35,700	35,700	35,700	25,300	25,300	25,300	25,300	25,300	25,300
6	Enhanced Powerline Safety Settings	4	4.6	18,203	148,921	151,129	–	–	–	–	–	–
7	Overhead and Underground ED Maintenance	4	11	–	–	–	88,859	16,804	–	–	–	–
8	Pole Asset Management	4	12	–	–	–	–	3,303	3,296	3,500	3,709	3,924
9	Community Rebuild Program	4	23	–	–	–	–	–	88,450	71,511	44,087	-
10	Customer Outreach	6	2	16,402	16,826	17,057	–	–				–
11	Customer Resiliency	6	2	–	–	7,330	–	–	–	–	–	–
12	Communications	6	11	15,700	15,700	9,550	–	–	–	–	–	–
13	Total WMBA[(a)]			$307,978	$412,633	$404,503	$646,699	$1,180,686	$1,715,051	$2,716,326	$3,168,944	$3,533,538
14	Enhanced VM[(b)]	4	9	535,952	916,600	118,022	–	–	–	–	–	–
15	Total Wildfire Mitigations[(c)]			$843,930	$1,329,233	$522,525	–	–	–	–	–	–

(a) Certain 2021 and 2022 costs shown in this table are tracked in the FRMMA and/or the WMPMA. All 2023 and later forecast amounts shown on line 10 will be tracked in the WMBA.

(b) 2022 forecast value varies from the value listed in the Results of Operations (RO) Model. This amount does not align to the RO Model provided to the Public Advocates Office at the time of the filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

(c) Differences due to rounding.

TABLE 4-8
WILDFIRE MITIGATIONS – CHAPTERS 4.1, 4.2, 4.3, 4.4, AND 4.6
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE: FEBRUARY 25, 2022 UPDATED FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation Number	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total
1	Chapter 4.1 – Situational Awareness and Forecasting Initiatives							
2	WLDFR-M07B	Weather Stations	AB6	$111	$1,572	$1,641	$1,764	$5,088
3	WLDFR-M07C	Wildfire Safety Operations Center (WSOC)	AB6	4,348	9,139	7,181	–	20,668
4	WLDFR-M07D	Cameras	AB6	6,956	9,385	11,532	8,234	36,107
5	WLDFR-M07E	SA&FI – Satellite Fire Detection	AB6	–	341	351	362	1,054
6	WLDFR-M07G	Partial Voltage Detection	AB6	4	–	85	233	322
7	WLDFR-M07H	Storm Outage Prediction Program Improvements	AB6	1,627	1,969	2,029	–	5,625
8	WLDFR-M07I	Advance Fire Modeling	AB6	5,541	5,969	6,152	6,345	24,007
9	WLDFR-M07J	Meteorology	AB6	–	515	531	438	1,483
10	WLDFR-M07K	Fire Potential Index	AB6	93	154	159	174	580
11	WLDFR-M008	Safety and Infrastructure Protection Teams	AB6	15,342	30,304	24,899	25,867	96,411
12		Total Situational Awareness and Forecasting Initiatives		$34,022	$59,348	$54,559	$43,416	$194,998
13	Chapter 4.2 – PSPS Operations							
14	WLDFR-M005	PSPS Event (Distribution)	AB6	$80,706	$82,741	$70,782	$72,998	$307,227
15	WLDFR-M006	Emergency Preparedness and Response (EP&R) Field Operations	AB6	3,691	9,974	–	–	13,665
16	WLDFR-M006	EP&R Field Operations (Includes Tech, Training and Other Misc)	AB6			6,903		6,903
17	WLDFR-M006	EP&R Field Ops Tech Expense	AB6	18	103	106	–	227
18	WLDFR-M006	Community Resource Center (CRC) Preparedness Program	AB6	15,423	14,774	15,226	15,703	61,126
19	WLDFR-M006	PSPS – EP&R Field Ops Tech Expense	AB6	92	206	212		510
20	WLDFR-M006	PSPS – Collateral/Segment Creations Exp	AB6	249	103	106	109	568
21	WLDFR-M006	PSPS – EP&R Field Ops Misc.	AB6	108	257	265	–	630
22	WLDFR-M006	PSPS – Field Exercise Dist. Exp	AB6	1,073	2,470	2,546	2,625	8,714
23	WLDFR-M006	PSPS – Increased Helicopter EU (Dist.)	AB6	28,668	7,976	14,944	15,411	66,999
24	WLDFR-M006	PSPS – PMO	AB6	2,180	5,533	4,502	4,643	16,857
25	WLDFR-M006	PSPS – PMO Projects	AB6	6,898	1,544	1,591	1,641	11,674
26	WLDFR-M006	PSPS – Pre-flights Expense	AB6	1,775	1,081	1,114	1,149	5,118

TABLE 4-8
WILDFIRE MITIGATIONS – CHAPTERS 4.1, 4.2, 4.3, 4.4 AND 4.6
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE: FEBRUARY 25, 2022 UPDATED FORECAST
(THOUSANDS OF NOMINAL DOLLARS)
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total
27	WLDFR-M006	Wildfire Public Engagement Team	AB6	298	1,158	957	987	3,399
28		Total PSPS Operations		$141,178	$127,920	$119,254	$115,266	$503,618
29	Chapter 4.3 – System Hardening, Enhanced Automation, and PSPS Impact Initiatives							
30	WLDFR-M006	Generation Enablement and Deployment PMO	AB#	–	–	$2,063	$1,957	$4,020
31	WLDFR-M006	Generation Enablement and Deployment PMO	IG#	$3,494	$3,031	–	–	6,525
32	WLDFR-M07A	Situational Awareness and Forecasting Initiative – Line Sensors	FZA	$1,487	$2,344	2,576	3,437	9,844
33	WLDFR-M07A	Situational Awareness and Forecasting Initiative – Line Sensors	HG#	10	–	–	–	10
34	WLDFR-M07F	Situational Awareness and Forecasting Initiative – Sensor IQ (SIQ)	AB#	$1,871	$145	–	3,783	5,799
35	WLDFR-M017	System Hardening – Remote Grid	AB#	1,010	1,382	1,423	1,464	5,279
36	WLDFR-M017	System Hardening – Remote Grid	KAT			617	953	1,571
37		Total System Hardening, Enhanced Automation and PSPS Impact Initiatives		$7,872	$6,903	$6,679	$11,595	$33,048
38	Chapter 4.4 – CWSP PMO							
39	WLDR-M009	CWSP PMO	AB#	$17,724	$15,348	$14,994	$13,460	$61,526
40		Total CWSP PMO[(b)]		$17,724	$15,348	$14,994	$13,460	$61,526
41	Chapter 4.6 – Enhanced Power Line Safety Shutoff							
42	WLDFR-M020	Enhanced Powerline Safety Settings (EPSS)[(c)]	Various	$0	$18,203	$148,921	$151,129	$318,253
43		Total EPSS		$0	$18,203	$148,921	$151,129	$318,253
44		Total Expense[(a)]		$200,797	$227,811	$344,408	$334,866	$1,136,784

(a) See WP 4-34.

(b) The 2020 and 2021 amounts for WLDFR-M009: CWSP PMO were changed during the February 25, 2022 update and will be incorporated in a future errata.

(c) The WLDFR-M020: EPSS forecast was added to Table 4-8 as part of the February 25, 2022 update.

TABLE 4-9
WILDFIRE MITIGATIONS – CHAPTERS 4.1, 4.2, AND 4.3
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL: FEBRUARY 25, 2022 UPDATED FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation Number	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total
1	Chapter 4.1 – Situational Awareness and Forecasting Initiatives										
2	WLDFR-M07B	Weather Stations	21A	$8,315	$6,399	$6,377	$3,270	$1,122	$1,155	$1,189	$27,827
3	WLDFR-M07C	WSOC	21A	(38)	1,542	129	–	–	–	–	1,633
4	WLDFR-M07G	Partial Voltage Detection	21A	1,216	331	627	–	–	–	–	2,174
5	WLDFR-M07I	Advanced Fire Modeling	21A	899	–						899
6	WLDFR-M07J	Meteorology	21A		1,028	1,055	1,083	1,890	1,905	1,967	8,928
7	WLDFR-M008	Safety and Infrastructure Protection Teams	21A	1,254	152	1,187	248	278	281	290	3,690
8		Total Situational Awareness and Forecasting Initiatives		$11,646	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446	$45,151
9	Chapter 4.2 – PSPS Operations										
10	WLDFR-M006	PSPS Field Ops Tech Capital	21A	–	$1,028	$994.09	–	–	–	–	$2,022
11	WLDFR-M006	CRC Preparedness Program	21A	1,021		255	261	269	277	284	2,368
12	WLDFR-M006	PSPS Capital Equipment	21A	1,376	2,056	1,987.19	–	–	–	–	5,419
13		Total PSPS Operations		$2,397	$3,084	$3,237	$261	$269	$277	$284	$9,808
14	Chapter 4.3 – System Hardening, Enhanced Automation, and PSPS Impact Initiatives										
15	WLDFR-M002	System Hardening[(c)]	08W	$484,915	$415,654	1,030,125	1,512,026	2,541,346	3,018,650	3,423,762	12,426,478
16	WLDFR-M004	Expulsion Fuse Replacement	2AP	7,847	15,125	15,388	15,752	16,257	16,777	17,314	104,460
17	WLDFR-M006	PSPS Reduction Initiatives – Sectionalizer Device Install/Replace	49H	69,441	42,890	20,919	11,933	12,255	12,586	12,926	182,949
18	WLDFR-M006	PSPS Reduction Initiatives – Temporary Distribution Microgrids	49M	3,746	16,448	13,559	–	–	–	–	33,753
19	WLDFR-M07A	Situational Awareness and Forecasting Initiatives - Line Sensors	49I	2,272	12,369	8,037	8,254	6,474	5,964	6,125	49,496
20	WLDFR-M07F	Situational Awareness and Forecasting Initiatives – SIQ	21A	–	–	–	10,507	–	–	–	10,507
21	WLDFR-M10A	Additional System Automation and Protection	49A	1,456	6,990	–	–	–	–	–	8,446
22	WLDFR-M10B	Additional System Automation and Protection – FuseSaver	49T	–	2,305	2,764	2,940	3,087	3,241	3,403	17,740

TABLE 4-9
WILDFIRE MITIGATIONS – CHAPTERS 4.1, 4.2, AND 4.3
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL: FEBRUARY 25, 2022 UPDATED FORECAST
(THOUSANDS OF NOMINAL DOLLARS)
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total
23	WLDFR-M10C	Additional System Automation and Protection – REFCL	49R	4,798	8,224	16,876	17,331	17,800	18,280	18,774	102,083
24	WLDFR-M011	Situational Awareness and Forecasting Initiatives – EFD	49I	–	–	4,647	5,434	6,234	7,486	8,786	32,588
25	WLDFR-M012	Situational Awareness and Forecasting Initiatives – DFA	49I	–	–	10,351	8,965	9,002	9,245	9,495	47,058
26		Total System Hardening, Enhanced Automation and PSPS Impact Initiatives		$574,476	$520,005	$1,122,666	$1,593,142	$2,612,455	$3,092,229	$3,500,585	$13,015,557
30		Total Capital[(a)(b)]		$588,518	$532,540	$1,135,277	$1,598,004	$2,616,014	$3,095,315	$3,504,315	$13,070,516

(a) The 2020 recorded adjusted total includes $287 associated with Chapter 4.4 that is not shown on this table because costs are shown rounded to the nearest thousand dollars.

(b) See WP 2-35.

(c) The System Hardening forecast has been updated in the February 25, 2022 testimony. The change in forecast costs is: $102.2 million in 2022; $603.1 million in 2023; $1,661.4 million in 2024; $2,154.2 million in 2025; and $2,606.6 million in 2026.

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony ____x_____ Workpapers _____ SOQ _____

Exhibit Number: __4__ Chapter Number: ___4.0_____

Chapter Title:__ Wildfire Mitigations_____

Witness Name: Matthew Pender

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
4-20	1	Section Header	Wildfire Memorandum Account	Wildfire Memorandum Accounts
4-22	N/A	Footnote (a) for table 4-5	All 2023 and later forecast amounts shown on line 11 will be tracked in the WMBA.	All 2023 and later forecast amounts shown on line 10 will be tracked in the WMBA.
4-25, Table 4-7	5	WLDFR-M07I 2021 Forecast, Total	1,028, 1,927	$0, 899
4-25, Table 4-7	6	WLDFR-M07J 2021 Forecast, Total	Blank, 7,900	1,028, 8,928

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4.1

SITUATIONAL AWARENESS AND FORECASTING

[INCLUDES NOVEMBER 5, 2021 ERRATA]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.1
SITUATIONAL AWARENESS AND FORECASTING

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.1
SITUATIONAL AWARENESS AND FORECASTING

A. Introduction

1. Scope, Purpose, and Support for this Request

This chapter presents Pacific Gas and Electric Company's (PG&E or the Company) 2023 expense and capital forecast for its Electric Distribution Situational Awareness and Forecasting activities. This chapter demonstrates that the forecast for these activities is reasonable and should be adopted by the California Public Utilities Commission (CPUC or Commission). The programs described in this chapter represent critical elements of PG&E's wildfire risk mitigation program. Electric Distribution Situational Awareness includes the Wildfire Safety Operations Center (WSOC),[1] Safety and Infrastructure Protection Team (SIPT), wildfire cameras, Partial Voltage Detection, and meteorology and fire detection.

WSOC serves as a physical hub for coordination, facilitation, and communications of PG&E's wildfire-response activities.

SIPT crews perform high priority fire mitigation work, protect PG&E assets, and gather critical data to help prepare for and manage wildfire risk.

Wildfire cameras improve PG&E's overall situational awareness and are used by California Department of Forestry and Fire Protection, California Office of Emergency Services (OES), United States Forest Service (USFS), PG&E, and other local agencies to identify and track wildfires in real-time, from ignition to containment.

PG&E's Partial Voltage Detection program enhances customer/public safety and helps to mitigate wildfires.

Programs associated with meteorology, weather forecasting, the fire potential index (FPI) and fire detection projects help to maintain and enhance PG&E's weather forecasting capabilities and wildfire detection capabilities. Many of these capabilities are foundational to the Public Safety

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[1] PG&E describes the forecast for WSOC in this chapter through 2022. In 2023 and beyond, the WSOC forecast moves to Ch. 5 of this exhibit to reflect a shift towards an All Hazards approach.

Power Shutoff (PSPS) program. This work includes expanded weather station deployment, a satellite-based fire detection system, and Advanced Fire Modeling (AFM).

2. Summary of Request

PG&E requests that the Commission adopt its 2023 expense forecast of $43.4 million[2] for five activities addressed in this chapter: (1) SIPT; (2) Wildfire Cameras; (3) Partial Voltage Detection; (4) Expanded Weather Station Deployment; and (5) Meteorology Weather Forecasting, FPI and Fire Detection Projects. PG&E's 2023 forecast is $9.4 million higher than its 2020 recorded expenses of $34 million.[3]

PG&E further requests that the Commission adopt its capital expenditure forecasts for five activities addressed in this chapter: (1) the WSOC;[4] (2) SIPT; (3) Partial Voltage Detection; (4) Expanded Weather Station Deployment; and (5) Meteorology Information Technology (IT) Support. PG&E forecasts $9.5 million 2021, $9.4 million for 2022, $4.6 million for 2023, $3.3 million for 2024, $3.3 million for 2025, and $3.4 million for 2026.[5] PG&E's 2023 forecast is $7.0 million lower than its 2020 recorded expenses of $11.6 million.

Forecasts in this chapter are shown with escalation at the Major Work Category (MWC) level and escalation is included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

3. Overview of Recorded and Forecast Costs

Expenditures for the activities described herein are divided into one expense and one capital MWC, listed in Table 4.1-1 below. The following sections describe each of the MWCs and explain how the cost forecasts for each were derived. Tables 4.1-6 and 4.1-7 at the end of this chapter show

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2 See Exhibit (PG&E-4), WP 4-6, line 12.

3 Values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal. 2020 recorded amounts include the WSOC.

4 PG&E's capital forecast in this chapter includes the WSOC through 2022.

5 See Exhibit (PG&E-4), WP 4-19, line 5.

the 2016-2020 capital and expense recorded amounts, the 2021-2023 expense forecast, and the 2021-2026 capital forecast by MWC.

TABLE 4.1-1
ELECTRIC DISTRIBUTION SITUATIONAL AWARENESS AND FORECASTING MWCS

Line No.	MWCs	Title
1	Expense	
2	AB	Miscellaneous Expense
3	Capital	
4	21	Miscellaneous Capital

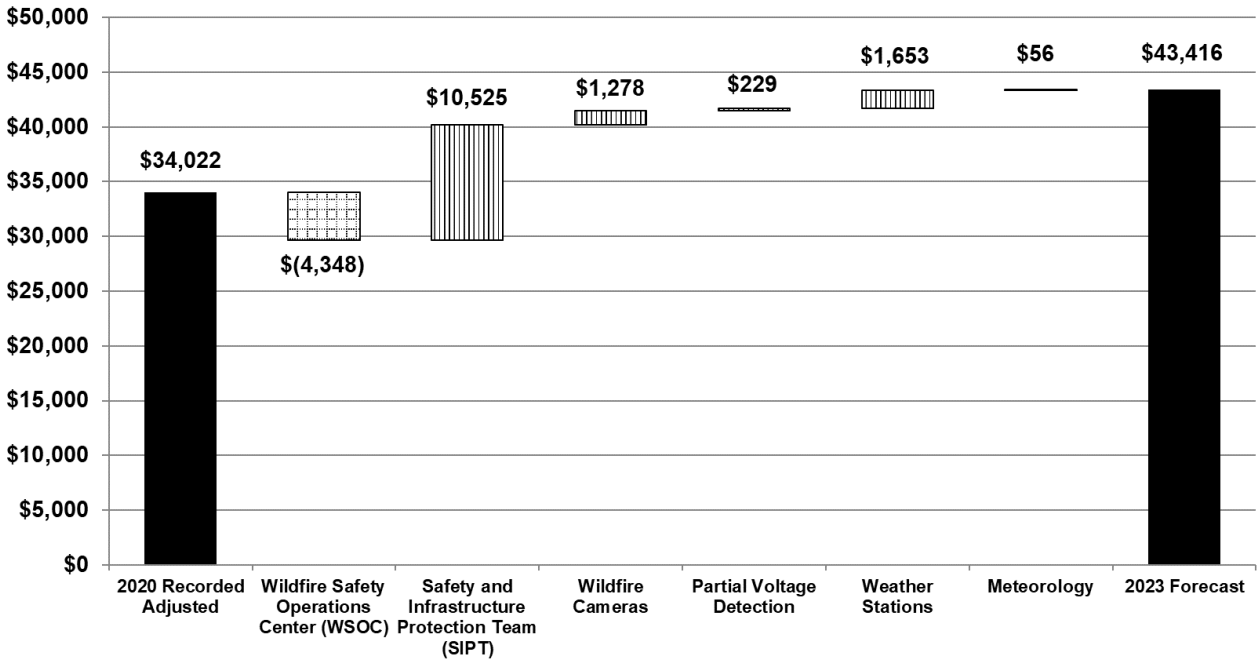
a. Expense

Expense activities in this chapter are recorded in MWC AB. As shown in Figure 4.1-1 below, forecast costs for expense activities are expected to increase by $9.4 million, or 28 percent, between 2020 and 2023.[6] PG&E describes below the major expense drivers of the forecast shown in Figure 4.1-1. PG&E's 2023 expense forecast for Situational Awareness and Forecasting wildfire mitigation activities in 2023 is $43.4 million, which is $9.4 million higher than 2020 recorded costs of $34 million.[7]

[6] Values vary from the values listed in the RO Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

[7] See Exhibit (PG&E-4), WP 4-6, line 12.

FIGURE 4.1-1
EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



The activities driving this increase include increased costs due to the expansion of the SIPT and expanded weather station deployment. These increases are partially offset by the removal of the WSOC from PG&E's 2023 forecast in this chapter. In 2023, the former WSOC will transition to become the Hazard Awareness and Warning Center (HAWC)[8] supporting PG&E's overall emergency response, as opposed to just wildfire response. The 2023 expense forecast for the HAWC is discussed Chapter 5 of this exhibit.

b. Capital

Capital activities in this chapter are recorded in MWC 21. As shown in Figure 4.1-2 below, forecast costs for capital activities are expected to decrease by $7.0 million, or 61 percent, between 2020 and 2023.

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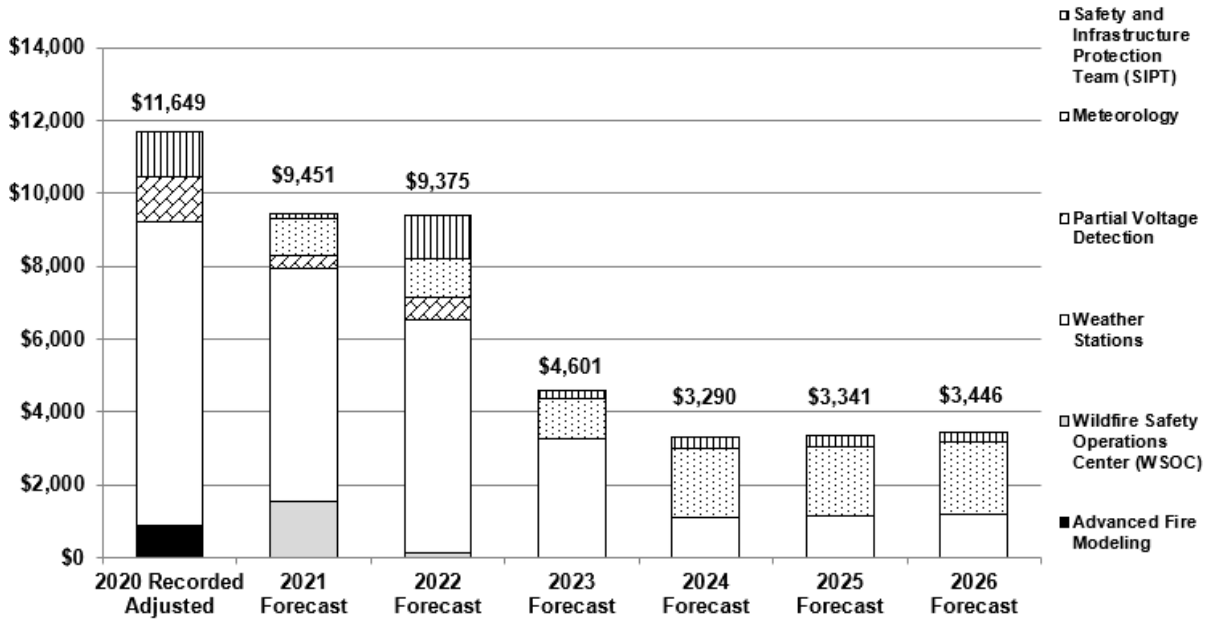
8 The control/mitigation name associated with the WSOC as well as its future state (HAWC) will remain "WSOC" across Ch. 4.1 and Ch. 5.

FIGURE 4.1-2
CAPITAL RECORDED AND FORECAST 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



The activities driving this decrease include: a reduction in costs for WSOC capital equipment; deploying fewer weather stations; and reduced capital expenditures for the Partial Voltage Detection program.

PG&E describes below the major capital drivers of the forecast shown in Figure 4.1-2. In 2020, recorded capital expenditures were $11.6 million. Situational Awareness and Forecasting is forecasting capital expenditures of $9.5 million for 2021, $9.4 million for 2022, $4.6 million for 2023, $3.3 million for 2024, $3.3 million for 2025, and $3.4 million for 2026.[9] PG&E's 2023 capital forecast is $7.0 million lower than its 2020 recorded expenditures of $11.6 million.

B. Program and Risk Overview

1. Program Overview

The work forecast in this chapter is designed to reduce the risk of wildfire through activities and services aimed at improving situational awareness, weather forecasting and fire risk modeling that is used by PG&E and other agencies to help protect all Californians.

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9 See Exhibit (PG&E-4), WP 4-19, line 5.

2. Risk Integration

Chapter 3 of this exhibit describes how Electric Operations (EO) uses the Enterprise and Operational Risk Management Program to manage electric system risks. In Chapter 3 of this exhibit, PG&E describes how management of the Wildfire risk has changed since the filing of the 2020 RAMP Report, provides updated Risk Spend Efficiency (RSE) scores, and lists each Wildfire mitigation and control and indicates if it has changed since the 2020 RAMP Report filing. PG&E provides more information about the wildfire mitigations associated with activities in this chapter and the work needed to implement them.

Table 4.1-2 below shows the EO risks associated with the forecasts discussed in this chapter.

TABLE 4.1-2
RISKS DISCUSSED IN THIS CHAPTER

Risk Name	Risk ID	Type of Risk	Maintenance Activity Type (MAT)
Wildfire	WLDFR	Risk Assessment and Mitigation Phase (RAMP)	AB6, 21A

a. RAMP Risk – Wildfire

1) Risk Overview

The Wildfire risk is defined as PG&E assets or activities that may initiate a fire that is not easily contained and endangers the public, private property, sensitive lands, or environment. Wildfire was one of PG&E's 2020 RAMP risks.[10]

2) General Rate Case (GRC) Risk Mitigations

As shown in the tables below, PG&E is forecasting two mitigations in this chapter, one of which has nine subparts. These mitigations were determined to reduce the frequency or consequence of risk of wildfire. A brief description of each

[10] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10.

mitigation is provided in the tables below. More detail is included in the 2020 RAMP Report.[11]

[11] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), starting at page 10-22.

TABLE 4.1-3
WILDFIRE
FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	WLDFR-M07B	Situational Awareness and Forecasting Initiatives - Weather Station	Purchase, installation, maintenance, and operation of weather stations. Collection, recording, and analysis of weather data from weather stations and from external sources.	Foundational	See Section C.1.c.1 and Section C.2.b for more information	21A, AB6
2	WLDFR-M07C	Situational Awareness and Forecasting Initiatives - WSOC	The WSOC is a physical facility which serves as PG&E's central information hub for all wildfire-related data. The WSOC team monitors, analyzes, and initiates wildfire mitigation and response efforts throughout the service area.	Foundational	This becomes EPNDR-C002 in 2023. See Section C.1.a and Section C.2.a for more information	21A, AB6
3	WLDFR-M07D	Situational Awareness and Forecasting Initiatives - Cameras	Purchase, installation, maintenance, and operation of HD cameras. Cameras used to identify and track wildfires in real-time, from ignition to containment.	All Consequences	See Section C.1.b for more information	AB6
4	WLDFR-M07E	Situational Awareness and Forecasting Initiatives - Satellite Fire Detection	Collection, recording, and analysis of Satellite data indicating fires in our service territory	All Consequences	See Section C.1.c.3 for more information	AB6
5	WLDFR-M07G	Situational Awareness and Forecasting Initiatives – Partial Voltage Detection	Single-Phase and Three-phase SmartMeters™ send real-time alarms indicating partial voltage conditions to the Distribution Management System. Detection of partial voltage conditions allows Control Center Operators to dispatch field personnel to locations where equipment may be in a condition that increases wildfire risk.	Equipment/Facility Failure, Vegetation Contact	See Section C.1.e and Section C.2.c for more information. Formerly called Enhanced Wire Down.	21A, AB6
6	WLDFR-M07H	Situational Awareness and Forecasting Initiatives – Storm Outage Prediction Project (SOPP) Improvements	Develop methodology for forecast of weather conditions relevant to utility operations. forecasting weather conditions and conducting analysis to incorporate into utility decision-making.	Foundational	See Section C.1.c.2 for more information; This mitigation was named Meteorology/Fire and Storm Modeling in RAMP	AB6
7	WLDFR-M07I	Situational Awareness and Forecasting Initiatives – Advance Fire Modeling	Foundational element to the PSPS program and daily mitigation activities that reduce the risk of utility caused ignition. Fuel sampling and fire spread modeling initiatives improve, deploy, and maintain operational models that help PG&E predict the consequence and risk of fires.	Foundational	See Section C.1. d for more information; Advance Fire Modeling includes Dead and Live Fuel Moisture Modeling, Fire Spread Modeling and FPI (WLDFR-M07K).	AB6

TABLE 4.1-3
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
8	WLDFR-M07J	Situational Awareness and Forecasting Initiatives – Meteorology	Deployment of high-resolution models which are based on historical datasets which are used to develop outage potential and FPI forecasts.	Foundational	See Section C.1.c.2 for more information. The meteorology IT support, discussed in Section C.1.g and Section C.2.e, provides foundational support to this mitigation.	21A, AB6
9	WLDFR-M07K	Situational Awareness and Forecasting Initiatives – FPI	The FPI model combines weather (wind, temperature, and relative humidity) and vegetative fuels (10-hour dead fuel moisture, live fuel moisture, and fuel type) into an index that represents the probability of large fires to occur.	Foundational	See Section C.1.d.3 for more information	AB6
10	WLDFR-M008	SIPT	Personnel position within utility service territory to monitor system conditions and weather on site. Field observations shall inform operational decisions.	Consequence only	See Section C.1.f and Section C.2.d 2 for more information	21A, AB6

3) Changes to Mitigations

PG&E modified its portfolio of mitigations associated with Situational Awareness and Forecasting since filing the 2020 RAMP Report. The work for some of the mitigations proposed in the 2020 RAMP Report has also changed as described below.

In the 2020 RAMP Report, PG&E proposed an omnibus mitigation that contained several distinct situational awareness and forecasting activities: M7—Situational Awareness and Forecasting Initiatives. For the 2023 GRC, PG&E has divided the M7 mitigation into eleven subparts (M07A-M07K) to provide a more granular view of its forecast and risk modeling. Nine of these Situational Awareness and Forecasting mitigations are discussed in this chapter; the remaining two are discussed in Chapter 4.3. In the 2020 RAMP Report, the activities associated with the M7 mitigation were identified and have not changed.

Additionally, PG&E has refined its forecast for the SIPT mitigation described in the 2020 RAMP Report. PG&E's 2023 GRC forecast for SIPT is lower than what was presented in the 2020 RAMP Report.[12] PG&E believes that this forecast more accurately reflects the level of staffing needed for SIPT to meet its goals and commitments. In this GRC, PG&E has also added a small capital forecast for SIPT for radios, pumps, lighting, and other equipment for crews.

4) Cost Tables

Tables 4.1-4 and 4.1-5 below shows the forecast costs for the mitigations described above.[13]

[12] See Exhibit (PG&E-4), WP 3-20, lines 62 and 63.

[13] See Exhibit (PG&E-4), WP 3-5, line 31 (WLDFR mitigations, capital) and WP 3-7, line 31 (WLDFR mitigations, expense).

TABLE 4.1-4
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Record Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	Total	RSE[a]
1	WLDFR-M07B	Situational Awareness and Forecasting Initiatives – Weather Station	AB6	$111	$1,572	$1,641	$1,764	$5,088	[b]
2	WLDFR-M07C	Situational Awareness and Forecasting Initiatives – WSOC	AB6	4,348	9,139	7,181	–	$20,668	[b]
3	WLDFR-M07D	Situational Awareness and Forecasting Initiatives – Cameras	AB6	6,956	9,385	11,532	8,234	$36,107	19.45
4	WLDFR-M07E	Situational Awareness and Forecasting Initiatives – Satellite Fire Detection	AB6	–	341	351	362	$1,054	154.74
5	WLDFR-M07G	Situational Awareness and Forecasting Initiatives – Partial Voltage Detection	AB6	4	–	85	233	$318	283.0
6	WLDFR-M07H	Situational Awareness and Forecasting Initiatives – SOPP Improvements	AB6	1,627	1,969	2,029	–	$5,625	[b]
7	WLDFR-M07I	Situational Awareness and Forecasting Initiatives – Advance Fire Modeling	AB6	5,541	5,969	6,152	6,345	$24,007	[b]
8	WLDFR-M07J	Situational Awareness and Forecasting Initiatives – Meteorology	AB6	–	515	531	438	$1,484	[b]
9	WLDFR-M07K	Additional System Automation and Protection – FPI	AB6	93	154	159	174	$580	[b]
10	WLDFR-M008	SIPT	AB6	15,342	30,304	24,899	25,867	$96,412	1.0
11		Total		$34,021	$59,348	$54,560	$43,416	$191,345	

(a) RSE values include all the MATs associated with a mitigation or control, not for individual MATs. While the RSEs may be shown for the individual MATs, the RSE value is assumed to incorporate the combined costs and risk reduction for all the assigned MATs.

(b) PG&E considers these foundational mitigations and, as such, does not calculate and RSE for them.

TABLE 4.1-5
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Record Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total	RSE[a]
1	WLDFR-M07B	Situational Awareness and Forecasting Initiatives – Weather Station	21A	$8,315	$6,399	$6,377	$3,270	$1,122	$1,155	$1,189	$27,827	[b]
2	WLDFR-M07C	Situational Awareness and Forecasting Initiatives – WSOC	21A	(34)	1,542	129	–	–	–	–	1,637	[b]
3	WLDFR-M07G	Situational Awareness and Forecasting Initiatives – Partial Voltage Detection	21A	1,216	331	627	–	–	–	–	2,174	283.0
4	WLDFR-M07I	Situational Awareness and Forecasting Initiatives – Advance Fire Modeling	21A	899	-						899	[b]
5	WLDFR-M07J	Situational Awareness and Forecasting Initiatives – Meteorology	21A	-	1,028	1,055	1,083	1,890	1,905	1,967	8,928	[b]
6	WLDFR-M008	SIPT (Capital)	21A	1,254	152	1,187	248	278	281	290	3,689	1.0
7		Total		$11,649	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446	$45,153	

(a) RSE values include all the MATs associated with a mitigation or control, not for individual MATs. While the RSEs may be shown for the individual MATs, the RSE value is assumed to incorporate the combined costs and effectiveness for all the assigned MATs.

(b) PG&E considers these foundational mitigations and, as such, does not calculate and RSE for them.

(PG&E-4)

C. Activities, Costs, and Forecast Drivers by Risk Mitigation

1. Expense (MWC AB)

PG&E's Situational Awareness and Forecasting activities are a combination of expense and capital work. The expense work, recorded in MWC AB, is described in this section. The capital work, recorded in MWC 21, is described in Section C.2. below.

a. WSOC/HAWC (WLDFR-M07C)

PG&E opened the WSOC in May 2018 to serve as a physical hub for coordination, facilitation, and communications of PG&E's wildfire-response activities. The WSOC plays a key role in PG&E's efforts to provide customer and community safety while addressing the challenges of climate-driven extreme weather events such as wildfires. In future years, PG&E plans to change the WSOC charter to provide "All Hazards" monitoring. The WSOC currently monitors for fire ignitions across PG&E's service area 24-hours a day, seven days a week, leveraging PG&E's resources and publicly available weather information, wildfire camera data, and first responder (local and state) data. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – WSOC (WLDFR-M07C).

PG&E's WSOC monitors, assesses, and directs specific wildfire prevention and response efforts throughout its service territory. The WSOC interfaces and collaborates with various PG&E lines of business (LOB) to assist in deploying technology, processes, and procedures for wildfire prevention, response, and recovery. The WSOC also obtains information from PG&E field personnel, including Public Safety Specialists (PSS) and SIPT crews. When wildfires meet established criteria (e.g., certain proximity to PG&E assets), the WSOC generates and distributes notifications or reports via text message or email. These reports include the wildfire status, a list of PG&E assets threatened or impacted, and the location of the wildfire. The WSOC sends the reports to internal distribution lists within PG&E, including field staff, control center personnel, executive staff, supporting LOBs, and other PG&E emergency responders.

In addition, the WSOC communicates fire threat information to the various operations centers within PG&E (Gas Control, Electric Grid Control, Electric Distribution Control, IT/Telecom, Security, Power Generation, etc.). The real-time risk information communicated to internal control centers and field employees enables PG&E to act swiftly to protect customers and property. These notifications also facilitate the sharing of critical incident information so that PG&E can effectively coordinate with external emergency response agencies.

To that end, the WSOC coordinates with PG&E's PSS team, who interfaces with CAL FIRE, federal fire agencies and other jurisdictional agencies overseeing the response to wildfire threats and incidents. The WSOC and PSS Team share information regarding ongoing fires and new ignitions that have a potential to impact PG&E's customers and property.

In the event of a potential fire threat to one of the communities in PG&E's service area, the WSOC coordinates and helps mobilize response efforts with first responders, media, local government, and other safety officials. These response efforts may involve some of the new and enhanced safety measures PG&E is implementing to further reduce the risk of future wildfires, including temporarily de-energizing electric power lines in high fire-threat areas when extreme fire conditions are present. In 2020, the WSOC played an integral role in PG&E's effort to protect communities during the August Lightning Complex fires, as well as multiple PSPS events.

In 2021, PG&E will pursue expanding the charter of the WSOC into the HAWC. Additional hazards monitored will include debris flow/landslide events, Company response to earthquakes, and severe weather events. The center will remain staffed 24/7 with employees monitoring and reporting on broader real-time emergency events. The center will serve as a centralized hub for emergency and hazard communications and intelligence to internal stakeholders. PG&E's HAWC will not replace existing communication processes within the respective lines of businesses, but rather will operate as a centralized resource for real-time situational awareness and intelligence.

PG&E plans to implement phase one of the HAWC in 2021, and further stabilize and mature the center in 2022.

PG&E's 2020 recorded costs were $4.3 million.[14] PG&E's expense forecast for the WSOC is $9.1 million in 2021 and $7.2 million in 2022. Costs include labor-related costs for field, support, and leadership employees. In 2023, the WSOC will fully transition into the HAWC; the expense forecast for the HAWC from 2023 on is discussed in Chapter 5 of this exhibit. Comparisons from WSOC's recorded 2020 expenses and the 2023 forecast for the HAWC will be covered in Chapter 5 of this exhibit. For reference, the control/mitigation name of the HAWC will remain "WSOC" in Chapter 5 as mentioned above.

b. Wildfire Cameras (WLDFR-M07D)

Wildfire cameras improve PG&E's overall situational awareness and are a valuable tool for assisting the WSOC (including in its future state as a HAWC), first responders, and fire agencies. Wildfire cameras are used by CAL FIRE, OES, USFS, PG&E, and other local agencies at no cost to identify and track wildfires in real-time, from ignition to containment. These cameras allow PG&E employees and other stakeholders, including jurisdictional agencies, to more quickly confirm reports of fire, assess the size and spread, and ultimately help deploy resources directly to areas where they can have the most impact. After wildfire containment, the cameras allow PG&E, firefighting agencies, and other interested stakeholders to monitor conditions to ensure a wildfire does not re-ignite. First responders and external agencies such as CAL FIRE and the USFS have access to control PG&E's cameras (pan/tilt/zoom) to assist with their respective fire response efforts. Live feeds and time-lapse data from this camera network are available to the public.[15] ALERT Wildfire owns the camera infrastructure and camera data on its platform, including PG&E funded cameras. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Cameras (WLDFR-M07D).

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[14] See Exhibit (PG&E-4), WP 4-6, line 1.

[15] Available at <http://www.alertwildfire.org> (as of June 10, 2021).

By using camera technology, PG&E gains valuable visual intelligence and potential early warning of wildfires that could impact our electric and gas facilities. Wildfire cameras give us the information needed to: (1) issue alerts in the event of a fire and direct employees to seek safety; (2) suspend or reduce services that may be hazardous if damaged (such as lowering pressure in certain gas transmission pipes; or de-energizing power to electrical substations that may be adversely affected); and (3) initiate emergency management and response.

Benefits of wildfire cameras include:

- Heightened awareness of lightning strikes and wildfire; Increased ability to take safety precautions prior to a wildfire event, leading to increased employee safety;
- Increased ability to take damage mitigation actions prior to a wildfire event, leading to increased public safety;
- Increased ability to manage crews, assets, and individual personnel through knowledge of geographic areas likely to receive the most damage prior to a wildfire event; and
- Scaled wildfire response based on wildfire intelligence provided by the camera network; and potential for decreased restoration times due to improved situational awareness for senior management directing crew allocation and assignments.

PG&E plans to install approximately 134 additional cameras per year in 2021 and 2022,[16] for a total of 600 cameras. These camera installations will provide 90 percent viewshed coverage of Tier 2 and Tier 3 High Fire Threat District (HFTD) areas across PG&E's service territory. Between 2023-2026, forecasts are intended to cover replacement installations and operations and maintenance (O&M) costs. PG&E's partner (UCSD/ALERT Wildfire) will continue to provide and install the cameras; maintain and operate the cameras; and support and manage the program and software applications, as well as a Data Center with redundancy.

16 See Exhibit (PG&E-4), WP 4-7, line 15.

The number of cameras PG&E plans to install will exceed its capability to manually monitor each feed. PG&E currently leverages other information, such as satellite fire detections and Integrated Reporting Wildfire Information (IRWIN) to help determine which camera(s) should be viewed. PG&E plans to continue research with UCSD and leading vendors in a collaborative effort aimed at further advancing automated monitoring capabilities. This research is aimed at identifying and incorporating Artificial Intelligence (AI) early fire detection software which incorporates machine learning, and visualization techniques to display 360-degree imagery from spinning cameras. The technology would program cameras to automatically rotate and zoom to view emerging incidents based on input from fire incident reports (such as detections from the PG&E Fire Detection and Alert System). Due to the emergent nature of these new technologies, PG&E is unable to quantify a forecast at this time for testing/implementing advanced AI-capability software and incorporating it into the preexisting camera network. However, PG&E plans to record costs for any pilot and/or continued research through the Wildfire Mitigation Balancing Account (WMBA).

PG&E's expense forecast for Wildfire Cameras is $9.4 million in 2021, $11.5 million in 2022, and $8.2 million in 2023.[17] The forecast covers installation and on-going O&M expenses.[18] PG&E's 2023 forecast is $1.3 million higher than its 2020 recorded costs of $7.0 million. The primary reason for the increase is ongoing O&M expenses.

c. Wildfire Detection Meteorology Projects

1) Expanded Weather Station Deployment (WLDFR-M07B)

To bolster wildfire prevention and emergency response efforts, PG&E has expanded its weather monitoring capability by installing a network of PG&E-owned and operated weather stations across the service area. PG&E's meteorology team is leading the project to

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17 See Exhibit (PG&E-4), WP 4-6, line 3.

18 See Exhibit (PG&E-4), WP 4-36.

install 1,300 new weather stations across its territory between 2018 and 2022, with project management help from IT and other organizations. Our robust weather station network provides continuous, localized weather information that facilitates improved understanding of weather conditions in localized areas and real-time awareness of wildfire danger. Additionally, the weather station data improves weather modeling capabilities, and contributes to the selection of the most accurate weather model configuration for PG&E's service territory. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Weather Station (WLDFR-M07B)

PG&E Meteorology Department staff uses data from the weather stations to model and monitor real-time weather and fire danger conditions. For example, the weather stations provide temperature, humidity, and wind speed data which are key inputs in PG&E's AFM system. Weather station data is also foundational to the PSPS program and helps facilitate operational decision-making during PSPS events, both during the de-energization and re-energization (all clear) decision-making phases of a PSPS event.

As mentioned above, PG&E is in the process of expanding its weather station program to at least 1,300 weather stations by the end of 2022. From 2023-2026, PG&E plans to continue to install additional weather stations as needed to fill in data gaps and better support PSPS operations. PG&E also plans to optimize the placement of some existing weather stations by moving them to more ideal and windier locations on circuits if possible.

Operating and maintaining the weather stations requires an annual calibration by a technician and replacement of equipment as needed. These costs scale to the size of the network as each weather station requires calibration to ensure data fidelity for PSPS purposes.

PG&E's expense forecast for Expanded Weather Station Deployment is $1.6 million in 2021, $1.6 million 2022, and $1.8 million in 2023. PG&E's 2023 forecast is $1.7 million higher

than its 2020 recorded costs of $0.1 million.[19] The primary reason for the increase is growth in ongoing O&M costs as the size of the network increases.

This is primarily a capital project and is discussed further in Section C.2.b below.

2) Numerical Weather Prediction and SOPP Model Automation (WLDFR-M07H, WLDFR-M07J)

PG&E Meteorology remains committed to advancing its weather forecasting capabilities by working with external numerical weather prediction experts. Weather model data is foundational and informs many operational decisions throughout PG&E to prepare for forecasted conditions and mitigate risk, including through PSPS. PG&E has tested and deployed high-resolution models and built high-resolution historical datasets. These high-resolution historical datasets and forecasts drive outage potential and FPI models, which are the main inputs into PG&E's PSPS decision-making framework. More accurate forecasts and historical datasets may lead to smaller and more targeted PSPS events as well as improved ability to communicate the potential of a PSPS event to customers and all stakeholders. The work described in this section includes two Wildfire mitigations: (1) Situational Awareness and Forecasting Initiatives – SOPP Improvement (WLDFR-M07H); and (2) Situational Awareness and Forecasting Initiatives – Meteorology (WLDFR-M07J).

PG&E first deployed the PG&E Operational Mesoscale Modeling System (POMMS) in 2014, upgraded the system to POMMS 2.0 in 2018, and upgraded again to POMMS V3.0 in 2020. POMMS is a customized version of the National Center for Environmental Prediction Weather Research and Forecast model that is run at 2x2 km resolution across Northern and Central California. PG&E will continue operating this foundational numerical weather prediction program in 2021-2026 and plans to improve the

19 See Exhibit (PG&E-4), WP 4-6, line 5.

model's capabilities in future years, consistent with historical advancements described above. Advances in future years are expected to keep pace with advances in weather prediction technology and increases in forecast granularity.

PG&E's SOPP Model is the primary tool utilized by PG&E's Meteorology Department to forecast the magnitude and timing of unplanned outage activity on the distribution and transmission system that may occur due to weather events (e.g., wind, rain, snow, heat).

In addition, the SOPP model provides key input to PG&E's operational staffing and logistical decisions to support PG&E's planning for upcoming weather/storm emergency events. The primary goal of this program is to be prepared for storms and reduce customer outages to the extent possible. For example, the model informs PG&E's decisions regarding whether to open the Emergency Operations Center, and if the storm is severe enough, execute PG&E's mutual aid and mutual assistance agreements in advance of storms. The SOPP model mitigates operational risk and reduces customer outage times arising from weather events that create high unplanned outage volumes.

The SOPP model is comprised of multiple sub-models that predict wind-to-outage, heat-to-outage, and snow-to-outage relationships in specific geographic areas. PG&E plans to continue to improve certain aspects of these sub-models in future years to improve the overall SOPP model and PG&E's operational decisions based on the model.

PG&E's forecast for Numerical Weather Prediction and SOPP Model Automation in Chapter 4.1 is approximately $2.0 million in 2021 and $2.0 million in 2022.[20] The forecast covers continued advancements of the Outage Producing Wind (OPW), improvements to the heat-outage prediction model, and other developments described in more detail above. PG&E's 2020

[20] See Exhibit (PG&E-4), WP 4-6, line 7.

recorded costs were $1.6 million. Beginning with 2023, forecasts for this program are discussed in Chapter 5 (Emergency Preparedness and Response) of this exhibit to reflect the fact that this program is intended to be applicable to other emergencies in addition to wildfires (e.g., storms).

3) Satellite Fire Detection System (WLDFR-M07E)

This project involves continued operation of and improvements to a fully operational satellite-based fire detection and alert system. Satellite fire detection provides PG&E with valuable timely information about new fires and the spread of existing fires. This information can be used to ensure the safety of customers and utility workers in the area, help identify assets at risk, and provide situational awareness as to the burn severity and rate of spread. PG&E determined that a satellite-based fire detection system, which monitors continuously, was more effective than its prior approach, daily fixed-wing flight patrols.[21] This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Satellite Fire Detection (WLDFR-M07E).

As of December 31, 2020, the system ingested and reconciled fire detection data from two Geosynchronous Satellites and four polar orbiting satellites. PG&E developed the system to incorporate new fire detection data feeds as they become available and plans to incorporate new satellite feeds from 2023 to 2026 as more satellites are deployed by National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration. PG&E will continue to work with industry-leading fire detection algorithm developers and experts from the Space Science and Engineering Center at the University of Wisconsin-Madison to procure customized feeds of satellite fire detection data with the lowest latency available.

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[21] As of 2019, only one plane remained, and fixed-wing patrols were discontinued altogether by 2020.

To visualize and interact with the fire detection data, PG&E developed a proprietary internal application in 2019 and an external application available to the public in 2020 that combines and displays fire detection alerts as they arrive. PG&E plans to continue to support these websites and will make incremental improvements through 2023-2026. PG&E is committed to sharing this data with interested stakeholders and the public. This tool helps the PG&E respond to new and emerging events quickly and make faster operational decisions.

PG&E's expense forecast for the Satellite Fire Detection System is $0.3 million in 2021, $0.4 million in 2022, and $0.4 million in 2023.[22] This forecast covers internal labor and vendor costs. 2020 recorded costs associated with Satellite Fire Detection were $0.1 million.[23] The increase from 2020 to 2023 supports increased labor and increased integrations with other data systems throughout PG&E. The forecast also supports additional enhancements such as migrating the fire detection data pipelines and visualizations from on-premise infrastructure to Amazon Web Services (AWS). In addition, new satellites with Fire Detection capabilities are expected to come online in the 2023-2026 timeline and will need to be evaluated and incorporated into the system. An example is the NOAA – Joint Polar Satellite System program, where 2 additional satellites are expected to be launched into orbit from late 2022 to 2026.

4) Light Detection and Ranging (LiDAR) Wind Measurements

Although much can be learned about the atmosphere's meteorological conditions from a network of weather stations on the ground, these networks cannot provide information regarding conditions in certain areas of the atmosphere, most notably the Planetary Boundary Layer (PBL). The behavior of the PBL, defined

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22 See Exhibit (PG&E-4), WP 4-6, line 8.

23 2020 recorded dollars for Satellite Fire Detection were primarily recorded in the Vegetation Management program, thus are not reflected in the same planning order as Satellite Fire Detection's current and future forecasts.

as the lowest portion of the atmosphere, is directly influenced by its contact with the planetary surface. Understanding the PBL is not only important for current situational awareness, but if readily measured, it will improve our understanding, and our ability to forecast the timing and severity of extreme weather events.

Instrumentation to measure the PBL continues to evolve and, with the emergence of renewable wind energy over the last two decades, entities have started to move away from erecting large meteorological towers to collect data, in favor of ground-based LiDAR and/or microwave radiometers. These instruments continuously sample vertical profiles of temperature, humidity, and winds from the surface to around 1-3 kilometers (km) in the air. In comparison, entities like the National Weather Service only measure this part of the atmosphere with weather balloons twice a day. The continuous sampling of meteorological conditions in the PBL with LiDAR will provide a more complete, three-dimensional understanding of current conditions.

In 2021-2023, PG&E plans to investigate instrument options to continuously measure wind conditions with LiDAR. The project will include selecting test locations and evaluating the performance of LiDAR instrumentation. During the evaluation period, PG&E will plan additional LiDAR deployments, design support tools, and establish partnerships for modeling efforts. PG&E's long-term plan for 2024-2026 is to design and establish a network of LiDAR instruments. The information provided by the LiDAR network will support the Company's situational awareness and operational decision making.

The project has the potential to greatly improve PG&E's meteorology forecasts, while also providing additional information to track and study weather events. With new machine learning applications, the information from these instruments should significantly improve the accuracy and lead times for forecasting large scale changes in local and surface winds. The ultimate goal

will be to reduce PG&E's operational costs, continue to reduce our PSPS footprint, and reduce other negative reliability impacts.

At this time, PG&E is unable to predict a forecast for this project. PG&E will record costs for this program through the WMBA.

d. Advanced Fire Modeling (WLDFR-M07I)

The AFM project is foundational to the PSPS program and daily mitigation activities that reduce the risk of utility-caused ignitions. The main goals of the program are to improve, deploy and maintain operational models that help PG&E predict the consequence and risk of fires. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – AFM (WLDFR-M07I).

This program supports the following projects:

- Fire spread model operations utilizing Technosylva's fire spread model technology;
- Development of Dead Fuel Moisture (DFM) models that are required by PG&E's FPI;
- Development of Live Fuel Moisture (LFM) models that are required by PG&E's FPI;
- Live fuel moisture sampling efforts for field validation and model calibration;
- Improvements in PG&E's FPI, that predicts the probability of large fires based on weather and fuels; and
- Improvements in fire occurrence datasets to enhance the predictive skill of the FPI.

Most of these projects have a historical component as well as a forecast component. The historical component involves creating datasets across PG&E's weather climatology to create a history of dead and live fuels and fire spread simulations, in order to calibrate and train FPI and PSPS models.

PG&E's expense forecast for AFM is $6.0 million in 2021, $6.2 million in 2022, and $6.3 million in 2023.[24] This forecast supports the various activities discussed in more detail below. In addition to this

[24] See Exhibit (PG&E-4), WP 4-6, line 9.

overall AFM forecast, FPI has its own small, separate expense forecast, which is highlighted in its subsection below. PG&E's 2023 AFM forecast is $0.8 million higher than its 2020 recorded costs of $5.5 million.[25] The primary reason for the increase is escalation.

1) Dead Fuel Moisture and Live Fuel Moisture Modeling (WLDFR-M07I)

The moisture content in living and dead vegetation is a critical input to PG&E's FPI and the National Fire Danger Rating System used by state and federal fire agencies. PG&E meteorologists remain committed to advancing models utilized to simulate fuel moistures in dead and living vegetation. This work is part of the AFM Wildfire mitigation (WLDFR-M07I).

In 2020, PG&E partnered with Atmospheric Data Solutions and Technosylva to develop the next generation of LFM and DFM models deployed at PG&E. These models provide hourly DFM forecasts out four days for various types of vegetative fuel. PG&E also deployed 2x2 km LFM models for Chamise as well as Manzanita plant species. These are machine-learning models developed by Automated Dispatch System using National Fuel Moisture Database observations.

In addition to creating new forecast models, PG&E created a 30-year climatology of DFM and LFM output at 2x2 km resolution as well. These robust historical datasets allow PG&E meteorologists and data scientists to evaluate the fuel conditions present during historical fires.

From 2023 to 2026, PG&E plans to continue to operate the DFM and LFM models operationally as they are foundational to PG&E's FPI, Fire Spread Modeling, and PSPS programs. Each year, PG&E plans to add to its existing weather and fuels climatology such that additional studies to recalibrate and improve FPI predictions are possible.

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25 See Exhibit (PG&E-4), WP 4-6, line 9.

2) Fire Spread Modeling (WLDFR-M07I)

Fire spread modeling helps PG&E understand the impact and potential consequences of an ignition. Some ignitions may have minimal impact on the surrounding area and communities, while other ignitions could create significant risks including loss of life and property damage, as well as other wildfire related impacts such as air quality impacts. This work is part of the AFM Wildfire mitigation (WLDFR-M07I).

PG&E has developed several new models to better understand the impact of ignitions on surrounding areas and communities. In 2019-2020, PG&E partnered with Technosylva, an external expert in the wildfire modeling field, to test and deploy cloud-based wildfire spread model capabilities. PG&E also has the ability through a Technosylva application (Wildfire Analyst Enterprise) to simulate fires on-demand across historical, real-time, and future time horizons. The technology allows PG&E to forecast 100 million virtual fires daily across its territory in forecast mode, simulate fires on demand as they start, simulate hypothetical fires based on PSPS damage and hazard reports, and simulate fires in past weather scenarios.

Finally, PG&E has also developed a Wildfire Consequence Model using the Technosylva fire simulations. This model, in combination with wildfire ignition probability models, is used in PG&E's 2021 Wildfire Distribution Risk Model. The model can then be used to inform initiatives such as Enhanced Vegetation Management and System Hardening.

In 2021, PG&E will continue to evaluate and test a methodology to incorporate fire spread model outputs into PSPS decision making and expand the forecast horizon from three to four days. PG&E will also work with Technosylva to update the fuel model layers on an annual basis. This includes modeling new vegetation growth in recently burned areas as well as accounting for recent fire disturbances.

From 2022 to 2026, PG&E plans to continue using this technology, which will undergo annual improvements. These improvements involve an annual update to the fuels mapping datasets, updates to incorporate recent fire disturbances (fire scars), updates to building and population datasets, and updates to the core fire spread model engine and risk outputs and metrics.

3) Fire Potential Index (WLDFR-M07K)

To understand the potential for large fires to occur across its service territory, PG&E developed the FPI in 2015 and significantly enhanced the model in 2018 and 2019. The current FPI is modeled on historical fires using PG&E's 30-year downscaled climatology, DFM and LFM models, fire weather indices, and other models and data. The FPI model outputs the probability from 0 to 100 percent of observing a large (>1000 acre) fire, given an ignition. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – FPI (WLDFR-M07K).

From 2022 to 2026, the work around FPI will focus on annual recalibration, which will support operations and help inform fire mitigations on a daily basis.

PG&E's expense forecast for FPI is $0.2 million in 2021, $0.2 million in 2022, and $0.2 million in 2023.[26]

e. Partial Voltage Detection (WLDFR-M07G)

As part of its effort to enhance customer/public safety and further mitigate wildfires, PG&E initiated the Partial Voltage Detection (formerly referred to as Enhanced Wire Down Detection) project in 2018. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Partial Voltage Detection (WLDFR-M07G).

Prior to implementing SmartMeter™ technology, Control Center Operators and Dispatch were not provided with information on partial voltage conditions, which indicate loss of phase/conductor on the distribution circuit. In addition, SmartMeters™ only informed Control Center Operators of full power-out conditions. PG&E has now enabled

26 See Exhibit (PG&E-4), WP 4-6, line 10.

single-phase SmartMeters™ to send real-time alarms occurring in the Distribution Management System under partial voltage conditions (25 to 75 percent of nominal voltage). Detection of partial voltage conditions allows Control Center Operators to dispatch field personnel to locations where equipment may be in a condition that increases wildfire risk. This technology will help PG&E detect and locate a wire down condition within minutes, instead of relying on a customer phone call or employee assessment to provide notification of a wire down. This may reduce the amount of time a line is down (where it can cause an ignition) and allow first responders to extinguish wire down-related ignitions more quickly if they occur.

In the initial phase of the project in 2019, the technology was deployed in to 4.5 million single-phase SmartMeters™. The second phase, which began in 2020 and is continuing in 2021, will deploy the technology to 365,000 three-phase meters.[27]

The project will be complete after the second phase. After 2021, costs will be tied to ongoing O&M (steady state) unless additional modifications are necessary.

PG&E's expense forecast for Partial Voltage Detection is $0.1 million in 2022, and $0.2 million in 2023, which will cover on-going and future software maintenance for existing meters and any additional meters that may be installed.[28]

PG&E's 2023 forecast is $0.2 million higher than its 2020 recorded costs of $0.004 million.[29,30] The primary reason for the increase is to cover additional meters and software maintenance to installed meters.

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27 Due to unforeseen issues with contract negotiations and software issues discovered in testing, PG&E submitted a request to the CPUC Wildfire Safety Division to extend the project completion time from February 2021 to June 2021. Approval for the extension was granted in January 2021.

28 PG&E is not including a forecast for this program for 2021 but may incur some minor costs. Any such costs will be absorbed in the overall IT budget.

29 See Exhibit (PG&E-4), WP 4-6, line 4.

30 Values vary from the values listed in the Results of Operation (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

There is also a small capital expenditure forecast associated with this program, which is discussed in Section C.2.c below.

f. Safety and Infrastructure Protection Team (WLDFR-M008)

As a result of SB 901, PG&E established in-house fire protection services. Planning for these services began in December of 2018, and the SIPT was established in 2019 to support resources performing work in high fire risk areas. SIPT crews consist of two to three International Brotherhood of Electrical Workers-represented employees who are trained and certified as SIPT personnel. The SIPT crews provide standby resources for PG&E crews performing work in high fire hazard areas, pre-treatment of PG&E assets during any ongoing fire, fire protection to PG&E assets, and emergency medical services. SIPT crews perform high priority fire mitigation work, protect PG&E assets, and gather critical data to help prepare for and manage wildfire risk. SIPT crews perform both routine and emergency work. This program is a Wildfire mitigation referred to as SIPT (WLDFR-M008).

While SIPT crews do not respond to wildfires without Agency Having Jurisdiction (AHJ) approval, they can help suppress any potential ignition at PG&E work sites when protecting our crews and assets. When first responders arrive on scene, SIPT crews follow the incident command system established by the responding AHJ. SIPT crews may also perform non-wildfire related emergency response work and charge their time for these responses to the appropriate cost centers (e.g., Major Emergency response activities, maintenance work).

During PSPS events, SIPT crews are deployed to collect real-time weather and field conditions data to report to the WSOC. This data is used to inform and validate PG&E's PSPS decision making process. SIPT crews provide information to support a finding of "all clear" conditions necessary to authorize power restoration activities. As additional support following a decision to restore power, they patrol sections of re-energized lines.

SIPT crews also gather fuel samples at regular intervals at 30 locations across the service territory, which are then analyzed for

their live moisture content. PG&E Meteorology uses this information as a key input to their advanced fire modelling.

Currently, the SIPT team consists of one manager, seven supervisors, two clerks, one analyst, and 40 two to three-person crews. PG&E expects to continue staffing about 40 SIPT crews year-round throughout PG&E's service territory, focusing on Tier 2 and Tier 3 HFTD areas.

In 2022, SIPT plans to add five additional engines and corresponding crews, additional supervisors, and additional clerks. These additions will help create a stable and adequately staffed SIPT program, capable of meeting the Company's needs for the foreseeable future. The additional engines and crews will increase coverage to critical areas of our service territory (particularly those that have been impacted by devastating wildfires over the last five years), and areas that are especially susceptible to PSPS events.

In 2023, SIPT aims to add a dedicated facility for base of operations. The facility will serve as a designated location to store reserve engines, program supplies, and administrative staff. No amounts for this facility is reflected in PG&E's GRC forecast; if construction of the facility goes forward, PG&E will record costs to the WMBA. By 2026, planning should commence to determine upgrades to existing equipment (specifically engines), and enhancements to the program overall. PG&E will continue to assess the SIPT program's effectiveness and develop risk-informed business cases to determine if increases to staffing and or equipment are recommended.

PG&E's expense forecast for SIPT is $30.3 million in 2021, $24.9 million in 2022, and $25.9 million in 2023.[31] Costs include labor-related costs for field, support, and leadership employees.[32] PG&E's 2023 forecast is $10.5 million higher than its 2020 recorded costs of $15.3 million. The primary reason for this increase is additional

[31] See Exhibit (PG&E-4), WP 4-6, line 2.

[32] See Exhibit (PG&E-4), WP 4-58.

headcount. The increase from 2020 recorded to 2021 forecast is also driven by increased headcount.

g. Meteorology IT Support

Meteorology IT Support expense costs primarily entail labor activities such as planning and data migration/conversion, certain third-party contracts as well as incremental AWS costs resulting from new development activities that are necessary to deliver the technology solutions described earlier in Sections C.1.c and C.1.d (Meteorology Projects) and later in C.2.e.

PG&E's expense forecast to support these various projects and programs (primarily AFM and the SOPP Numerical Weather Prediction Program) is $0.5 million in 2021, $0.5 million in 2022, and $0.4 million in 2023.[33] 2020 recorded costs were not separately tracked for the various projects and programs that were supported; they are woven into each respective project or program's recorded dollars. The capital portion which includes the majority forecast dollars for Meteorology IT Support is discussed in more detail in Section C.2.e.

Meteorology IT Support provides foundational support to the meteorological Wildfire mitigations including Numerical Weather Prediction and SOPP Model Automation. This program does not have a unique mitigation number.

2. Capital (MWC 21)

a. WSOC (WLDFR-M07C)

The capital expenditures associated with the WSOC include costs for establishing a physical monitoring site outside of San Francisco in a new or upgraded facility, which is projected to take place in 2021. Equipment costs (new laptops or other technical upgrades) are also included in the forecast. The work described in this section is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – WSOC (WLDFR-M07C).

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33 See Exhibit (PG&E-4), WP 4-6, line 11.

PG&E's 2020 recorded capital expenditures were $(0.03) million. The credit was due to vendor invoice returns/true-ups. PG&E's capital expenditure forecast for the WSOC is $1.5 million in 2021 and $0.1 million in 2022.[34] In 2023, the WSOC will transition into the HAWC; expenditures for the HAWC are discussed in Chapter 5 of this exhibit.

b. Expanded Weather Station Deployment (WLDFR-M07B)

As described in Section C.1.c.1 above, PG&E's Meteorology team will be leading the project to install a minimum of 1,300 weather stations between 2018 and 2022. Weather station data facilitates improved understanding, modeling, and prediction of fire danger and better real-time awareness of fire danger. From 2023 to 2026, PG&E plans to continue to optimize and install additional weather stations as needed to fill in data gaps and support PSPS operations in order to reduce the scope of PSPS. PG&E plans to install 150 new weather stations in 2023, and an additional 50 weather stations each year in 2024-2026.[35] This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Weather Station (WLDFR-M07B). PG&E's capital expenditure forecast for Expanded Weather Station Deployment is $6.4 million per year in 2021 and 2022, $3.3 million in 2023, and $1.1 million in 2024, $1.2 million in 2025, and $1.2 million in 2026.[36] PG&E's 2023 forecast is $5 million lower than its 2020 recorded expenditures of $8.3 million because PG&E plans to install fewer weather stations in 2023 than it did in 2020. The capital forecast for weather stations covers material and labor costs.

c. Partial Voltage Detection (WLDFR-M07G)

As described in Section C.1.e above, EP&R will initiate a Partial Voltage Detection project. This technology will help inform PG&E of a wire down condition within minutes, instead of relying on a customer calls or employee assessments to provide notification of a wire down.

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34 See Exhibit (PG&E-4), WP 4-20, line 2.

35 See Exhibit (PG&E-4), WP 4-21, line 15.

36 See Exhibit (PG&E-4), WP 4-20, line 3.

This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Partial Voltage Detection (WLDFR-M07G).

PG&E's capital expenditure forecast for this project is $0.3 million in 2021 and $0.6 million in 2022. There are no forecasted capital dollars past 2022. PG&E's 2020 recorded capital expenditures were $1.2 million.[37]

d. Safety and Infrastructure Protection Team (WLDFR-M008)

PG&E's capital expenditure forecast for SIPT is $0.2 million in 2021, $1.2 million in 2022, $0.2 million in 2023, $0.3 million in 2024, $0.3 million in 2025, and $0.3 million in 2026. PG&E's 2023 forecast is $1.0 million less than its 2020 recorded capital expenditures of $1.3 million.[38] The reason for this decrease is start-up vehicle-related (engine) costs in 2020 which are not present in later years. Capital investments will include replacement pumps and additional safety equipment. This program is a Wildfire mitigation referred to as SIPT (WLDFR-M008).

e. Meteorology IT Support

As described in Section C.1.g above, the funds in Meteorology IT Support will support improvements and initiatives across several meteorology projects and programs. As mentioned in previous sections, the data processing, computing, and storage environments required by meteorology have increased significantly as weather model output has become more granular and hundreds of millions of fire spread simulations are performed each day. Each day Meteorology processes several terabytes of data. In order to process and store these vast quantities of weather model data, as well as to run internal models such as the FPI and OPW model, a robust computing infrastructure and IT support structure will need to continue to be improved.

Meteorology IT Support will also support the continued migration of the Meteorology Department's web applications into PG&E's AWS

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37 See Exhibit (PG&E-4), WP 4-20, line 4.

38 See Exhibit (PG&E-4), WP 4-20, line 6.

cloud. This will include the implementation of new connectivity required to enable those applications, the development of interfaces for any systems that require access to the migrated applications and any networking or firewall updates to support the migration of those applications.

PG&E deployed its upgraded POMMS v3.0 into AWS in 2020. PG&E will continue to mature its POMMS system by (1) updating data transfer and storage policies; (2) improving the patching process; and (3) implementing improved data life cycling policies to drive more cost-effective data storage and archival costs while remaining in compliance with data retention requirements. Starting in 2021, Meteorology IT Support will update the data transfer and storage policies within AWS. Doing this will allow the POMMS system to minimize the copies of data that are required from the processing of POMMS data and thus reduce future AWS usage costs.

With on-premise infrastructure, PG&E has an existing patching process that helps to keep systems secure and up-to-date, but this process is not yet applied within AWS. In 2021, Meteorology IT Support will establish a recurring process that will provide new patches to both production and non-production systems.

From 2022 to 2026, Meteorology IT Support will focus on scaling the computing infrastructure that is needed to support the operation of its models and inform daily fire mitigations and PSPS (utilizing FPI). As it continues to develop the next generation of PSPS forecast models, Meteorology IT Support will enable regular asset data updates by integrating Geographic Information System data into the POMMS system. Work will also focus on developing new model pipelines to support new/emerging data streams, as well as a more granular weather prediction model. Meteorology IT Support will enable PG&E to transition to a 1km weather model starting in 2024 that will increase the granularity of its fire weather modeling.

PG&E's capital expenditures associated with these initiatives are forecasted to be $1.0 million in 2021, $1.1 million in 2022, $1.1 million in

2023, $1.9 million in 2024, $1.9 million in 2025, and $2.0 million in 2026.[39]

2020 recorded expense dollars related to IT Support were embedded into each respective program's recorded dollar planning orders. It was not until 2021 that the Meteorology IT support dollars that support various meteorology programs/projects were broken out into their own planning order.

Meteorology IT Support provides foundational support to the meteorological guidance Wildfire mitigations including Numerical Weather Prediction and SOPP Model Automation. This program does not have a unique mitigation number.

D. Estimating Methods

PG&E used both the unit cost forecast methodology and program cost estimating methodology for forecasting the costs for the work described herein. PG&E describes its basic method for developing unit and program cost estimates in Chapter 2 of this exhibit. PG&E describes below how those methods were used to forecast each of the work types described in this chapter.

Forecasts in this chapter are shown with escalation. For more information on escalation, please refer to Chapter 2 in this exhibit.

1. Unit Cost Estimating

Unit cost estimating calculates the cost to install one unit of work and is generally based on recent historic actual unit costs for similar work. The work in this chapter that was forecast using this method includes:

- Wildfire Cameras
- Expanded Weather Station Deployment (capital and expense costs)

2. Program Cost Estimating

Program cost estimating is used to forecast costs for work that is not unit driven and that includes similar work year after year. Work is generally forecast based on 2020 recorded costs with adjustments for any known changes to the scope of work. The work in this chapter that was forecast using this method includes:

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39 See Exhibit (PG&E-4), WP 4-20, line 5.

- Partial Voltage Detection (expense and capital)
- Numerical Weather Prediction and SOPP Model Automation
- AFM
- Meteorology IT Support (expense and capital)
- WSOC (capital)
- SIPT (capital)

3. Cost Estimating Based on Headcount

Cost estimating based on headcount is used for work where the costs are driven by the number of people (often referred to as full time equivalents) who make up the team executing the work. The work in this chapter that was forecast using this method includes:

- WSOC (expense)
- SIPT (expense)

E. Cost Tables

The expense and capital forecasts for Situational Awareness and Forecasting are summarized in the following tables:

- Table 4.1-6 lists expense MWCs showing 2016 through 2020 recorded adjusted expenses and 2021 through 2023 forecast expenses; and
- Table 4.1-7 lists capital MWCs showing 2016 through 2020 recorded capital adjusted expenditures and 2021 through 2026 forecast expenditures.

TABLE 4.1-6
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	Workpaper Reference
1	AB	Misc. Expense	–	–	$18,960	$24,321	$34,022	$59,348	$54,559	$43,416	WP 4-6, line 12
2		Total[(a)]	–	–	$18,960	$24,321	$34,022	$59,348	$54,559	$43,416	

(a) Values may vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

TABLE 4.1-7
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	2024	2025	2026	Workpaper Reference
1	21	Misc. Capital	–	–	$7,167	$10,368	$11,649	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446	WP 4-19, line 5
2		Total	–	–	$7,167	$10,368	$11,649	$9,451	$9,375	$4,601	$3,290	$3,341	$3,446	

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony _____X_____ Workpapers _____ SOQ _____

Exhibit Number: _____4____ Chapter Number: ____4.1____

Chapter Title: Situational Awareness and Forecasting

Witness Name: Ben Almario

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
4.1-8, Table 4.1-3	1	WLDFR-M07B Risk Drivers	Consequences Only	Foundational
4.1-8, Table 4.1-3	3	WLDFR-M07D Risk Drivers	All Drivers	All Consequences
4.1-8, Table 4.1-3	4	WLDFR-M07E Risk Drivers	All Drivers	All Consequences
4.1-8, Table 4.1-3	5	WLDFR-M07G Risk Drivers	Equipment Failure	Equipment/Facility Failure, Vegetation Contact
4.1-8, Table 4.1-3	6	WLDFR-M07H Risk Drivers	Consequences Only	Foundational
4.1-8, Table 4.1-3	7	WLDFR-M07I Risk Drivers	Consequences Only	Foundational
4.1-11, Table 4.1-4	3	WLDFR-M07D RSE	19.4	19.45
4.1-11, Table 4.1-4	4	WLDFR-M07E RSE	154.01	154.74
4.1-11, Table 4.1-4	5	WLDFR-M07G RSE	281.9	283.0
4.1-12, Table 4.1-5	3	WLDFR-M07G RSE	281.9	283.0
4.1-12, Table 4.1-5	4	WLDFR-M07I 2021 Forecast, Total	1,028	0, 899
4.1-12, Table 4.1-5	5	WLDFR-M07J 2021 Forecast, Total	0	1,208, 8,928

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CHAPTER 4.2

PSPS OPERATIONS

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PSPS OPERATIONS

A. Introduction

1. Scope, Purpose, and Support for this Request

This chapter presents Pacific Gas and Electric Company's (PG&E or the Company) expense and capital forecasts for its Public Safety Power Shutoff (PSPS) program. This chapter demonstrates that the forecast for this program is reasonable and should be adopted by the California Public Utilities Commission (CPUC or Commission). PSPS is a critical element of PG&E's wildfire mitigation program.

The Commission has affirmed that regulated utilities should implement PSPS events when—and only when—necessary to prevent catastrophic wildfires. The Commission has ordered that, pursuant to Sections 451 and 399.2(a) of the Public Utilities Code, the "statutory obligation … to operate [a utility's] system safely requires [the utility] to shut off its system if doing so is necessary to protect public safety." That is, when utilities "reasonably believe there is an imminent and significant risk that strong winds will topple its power lines onto tinder dry vegetation … during periods of extreme fire hazard,"[1] they may exercise their statutory authority to de-energize.

PG&E's expense and capital forecasts for its PSPS program are reasonable and necessary to mitigate wildfire risk. PG&E's PSPS program includes activities supporting information-gathering, decision-making, and customer-outreach processes when PG&E considers proactively de-energizing portions of the PG&E electric system in the interest of public safety. Line de-energization may be necessary when a combination of winds and location-specific factors are forecast to present a statistically high likelihood of damage or disruption to PG&E's above-ground power lines, suggesting a heightened risk of a catastrophic wildfire.

The expense and capital costs for the PSPS program are recorded to the Wildfire Mitigation Balancing Account (WMBA). This treatment is

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[1] D.12-04-024, pp. 3, 4 and 31.

necessary due to the uncertainty in forecasting the number of PSPS events, along with the associated event and program support costs. For the forecast period, PG&E has forecast the number of PSPS events based on a 10-year historical weather analysis. The analysis evaluates prior weather events from the past decade, modeling the PSPS events that would have occurred had the PSPS program been in place during that time frame, including associated transmission and distribution system impacts.

Although a valuable planning tool, the historical lookback can only give a general estimate as to the probability of occurrence of future PSPS events. Weather is highly variable year to year, which drives variability in not only the location of events, but also the number of events and their size and duration.

The historical lookback is a computationally intensive analysis that PG&E completed in the fall of 2020. It does not fully include updates to the PSPS scoping models anticipated to be incorporated before the 2021 fire season, based on work done by PG&E meteorologists and data scientists. A more granular climatology lookback and additional studies are still underway and are not expected to be complete until the end of summer 2021. While our data and analysis are constantly improving and evolving, waiting for an improved data set before planning for PSPS-mitigation activities was not feasible given the lead times required to execute the work required for our PSPS impact reduction initiatives.

In addition, PG&E is in the process of incorporating conditions not currently included in the scoping of PSPS events that may drive an expansion in PSPS scope in the future. PG&E is reviewing its criteria for what conditions warrant initiating a PSPS event to prevent catastrophic wildfires, in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate asset health as well as the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment will result in PG&E executing PSPS in

2021 and beyond for powerlines where high priority vegetation tags[2] have been identified, including on lines that may not have met the 2020 PSPS event criteria.

Based on an initial assessment of these factors, PG&E has recently modified its 2021 Wildfire Mitigation Plan (WMP)[3] to reflect five PSPS events per year. The forecast in this GRC is based on three events plus one additional borderline event. The inherent nature of PSPS events make it difficult to predict accurately the number of events in a given year and the associated event costs. In light of these factors, PG&E will continue to record its PSPS Operations costs in the WMBA. Use of the WMBA will allow PG&E to account for the variability in number of events during the forecast period.

2. Summary of Request

PG&E requests that the Commission adopt its 2023 expense forecast of $115.3 million[4] for PSPS event costs and associated programs including: field training and field exercises; Community Resource Center (CRC) preparedness projects; aviation costs; the Wildfire Safety Public Engagement (WSPE) team; the PSPS Program Team; and, Emergency Preparedness and Response (EP&R) Field Operations.

PG&E further requests that the Commission adopt its capital expenditure forecasts for CRC preparedness projects, PSPS field operations technology equipment and PSPS Information Technology (IT) projects. PG&E's capital expenditure forecast is $3.1 million in 2021,

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2 Namely "Priority 1" and "Priority 2" vegetation tags which are created when trained vegetation inspectors identify trees or limbs that currently present elevated risk and must be worked on an expedited basis. Inspectors use Priority 1 tags for vegetation (i) in contact or showing signs of previous contact with a primary conductor; (ii) actively failing or at immediate risk of failing and which could strike PG&E's facilities; or (iii) presenting an immediate risk to PG&E's facilities. Inspectors use Priority 2 tags for vegetation that does not rise to the level of Priority 1 but has encroached within the PG&E minimum clearance requirements or has an identifiable potential safety issue requiring expedited work.

3 PG&E's 2021 WMP – Revised Report, R.18-10-007 (June 3, 2021) (Revised 2021 WMP).

4 See Exhibit (PG&E-4), WP 4-8, line 23.

$3.2 million in 2022, $0.3 million in 2023, $0.3 million in 2024, $0.3 million in 2025, $0.3 million in 2026.[5]

Forecasts in this chapter are shown with escalation at the Major Work Category (MWC) level and escalation is included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

3. Overview of Recorded and Forecast Costs

Expenditures for the activities described herein are forecast in one expense and one capital MWC, listed in Table 4.2-1 below. The following sections describe each of the MWCs and explain how the cost forecasts for each were derived. Tables 4.2-6 and 4.2-7 at the end of this chapter show the 2020 recorded amounts, the 2021-2023 expense forecast, and the 2021-2026 capital forecast by MWC.

TABLE 4.2-1
PSPS PROGRAM MWCS

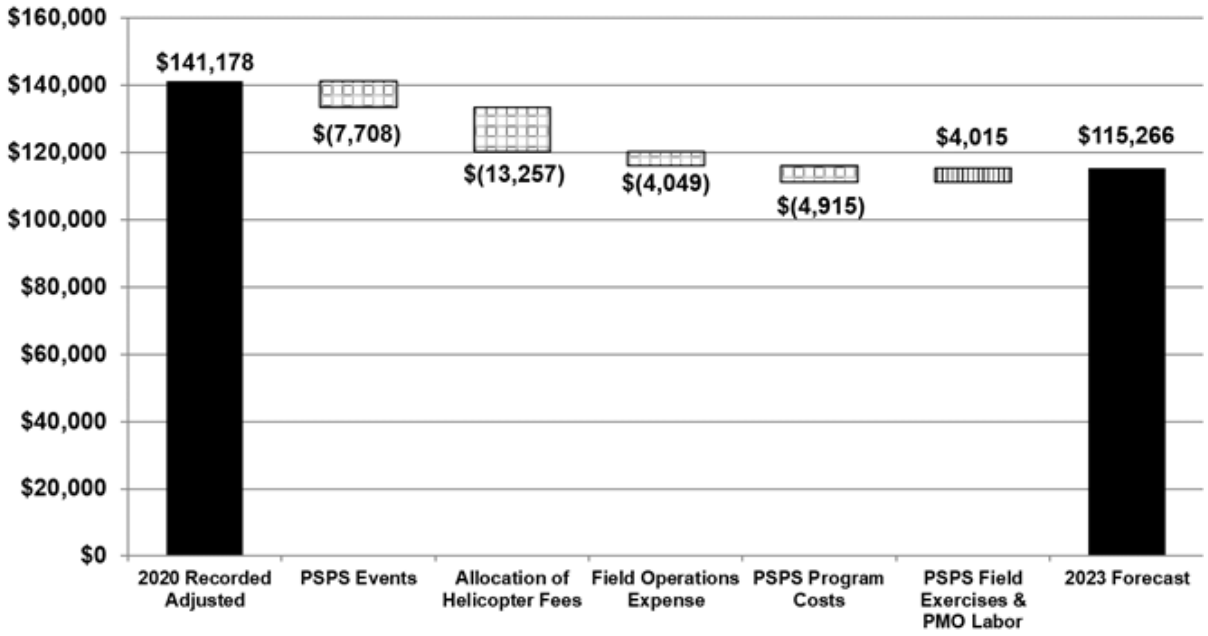
Line No.	MWCs	Description
1	Expense	
2	AB	Miscellaneous Expense
3	Expense	
4	21	Miscellaneous Capital

a. Expense

Expense activities in this chapter are recorded in MWC AB. As shown in Figure 4.2-1 below, forecast costs for expense activities are expected to decrease by approximately $25.9 million between 2020 and 2023.

[5] See Exhibit (PG&E-4), WP 4-19, lines 6 and 7.

FIGURE 4.2-1
EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



The activities driving this decrease include: a decrease of $7.7 million for PSPS event costs; a decrease of $13.3 million due to allocation of helicopter fees recorded to non-PSPS programs[6], a decrease of $4.0 million due to Field Operations Expense forecast being moved to Chapter 5 as part of all-hazards approach, a $5.1 million decrease mainly for PSPS Program Costs; and an increase of $4.0 million primarily for PSPS field exercises and PSPS Program Team labor.

b. Capital

The PSPS program's capital expenditures are recorded in MWC 21, which is further broken down into Maintenance Activity Types (MAT).

As shown in Figure 4.2-2 below, forecast costs for capital activities are expected to decrease by approximately $2.1 million from 2020 to

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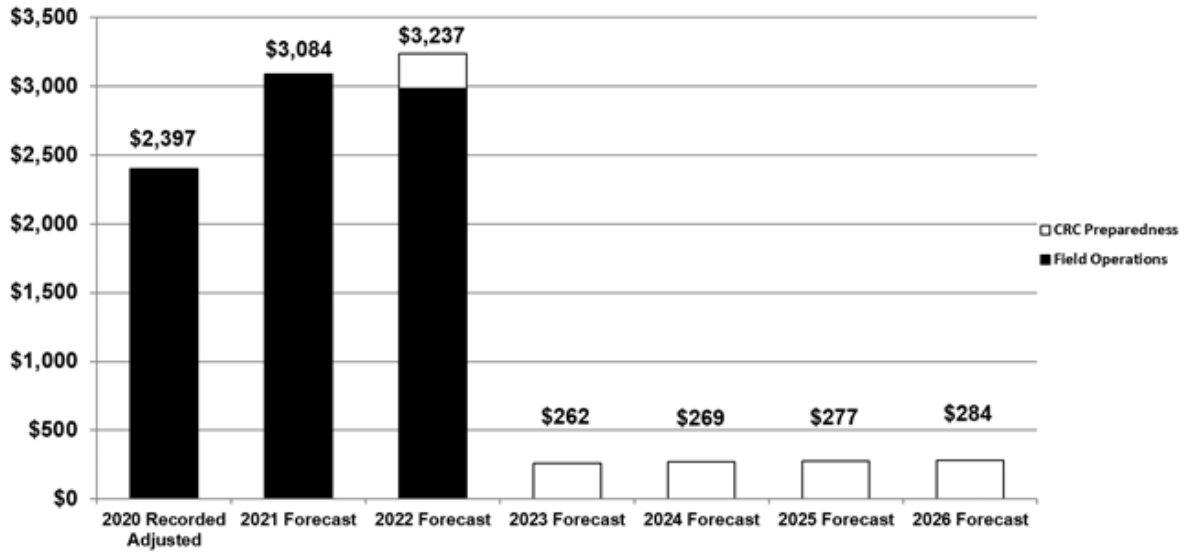
6 Due to timing of GRC preparations, the 2020 recorded helicopter cost of $28.7 million did not reflect post-close adjustments to move $14.4 million out of PSPS and into other programs for the prorated use of helicopters. See Exhibit (PG&E-4), WP 4-8, line 20 and fn (2).

2023 mainly due to the Field Operations Capital forecast moving to Chapter 5 as part of an all-hazards approach.

FIGURE 4.2-2
CAPITAL RECORDED AND FORECAST 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



B. Program and Risk Overview

1. Program Overview

PSPS event costs consist of the cost for activities directly associated with PG&E's proactive de-energization of its electric transmission[7] or distribution lines following a determination of weather-related imminent threats to power line assets and increased risk of catastrophic wildfire. This includes the sequence of activities associated with activating the Emergency Operations Center (EOC), sending customer and agency notifications, de-energizing power lines to reduce the risk of those lines igniting a wildfire during a weather-related event, and re-energizing the lines once the event has ended.

PSPS program costs include the costs for all activities supporting but not directly connected to PSPS events. PG&E's PSPS program involves

[7] Transmission patrol costs are funded through the Transmission Owner rate case.

various activities supporting PG&E's information-gathering, decision-making, and customer-outreach processes when PG&E considers initiating a PSPS event.

The PSPS program encompasses PG&E electric lines in High Fire Threat District (HFTD) areas, including both distribution and transmission lines. The most common electric lines considered for de-energization are those in Tier 2 or Tier 3 HFTD areas. Often, lines that traverse Tier 2 or Tier 3 HFTD areas also feed customers outside those areas, meaning customers could be impacted by the risk associated with lines many miles away. While customers in HFTD areas are more likely to be affected by a PSPS event, any of PG&E's more than five million electric customers could have their power shut off if their community relies upon a line that passes through an HFTD area.

As described in PG&E's testimony in the PSPS Rulemaking, the wildfire risk in northern California has changed dramatically in the past several years.[8] As of 2012, only 15 percent of PG&E's service area was designated as having an elevated wildfire risk on the fire-threat maps recognized by the CPUC at that time. Today, more than 50 percent of PG&E's service territory is in a designated Tier 2 or Tier 3 HFTD area according to the CPUC's designated HFTD Map.[9]

In 2020, the first version of the High Fire Risk Area (HFRA) map was developed to identify approximately 115 additional areas not designated as HFTD areas that PG&E is including in its PSPS scope. Many of these areas do not contain a high number of customers or PG&E assets and are in rural, hard to access locations where fire could grow and spread rapidly. The purpose of developing the HFRA map is to ensure that all areas of catastrophic wildfire risk are fully captured in PG&E's PSPS program. PG&E will continue to evaluate the inclusion of additional areas requiring wildfire risk reduction activity.

The scope and duration of a PSPS event is based upon PG&E's near-term modeling of weather forecasts and vegetation fire potential.

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8 PG&E's Opening Testimony, R.18-12-005 (February 5, 2020), p. 1-2, lines 8-10.

9 CPUC, Fire-Threat Maps & the High Fire-Threat District (HFTD), at: <https://www.cpuc.ca.gov/FireThreatMaps/> (as of May 27, 2021).

PG&E's models develop near-term forecasts four times a day. These forecasts, in conjunction with other global and local forecasts from external agencies, are evaluated by members of PG&E's Fire Science and Meteorology teams to determine if a heightened outage risk from a wind event and the potential for large wildfires to occur if there is an ignition are both present. If severe weather conditions exist, PG&E determines the potential scope of a PSPS event by identifying which distribution and transmission facilities, if any, are within the area forecast to be impacted by the weather event and therefore require de-energization. PG&E's Meteorology team closely monitors changing forecasts and conditions, updates the PSPS Incident Command team in the event of any changes, and continually revises the scope of a possible event, both in terms of the estimated magnitude and timing. Forecast updates may add to or remove additional areas from the scope of a PSPS event or change the timing of a PSPS event.

One of the key components of PG&E's PSPS response plan is the EOC. The EOC is tasked with executing PSPS events in compliance with the CPUC's Phase One and Phase Two Guidelines[10] and in a manner that minimizes disruptions to PG&E's customers.

PG&E has developed a process for determining whether to activate the EOC and what to do once the EOC is activated for a PSPS event. The process includes: (1) monitoring weather conditions before the EOC is activated; (2) activating the EOC when conditions indicate a PSPS event may become necessary; (3) identifying and approving the initial scope of the de-energization event along with watch notifications to Public Safety Partners and customers impacted by that scope; (4) deciding whether to de-energize based on updated forecast and situational intelligence information; (5) sending final warning notifications to impacted Public Safety Partners and customers; (6) de-energizing transmission and distribution assets identified to be in scope; and (7) making the weather all-clear determination to begin patrolling affected Tier 2 and 3 circuits and re-energizing the power grid.

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10 D.19-05-042 and D.20-05-051, respectively.

PG&E understands that PSPS events cause significant disruptions to our customers, and we aim to reduce the size and duration of these events. As described in Chapter 4.1 on Situational Awareness and Chapter 4.3 on Impact Mitigations, we are making every effort to mitigate PSPS impacts to PG&E's customers by using advanced meteorology models to forecast wildfire risk conditions more granularly, applying improved analyses to determine which portions of PG&E's electric system face high fire risk, and improving switching and sectionalization such that PSPS events affect smaller portions of the grid. We have adopted a new goal of conducting inspections of the de-energized power lines prior to re-energization, and restoring service to 100 percent of PSPS-affected customers within 24 hours of the "weather all-clear" declaration. We are also working to improve PG&E's coordination with state, local, and community agencies, and to provide extensive information and support to customers before, during, and after PSPS events.

In 2020, PG&E used improved scoping techniques and mitigation strategies to significantly reduce the size of our PSPS events. We reduced the number of customers impacted by each PSPS event by approximately 55 percent on average in 2020, when compared to the number of customers that would have been impacted by the same weather conditions under our 2019 PSPS program. For instance, October 25th was PG&E's largest PSPS event in 2020. It had a weather footprint similar to the large weather events that drove the initiation of PSPS in October 2019. However, our 2020 PSPS improvements resulted in PG&E's de-energizing approximately 300,000 fewer customers (47 percent) during the October 25, 2020 event than we would have de-energized for the same weather event in 2019.

Despite improvements already made and future planned improvements, PG&E is evaluating conditions not currently included in the scoping of PSPS events that may drive an expansion in PSPS scope in the future. PG&E is reviewing its criteria for initiating a PSPS event in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in PG&E executing PSPS in 2021 and beyond for powerlines where high

priority vegetation tags have been identified, including on lines that may not have met the 2020 PSPS event criteria. PG&E is still working to finalize what changes to the PSPS decision making criteria may be needed to account for this risk. Following that activity over the next few months, PG&E will need to analyze the likely impact of that updated criteria in making PSPS events larger and compare that impact to the actions being taken to make PSPS events smaller.

2. Risk Integration

Chapter 3 of this exhibit describes how Electric Operations (EO) uses the Enterprise and Operational Risk Management program to manage electric system risks. In Chapter 3 of this exhibit PG&E described how management of the Wildfire risk has changed since the filing of the 2020 Risk Assessment and Mitigation Phase (RAMP) Report; provided updated Risk Spend Efficiency (RSE) scores; and listed each mitigation and control and indicated if it has changed since the 2020 RAMP Report filing. In this chapter PG&E provides more information about the mitigations and the work needed to implement them.

Table 4.2-2 below shows the EO risks associated with the forecasts discussed in this chapter.

TABLE 4.2-2
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	MATs
1	Wildfire	WLDFR	RAMP	AB6, 21A

a. RAMP Risk – Wildfire

1) Risk Overview

The Wildfire risk is defined as PG&E assets or activities may initiate a fire that is not easily contained and endangers the public, private property, sensitive lands, or environment. Wildfire was one of PG&E's 2020 RAMP risks.[11]

[11] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10.

2) Risk Mitigations

As shown in the tables below, PG&E is forecasting two mitigations, one of which has several subparts, related to work forecast in this chapter. These programs were determined to reduce the frequency or consequence of wildfire. A brief description of these mitigations is provided in the tables below. More detail is included in the 2020 RAMP Report.[12]

[12] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10, starting at page 10-22.

TABLE 4.2-3
WILDFIRE
FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	WLDFR-M005	PSPS Event (Distribution)	PG&E's PSPS program proactively de-energizes select transmission and distribution circuit segments within (or that pass through) Tier 2 and Tier 3 HFTD areas when elevated fire danger conditions occur. Include patrol and inspection costs	N/A	See Section C.1 for more information.	AB6
2	WLDFR-M006	PSPS Capital Equipment	The cost to provide radio and communications equipment necessary to support PSPS events.	Consequence – PSPS	See Section C.2 for more information.	21A
3	WLDFR-M006	EP&R Field Operations	Response group to maintain established relationships with external agency partners and to support emergency planning and information sharing during emergencies.	Consequence – PSPS	See Section C.2 for more information. Starting in 2023, this mitigation moves to EP&R.	AB6
4	WLDFR-M006	PSPS Field Exercises	Our crews conduct restoration drills in HFTD areas across northern and central California. These efforts focused on practicing the coordination of emergency response teams, inspecting lines for damage, and quickly restoring power while maintaining public and employee safety.	Consequence – PSPS	See Section C.2 for more information. Starting in 2023, this mitigation moves to EP&R.	AB6
5	WLDFR-M006	PSPS Project	PG&E's PSPS expense forecast also includes the cost to build out and improve tools that are critical to PSPS execution, such as: PSPS Viewer, PSPS Portal, PSPS Situational Intelligence Platform, and PSPS FORCE Tool.	Consequence – PSPS	See Section C.2 for more information.	AB6

TABLE 4.2-3
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
6	WLDFR-M006	PSPS Pre-Flights	The PSPS circuit pre-flights project will identify the HFRAs additions, Tier 2 and Tier 3 portions of circuits that must be patrolled by air and the portions of circuits that must be patrolled by ground. The pre-flights also capture the number of circuit miles patrolled by air and ground and capture the time needed to patrol the circuits. This allows a more accurate allocation of helicopters for patrols and ultimately faster restoration.	Consequence – PSPS	See Section C.2 for more information.	AB6
7	WLDFR-M006	PSPS Impact Reduction Initiatives - PSPS Increased Helicopter Exclusive Use (EU)	Helicopter contracts associated with PG&E's PSPS activities. These contracts ensure PG&E has access to 65 helicopters during the peak PSPS season. The amount of helicopters available allows PG&E to shorten the patrol time of our circuits following an all-clear, therefore, reducing the duration of a PSPS event.	Consequence – PSPS	See Section C.2 for more information.	AB6
8	WLDFR-M006	PSPS Collateral/Segment Creations	This project is to support the enhancement of PG&E's Segment Guides for distribution circuits (Segment Guides). These guides are the primary reference documents that Distribution Control Centers and field patrol personnel utilize for alignment in executing "step restoration" efforts during PSPS restoration.	Consequence – PSPS	See Section C.2 for more information.	AB6

TABLE 4.2-3
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
9	WLDFR-M006	CRC Preparedness Program	Community Resource Centers (CRC) provide a safe, energized space for impacted customers and residents experiencing a PSPS related outage. This mitigation builds out a portfolio of indoor and outdoor CRC locations and preparing to staff and set up CRCs during PSPS events.	Consequence – PSPS	See Section C.2 for more information.	AB6, 21A
10	WLDFR-M006	Wildfire Public Engagement Team	The Wildfire Safety Public Engagement (WSPE) team is focused on increasing the transparency of PG&E's wildfire safety and PSPS program with external stakeholders — in particular, local and tribal government and public agencies — to increase mutual trust and cooperation. The WSPE mission is to organize and execute planning and outreach work to provide external stakeholders with increased understanding and coordination, with a focus on county and tribal emergency management.	Consequence – PSPS	See Section C.2 for more information.	AB6
11	WLDFR-M006	EP&R Field Ops Misc.	This project is for items including (but not limited to) the additional subject matter expert support needed to develop and formalize strategic activities associated with enhancing and improving the overall PSPS processes and procedures to provide for the safe and efficient execution of PSPS activities.	Consequence – PSPS	See Section C.2 for more information Starting in 2023, this mitigation moves to EP&R.	AB6

TABLE 4.2-3
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
12	WLDFR-M006	EP&R Field Ops Training	Develop and deliver training based upon training needs identified during field exercises and gaps in performance. Training includes, but is not limited to emerging technology, tools and skills required for Field Operations to successfully and safely prepare in advance of PSPS restoration events.	Consequence – PSPS	See Section C.2.h for more information. Starting in 2023, this mitigation moves to EP&R.	AB6
13	WLDFR-M006	EP&R Field Ops Tech Expense	The expense component allows the Public Safety Specialist team to utilize the Salesforce database platform to capture activity and regulatory compliance engagement.	Consequence – PSPS	See Section C.3 for more information.	AB6
14	WLDFR-M006	PSPS Field Ops Tech Capital	The goal of this project is to continue to provide the appropriate complement of IT solutions enabling a safe, scalable, and expedient response posture for planned and unplanned events.	Consequence – PSPS	See Section C.3 for more information. Starting in 2023, this mitigation moves to EP&R.	21A
15	WLDFR-M006	PSPS Program Team	The PSPS Program team is focused on continuously improving and refining the overall program.	Consequence – PSPS	See Section C.2.f for more information.	AB6
16	WLDFR-M006	PSPS Projects	This program builds out and improves tools that are critical to PSPS execution.	Consequence – PSPS	See Section C.2.f for more information.	AB6

3) Changes to Mitigations

PG&E modified its portfolio of mitigations since filing the 2020 RAMP Report. The work forecast in some of the mitigations proposed in the 2020 RAMP Report has also changed as described below.

In its 2020 RAMP Report, PG&E proposed one mitigation for PSPS events (M5) and a second mitigation—PSPS Impact Reduction Initiatives (M6)—that combined a number of different activities. In this GRC, PG&E is separately forecasting the individual activities that make up the PSPS Program and Impact Reduction Initiatives to enable more granular evaluation of risk reduction by activity.

The overall forecast for PSPS Impact Reduction Initiatives in the 2023 GRC is lower that what was presented for that mitigation in its 2020 RAMP Report.[13] The primary reason for this is that costs for certain activities—such as for the provision of temporary generation at substations and for transmission work—are not included in the GRC because they are recovered in other proceedings. Also, while in the 2020 RAMP Report PG&E categorized Ground Grid and Substation Circuit Replacement activities to be part of the PSPS Reduction Initiatives mitigation, PG&E now considers those activities to be controls that address the Failure of Electric Distribution Substation Assets risk. Those activities are discussed in Chapter 15 of this exhibit.

b. Cost Tables

Tables 4.2-4 and 4.2-5 below show the forecast costs for mitigations.[14] Tables showing the GRC forecast costs compared to the costs estimated in the 2020 RAMP Report by initiative are provided in workpapers.[15]

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13 See Exhibit (PG&E-4), WP 3-20, lines 25 and 33.

14 See Exhibit (PG&E-4), WP 3-5, line 32 (WLDFR mitigations, capital), and WP 3-7, line 32 (WLDFR mitigations, expense).

15 See Exhibit (PG&E-4), WP 3-20.

TABLE 4.2-4
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 –EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total	RSE[b]
1	WLDFR-M005	Public Safety Power Shutoff – PSPS Event (Distribution)	AB6	$80,706	$82,741	$70,782	$72,998	$307,227	–
2	WLDFR-M006	EP&R Field Operations[a]	AB6	3,691	9,974	6,903	–	20,568	–
3	WLDFR-M006	EP&R Field Ops Tech Expense	AB6	92	206	212	–	510	–
4	WLDFR-M006	PSPS – EP&R Field Ops Tech Expense	AB6	18	103	106	–	227	–
5	WLDFR-M006	CRC Preparedness Program	AB6	15,423	14,774	15,226	15,703	61,126	–
6	WLDFR-M006	PSPS Collateral/Segment Creations	AB6	249	103	106	109	568	–
7	WLDFR-M006	PSPS EP&R Field Ops Misc.[a]	AB6	108	257	265	–	605	–
8	WLDFR-M006	PSPS Field Exercise Dist.	AB6	1,073	2,470	2,546	2,625	8,714	–
9	WLDFR-M006	PSPS Increased Helicopter Exclusive Use[c]	AB6	28,668	7,976	14,944	15,411	66,999	–
10	WLDFR-M006	PSPS Program Team	AB6	2,180	5,533	4,502	4,643	16,857	–
11	WLDFR-M006	PSPS Projects	AB6	6,898	1,544	1,591	1,641	11,674	–
12	WLDFR-M006	PSPS Pre-flights	AB6	1,775	1,081	1,114	1,149	5,118	–
13	WLDFR-M006	Wildfire Public Engagement Team	AB6	298	1,158	957	987	3,399	–
14		Total		$141,178	$127,920	$119,254	$115,266	$503,618	–

(a) 2023 forecast is in Ch. 5 as the work shifts to an all-hazards approach.

(b) To comply with guidance from the Safety Policy Division (SPD), PG&E will not be calculating an RSE for the benefits of PSPS on Wildfire mitigation, per Resolution (Res.) WSD-002 (June 11, 2020), Appendix A, p. A-1. See Exhibit (PG&E-4), Ch. 3 for more information.

(c) 2020 recorded costs did not include post-close adjustments due to timing of GRC preparation. There were post-close adjustments that allocated helicopter daily exclusive use (EU) fees to various non-PSPS programs/projects that used the helicopters. The final 2020 recorded costs that remain in the PSPS program is $14.3 million.

TABLE 4.2-5
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total	RSE[a]
1	WLDFR-M006	PSPS Field Ops Tech Capital[b]	21A	–	$1,028	$994	–	–	–	–	$2,022	–
2	WLDFR-M006	CRC Preparedness Program	21A	$1,021	–	255	262	269	277	284	2,368	–
3	WLDFR-M006	PSPS Capital Equipment[b]	21A	1,376	2,056	1,987	–	–	–	–	5,419	–
4		Total		$2,397	$3,084	$3,237	$262	$269	$277	$284	$9,809	–

(a) To comply with guidance from the SPD, PG&E will not be calculating an RSE for the benefits of PSPS on Wildfire Mitigation, per Res. WSD-002 (June 11, 2020), Appendix A, p. A-1. See Exhibit (PG&E-4), Ch. 3 for more information.

(b) 2023 forecast is in Ch. 5 as the work shifts to an all-hazards approach.

C. Activities, Costs, and Forecast Drivers by Risk Mitigation

PSPS is a Wildfire risk mitigation with both expense and capital forecasts. The PSPS program's expenses are recorded in MWC AB, MAT AB6; its capital expenditures are recorded in MWC 21, MAT 21A.

1. PSPS Event (WLDFR-M005)

PG&E's expense forecast for PSPS Events is $82.7 million in 2021, $70.8 million in 2022, and $73.0 million in 2023.[16] PG&E's 2023 forecast is $7.7 million lower than 2020 recorded cost of $80.7 million. This program is a Wildfire mitigation referred to as PSPS – Event (Distribution) (WLDFR-M005).

PG&E has recently modified its 2021 WMP[17] to reflect five PSPS events per year. The forecast in this GRC is based on three events plus one additional borderline event.

PG&E's PSPS Event expense forecast assumes three annual PSPS events with an additional potential/borderline event over the course of the GRC rate case period. The forecasted cost per PSPS event is based upon the average cost per PSPS event recorded during 2019 and 2020. As explained below, PG&E has recently modified its 2021 WMP to reflect five PSPS events per year, as compared to three events in the original 2021 WMP filing. However, due to timing of when the GRC is prepared, the PSPS Event expense forecast still reflects three annual PSPS events with an additional potential/borderline event.

a. Number of Events

PG&E's assumption of annual PSPS events is based on a 10-year historical weather analysis. The analysis evaluates prior weather events from the past decade, modeling the PSPS events that would have occurred had the PSPS program been in place during that time frame, including associated transmission and distribution system impacts. The analysis identified approximately 30 weather events across the past

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16 See Exhibit (PG&E-4), WP 4-8, line 2.

17 Revised 2021 WMP.

decade that would have triggered a PSPS event under PG&E's 2020 PSPS decision-making protocols.

PG&E is in the process of incorporating conditions not currently included in the scoping of PSPS events that may drive an expansion in PSPS scope in the future. PG&E is reviewing its criteria for what conditions warrant initiating a PSPS event to prevent catastrophic wildfires, in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate asset health as well as the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment will result in PG&E executing PSPS in 2021 and beyond for powerlines where high priority vegetation tags have been identified, including on lines that may not have met the 2020 PSPS event criteria.

Based on PG&E's initial update of studies of 10 years of weather data from 2011-2020, and incorporating some of the potential impact of the proposed vegetation criteria, PG&E has increased the number of PSPS events per year from three events to five events in its 2021 WMP, with an increased customer impact and increased event duration. However, due to timing of GRC preparation, the PSPS event forecast still reflects three annual PSPS events with an additional potential/borderline event.

Further, given what appears to be a trend of more extreme weather in the last few years, PG&E's use of a ten-year average to arrive at its 2021-2023 forecast of number of events per year may be conservative. PG&E experienced nine PSPS events in 2019, six more in 2020 and, with no significant rainfall in 2020 and 2021, it is possible that PG&E could be under-estimating the amount of PSPS events for 2021.

b. Cost per Event

The cost per PSPS event utilized in PG&E's PSPS cost forecast is based upon the average cost per PSPS event recorded during 2019 and 2020. PSPS event costs are broken down into the following categories:[18]

[18] Exhibit (PG&E-4), WP 4-64 to WP 4-66.

- EOC Support – The EOC is comprised of a multi-disciplinary team of PG&E employees who assume emergency response positions consistent with the Incident Command System;
- IT – Coordinates the response of PG&E's IT resources and systems in support of all stages of PSPS;
- Aviation Services – These include the flight costs associated with aerial patrols of de-energized Transmission and Distribution lines, prior to re-energization, to ensure it is safe to do so;
- Ground Patrols – These include the costs of internal and contract crews that are utilized to patrol and inspect the de-energized lines, to ensure that it is safe to re-energize the lines and restore power to customers;
- Customer Outreach – During PSPS events, PG&E's Customer teams provide key support to customers and partner agencies;
- Electric Distribution Operations – The Electric Distribution Operations Branch coordinates with the Electric Distribution Emergency Center in connection with the de-energization, recovery, and restoration of PG&E's electric distribution system. The branch also provides information on customer outages and field operational challenges to the EOC;
- Mutual Assistance – Re-energizing electrical lines after a major PSPS event may require a significant number of line workers to patrol and inspect the lines and specialized equipment, have technical gas service recovery expertise, and other related capabilities. Electric utilities implementing a PSPS may turn to the industry's mutual assistance network for additional help in restoration;
- CRCs – To minimize public safety impacts during a PSPS event, PG&E opens CRCs in potentially impacted counties and tribal communities. CRCs provide customers and residents a safe location to meet their basic power needs, such as charging medical equipment and electronic devices;
- In-Event Vegetation Management – Beginning in 2020, PG&E began investigating whether vegetation mitigation work can occur to

prevent de-energization of a line during a PSPS event. This cost is for expedited vegetation work that could potentially avoid de-energizing a line; and

- Other – Includes various categories with small dollars to support PSPS events such as, Hydro Support to provide EOC leads with a list of potentially impacted PG&E Power Generation managed facilities and business continuity plans as a result of a PSPS event; and staging and mobilizing response resources as necessary.

2. PSPS Program (WLDFR-M006)

Wildfire mitigation M006 includes a number of programs that are described below.

a. Field Training and Exercise

This program is part of the Wildfire PSPS Program mitigation and is referred to as PSPS Field Exercise Dist. Exp. (WLDFR-M006).

PG&E's expense forecast for Field Training and Exercise related to PSPS is $2.5 million in 2021, $2.5 million in 2022, and $2.6 million in 2023.[19] PG&E's 2023 forecast is $1.6 million higher than 2020 recorded costs. PG&E expects to incur similar costs on an annual basis.

PG&E invests resources in training our crews to efficiently restore power following a PSPS event while maintaining public and employee safety. Our crews conduct restoration drills in HFTD areas across northern and central California to practice coordinating emergency response teams, inspecting lines for damage, and efficiently restoring power while maintaining public and employee safety. These full-scale drills are part of PG&E's expanded Community Wildfire Safety Program and help PG&E personnel and contractors prepare for the challenges posed by actual PSPS events. This program will allow resources to be trained prior to the beginning of PSPS peak season, which typically begins in September.

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19 See Exhibit (PG&E-4), WP 4-8, line 16.

b. CRC Preparedness Program

The CRC Preparedness Program is part of the Wildfire PSPS Program mitigation referred to as the CRC Preparedness Program (WLDFR-M006).

PG&E's expense forecast for the CRC Preparedness Program is $14.8 million in 2021, $15.2 million in 2022, and $15.7 million in 2023.[20] PG&E's 2023 forecast is $0.3 million higher than 2020 recorded costs.

PG&E's capital forecast for the CRC Preparedness Program is $0.3 million for 2022, $0.3 million for 2023, $0.3 million for 2024, $0.3 million for 2025, and $0.3 million for 2026[21].

As discussed above, during PSPS events PG&E opens CRCs to provide a safe, energized space for impacted customers and residents experiencing a PSPS related outage.

This project ensures that CRCs are ready to be activated during PSPS events. It includes a small project management team, construction to make all indoor sites Americans with Disabilities Act (ADA) compliant and perform electrical upgrades where needed for placement of temporary generating units, CRC material procurement, and key third party vendor contracts (including contracts with emergency service providers and external customer staffing for the sites).

To prepare indoor sites in advance of PSPS season, all indoor CRC sites are made ADA compliant and undergo electrical upgrades. Any building improvements required to make the facility compliant, such as repairing cracks in the path of travel or restriping ADA parking is included. Indoor CRC sites are also equipped with an automatic transfer switch so that the PG&E-provided or site-owned generator will automatically activate during an outage. By the end of 2020, PG&E had 98 event-ready indoor sites where all of the aforementioned work was complete. In the forecast, PG&E includes site turnover and additional site requests from counties and tribal governments of approximately 20 percent per year.

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20 See Exhibit (PG&E-4), WP 4-8, line 19.

21 See Exhibit (PG&E-4), WP 4-19, line 7.

The CRC Preparedness Program includes budget for two key third party providers to prepare in advance for PSPS events. This includes work by a professional staffing agency to recruit and train Customer Service Leads (CSL) and Customer Service Support (CSS) staff in how to operate CRCs. This firm hires and trains 850-1,000 CSLs and CSSs in advance so they are ready to deploy during PSPS season. The forecast also includes the retainer for emergency service providers who set up the CRC sites during activations. The actual costs of staff time during events are not included in this forecast but are included in the PSPS Event forecast. If a PSPS is initiated, the costs of the emergency service providers are charged to PSPS events.

The CRC forecast also includes logistics support which is primarily the acquisition of supplies provided to visitors including, but not limited to batteries and blankets. The logistics support also includes expenses associated with updating signage and replenishing other supplies.

The CRC Preparedness Program forecast also includes the internal project management work conducted by a dedicated team of four people and time from supporting departments such as land, logistics, IT and materials.

c. Aviation Cost

The work described in this section includes two Wildfire PSPS Program mitigations referred to as PSPS Pre-Flights Expense (WLDFR-M006) and PSPS Increased Helicopter EU (Dist.) (WLDFR-M006).

PG&E's 2020 expenses for aviation costs totaled $30.5 million, which is made up of exclusive use helicopter contracts of $28.7 million and helicopter pre-flights of $1.8 million.[22] However, after post-close adjustments allocating some helicopter fees to non-PSPS programs, actual exclusive use helicopter cost for 2020 associated with PSPS was $14.4 million. PG&E's expense forecast for exclusive use helicopters

[22] See Exhibit (PG&E-4), WP 4-8, lines 20 and 21.

contracts and helicopter pre-flights to support PSPS is $9.1 million in 2021, $16.1 million in 2022, and $16.6 million in 2023.[23]

PG&E's forecast for PSPS-related aviation resources includes costs for exclusive use helicopter contracts for helicopters that may be used during PSPS and helicopter "pre-flights" to assist PSPS planning.

PG&E's exclusive use helicopter contracts ensure access of up to 65 helicopters during the peak PSPS season. Access to these helicopters allows PG&E to significantly shorten the patrol time for circuits following an all-clear, thereby reducing the duration of a PSPS event. While all 65 helicopters may not be deployed for smaller events, utilization of all 65 helicopters during larger events facilitated faster restoration times in 2020.

Additionally, forecast here also includes cost for helicopter "pre-flights", which are part of preparation and planning for potential PSPS events. Since 2019 PG&E has been flying helicopters on distribution circuits with assets located in HFRA. The purpose of these patrols was to:

- Provide critical information used to develop effective plans for air and ground resource needs during PSPS events. This included noting circuits that require ground or air patrols only and ensuring the resources are appropriately staged during events;
- Improve planning capabilities to ensure more accurate estimated times of restoration forecasting (by gathering patrol time data);
- Identify potential hazards on circuits and take appropriate action; and
- Enhance patrollers training and expand the patrollers resource pool.

d. PSPS Project Cost

The work described in this section is part of the PSPS Program Wildfire mitigation referred to as PSPS Projects (WLDFR-M006).

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23 See Exhibit (PG&E-4), WP 4-8, lines 20 and 21.

PG&E's expense forecast for PSPS Projects is $1.5 million in 2021, $1.6 million in 2022, and $1.6 million in 2023.[24] PG&E's 2023 forecast is $5.2 million lower than 2020 recorded costs.

PG&E's expense forecast include costs for PSPS Projects. This program builds out and improves tools that are critical to PSPS execution. Examples of such tools include:

1) PSPS Viewer – provides the ability to orchestrate the scoping of a PSPS event from planning until the point of de-energization. It translates geographic areas of meteorological fire risk to the Distribution and Transmission assets potentially compromised by those conditions;
2) PSPS Portal – online platform to share key event and sensitive customer information with Public Safety Partners;
3) PSPS Situational Intelligence Platform – provides the primary interface to support PSPS events, connecting PSPS data together across multiple systems for real-time intelligence and post-event reporting; it is a central repository of event data for decision making during events; and
4) PSPS FORCE Tool – estimates field resources needed to patrol de-energized lines and restore customers during PSPS events.

In addition, the PSPS Operations team, develops processes for PSPS scoping working with meteorology and asset strategy, improves overall PSPS event scoping process by minimizing manual process steps, ensures accuracy and timeliness of reporting data, and manages PSPS Process Documentation.

e. WSPE Team

The WSPE Team is part of the Wildfire PSPS Program mitigation (WLDFR-M006).

PG&E's expense forecast for the WSPE team is $1.2 million in 2021, $1.0 million in 2022, and $1.0 million in 2023.[25] PG&E's 2023 forecast is $0.7 million higher than 2020 recorded costs.

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[24] See Exhibit (PG&E-4), WP 4-8, line 18.

[25] See Exhibit (PG&E-4), WP 4-8, line 22.

This portion of the PSPS forecast includes the cost of a WSPE team that is focused on increasing the transparency of PG&E's wildfire safety and PSPS programs with external stakeholders—in particular, local and tribal government and public agencies—to increase mutual trust and cooperation. The team is made up of five FTEs who concentrate on three key workstreams:

- Outreach to county and tribal government and public agencies to provide detailed local insight into PG&E wildfire and PSPS mitigation work, and to gather continuous feedback on improvement efforts;
- Evolve the Liaison Officer and supporting roles during PSPS events, in particular PG&E's support and coordination with local emergency management during events; and
- Identify, prioritize, and advocate for local projects based on community feedback as part of wildfire and PSPS mitigation work in EO (e.g., hardening, sectionalizing, vegetation management).

f. PSPS Program Team

The PSPS Program Team is part of the PSPS Program Wildfire mitigation (WLDFR-M006).

PG&E's expense forecast for the PSPS Program team is $5.5 million in 2021, $4.5 million in 2022, and $4.6 million in 2023.[26] PG&E's 2023 forecast is $2.5 million higher than 2020 recorded costs.

This portion of the forecast includes costs for the PSPS Operations and PSPS PMO. The PSPS Program Team is a Wildfire mitigation (WLDFR-M006). Primary functions of the PSPS Program team include:

- Building a cross-functional process by collaborating with various line-of-business teams to build and continuously improve the end-to-end PSPS execution process, including gathering and prioritizing requirements, establishing process handoffs, and conducting tabletops;
- Establishing and evolving the PSPS decision-making process by working closely with Meteorology and Electric Asset Management to

26 See Exhibit (PG&E-4), WP 4-8, line 17.

develop and operationalize PSPS thresholds and Officer in Charge (OIC) decisions to support successful execution;

- Leading the development of the HFRA effort by determining program scope by identifying areas at risk of catastrophic fire risk during high-wind events;
- Driving and tracking execution against PSPS regulatory requirements;
- Managing PSPS event data including design control, system, and reporting for key PSPS data;
- Developing and leading PSPS training; and
- Supporting every PSPS event, including preparation and submission of CPUC post-de-energization reports.

g. PSPS Collateral/Segment Creations

This program is part of the PSPS Program Wildfire mitigation and is referred to as PSPS Collateral/Segment Creations (WLDFR-M006).

PG&E's expense forecast for PSPS Collateral and Segmentation Creations is $0.1 million in 2021, $0.1 million in 2022, and $0.1 million in 2023.[27]

PSPS Collateral and Segmentation Creations support the enhancement of PG&E's Segment Guides for distribution circuits (Segment Guides). These guides are the primary reference documents that Distribution Control Centers and field patrol personnel utilize for alignment in executing "step restoration" efforts during PSPS restoration. "Step restoration" is the breaking up of a given distribution circuit into incremental "segments" that, once patrolled, are energized individually rather than waiting to patrol the entire circuit (and then energizing all customers at once). Step restoration provides for safer and more efficient customer restoration.

h. EP&R Field Operations

This work is part of the Wildfire PSPS Program mitigation (WLDFR-M005) through 2022. Beginning in 2023, this program becomes a control in Chapter 5, EP&R (EPNDR-C005).

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27 See Exhibit (PG&E-4), WP 4-8, line 15.

PG&E's expense forecast for Field Operations is $10.5 million in 2021, $7.5 million in 2022.[28] Beginning in 2023 this program shifts to the all hazards approach in Chapter 5 (EP&R).

The PSPS forecast includes costs for EP&R Field Operations-related costs which include headcount, team specific training, support expenditures, and other miscellaneous costs. EP&R related costs will remain in Chapter 4.2 (PSPS Operations) through 2022. By the end of 2022, EP&R Field Operations is expected to complete its shift to an all hazards approach. Because program will no longer exclusively support wildfire risk, capital and expense dollars will then shift to Chapter 5 (EP&R) to better reflect the nature of Field Operations starting in 2023.

3. PSPS IT Equipment

This work is part of the PSPS Program Wildfire mitigation and includes two parts: PSPS Field Ops Tech. Capital (WLDFR-M006); and, PSPS Reduction Initiatives – PSPS Capital Equipment (WLDFR-M006).

PG&E's capital forecast for PSPS IT Equipment is $3.1 million in 2021 and $3.0 million in 2022.[29] Beginning in 2023, these costs will shift to an all hazards approach and be in Chapter 5 (EP&R).

This program provides radio communications hardware and solutions to support essential roles activated in support of PSPS restoration and patrols.

D. Cost Tables

The expense and capital forecasts in this chapter are summarized in the following tables:

- Table 4.2-6 shows 2016 through 2020 recorded adjusted expenses and 2021 through 2023 forecast expenses; and
- Table 4.2-7 shows 2016 through 2020 recorded capital adjusted expenditures and 2021 through 2026 forecast expenditures.

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28 See Exhibit (PG&E-4), WP 4-8, totals of lines 12, 13, and 14.

29 See Exhibit (PG&E-4), WP 4-19, line 6.

TABLE 4.2-6
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	Forecast 2020	2021	2022	2023	WP Reference
1	AB	Misc Expense	–	–	$4,981	$182,233	$141,178	$127,920	$119,254	$115,266	WP 4-8, line 23
2		Total	–	–	$4,981	$182,233	$141,178	$127,920	$119,254	$115,266	

TABLE 4.2-7
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	2021	Forecast 2022	2023	2024	2025	2026	WP Reference
1	21	Misc Capital	–	–	–	$757	$2,397	$3,084	$3,237	$262	$269	$277	$284	WP 4-19, lines 6 and 7
2		Total	–	–	–	$757	$2,397	$3,084	$3,237	$262	$269	$277	$284	

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4.3

SYSTEM HARDENING, ENHANCED AUTOMATION, AND PSPS IMPACT MITIGATIONS

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022 AND FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.3
SYSTEM HARDENING, ENHANCED AUTOMATION, AND PSPS IMPACT MITIGATIONS

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.3
SYSTEM HARDENING, ENHANCED AUTOMATION, AND PSPS IMPACT MITIGATIONS

A. Introduction

1. Scope, Purpose, and Support for this Request (Mark Esguerra)

This chapter presents Pacific Gas and Electric Company's (PG&E) expense and capital forecast for its Electric Distribution System Hardening Program, expulsion fuse replacement, enhanced automation for wildfire mitigation, and Public Safety Power Shutoff (PSPS) impact reduction initiatives. This chapter demonstrates that the forecast for these activities is reasonable and should be adopted by the California Public Utilities Commission (CPUC or Commission). The programs described in this chapter are critical elements of PG&E's wildfire mitigation program.

- PG&E's expense and capital forecasts in this chapter are reasonable and necessary to mitigate wildfire risk: PG&E's System Hardening Program is an important initiative that reduces the risk of wildfire ignitions caused by distribution facilities. PG&E's System Hardening Program focuses on mitigating against wildfire risk posed by distribution overhead assets in and near Tier 2 and 3 High Fire Threat Districts (HFTD) in PG&E's service territory. This program targets high wildfire risk miles and applies various mitigation activities, including: (1) line removal, (2) conversion from overhead to underground, (3) application of Remote Grid alternatives, (4) mitigation of exposure through relocation of overhead facilities, and (5) in-place overhead system hardening. The underground construction of electric distribution assets in the Community Rebuild Program includes undergrounding the majority of the electric distribution assets in the Town of Paradise and parts of Butte County. The undergrounding will help reduce wildfire risk from power lines and help ensure access to safe egress routes in the event there is a wildfire.
- Removal of non-exempt expulsion fuses enables PG&E to reduce the potential for vegetation ignitions due to normal operation of a fuse.

- Installing enhanced automation technologies will continue to reduce the possibility of ignitions caused by PG&E assets. These technologies include the following: single phase reclosers with the capability to trip all phases (i.e., open all phases), eliminating the risk associated with wire down events; distribution grid sensors that detect non-equipment failure types that cannot be detected by existing detection methods or patrol techniques; technology that can decrease overall wildfire ignition risk by detecting early-stage equipment failure, enabling PG&E to conduct repairs before infrastructure fails; technology that mitigates ignitions from line-to-ground faults such as wire down or tree contacts; and technologies that detect an object approaching an energized power line and respond quickly to shut off power before the object impacts the line.
- Programs for mitigating the impacts of PSPS on customers include the installation of sectionalizing devices and support for Temporary Generation (TG) programs that support temporary microgrids.

2. Summary of Request (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

PG&E requests that the Commission adopt its 2023 expense forecast of $11.6 million[1] for four initiatives addressed in this chapter: (1) Sensor IQ™ (SIQ) software used to enable predictive maintenance data analytics; (2) the Generation Enablement and Development organization that procures and deploys TG to support PSPS mitigation; (3) costs for the Asset Performance Center (APC) Distribution Engineering team that supports the wildfire risk mitigation technologies and activities described in this chapter; and (4) expense forecasts for the Remote Grid program. PG&E's 2023 expense forecast is $3.7 million higher (46 percent) than 2020 recorded costs of $7.9 million.

PG&E further requests that the Commission adopt its capital expenditure forecasts for: (1) System Hardening; (2) expulsion fuse replacement; (3) enhanced automation for wildfire mitigation; and (4) PSPS impact reduction initiatives. In our June 2021 testimony, PG&E forecast

[1] See Exhibit (PG&E-4), WP 4-5, lines 4-7, 12, 16, 25, 28, and 32.

$520.0 million for 2021, $1,122.7 million for 2022, $1,593.1 million for 2023, $2,612.5 million for 2024, $3,092.2 million for 2025, and $3,500.6 million for 2026. PG&E's 2023 forecast was $1,008.7 million more than 2020 recorded expenditures of $584.4 million.[2] This forecast has been updated as shown in Table 4.3-15.

Forecasts in this chapter are shown with escalation at the MWC level and escalation is included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

3. Summary of February 25, 2022 Forecast Updates (Mark Esguerra)

This section has been added as of February 25, 2022.

As directed in the October 1, 2021 Scoping Memo (Scoping Memo), PG&E is updating its 2023 General Rate Case (GRC) forecast to reflect changes in its wildfire mitigation strategies. This supplemental testimony includes the following change to PG&E's 2023 forecast:

Capital:

- Addition of $603.1 million to reflect PG&E's plan to underground additional miles at a lower unit cost as part of its System Hardening Program.

Summaries of the forecast changes, including capital changes through 2026, are provided in Tables 4.3-13, 4.3-14, and 4.3-15 at the end of this chapter. The remainder of this chapter shows PG&E's updated forecast as compared to 2020 recorded amounts.

4. Overview of Recorded and Forecast Costs (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

Expenditures for the activities described herein are divided into two expense and three capital MWCs, listed in Table 4.3-1 below. In the following sections, we describe each of the MWCs and explain how the cost forecasts for each were derived. Tables 4.3-12 and 4.3-15 at the end of this chapter show by MWC the 2020 recorded amounts, the 2021-2023 expense forecast, and the 2021-2026 capital forecast.

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2 See Exhibit (PG&E-4), WP 4-22, line 23.

TABLE 4.3-1
SYSTEM HARDENING, ENHANCED AUTOMATION, AND PSPS IMPACT MITIGATIONS MWCS

Line No.	MWCs	Description
1	Expense	
2	AB	Miscellaneous Expense
3	FZ	Electric Distribution Planning and Operations Engineering
4	HG	Distribution Operations Technology
5	IG	Manage Various Balancing Account Processes
6	KA	Electric Distribution Maintenance Overhead
7	Capital	
8	08	Electric Distribution Replace Overhead Assets
9	21	Miscellaneous Capital
10	49	Distribution Circuit/Zone Reliability
11	2A	Electric Distribution Install/Replace Overhead Asset

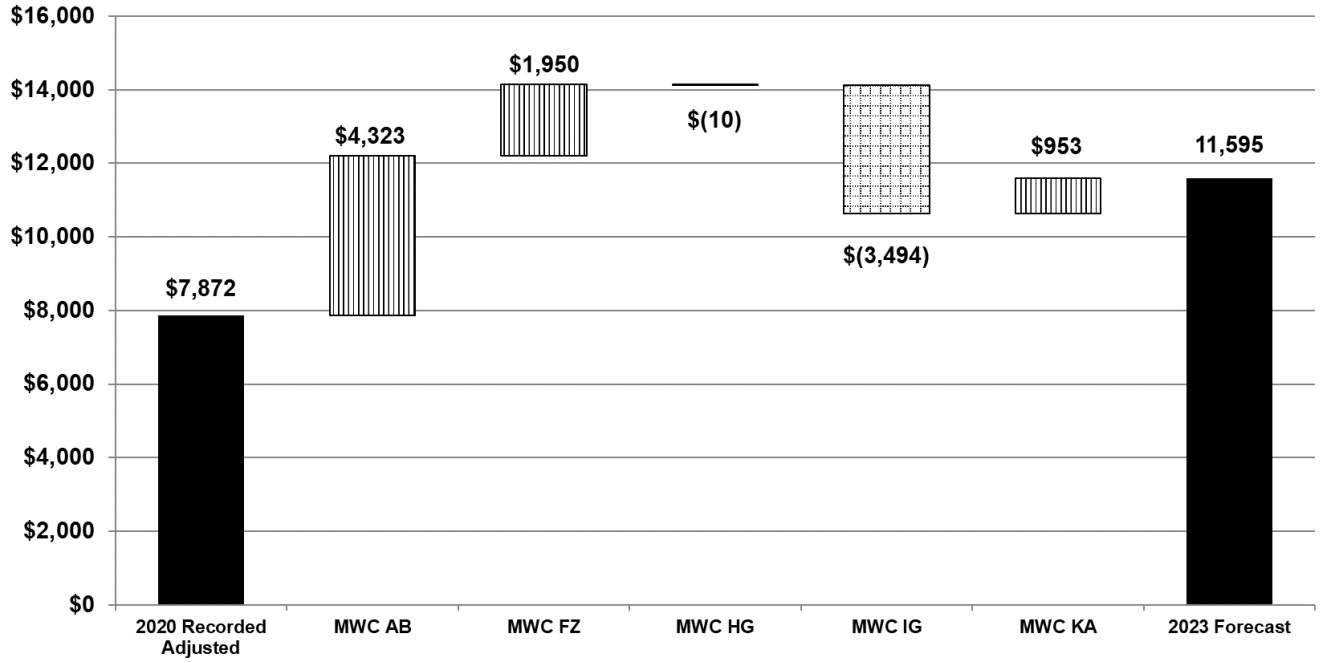
Work in these MWCs is further broken down into MAT codes, as described in Section C. Forecasts in this chapter are shown with escalation at the MWC level and escalation is included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

a. Expense (Mark Esguerra)

Expense activities in this chapter[3] are recorded in MWCs AB, FZ, HG, IG, and KA. As shown in Figure 4.3-1 below, forecast costs for expense activities are expected to increase by approximately $3.7 million, or 46 percent, between 2020 and 2023.

[3] Values vary from the values in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model previously provided to the Public Advocates Office. The RO will be updated to incorporate this February 25, 2022 update and additional errata.

FIGURE 4.3-1
EXPENSE WALK BY MWC 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)

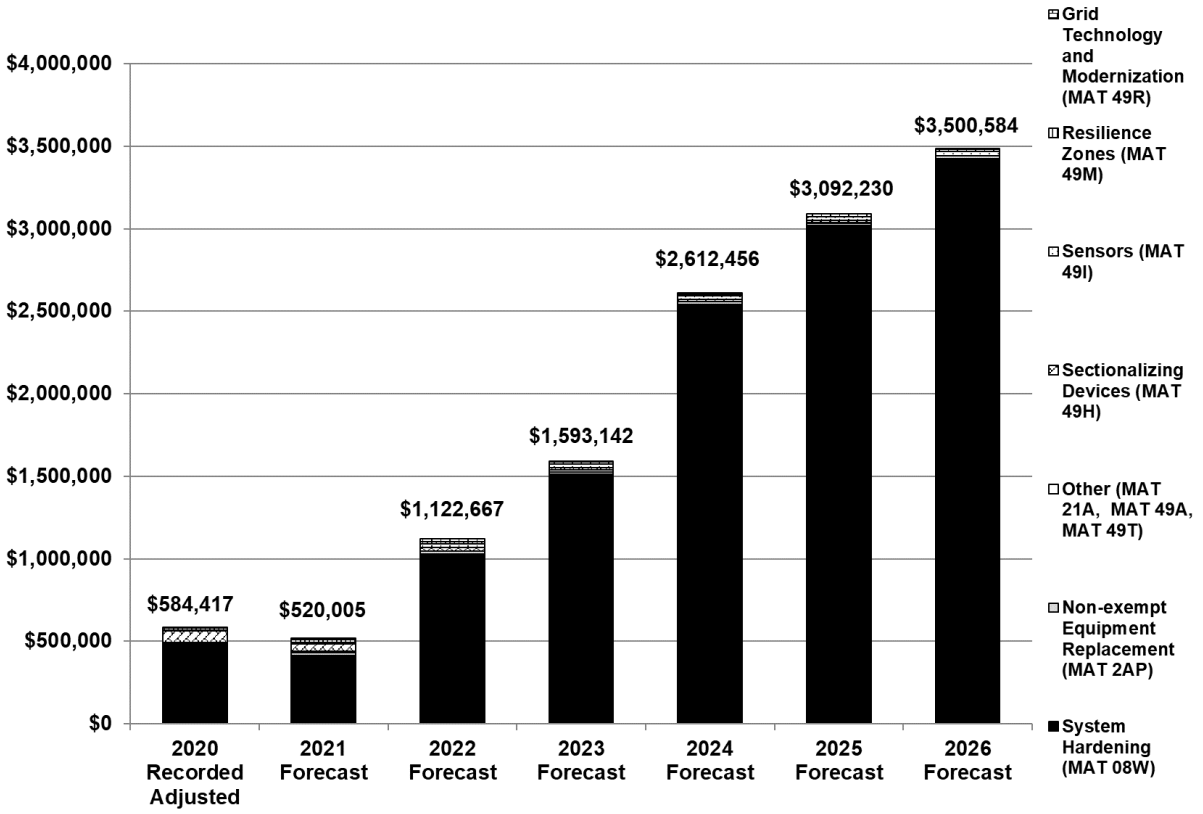


The activities driving this increase are: $1.9 million for SIQ in MWC AB that began as a pilot program in 2020, but is now forecast as a wildfire risk mitigation; $1.5 million for Remote Grid in MWCs AB and KA; $1.9 million for the Generation Enablement and Deployment Project Management Office (PMO) in MWC AB; and $1.9 million in MWC FZ for monitoring, maintenance and support of new wildfire mitigation technologies PG&E is forecasting in this GRC. These increases are offset by a decrease of $3.5 million in MWC IG for costs related to developing generation.

b. Capital (Mark Esguerra)

Capital activities in this chapter are recorded in MWCs 08, 2A, 21, and 49. As shown in Figure 4.3-2 below, forecast costs for capital activities are expected to increase by approximately $1,008.7 million, or 173 percent, between 2020 and 2023.

FIGURE 4.3-2
FEBRUARY 25, 2022 CAPITAL RECORDED AND FORECAST BY MWC 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



The activities driving this increase include:

- An increase of approximately $1,027 million for the System Hardening program (08W) due to an increase in the forecast number of system hardening underground miles in 2023;
- A change in the scope and pace of expulsion fuse replacements resulting in an increase of approximately $7.9 million;
- An increase of $10.5 million for the SIQ Program (21A); and
- Increases in line sensor activities (49I), and Rapid Earth Fault Current Limiter (REFCL) deployments (49R).

The increase is offset by:

- A decrease of approximately $35 million consisting of a decrease in PSPS sectionalizing projects (49H) and a decrease in temporary distribution microgrids (49M).

B. Program and Risk Overview

1. Program Overview (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

The work described in this chapter includes the following components of PG&E's wildfire risk mitigation program: system hardening, expulsion fuse replacement, enhanced automation, and PSPS impact mitigation.

As demonstrated by our 10,000-mile program, PG&E is making a fundamental shift in our system hardening work and using undergrounding as the preferred option after line removal or remote grid, where appropriate. While undergrounding is the preferred mitigation for its risk reduction and other benefits, we will also use other mitigations. In some instances, overhead system hardening may be a more appropriate mitigation method because of environmental factors in certain areas. For example, in areas with more grass and fewer strike potential trees, PG&E may determine that overhead hardening work is faster, and more cost effective, than undergrounding. In addition, some remote or inaccessible areas may be cost prohibitive to underground. These areas may be better suited for a remote grid[4] solution, especially if limited customers are involved.

This work is designed to reduce the risk of wildfire and failure of overhead distribution assets through both traditional asset replacement programs and the addition of new technologies to the electric distribution grid that will enable PG&E to better predict and detect failures. Programs in this chapter are also designed to reduce the impact of PSPS events on PG&E's customers.

2. Undergrounding Program (Jamie Martin)

This section has been added as of February 25, 2022.

a. Introduction (Jamie Martin)

Extraordinary times call for extraordinary solutions. California, along with other western states, continues to experience an increase in wildfire risk and a longer wildfire season. In 2020 and 2021, PG&E's service

[4] Remote Grid is discussed in Section C.1.c. below.

area was under extreme and severe drought conditions, with California experiencing its 5th and 2nd driest water years, respectively, in the last century.[5] Climate scientists at the University of California, Los Angeles recently concluded that for the Western United States "2000-2021 [was] the driest 22-year period since 800 A.D., which is as far as the data goes back."[6] Simply put, the wildfire threat is growing; PG&E's programs must evolve commensurate with the increasing risks.

To respond to this challenge, in July 2021, PG&E announced a multi-year program to underground 10,000 distribution circuit miles[7] in and near HFTDs.

PG&E's undergrounding efforts, and other wildfire safety measures, will make our system safer and more resilient to better serve customers and respond to the state's evolving climate challenges. Building and expanding PG&E's electric distribution system underground will not only help eliminate wildfires caused by overhead equipment failures, but it will also help to reduce the need for and/or frequency of PSPS outages and Enhanced Powerline Safety Settings (EPSS), improving system reliability under the full range of weather and fire risk conditions. While both PSPS and EPSS have effectively reduced wildfire risk, these programs also impact system reliability. PG&E will seek to balance reducing risk and improving system reliability, in order to serve customers the way they deserve to be served – in a safe and reliable manner. Undergrounding will also help protect trees and retain the ecological, environmental, and other benefits they provide. In sum,

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5 Water years run from October 1 to September 30. *See* Water Year 2021: An Extreme Year (ca.gov).

6 How Bad Is the Western Drought? Worst in 12 Centuries, Study Finds. - The New York Times (nytimes.com).

7 10,000 miles refers to the length of the underground circuit miles being installed. The underground line miles may not necessarily equate to the number of relocated overhead line miles. An underground trench mile may not necessarily equate to the number of relocated overhead line miles. The difference between the two units is that one trench mile is defined as one mile of underground trench that includes electric distribution primary cable regardless of the quantity of primary cable. Whereas circuit-mile measures every mile of primary cable installed underground, which is sometimes installed with multiple cables installed in the same trench. PG&E uses circuit miles as the primary measure.

PG&E believes that undergrounding electric lines is the best long-term solution for stopping catastrophic wildfires while improving reliability for our customers.

The undergrounding plans outlined in this chapter set the stage for building a safer electric distribution system for the future.[8] PG&E plans to scale up its undergrounding efforts during this rate case period. Table 4.3-2 shows the PG&E plans for its undergrounding program[9] from 2022 through 2026.

TABLE 4.3-2
SYSTEM HARDENING UNDERGROUND MILES
FEBRUARY 25, 2022 GRC UPDATE FILING

Line No.	Underground Program	Exh. (PG&E-4) Chapter	MAT	2022	2023	2024	2025	2026	Total
1	10,000 Miles Underground Program	4.3	08W	163	357	764	976	1,200	3,460
2	Community Rebuild Miles[(a)]	4.3	08W	22	25	22	14	–	84
3	Community Rebuild Miles[(a)]	23	95F	36	42	35	23	–	136
4	Total Forecast Miles			221	424	821	1,103	1,200	3,680

Note: Mileage amounts are rounded to the nearest whole number.

(a) Relocated Community Rebuild overhead line miles (2022-2025) have been converted to underground circuit miles using a factor of 1.57 underground circuit miles for every 1.0 of relocated overhead circuit mile.

b. Program Benefits

1) Near Total Elimination of Wildfire Risk (Jamie Martin)

There is no single solution for wildfire risk. Instead, wildfire risk must be addressed through a series of integrated programs and initiatives. As the climate continues to change, PG&E must remain nimble and continue to adapt and evolve its programs and initiatives

8 The undergrounding plans discussed in this chapter are also discussed in detail in PG&E's 2022 Wildfire Mitigation Plan (WMP) in Section 7.3.3.16.

9 The Community Rebuild Miles are shown in this table to show the total undergrounding miles PG&E plans to complete in this rate case period. Community Rebuild miles recorded to MAT 08W include underground construction of electric distribution assets in Tier 2 or Tier 3 HFTD areas. These assets were previously overhead and are being transitioned to underground. Community Rebuild miles recorded to MAT 95F include work to restore electric distribution assets underground or where the underground mainline work is located in non-HFTD areas. See Exhibit (PG&E-4), Ch. 23 for more information.

to those changes. PG&E is committed to delivering programs and initiatives that will continue to significantly reduce wildfire risk, and to design those activities based on data, experience, and feedback.

While PG&E has and will continue to use a suite of wildfire mitigation solutions, undergrounding electric lines in and near HFTDs is the best long-term solution to keep customers and communities safe. Undergrounding distribution lines will not only address the risk we face from climate change today, but will also position us for future climate change challenges. Aside from asset removal (e.g., line removal or remote grid), no other wildfire mitigation provides the same level of long-term risk mitigation as undergrounding. Underground lines are not vulnerable to tree strikes caused by high-winds and are better protected from wildlife, objects, and environmental conditions that cause degradation and failure. Consequently, placing overhead lines underground reduces ignition risk by approximately 99 percent.[10]

2) Improving Reliability With Reduced Customer Impacts (Jamie Martin)

While PG&E has deployed mitigations that meaningfully reduce risk – PSPS and EPSS – these safety measures impact customers. Specifically, PSPS (i.e., de-energizing lines) and EPSS (i.e., re-adjusting protective settings on portions of lines) have created uncertainty, caused disruptions, and negatively impacted service reliability. Customers in and near HFTDs are less confident in the availability of electricity in their homes and businesses during PSPS and EPSS events As overhead lines are relocated underground, the need for PSPS events and EPSS will decrease.

3) Cost Benefits to Customers (Jamie Martin)

PG&E is committed to providing a safe, reliable and affordable system for our customers. Undergrounding is an investment that PG&E expects will provide long-term savings for customers. The

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10 See Exhibit (PG&E-4), Chapter 3.

baseline expected lifespan of modern undergrounded lines is approximately 50 years. However, in many cases, newer underground lines are expected to last much longer because of engineering innovations like application of jacketed cable.

PG&E expects that in the long-term, operations and maintenance expenses will be lower for underground lines than overhead lines. For example, activities such as equipment inspections, routine and enhanced vegetation management, and weather-related repairs should be significantly reduced when compared to those activities for overhead lines.

Vegetation management needs are also expected to reduce as undergrounding assets become more prevalent. There are over 8 million trees within striking distance of our lines; in 2021, we removed approximately 300,000 trees and trimmed approximately one million trees. Many of these trees that require vegetation management work are in HFTD areas where undergrounding work is being targeted. As PG&E increases undergrounding efforts, vegetation work and the associated costs can be reduced and, for some circuit segments, eliminated.

4) Additional Benefits of Undergrounding (Jamie Martin)

In addition, undergrounding will provide other benefits, including long-term resiliency and an improved customer experience.

One key system-resiliency benefit of undergrounding includes reduced weather-related outages. For example, falling tree limbs, high winds, and heavy snow during storms will not cause damage or create the same disruptions experienced with overhead power lines under the same harsh conditions. Moreover, decreased exposure to harsh weather conditions that degrade or damage electric facilities will also improve system resiliency in the long-term.

Many customers and communities want PG&E to underground its lines. Undergrounding will improve our customers' experience with their electric service by allowing customers to have greater confidence that their electric service will not cause wildfires and disrupt their lives. This will provide peace of mind to customers who

live in and near HFTDs, and promote economic security and stability for businesses, developments, and communities that have been impacted by the constant threat of wildfires. Also, by leaving more of California's trees untouched, undergrounding overhead lines will improve the aesthetics of our hometowns across PG&E's service territory; undergrounding will also provide environmental benefits, including the substantial elimination of electric grid-initiated wildfires that create harmful smoke and pollution. These important ancillary benefits will improve customers' overall experience with their electric service.

3. Risk Integration (Mark Esguerra)

This section has been modified to describe changes in risk integration as of February 25, 2022.

Chapter 3 of this exhibit describes how Electric Operations (EO) uses the Enterprise and Operational Risk Management Program to manage electric system risks. Table 4.3-3 below shows the EO risks associated with the forecasts discussed in this chapter.

In Chapter 3 of this exhibit, we describe how management of the risk has changed since the filing of the 2020 RAMP Report; provide updated Risk Spend Efficiency (RSE) scores; list each mitigation and control; and indicate if it has changed since the 2020 RAMP Report.

TABLE 4.3-3
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	MAT
1	Failure of Electric Distribution Overhead Assets	DOVHD	Risk Assessment and Mitigation Phase (RAMP)	08W, 2AP, 49A, AB#, KAT
2	Wildfire	WLDFR	RAMP	AB#, FZA, 08W, 2AP, 21A, 49A, 49H, 49I, 49M, 49R, 49T

Some mitigations and/or controls may overlap across risks (i.e., one mitigation or control offsets more than one risk). For example, a mitigation can reduce both the Failure of Electric Distribution Overhead

Assets risk and the Wildfire risk. Where mitigations and/or controls overlap across risks, the forecasts are included for only one risk.

a. RAMP Risk – Failure of Electric Distribution Overhead Assets (Mark Esguerra)

1) Risk Overview (Mark Esguerra)

The Failure of Electric Distribution Overhead Assets risk is defined as the failure of distribution overhead assets or lack of remote operation functionality may result in public or employee safety issues, property damage, environmental damage or inability to deliver energy. The Failure of Electric Distribution Overhead Assets risk was one of PG&E's 2020 RAMP risks.[11]

2) GRC Risk Mitigations and Controls (Mark Esguerra)

As shown in the tables below, PG&E is forecasting two mitigations. These programs were determined to reduce the frequency or consequence of risk of failure of distribution overhead assets. A brief description of the mitigations is provided in the table below. More detail is included in the 2020 RAMP Report.[12]

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11 PG&E's 2020 RAMP Report, A.20-06-012 (June 30, 2020), Ch. 11.

12 PG&E's 2020 RAMP Report, A.20-06-012 (June 30, 2020), Ch. 11, starting at p. 11-14.

TABLE 4.3-4
FAILURE OF ELECTRIC DISTRIBUTION OVERHEAD ASSETS
FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	DOVHD-M002	System Hardening	The Distribution System Hardening Program is an ongoing, long-term capital investment program to rebuild portions of PG&E's overhead electric distribution system to reduce fire risk.	D-Line Equipment Failure, Animal, Natural Hazard, Other PG&E Assets or Processes, Vegetation	See Section C.1 for more information	08W
2	DOVHD-M011	Remote Grid	Remote Grid is a new concept for utility service using standalone, decentralized energy sources and utility infrastructure for continuous, permanent energy delivery in lieu of traditional wires to small loads in remote locations at the edges of the distribution system. In many circumstances, the feeders serving these remote locations traverse through HFTD areas.	Equipment Failure, Third-Party, Animal, Vegetation, Unknown, or Other	See Section C.1.c for more information	08W, AB#, KAT

System Hardening, DOVHD-M002, is described below in the Wildfire risk section.

3) Changes to Mitigations (Mark Esguerra)

The Remote Grid Program described in the GRC has not changed since PG&E filed its 2020 RAMP Report (i.e., the number of line miles that will be removed as a result of deploying Remote Grid projects remains the same). However, instead of completing these projects by the end of 2020, PG&E now plans to complete the first project, the Briceburg project, by the end of 2021.[13] PG&E is proceeding with scoping new remote grid locations as part of the 2021-2023 workplan and, if the initial projects prove successful, may proceed with additional sites. PG&E describes its remote grid activities in Section C.1.c below.

b. RAMP Risk – Wildfire (Mark Esguerra)

1) Risk Overview (Mark Esguerra)

The Wildfire risk is defined as PG&E assets or activities that may initiate a fire that is not easily contained, endangers the public, private property, sensitive lands or environment. Wildfire was one of PG&E's 2020 RAMP risks.[14]

2) GRC Risk Mitigations and Controls (Mark Esguerra)

As shown in the tables below, PG&E is forecasting eight mitigations (including mitigations that are divided into subparts). These programs were determined to reduce the frequency or consequence of risk of wildfire. A brief description of the mitigations and controls are provided in the tables below. More detail is included in the 2020 RAMP Report.[15]

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[13] This project is in service as of the February 25, 2022 update.

[14] PG&E's 2020 RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10.

[15] PG&E's 2020 RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10, starting at p. 10-22.

TABLE 4.3-5
WILDFIRE
FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	WLDFR-M002	System Hardening	The Distribution System Hardening Program is an ongoing, long-term capital investment program to rebuild portions of PG&E's overhead electric distribution system to reduce fire risk.	Equipment/ facility failure, Contamination, Vegetation Contact, Contact from Object, Other, Unknown	See Sections C.1.a and C.1.b for more information	08W
2	WLDFR-M004	Expulsion Fuse Replacement	This program is a targeted replacement program for non-exempt distribution line equipment, including non-exempt fuses. Such equipment has the potential to expel hot or molten material upon normal operation leading to an increased risk of wildfire.	Equipment/facility failure	See Section C.2 for more information	2AP
3	WLDFR-M006	PSPS Impact Reduction Initiatives – Sectionalizer Device Install/Replace	The installation of remote operated Supervisory Control and Data Acquisition (SCADA) sectionalizing devices on PG&E's distribution system can support PG&E's ability to segment the distribution circuits near HFTD boundaries to reduce the impact and scope of PSPS events.	Consequence only	See Section C.4.b for more information	49H
4	WLDFR-M006	PSPS Impact Reduction Initiatives – Temporary Distribution Microgrids	PG&E's temporary distribution microgrids are designed to reduce the number of customers impacted by PSPS events and support community resilience by powering a cluster of shared resources (e.g., commercial corridors and critical facilities within the energized zones) so that those resources can continue serving surrounding residents during PSPS events.	Consequence only	See Section C.4.a.2 for more information	49M

TABLE 4.3-5
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
5	WLDFR-M006	PSPS Impact Reduction Initiatives – Generation Enablement and Deployment PMO	In Q1 of 2021, PG&E established a new Generation Enablement and Development organization, whose goal is to procure and deploy TG system wide across the four generation initiatives supporting PSPS mitigation.	Consequence only	See Section C.4.a.1 for more information	AB#
6	WLDFR-M07A	Situational Awareness and Forecasting Initiatives – Line Sensors	Installation, maintenance, and monitoring of sensors and sensorized equipment used to monitor the condition of electric lines and equipment.	Equipment/facility failure, Vegetation Contact, Other, Contact from Object, Vandalism/ Theft, All Consequences	See Section C.3.c.1 and C.3.c.2 for more information	49I, FZA
7	WLDFR-M07F	Situational Awareness and Forecasting Initiatives – SIQ	The SIQ software works with existing SmartMeter™[(a)] to capture and store high resolution, real-time, and granular: load, voltage, and outage data to enable predictive maintenance data analytics.	Foundational	See Section C.3.d for more information	AB#, 21A
8	WLDFR-M10A	Additional System Automation and Protection	This includes the Distribution Automation Initiative, installing new Remote Terminal Units to improve visibility, reliability, and operations, and continuing to upgrade and replace obsolete, deficient, and failed automation and protection equipment.	Consequence only	See Section C.3.a for more information; This mitigation ends in 2021	49A
9	WLDFR-M10B	Additional System Automation and Protection – FuseSaver	A FuseSaver is a cost-effective intelligent device which can replace fuses and act as a single phase recloser with the capability to trip all phases (i.e., open all phases) eliminating the risk associated with wire down events where a downed wire remains energized by a back-feed condition.	Equipment/facility failure, Vegetation Contact, Contact from Object, Vandalism/Theft, Unknown, Other	See Section C.3.b for more information	49T

TABLE 4.3-5
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
10	WLDFR-M10C	Additional System Automation and Protection – REFCL	This program is targeted at 12 kilovolt (kV) and 17 kV overhead distribution lines in Tier 2 and Tier 3 HFTD areas. REFCL technology has potential benefits of significantly lowering the energy for single line to ground faults, reducing the potential for arc-flash.	All Drivers	See Section C.3.e for more information	49R
11	WLDFR-M10D	Additional System Automation and Protection – DTS FAST	DTS-FAST is a system developed internally at PG&E. The system uses fraction-of-a-second technologies to detect objects approaching an energized power line and respond quickly to shut off power before the object impacts the line.	Equipment/facility failure	See Section C.3.f for more information	PG&E is not forecasting any expenditures for this program.
12	WLDFR-M011	Situational Awareness and Forecasting Initiatives – EFD	Radio Frequency (RF) sensors are sophisticated technology that listens for the RF signal that is generated by partial discharge arcing on alternating current (AC) circuits and uses precision time measurement of events to locate the source along the conductors. Early Fault Detection is the product name.	Equipment/facility failure, Vegetation Contact, Other, Contact from Object, Vandalism/ Theft, All Consequences	See Section C.3.c.3 for more information	49I
13	WLDFR-M012	Situational Awareness and Forecasting Initiatives – Distribution Fault Anticipation (DFA)	Event Classification Through Current and Voltage Monitoring Sensors (ECCVM) (also called Distribution Fault Anticipation) are substation Current Transformers (CT)/Potential Transformer (PT)-based devices measuring volts, amps, and arcing conditions. The sensors monitor magnitude, phase, harmonics, real and reactive power, and cycle-to-cycle deltas in these values.	Equipment/facility failure, Vegetation Contact, Contact from Object, Other, Unknown	See Section C.3.c.4 for more information	49I

(PG&E-4)

TABLE 4.3-5
WILDFIRE
FORECAST MITIGATIONS
(CONTINUED)

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
14	WLDFR-M017	Alternative Mitigation: System Hardening – Remote Grid	The Remote Grid Program will remove long feeders and serve customers from a local and decentralized energy source (i.e., a "Remote Grid").	Equipment/facility failure, Vegetation Contact, Contact from Object, Contamination, Unknown, Other	See Section C.1.c for more information	08W, KAT, AB#

(a) SmartMeter is a PG&E registered trademark. All further references to SmartMeters in PG&E's testimony in this proceeding should be assumed to refer to the trademarked name, without continually using the ™ symbol, consistent with legally-acceptable practice.

3) Changes to Mitigations (Mark Esguerra)

PG&E modified its portfolio of mitigations since filing the 2020 RAMP Report. The work forecast in some of the mitigations proposed in the 2020 RAMP Report and in PG&E's June 30, 2021 GRC testimony has also changed as described below.

System Hardening (WLDFR-M002)

In the June 30, 2021 GRC testimony, PG&E forecast approximately 260 fewer miles between 2023-2026 as compared to the miles set forth in the 2020 RAMP Report.[16] PG&E reported that it would continue to refine its strategy and improve the scope of the System Hardening Program. The exact scope of PG&E's System Hardening Program will continue to evolve as PG&E enhances its Wildfire Risk Model as well as performs more detailed scoping and inspections, estimating, and engineering review. Because PG&E's System Hardening Program is evolving, some level of uncertainty as to the exact number of miles of undergrounding versus overhead system hardening is to be expected.

As of PG&E's February 25, 2022 update, PG&E now plans to install fewer miles of overhead system hardening and more miles of underground system hardening. Table 4.3-11 below shows the revised forecast miles of overhead and underground system hardening. The changes in the number of overhead and underground miles aligns to PG&E's updated wildfire mitigation strategy because undergrounding is more effective at reducing wildfire risk.

PG&E continues to evaluate other technologies such as REFCL as described in Section C.3 below. PG&E will seek closer alignment of our system hardening efforts with PSPS mitigation opportunities.

Expulsion Fuse Replacement (WLDFR-M004)

The program has not changed since the 2020 RAMP Report was filed. However, in this GRC, PG&E proposes to install

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16 PG&E estimated 2,118 miles for System Hardening in its 2020 RAMP Report, A.20-06-012 (June 30, 2020), p. 10-59, Table 10-11, line 2) compared to an estimated 1,859 miles of System Hardening in this GRC (Exhibit (PG&E-4), WP 4-28, line 26).

approximately 2,800 more units in 2021-2026 as compared to the number of units in the 2020 RAMP Report.[17] The increased units drive an increase in costs as compared to the 2020 RAMP Report. See Section C.2 for additional information about the GRC forecast.

PSPS Impact Reduction Initiatives (WLDFR-M006)

In the 2020 RAMP Report, PG&E proposed a single PSPS Impact Reduction Initiatives mitigation (M6). Since PG&E filed its 2020 RAMP Report, PG&E has separated its GRC forecast for the PSPS Impact Reduction Initiatives into the individual activities that make up the PSPS Impact Reduction Initiatives to enable more granular evaluation of risk reduction by activity. In this chapter, there are two individual activities related to PSPS Impact Reduction Initiatives: PSPS Impact Reduction Initiatives – Sectionalizer Device Install/Replace and PSPS Impact Reduction Initiatives – Temporary Distribution Microgrids (which were referred to as Resilience Zones in the 2020 GRC).

In the 2020 RAMP Report, PG&E estimated installing sectionalizing 592 devices in 2020 and 130 devices in 2021 and then assessing the number of devices to be installed after 2021.[18] The units of work have changed since PG&E filed its 2020 RAMP Report. In 2020, PG&E actually installed 603 sectionalizing devices and plans to install at least 250 more distribution sectionalizing devices in 2021.

In the 2020 RAMP, PG&E described pursuing resiliency and reliability improvements to mitigate the customer impacts of PSPS using temporary front of the meter microgrid solutions. This is the work referred to as PSPS Reduction Initiatives – Temporary Distribution Microgrids. In the GRC, PG&E proposes to develop additional microgrids/TG sites.

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17 PG&E estimated 4,375 units for Expulsion Fuse Replacement in its 2020 RAMP Report, A.20-06-012 (June 30, 2020), p. 10-55, Table 10-8, line 4, and p. 10-59, Table 10-11, line 3), compared to an estimated 7,170 units in this GRC (Exhibit (PG&E-4), WP 4-29, line 16).

18 PG&E's 2020 RAMP Report, A.20-06-012 (June 30, 2020), p. 10-51, lines 7-10.

Situational Awareness and Forecasting Initiatives

In the 2020 RAMP Report, PG&E proposed a single Situational Awareness and Forecasting Initiatives mitigation (M7). Since filing the 2020 RAMP Report, PG&E is forecasting individual activities that make up Situational Awareness and Forecasting Initiatives to enable more granular evaluation of risk reduction by activity.

The Line Sensor initiative includes two mitigations that were included in PG&E's 2020 RAMP Report: WLDFR-M07A (Line Sensors) and WLDFR-M011 (EFD/RF Sensors). These mitigations are described in Section C.3.b below. PG&E is also including a new initiative, SIQ (WLDFR-M07F), which is described Section C.3.c below.

In the 2020 RAMP Report, PG&E identified a pilot of several types of technologies to detect system anomalies such as overhead line sensors, early fault detection, and DFA; PG&E noted that it might deploy these sensors more broadly in the future, depending on the outcome of the pilots. After filing the 2020 RAMP Report, PG&E completed pilot projects and is forecasting to complete installation of sensors on 160 circuits between 2020-2022 and on 464 circuits between 2023-2026 in this GRC.

Additional Automation and System Protection

In the 2020 RAMP Report, PG&E proposed a single Additional Automation and System Protection mitigation (M10) made up of several activities. In this GRC, PG&E is forecasting individual activities that make up Additional Automation and System Protection separately to enable more granular evaluation of risk reduction by activity. As part of this mitigation in the 2020 RAMP Report, PG&E stated that it would evaluate new system protection technologies that may reduce wildfire risk. As part of this GRC, PG&E plans to evaluate two new technologies, REFCL (WLDFR-M10C) and DTS-FAST (WLDFR-M10D). Other projects include FuseSavers, meter-based sensors, and distribution grid sensors.

c. Cost Tables (Mark Esguerra)

Tables 4.3-6 and 4.3-7 below show the forecast costs for mitigations.[19]

There are no changes to forecast expense amounts for mitigations (Table 4.3-6) in the February 25, 2022 update.

The forecast capital costs for mitigations have been updated to account for the February 25, 2022 updates. The updated forecast costs are shown in Table 4.3-7.

Tables showing the GRC forecast costs compared to the costs estimated in the RAMP Report are provided in workpapers.[20]

19 See Exhibit (PG&E-4), WP 3-4, line 29 (WLDFR mitigations, capital); WP 3-7, line 34 (WLDFR mitigations, expense); WP 3-10, line 12 (DOVHD mitigations, capital); and, WP 3-10, line 32 (DOVHD mitigations, expense).

20 See Exhibit (PG&E-4), WP 3-20 and 3-21.

TABLE 4.3-6
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Recorded Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total	June 30, 2021 GRC Filing RSE[a]	Feb. 25, 2022 GRC Update RSE
1	WLDFR-M006	Generation Enablement and Deployment PMO	AB#	–	–	$2,063	$1,957	$4,020	[b]	No Update
2	WLDFR-M006	Generation Enablement and Deployment PMO	IG#	$3,494	$3,031	–	–	–	[b]	No Update
3	WLDFR-M07A	Situational Awareness and Forecasting Initiatives – Line Sensors	FZA	1,487	2,344	$2,576	3,437	9,843	[d]	No Update
4	WLDFR-M07A	Situational Awareness and Forecasting Initiatives – Line Sensors	HG#	10	–	–	–	–	[d]	No Update
5	WLDFR-M07F	Situational Awareness and Forecasting Initiatives – SIQ	AB#	1,871	145	–	3,783	5,799	[c]	No Update
6	WLDFR-M017	System Hardening - Remote Grid	AB#	1,010	1,382	$1,423	1,464	4,269	32.2	No Update
7	WLDFR-M017	System Hardening - Remote Grid	KAT	–	–	$617	953	1,571	32.2	No Update
8		Total		$7,872	$6,903	$6,679	$11,595	$25,502		

(a) RSE values include all the MATs associated with a mitigation or control, not for individual MATs. While the RSEs may be shown for an individual MATs, the RSE value is assumed to incorporate the combined costs and risk reduction for all the assigned MATs.

(b) To comply with guidance from the Safety Policy Division PG&E will not be calculating an RSE for the benefits of PSPS on Wildfire mitigation per Resolution (Res.) WSD-002 (June 11, 2020).

(c) PG&E considers this a foundational mitigation and does not calculate RSEs for foundational programs.

(d) The work tracked in MAT FZA and HG# supports risk reduction work in mitigation WLDFR-M07A but it does not reduce risk itself. Therefore, the forecast costs for FZA are not included in the RSE calculation.

TABLE 4.3-7
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Recorded Adj.	2021 Forecast	2022 Forecast	February 25, 2022 Updated Forecast					June 30, 2021 GRC Filing RSE	Feb. 25, 2022 GRC Update RSE
							2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total(a)		
1	WLDFR-M002	System Hardening – Overhead	08W	$484,915	$287,880	$366,000	$265,377	$81,507	$83,918	$86,402	1,646,999	6.2	5.9[e]
2	WLDFR-M002	System Hardening – Underground	08W	–	127,774	611,250	1,192,578	2,415,857	2,907,624	3,337,360	10,592,444	4.5	5.4[e]
3	WLDFR-M004	Expulsion Fuse Replacement	2AP	7,847	15,125	15,388	15,752	16,257	16,777	17,314	104,460	3.6	No update
4	WLDFR-M006	PSPS Reduction Initiatives – Sectionalizer Device Install/ Replace	49H	69,441	42,890	20,919	11,933	12,255	12,586	12,926	182,949	12.3	No update
5	WLDFR-M006	PSPS Reduction Initiatives – Temporary Distribution Microgrids	49M	3,746	16,448	13,559	–	–	–	–	33,753	(c)	No update
6	WLDFR-M07A	Situational Awareness and Forecasting Initiatives – Line Sensors	49I	2,272	12,369	8,037	8,254	6,474	5,964	6,125	49,496	17.6	No update
7	WLDFR-M07F	Situational Awareness and Forecasting Initiatives – SIQ	21A	–	–	–	10,507	–	–	–	10,507	(b)	No update
8	WLDFR-M10A	Additional System Automation and Protection	49A	1,456	6,990	–	–	–	–	–	8,446	(c)	No update
9	WLDFR-M10B	Additional System Automation and Protection – FuseSaver	49T	–	2,305	2,764	2,940	3,087	3,241	3,403	17,740	19.4	No update
10	WLDFR-M10C	Additional System Automation and Protection – REFCL	49R	4,798	8,224	16,876	17,331	17,800	18,280	18,774	102,083	23.0	No update
11	WLDFR-M011	Situational Awareness and Forecasting Initiatives – EFD	49I	–	–	4,647	5,434	6,234	7,486	8,786	32,588	71.0	No update
12	WLDFR-M012	Situational Awareness and Forecasting Initiatives – DFA	49I	–	–	10,351	8,965	9,002	9,245	9,495	47,058	(d)	No update
13		Total		$574,476	$520,005	$1,069,791	$1,530,071	$2,568,473	$3,065,122	$3,500,585	12,828,522		

(a) The enterprise risk models use the expense and capital forecast by risk to calculate the RSEs. In certain cases, forecast costs for the same program are included in more than one risk model. Even through the same costs are used to calculate the RSEs, PG&E is only requesting recovery for these costs once.

(b) PG&E considers this a foundational mitigation and, as such, is not calculating an RSE for it.

(c) PG&E calculated RSEs for programs with forecast spend from 2023-2026.

(d) A single RSE is calculated for WLDFR-M012 and WLDFR-M07A since Line Sensors and DFA work in tandem to detect faults.

(e) See discussion regarding system hardening RSEs in Chapter 3 Section A.1 and Table 3-1.

C. Activities, Costs, and Forecast Drivers by Risk Mitigation

1. System Hardening

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022..

a. System Hardening (MAT 08W, WLDFR-M002, DOVHD-M002) (Mark Esguerra)

PG&E's System Hardening Program focuses on mitigating wildfire risk posed by distribution overhead assets in and near Tier 2 and 3 HFTDs in PG&E's service territory. This program targets high wildfire risk miles and applies various mitigation activities, including: (1) line removal, (2) conversion of distribution lines from overhead to underground, (3) application of Remote Grid alternatives, (4) mitigation of exposure through relocation of overhead facilities, and (5) in-place overhead system hardening. The forecast miles and unit costs for System Hardening is summarized in Table 4.3-10. This table was revised in this February 25, 2022 update (Table 4.3-11).

Distribution overhead assets represent a high ignition risk due to a combination of high exposure (i.e., many overhead assets located in or crossing through HFTD areas) and proximity to risk factors such as vegetation. Estimated ignitions associated with overhead utility distribution equipment are 1.6 times more frequent per circuit mile than transmission-related ignitions. When vegetation drivers are also considered, the estimated distribution ignitions per mile are up to six times more frequent than for transmission circuits.

PG&E's System Hardening Program is a continuously evolving initiative that reduces the risk of wildfire ignitions caused by distribution facilities. The System Hardening Program incorporates several key initiatives into a single program for comparison of alternatives, as well as work efficiency. The work performed within this program includes line removal, remote grid, underground conversion from overhead, relocation of overhead facilities, and hardening overhead in place. Hardening overhead in place includes the installation of covered conductor, intumescent wrapped wood poles or composite poles,

replacement of non-exempt equipment, replacement of transformers that do not have the now standard FR3 insulating fluid, composite crossarm, framing, and other animal/bird protections.

PG&E prioritizes projects at the circuit segment level, as opposed to the regional or full circuit level. Subsections (1) through (3) below describe three mitigation options PG&E considers for each circuit segment when developing a System Hardening Program project: Line Removal and Remote Grid; Relocation of Overhead to Underground; and Overhead Hardening.

The exact scope of PG&E's System Hardening Program will continue to evolve as PG&E enhances its Wildfire Risk Model as well as performs more detailed scoping and inspections, estimating, and engineering review. Because PG&E's System Hardening Program is a first of its kind program, some level of uncertainty as to the exact number of miles of undergrounding versus overhead system hardening is to be expected. This is one of the primary reasons PG&E proposes to continue use of the Wildfire Mitigation Balancing Account (WMBA) so that customers only pay for the actual work performed and if our forecast is higher than the actual costs, the difference is returned to customers.

System Hardening is a Wildfire risk mitigation (WLDFR-M002) and also mitigates the Failure of Electric Distribution Overhead Assets risk (DOVHD-M002).

1) Line Removal and Remote Grid (Mark Esguerra)

Complete removal of an existing overhead distribution line fully eliminates the fire risk associated with that line and is therefore explored for every identified system hardening project. For example, known or suspected idle facilities that are not currently, actively serving customer load can be removed.[21] Although idle, the lines can become energized through various means, including magnetic induction and/or electric induction. Another line removal

[21] In addition to the idle line removal work that is part of the System Hardening Program described here, PG&E's Idle Facilities Removal Program is described in Ch. 11 under MAT 2AF. (Exhibit (PG&E-4), Ch. 11, Section C.1.d.)

alternative is the rearrangement or re-alignment of the existing circuit path. PG&E reviews the targeted circuit segment for redundant distribution ties through high-risk areas. Removal of certain circuit segments might have little impact on operational flexibility and could provide the most cost-effective measure to reduce wildfire risk. Finally, lines may be removed as part of the installation of a Remote Grid, as discussed in Section C.1.c below.

2) Relocation of Overhead to Underground (Jamie Martin)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

a) Program Description (Jamie Martin)

A second system hardening approach is to relocate existing high-risk overhead distribution lines underground. Undergrounding effectively eliminates the ignition risk for overhead lines that have been placed underground.

b) Program Targets (Jamie Martin)

PG&E established the 10,000-mile target considering multiple factors, including risk reduction, reliability improvements, and long-term cost benefit to customers.

Undergrounding 10,000 miles of distribution lines in and near HFTDs will meaningfully reduce risk and improve reliability. For undergrounding to have this impact, a significant portion of overhead distribution lines in HFTDs must be relocated underground. Over half of PG&E's service territory lies in Tier 2 and Tier 3 HFTDs, and nearly one-third of PG&E's overhead lines lie within HFTDs. This means that nearly 25,500 line-miles of distribution assets lie within these HFTDs.

Undergrounding 10,000 miles in and near HFTDs will address a significant portion of the highest risk miles within those areas. Based on our 2021 risk model, approximately 8,000 – 10,000 miles of overhead miles in HFTDs represents 70 to 80 percent of our wildfire risk. This analysis informed our 10,000-mile distribution line target.

As discussed above, PG&E proposes to underground 10,000 circuit miles of electric distribution lines in and near HFTD areas to further mitigate the wildfire ignition risk. PG&E plans to underground the miles described in Table 4.3-11 from 2022 through 2026.

PG&E will sequence the execution of miles taking into account risk reduction, executability, and community impact. PG&E plans to underground fewer miles in the initial years and then ramp up in later years so that we can gain efficiencies and incorporate lessons learned as we achieve our 10,000-mile goal.

c) Program Unit Costs (Jamie Martin)

Table 4.3-8 below shows unescalated forecast unit costs by year.

TABLE 4.3-8
2022-2026 FORECAST UNIT COSTS AND MILES FOR UNDERGROUNDING
(THOUSANDS OF DOLLARS)

Line No.		2022	2023	2024	2025	2026
1	Undergrounding Program Miles	163	357	764	976	1,200
2	Unescalated Forecast Cost/Mile	$3,750	$3,250	$3,000	$2,750	$2,500

i) Cost Drivers and Cost Reduction Opportunities (Jamie Martin)

Thanks to achievements on undergrounding projects in recent years, undergrounding will play a much more prominent role in PG&E's ongoing efforts to harden the electric grid. PG&E's goal is to substantially reduce the cost of undergrounding.

The cost of converting an overhead distribution powerline to an underground powerline depends on many variables, such as density of nearby residences and businesses, surrounding vegetation, the number of powerlines involved, other existing structures underground,

terrain, road width (work access), nearby sidewalks (to comply with the Americans with Disabilities Act) and other environmental, land and permitting issues. These variables make it difficult to establish uniform unit costs across our service territory; nevertheless, PG&E will seek to reduce the average unit cost as it implements this program.

PG&E is focused on a variety of areas to reduce the cost of underground work, including:

- Updating standards for design and construction of underground lines that: (1) optimize the type of materials and equipment used and construction methodologies deployed, and (2) reflect the local environment (i.e., urban vs. rural);
- Strategically packaging work, including longer sections of circuits, to take advantage of economies of scale in construction;
- Reducing the cycle time from initial scoping to completion of construction to create efficiencies and expedite execution; and
- Deploying new and innovative tools, equipment and technologies to safely increase production rates and tenaciously reduce costs.

ii) Incorporating Project Experience (Jamie Martin)

Since July 2021, PG&E has performed extensive work to validate its existing 2022 and 2023 undergrounding work plans, including identifying opportunities to increase the amount of undergrounding work that will be done in the future. PG&E has benchmarked with utilities across the country and has engaged key stakeholders who will continue to provide feedback, support, and collaboration to shape the undergrounding program. PG&E will also incorporate experience gained from undergrounding projects completed in 2021.

In August 2021, PG&E initiated a Request for Information (RFI) from domestic and international project, engineering, and construction firms. The RFI requested information from these firms on their undergrounding experience including construction methods, cost assumptions, equipment and materials, program risks, safety, technology innovations, program structure, labor, and other related topics. Through this process, we gleaned insight and information on the importance of establishing an integrated PMO, the value of updating, standardizing and streamlining design and construction standards to safely and efficiently scale the program, opportunities to grow and develop the qualified workforce needed to execute the work, the prevalence of existing and emerging tools, technologies, materials and equipment that can help PG&E drive safe and efficient execution of the work and the criticality of early and frequent collaboration with all stakeholders.

Additionally, PG&E formed an Undergrounding Advisory Group, which is comprised of stakeholders representing the following sectors: environmental and land stewardship, environmental and social justice and policy, transportation, agriculture, labor, utilities and telecommunications, access and functional needs, public safety, and counties and tribes. Members were selected based on their expertise and ability to advise on large scale planning around issues related to infrastructure, wildfire response, permitting, climate change and the environment, community engagement, and public safety.

PG&E will use the results of the RFI process, learnings from on-going underground work and continued engagement with the Underground Advisory Group, the market, industry groups and other utilities to explore new technologies (including new construction methods, materials, and equipment). PG&E will also seek

opportunities to work with our joint trench partners (e.g., natural gas, water, sewer, telecommunications, and internet providers). New technologies will enable the safe and efficient execution of the program. Joint trenching opportunities will allow us to share costs.

d) Undergrounding Criteria (Jamie Martin)

PG&E is prioritizing undergrounding in areas where it can have the greatest impact on reducing wildfire risk and PSPS outages for customers, including identified critical facilities. As risk models and conditions evolve, PG&E will adjust prioritization so that the highest wildfire risk areas continue to be addressed. Several additional factors will inform our selection of locations for undergrounding. These considerations include:

- Topography (e.g., whether water crossings exist), geology (soil condition), and other geological/land/environmental considerations[22] that vary significantly across our service territory;
- Permitting feasibility with local, state, and federal agencies[23] (including California Department of Transportation (Caltrans), the Bureau of Land Management (BLM), the National Parks Service, and United States Forest Service);
- Existing infrastructure (e.g., natural gas, sewer, stormwater drainage systems), accessibility (rights-of-way, public utility easements, private property crossings), the number of services impacted, available space for subsurface and pad-mounted equipment, environmental restrictions (naturally occurring asbestos, endangered species);

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22 PG&E's service territory is home to over 700 protected or endangered species and over 1,800 protected or endangered plants.

23 PG&E's service territory covers millions of acres of federal, state, and other agency or protected lands.

- Ingress/egress considerations for communities in HFTD areas, general public safety, and traffic management considerations;
- Procurement and availability of construction materials as the underground program scales significantly in 2022 and beyond;
- Coordination with joint pole/joint trench tenants, including telecommunication; and
- Operational issues such as circuit segments that have multiple needs, including maintenance tags, vegetation management, or capacity upgrade needs.

PG&E recognizes the importance of coordinating undergrounding work with other identified or future work on a given circuit or segment to avoid the duplication of work and reduce disruptions for customers. These considerations, coupled with our utility experience and the professional judgement of engineering, design and construction teams, will assist with selecting sites and sequencing of our undergrounding program. This will result in the delivery of projects that will reduce risk and ensure executability, maximizing customer benefit.

In the coming years, PG&E also expects undergrounding to substitute for some previously anticipated overhead system hardening and vegetation management work. As we scope undergrounding mileage, given the multi-decade service life of modern underground assets, we will also assess and address other current and future needs on a given circuit or segment. For example, we will want to ensure that conductor and other assets installed in the early 2020s are sized to meet increased electrification driven by policy and/or customer preference in the 2030s. Consideration of these future needs will deliver the greatest value in risk reduction and other customer benefits for every customer dollar invested. Moving forward, we anticipate

implementing a holistic action plan to ensure the undergrounding program delivers on its full potential.

e) Program Execution (Jamie Martin)

i) Principal Undergrounding Activities (Jamie Martin)

Once a high-risk overhead circuit segment has been identified, PG&E's engineering and field teams develop and analyze possible hardening solutions (i.e., undergrounding, asset removal, relocation, overhead hardening) for that circuit segment. The recommended approach is then reviewed before we begin designing, permitting, and constructing the hardening project.

The undergrounding of electric distribution system assets will follow the same general process as most utility construction work. The process includes: (1) project scoping; (2) engineering and design; (3) material acquisition; (4) permitting and land rights; (5) construction; (6) quality controls and inspections; and (7) mapping, documentation, and closeout. It is important to note that there are intricacies associated with undergrounding that will be considered and balanced as the program proceeds, including:

- **Project Scoping** – The underground program will focus on circuits in and near HFTDs. In scoping projects, PG&E will balance the various location-selection and executability factors discussed above;
- **Engineering and Design** – Civil engineering work required to site the trench, bored tunnel, or other underground pathway for conduit or electric cable often results in significant time and evaluation from subject matter experts. This work is generally more complex than creating a similar length overhead "path" employing the installation of poles with spans in between them. PG&E expects to evolve its

engineering, design and construction standards to reflect learnings from recent projects and other utilities;

- **Material Acquisition** – The large scope of the program will present material supply challenges, including sourcing, storing, and staging materials. PG&E will work with current and new materials suppliers to ensure both availability of materials and innovation in materials;
- **Permitting and Land Rights** – Permitting for underground work, where a contiguous path of ground disturbance is required, could cross sensitive resources (e.g., waterways, cultural resources). Crossing such features underground is more complex than crossing aboveground with overhead powerlines. PG&E has begun and will continue to deploy construction methodologies that mitigate disturbances, as well as engage key agencies, cities, counties, tribes, individuals and other stakeholders early and often to mitigate risks and issues associated with permitting and land rights;
- **Construction** – Project scoping and design of the underground route must consider constructability issues, which include the local geology (whether hard rock exists), existing underground utilities (including water, natural gas and drainage systems), plans for future road widening, sensitive environmental and/or cultural resources, etc. Additionally, PG&E will seek to geographically bundle work to enable construction efficiencies and other economies of scale;
- **Quality Control and Inspections** – Quality inspection of underground assets can be performed only when the trench is open and the project is under construction. Any quality validation or inspection activities must be carefully timed and executed in partnership with construction activities; and

- **Mapping, Documentation, and Closeout** – Given the large scope of the initiative, this final step will require extensive coordination and efficient document management practices.

The most significant cost and time driver for undergrounding electric distribution assets is constructing (digging) the trench, tunnel, or path for the underground electric cables. PG&E currently uses the following installation methods: (1) the Horizontal Directional Drilling (HDD), (2) Conventional Open Trench (Excavator and Backhoe), (3) Mechanical Excavation (rock wheels and chain trenchers), and (4) Vibratory Plow. For additional information regarding these installation methods, see section 7.3.3.16 of PG&E's 2022 Wildfire Mitigation Plan.

In an effort to improve upon its existing methodology for increased construction productivity, PG&E has recently piloted additional approaches to undergrounding using Cable in Conduit (CIC). CIC methodology involves laying conduit with the cable already inside. CIC is best suited for longer spans in rural areas with fewer customer connections and typically when electricity is the sole utility (i.e., gas or other utilities are not planned for the trench). CIC presents some benefits where feasible as an undergrounding alternative, including improved efficiency, reduced above ground disturbance, and greater planning flexibility. CIC materials can be used for all of the construction methodologies outlined above.

The following pictures show undergrounding project construction sites:

FIGURE 4.3-3
UNDERGROUNDING TOOLS BEING STAGED PRIOR TO CONSTRUCTION

(PG&E-4)

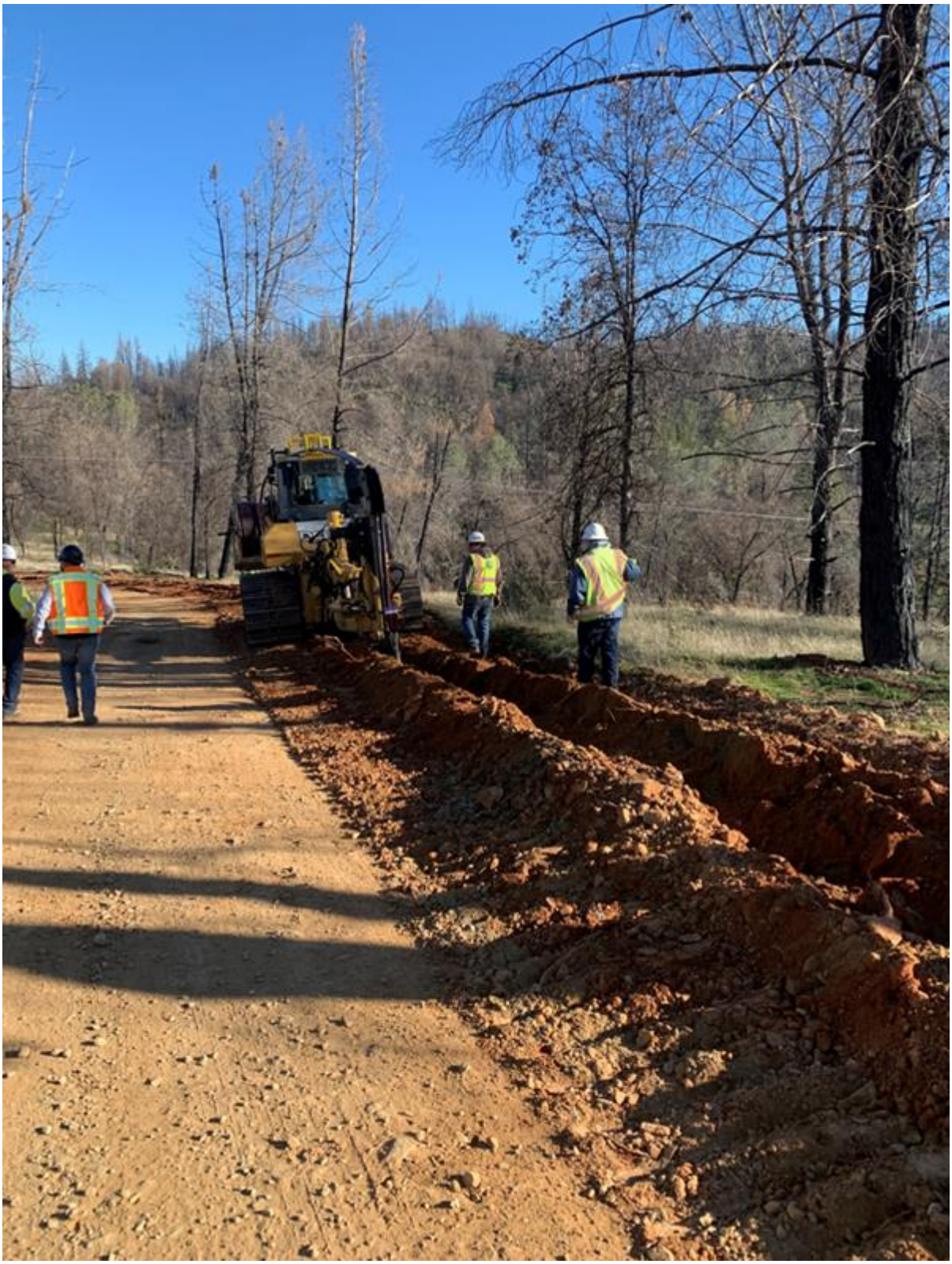
FIGURE 4.3-4
UNDERGROUNDING CONSTRUCTION IN PROGRESS

(PG&E-4)

FIGURE 4.3-5
UNDERGROUNDING CONSTRUCTION IN PROGRESS

(PG&E-4)

FIGURE 4.3-6
UNDERGROUNDING CONSTRUCTION IN PROGRESS



PG&E will continue to explore various tools and approaches for undergrounding assets as efficiently as possible to maximize the risk reduction and design and execution efficiency.

ii) Typical Schedule (Jamie Martin)

Based on recent projects completed to date, the average completion time for an undergrounding project is approximately 34 months.[24] PG&E is working to optimize each phase in this process, which is typically comprised of the following largely sequential phases as identified in Table 4.3-9:

[24] Estimated timelines for projected undergrounding work assume materials are readily available and that a workforce is available to perform the work. Other than the Construction phase, the other project phases, particularly the Permitting and Land Rights (Dependency), and Estimating and Design phases generally are not dependent on the number of miles for the project.

TABLE 4.3-9:
APPROXIMATE PROJECT DURATION TIMELINE - UNDERGROUNDING

Line No.	Phase	UG Duration	Notes
1	Scoping (Preliminary, Field, and Final)	4 months	Scoping determines the method of hardening. Most projects have multiple hardening methods considered.
2	Estimating and Design	6 months	Detailed plans (estimate and design) are created. This can be performed by either contract or internal estimators.
3	Permitting and Land Rights (Dependency)	9 months	All necessary permits (CalTrans, BLM, local agencies etc.) and land rights are obtained.
4	Construction Resourcing and Contracting and Scheduling	3 months	Projects are assigned to either internal construction crews or contractors. Vendors are selected primarily through a unit price mechanism by region. Projects are scheduled once a resource has been identified and dependencies are completed to allow construction start.
5	Construction	9 months	Construction activities are completed per construction standards. Quality Assurance inspectors (with the construction crews) ensure each project is built to standard and provide immediate feedback if necessary without waiting for the project to be fully complete. Clearances (planned outages) are taken when necessary to complete the projects and tie-in customers to the newly installed assets.
6	Document and Close Out	3 months	Gather all project documentation for completion including the final, as-built construction package. Mapping of the new assets into PG&E's Geographic Information System maps. Close out project.

Optimizing and shortening cycle time is a key area of focus in the scaling of the undergrounding program. PG&E forecasts that as it ramps up its undergrounding program these durations can be considerably reduced.

iii) Resource Plan (Jamie Martin)

PG&E will take an "all hands on deck" approach to resourcing to scale up to the level of undergrounding planned for the next several years. Internal and external resources will be used to complete undergrounding. PG&E generally separates the "civil" work (e.g., constructing the trench, tunnel or path, installing the conduit) from the "electrical" work (e.g., pulling the electrical cable through the

conduit and connecting it to other electrical equipment). This separation allows workers to focus on safely and efficiently completing the activities for which they are best suited.

The pace of future undergrounding work will require increased overall resources for both civil and electrical engineering/design and construction work, PG&E is in the process of developing specific plans to meet the resource demand of the planned undergrounding work.

The large program scope and the relatively rapid ramp-up of annual targets associated with the undergrounding program will create an unprecedented level of demand in the supply chain. For material suppliers, design, civil construction, and electric construction companies, as well as PG&E itself, to plan for this demand, it is vital that underground targets be set now, well in advance of the work. This is an important aspect of resource planning. By providing the market with our future undergrounding targets, PG&E is confident it can establish long-term partnerships and expand existing resources to support this work.

iv) Sourcing Strategies (Jamie Martin)

PG&E will employ a variety of sourcing approaches to obtain competitive pricing on third-party resources (contractors), materials, and equipment. This will include various sourcing events (e.g., requests for information, request for proposals and competitive bids) to establish competitive pricing.

PG&E is developing its long-term contract strategies. By developing partnerships and establishing pricing with skilled and qualified vendors, PG&E can develop a range of pricing required for different types of projects.

v) Partnerships (Jamie Martin)

This first-of-its-kind program will impact many stakeholders and we cannot do this alone. We will work closely with customers and with local, state, federal, tribal and regulatory stakeholders as we seek to build a stronger electric grid for the future. We will seek input to ensure undergrounding plans are empathetic to our stakeholders' interests and concerns.

3) Overhead Hardening (Mark Esguerra)

a) Program Description (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

Although PG&E is pivoting towards undergrounding for its hardening in high fire risk areas, currently the most frequently used method for system hardening is overhead hardening along the existing alignment. Overhead system hardening can often be done more quickly than line relocation or undergrounding, by taking advantage of existing rights and easements. After analyzing projected performance of overhead hardened facilities on more than 4,600 outage types, PG&E projects that overhead system hardening will reduce 62 percent of the distribution overhead asset ignitions caused by equipment failures or external contact/strikes with energized lines, such as vegetation tree strikes. This alternative generally has a higher RSE when compared to the undergrounding alternative in many scenarios. Overhead system hardening achieves risk reduction through these foundational elements:

- Primary and Secondary Covered Conductor Replacement: Replacement of bare overhead primary (high voltage) conductor and associated framing with conductor insulated with abrasion-resistant polyethylene coatings (sometimes referred to as covered conductor or tree wire) can be an effective mitigation against wildfire ignitions caused by

distribution lines. Installing covered conductor can help reduce the likelihood of faults due to line-to-line contacts, tree-branch contacts, and faults caused by animals. Installing covered conductor on secondary lines has similar benefits to installing it on primary lines.

- Pole Replacements: PG&E evaluates all existing poles where a hardening project is planned to determine whether those poles meet the strength requirements to withstand the new, heavier covered conductor and associated conductor. Often the majority or all poles on a circuit segment will need to be replaced. The new composite poles and intumescent wrapped poles that replace the old poles have increased fire damage resiliency to reduce the risk of a pole failure during a wildfire. Intumescent wrapped wood poles are now the standard new pole PG&E uses in Tier 2 and 3 HFTD areas. Composite poles may be considered where the life expectancy of a new intumescent wrapped wood pole is expected to be less than 20 years (often due to a high decay rate, in the water/wetlands) or where the largest class wood poles would be required to support the facilities.
- Replacement of Non-Exempt Equipment: Replacement of existing primary line equipment such as fuses/cutouts and switches with equipment that has been certified by the California Department of Forestry and Fire Protection (CAL FIRE) as low fire risk is another component of PG&E's System Hardening Program. This replacement work eliminates overhead line equipment and devices that may generate exposed electrical arcs, sparks, or hot material during their operation.
- Replacement of Overhead Distribution Line Transformers: Upgrading transformers with newer transformers that contain fire resistant "FR3" insulating fluid, consistent with PG&E's current equipment standards (PG&E implemented the transition from mineral oil to FR3 in 2014). "FR3"

insulating fluid, a natural ester derived from renewable vegetable oils, provides improved fire safety, transformer life, increased load capability, and environmental benefits. In addition, new transformers are manufactured to achieve higher Department of Energy electrical efficiency standards.

- Framing and Animal Protection Upgrades: Replacing crossarms with composite arms, wrapping jumpers, and installing animal protection upgrades reduces animal contacts and pole related ignition risks.
- Vegetation Clearing: Vegetation clearing is a critical component required and funded by the System Hardening Program. Accessing our facilities to execute a project often requires significant undergrowth clearing, which removes dense vegetation on the ground directly beneath the lines. In addition, some of the previously mentioned components of a system hardening project require additional clearance space to execute. Regulatory requirements mandate 4 feet of clearance all year long, so that if there is a change to a line's profile, including using taller poles or wider cross-arms, the vegetation must be cleared to be consistent with any profile changes and provide the required clearing for new overhead lines.

In addition to targeting the highest risk miles and frequently impacted PSPS areas, PG&E's System Hardening Program also includes work needed to rebuild overhead or underground assets damaged by wildfire. PG&E considers several alternatives when restoring services to customers. These include line removal, remote grid, underground, overhead harden in a different location, overhead harden in place, and restore in place. These solutions are tailored to the needs of the area and often used in conjunction with each other.

In addition to work performed in HFTD areas, PG&E may also perform system hardening in buffer zones, the areas immediately adjacent to HFTD areas. Because a specific

distribution line may continue from an HFTD area into a buffer zone, hardening the line may include both hardening both the HFTD and buffer zone areas of the line.

b) Program Targets (Mark Esguerra)

Currently, the System Hardening Program targets three risk areas in PG&E's service territory: (1) the top 20 percent of highest wildfire risk miles as identified by PG&E's 2021 Wildfire Distribution Risk Model for system hardening; (2) overhead structures previously impacted directly by wildfires, and (3) those areas most impacted by PSPS. PG&E intends to complete the overhead hardening miles shown in Table 4.3-11.

As PG&E shifts its System Hardening program to focus more on undergrounding, our overhead hardening goals and strategy are also shifting. Overhead hardening mileage will decrease from roughly 180 miles in 2021 to roughly 50 miles a year by 2026. PG&E will be shifting towards using an integrated planning process to identify locations for undergrounding in 2024 and beyond. PG&E's risk models are a key input to the integrated planning process; PG&E will continue to improve its risk models by incorporating more data sets and programmatic refinements, all of which should result in better scoping and targeting of highest risk locations.

In addition to the work that is part of the System Hardening Program in MAT 08W, PG&E also hardens its system for wildfire resilience through other activities that target high-risk components. These include the replacement of non-exempt equipment that may generate electrical arcs, sparks, or hot material during its normal operation. The Fuse Replacement Program is described below under MAT 2AP and the Replacement of Non-Exempt Surge Arresters is described in Chapter 11 under MAT 2AR. Also, in addition to the overhead line removal work that is performed as part of the System Hardening Program, PG&E has an Idle Facilities Removal Program described in Chapter 11 under MAT 2AF.

c) Overhead Hardening Costs (Mark Esguerra)

PG&E's February 25, 2022 updated forecasts include annual expenditures of $288.0 million in 2021, $366.0 million in 2022, $265.4 million in 2023, $81.5 million in 2024, $83.9 million in 2025, and $86.4 million in 2026 in MAT 08W for its overhead System Hardening Program.[25] These forecasts do not include the additional expenditures expected within MAT 08W in support of the undergrounding program or the Community Rebuild Undergrounding described in the next section.

b. Community Rebuild Undergrounding (MAT 08W, WLDFR-M002, DOVHD-M002) (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

The Community Rebuild Program was established to rebuild PG&E's infrastructure following the 2018 Camp Fire, which devastated the Town of Paradise and surrounding areas in Butte County. PG&E describes the Community Rebuild Program in Chapter 23 of this exhibit, but PG&E seeks approval for costs related to the underground construction of electric distribution assets that is part of the Community Rebuild Program in this chapter because that activity is part of the broader System Hardening Program in MAT 08W. The forecast for the Community Rebuild undergrounding is included in the overall System Hardening Program forecast. Assets in this category were previously overhead and transitioned to underground for the fire rebuild.

PG&E plans to underground 39.2 miles that were previously overhead as part of the Community Rebuild under the MAT 08W category of work. The forecast is for annual expenditures of $54.1 million in 2023 (16.2 miles), $44.0 million in 2024 (13.9 miles), and $27.1 million in 2025 (9.1 miles).[26] At this time, PG&E does not anticipate expenditures in 2026 because the majority of the Community Rebuild underground mainline construction is expected to conclude by

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25 See Exhibit (PG&E-4), WP 4-22, line 3.

26 See Exhibit (PG&E-4), WP 4-27, lines 8-10.

the end of 2025. Total expenditures in 2020 were $24.7 million and corresponding forecasts for 2021 and 2022 are $41.5 million and $52.9 million, respectively.[27]

c. Remote Grid (MATs 08W, AB# and KAT, Alternative Mitigation WLDFR-M017, DOVHD-M011) (Mark Esguerra)

Throughout PG&E's service territory, pockets of isolated small customer loads are currently served via long electric distribution feeders, some which traverse HFTD areas and require significant annual maintenance and vegetation management. The Remote Grid Program will remove these long feeders and serve customers from a local and decentralized energy source (i.e., a "Remote Grid"). This reduction in overhead lines can reduce fire ignition risk as an alternative to or in conjunction with system hardening and other risk mitigation efforts.

The Remote Grid facilities include a Standalone Power System (SPS) made up of local sources of electricity supply, such as solar photovoltaic generation, battery energy storage, and other distributed generation, as well as distribution and service facilities to connect customers to the SPS.

PG&E has six Remote Grid projects in the advanced stages of development, which when completed will eliminate a total of 11.6 miles of overhead line.[28] PG&E plans to begin operations of the first Remote Grid project to serve customer load by the end of 2021.

In 2021, PG&E will continue to mature the Remote Grid concept toward an eventual standard configuration. Experience gained through the deployment and initial operation of the initial Remote Grid projects will contribute to refinements in the deployment processes, design and performance standards, customer agreements, and operational and maintenance protocols for future Remote Grid solutions. PG&E is

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27 See Exhibit (PG&E-4), Ch. 23, Community Rebuild Program, Section D. for more details on how the costs are estimated.

28 One Remote Grid project will mitigate the need for 1.4 miles of overhead line in Tier 2/3 HFTD and is part of the 08W Hardening Program in 2021. The Remote Grid Program has five additional sites slated to come online in 2022 that will mitigate the need to harden an additional 10.2 miles of line in Tier 2/3 HFTD. Remote Grid projects included in the 08W capital forecast from 2023-2026 are restricted to HFTD areas.

identifying and evaluating Remote Grid projects based on prioritization of high-risk locations as identified by the 2021 Wildfire Distribution Risk Model assessment of Circuit Protection Zones. PG&E is selecting projects that have an RSE based on the 2021 Wildfire Distribution Risk Model that exceeds the RSE of hardening electric lines to serve the same customers.

The capital forecast for Remote Grid projects is included in the overall MAT 08W System Hardening forecast.[29] PG&E is forecasting expense amounts related to the initial Remote Grid projects. The expense amounts cover costs for the Remote Grid team and O&M. PG&E is forecasting $1.5 million in 2023 in MAT AB# for the Remote Grid team members and $0.95 million in 2023 in MAT KAT for O&M.[30]

PG&E plans to scale its Remote Grid program in the GRC forecast time frame from approximately 20 projects and 26 line miles in 2023 to 69 projects and 90-line miles per year by 2026 if the initial projects are successful.

d. System Hardening Forecast Summary (Mark Esguerra)

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

In the June 2021 testimony, the forecast annual costs, number of miles and cost per mile for System Hardening Overhead, System Hardening Underground and Community Rebuild, 2021 through 2026, as shown in Table 4.3-10 below.[31]

The updated forecast annual costs, number of miles and cost per mile for System Hardening Overhead, System Hardening Underground and Community Rebuild, 2021 through 2026, are shown in Table 4.3-11 below.

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29 For the purposes of risk modeling PG&E is assigning estimated capital costs for initial remote grid projects for each year 2020-2026. To the extent a remote grid project is conducted the capital funding will come from MAT 08W.

30 See Exhibit (PG&E-4), WP 4-5, lines 4 and 23.

31 See Exhibit (PG&E-4), WP 4-28.

TABLE 4.3-10
FORECAST UNIT COSTS AND MILES FOR SYSTEM HARDENING
(THOUSANDS OF NOMINAL DOLLARS)
JUNE 30, 2021 GRC FILING

Line No.		2021	2022	2023	2024	2025	2026
1	Overhead	$288,000	$667,113	$642,960	$625,949	$627,523	$629,109
2	Miles	180	423	423	405	405	405
3	Forecast Cost/Mile	$1,600	$1,577	$1,520	$1,546	$1,549	$1,553
4	Underground	$86,120	$202,664	$194,742	$188,100	$188,100	$188,100
5	Miles	20	47	47	45	45	45
6	Forecast Cost/Mile	$4,306	$4,312	$4,143	$4,180	$4,180	$4,180
7	Community Rebuild	$41,534	$58,172	$71,245	$65,922	$48,830	–
8	Miles[(a)]	10	14	16	14	9	0
9	Forecast Cost/Mile	$4,282	$4,126	$4,398	$4,743	$5,366	–
10	Total Forecast Cost	$415,654	$927,949	$908,947	$879,971	$864,454	$817,209
11	Total Forecast Miles	210	484	486	464	459	450

(a) The number of forecast miles for Community Rebuild shown in this table is rounded. The miles in the tables below are converted to underground circuit miles.

TABLE 4.3-11
FORECAST UNIT COSTS AND MILES FOR SYSTEM HARDENING
(THOUSANDS OF NOMINAL DOLLARS)
FEBRUARY 25, 2022 GRC UPDATE FILING

Line No.		2021	2022	2023	2024	2025	2026
1	Overhead	$288,000	$366,000	$265,377	$81,507	$83,918	$86,402
2	Miles	180	305	170	50	50	50
3	Forecast Cost/Mile	$1,600	$1,200	$1,561	$1,630	$1,678	$1,728
4	Underground[(a)]	$86,120	$611,250	$1,192,578	$2,415,857	$2,907,625	$3,337,360
5	Miles	20	163	357	764	976	1,200
6	Forecast Cost/Mile	$4,306	$3,750	$3,338	$3,164	$2,979	$2,781
7	Community Rebuild	$41,534	$52,875	$54,072	$43,982	$27,107	–
8	Miles[(b),(c)]	10	22	25	22	14	0
9	Forecast Cost/Mile	$4,282	$3,750	$3,338	$3,164	$2,979	–
10	Total Forecast Cost	$415,654	$1,030,125	$1,512,026	$2,541,346	$3,018,650	$3,423,762
11	Total Forecast Miles	210	490	553	835	1040	1,250

(a) Based upon the 10,000 mile undergrounding program described in this chapter.

(b) Forecast costs per mile are based on a trench mile as opposed to an underground circuit mile. This table shows the underground circuit miles per year. Relocated Community Rebuild overhead line miles (2022-2025) have been converted to underground circuit miles using a factor of 1.57 underground circuit miles for every 1.0 of relocated overhead circuit mile.

(c) Additional Community Rebuild work is described in Exhibit (PG&E-4), Chapter 23.

2. Expulsion Fuse Replacement (MAT 2AP, WLDFR-M004) (Mark Esguerra)

The Expulsion Fuse Replacement program only targets non-exempt expulsion fuses. Non-exempt[32] equipment is equipment that may generate electrical arcs, sparks, or hot material during its normal operation. If a non-exempt expulsion fuse operates, it has the potential to spread hot molten metal material that could cause an ignition. By contrast, exempt fuses are designed to internalize any molten material resulting from a fuse operation. By using exempt fuses instead of expulsion fuses, PG&E can reduce the potential for vegetation ignitions due to molten material spread. This program is a wildfire mitigation (WLDFR-M004).

HFTD Tier 2 and 3 areas are the focal point for the Expulsion Fuse Replacement Program. The Expulsion Fuse Replacement Program was initiated in 2019, and as the program has matured the prioritization of expulsion fuses has evolved. In 2019, expulsion fuse locations were spread across the territory. In 2020, PG&E targeted expulsion fuse replacement exclusively in the Sierra Division, which had the highest count of expulsion fuses, and therefore, the largest amount of risk reduction of any division.

PG&E is pivoting its Expulsion Fuse Replacement Program to use the 2021 Wildfire Distribution Risk Model, which became available for circuit prioritization in January 2021. Going forward, the Expulsion Fuse Replacement Program will target the circuits the model ranks as having the highest risk. PG&E will attempt replacement of all expulsion fuses on a circuit; previously, mostly end-of-line fuses were selected for replacement. PG&E's prioritization strategy will continue to evolve as refinements are made to the model and lessons continue to be learned from the execution program. This program is a complimentary wildfire risk reduction program, which will be coordinated with other programs that include expulsion fuse replacement, such as system hardening, which is targeting the

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32 "Exempt" and "Non-Exempt" refer to the fact that California Pub. Resources Code, § 4292 requires utilities to maintain a 10-foot radial clearance around poles that have asset types that pose a fire risk [non-exempt equipment], but also provides that CAL FIRE can issue exemptions for particular models of those asset types that have been shown to have a low fire risk [exempt equipment].

highest wildfire risk distribution miles, and pole replacement, to avoid duplicating work.

PG&E has identified 13,305 expulsion fuses at known operating locations in HFTD areas. System hardening and other programs are forecast to replace between 3,000 and 4,000 units as part of the scope of their rebuild efforts. The remaining approximately 10,000 fuses will be addressed as part of the Expulsion Fuse Program. PG&E replaced 707 fuses in 2019 and 643 fuses in 2020, but is accelerating this activity beginning in 2021. PG&E forecasts replacing approximately 1,200 fuses per year at $15 million per year (with escalation) starting in 2021 until all of the non-exempt fuses are replaced in 2027.[33] As efficiency gains are realized or if more funds become available, the program is scalable to ramp to expedite the program.

In addition to non-exempt fuses identified with known operating numbers, PG&E also has population of 25,000-32,000 non-exempt fuses connected to transformers in HFTD areas. Most of these are transformer bushing mounted cut-outs. Replacement of bushing mounted cut-outs may require addition of a cross-arm or even replacement of the pole. PG&E initiated a pilot in 2021 to investigate the use of retrofit kits that could avoid the need for cross-arm installation at these locations. Based on the results of this pilot and finalization on the count of non-exempt transformer fuses, a formal program for replacement of non-exempt transformer fuses is planned for 2022.

PG&E's forecasts annual expenditures of $15.1 million in 2021, $15.4 million in 2022, $15.7 million in 2023, $16.3 million in 2024, $16.8 million in 2025, and $17.3 million in 2026 in MAT 2AP for its Expulsion Fuse Replacement Program.[34]

3. Enhanced Automation for Wildfire Mitigation (Mark Esguerra)

a. Reclosers (MAT 49A, WLDFR-M10A) (Mark Esguerra)

The Distribution Line Automation program (MAT 49A) includes forecasts for the replacement of outdated line recloser controllers in both

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33 See Exhibit (PG&E-4), WP 4-29, lines 15 and 16.

34 See Exhibit (PG&E-4), WP 4-22, line 8.

HFTD areas (in 2021) and non-HFTD areas (in 2022-2026).[35] The wildfire mitigation work performed in 2021 is discussed below and the work in non-HFTD areas is discussed in Chapter 13. This program is a Wildfire mitigation referred to as "Additional Automation and System Protection" (WLDFR-M10A).

High impedance faults are conditions where line-to-ground faults do not draw a full fault current that a protective device can reliably sense and trip, creating a potential ignition source. The replacement of the legacy SCADA recloser controls protecting Tier 2 and 3 HFTD areas with new recloser controllers will enable the use of protective features designed to address high impedance fault conditions as well as integrating with current communication protocols. Under this distribution system automation initiative, the existing oil-filled reclosers and controllers will be replaced with a solid dielectric recloser and new micro-processor controller with protection elements like Downed Conductor Detection, Sensitive Ground Fault, and platforms that will allow for future protection elements that are under development to reliably detect high impedance faults.

In 2021, PG&E will replace approximately 80 remaining legacy controllers that are located throughout PG&E's service territory in Tier 2 and 3 HFTD areas. Due to a change in recloser standards driven by unreliability in the product provided by the original vendor, PG&E will be replacing the entire recloser assembly, including both the control and the tank for most installations.

PG&E forecasts expenditures of $7.0 million in 2021 in 49A for the work in HFTD areas described above.[36]

b. Single Phase Reclosers (MAT 49T, WLDFR-M10B) (Mark Esguerra)

A single phase recloser is a cost-effective, intelligent device mounted on cross-arms that can replace fuses. The model of single phase recloser that PG&E is installing in HFTD areas—known as a

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35 This work was forecast in MAT 09A in the 2020 GRC. (A.18-12-009, HE-16: Exhibit (PG&E-4), p. 10-18, line 26 to p. 10-20, line 8.).

36 See Exhibit (PG&E-4), WP 4-22, line 16.

FuseSaver—has gang trip capability (i.e., the capability to open all phases, rather than just one).[37] This capability makes FuseSavers ideal for areas with high wildfire risk. FuseSavers are also equipped with SCADA, which allows them to be used as PSPS sectionalizing devices. This program is a Wildfire risk mitigation referred to as "Additional System Automation and Protection – FuseSaver" (WLDFR-M10B).

Single phase reclosers with gang trip capability eliminate the risk associated with wire down events where a downed wire remains energized by a back-feed condition. This is a condition that traditional overcurrent protection devices like fuses are not able to sense and trip. PG&E will install single phase reclosers with gang trip capability on distribution laterals that have a history of energized wire down conditions. The single phase recloser with gang tripping will open all phases for the initial line to ground fault and eliminate the risk of ignition from a back-feed condition.

For purposes of wildfire risk mitigation, PG&E currently forecasts ramping from 66 FuseSaver installations in Tier 2 and 3 HFTD areas in 2021 to approximately 80 per year starting in 2023.

PG&E identified locations for 2021 FuseSaver installations based on the following criteria: (1) Tier 2 or Tier 3 HFTD areas; (2) one or more wire down outages in the last 10 years; (3) fused cutout locations within Fire Index Areas[38] with elevated fire risk potential days; (4) and load on all phases greater than 1 ampere. Site selection for FuseSaver installations in 2022 through 2026 will utilize similar risk modeling and will evolve as refinements are made to the model and lessons continue to be learned from the execution program.

PG&E forecasts annual expenditures of $2.3 million in 2021, $2.8 million in 2022, $2.9 million in 2023, $3.1 million in 2024, $3.2 million in 2025, and $3.4 million in 2026 in MAT 49T for the wildfire

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37 PG&E is also installing single-phase reclosers in non-HFTD areas. This work, which is also recorded in MAT 49T, is discussed in Ch. 13 of this exhibit.

38 Fire Index Area is a PG&E term for segmenting the HFTD areas into geographic operational zones.

mitigation portion of its Single Phase Recloser Program.[39] PG&E's forecasts for this work is as of March 2021. PG&E will aim to install additional units of FuseSavers, above this forecast, during the 2020 GRC rate case period.

c. Distribution Grid Sensors (Mark Esguerra)

The three types of distribution grid sensors described below detect non-equipment failure types that cannot be detected by existing detection methods or patrol techniques. In some cases, non-equipment failure-type outages (no problem found) are indicators of latent conditions that could cause more significant issues or fire risks if left unresolved. These sensor technologies also detect other power flow anomalies/disruptions that may be indicative of incipient faults. By proactively detecting failing conditions before they continue to degrade, these sensors enable PG&E to address latent or incipient issues in their early stages before they cause an ignition that leads to a wildfire.

The sensors described below, based on monitoring different signals, act in conjunction as a system to detect a wide variety of conditions that could not be effectively detected or located with just a single technology.

- Line Sensors and Communicating Faulted Circuit Indicators (cFCI) are able to detect larger overcurrent conditions (faults) and can moderately categorize and localize the location of the condition. Line sensors are commercially available and can be immediately deployed. cFCIs will be available in 2021.
- Event Classification Through Current and Voltage Monitoring (ECCVM) sensors also measure current and high resolution, but add voltage reads for a comprehensive and synchronized power measurement of each phase from the substation outlet. This high-resolution data matched with a 20-year distribution event waveform library can accurately categorize the type of event, but due to its single measurement location cannot determine location on the circuit.

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39 See Exhibit (PG&E-4), WP 4-22, line 21.

- Radio Frequency (RF) sensors are an emerging technology designed to detect incipient conditions as subtle as a broken wire strand or vegetation proximity, as well as larger fault conditions based on the RF energy created by partial discharge, with sub-span locational accuracy. PG&E envisions that Line Sensors/cFCIs and ECCVM would be used initially to cover most circuits in HFTD area, with RF sensors gradually replacing most of the Line Sensor/cFCI functionality over time.

Standing alone, each of these three sensor types would have a limited impact on the detection of equipment issues; however, when combined, they are a powerful tool that can provide the location (Line Sensors/cFCIs and RF sensors) and the cause of the event (ECCVM sensors) for quick action and remedy. This technology combination requires using an analytical platform to merge and analyze the data.

PG&E provides specific forecasts and deployment plans for each of type of sensor below. These plans could change depending on continued evaluation of each technology's capabilities, as well as integration with other enhanced automation and wildfire mitigation efforts. In coordination with deployments of other technologies, future sensor deployments will utilize PG&E's risk modeling tools in combination with feasibility screens to help prioritize the highest-risk locations for installations. Deployment costs should also factor in IT costs for data integration and grid sensing analytics to support grid operations.

PG&E forecasts annual expenditures of $12.4 million in 2021, $23.0 million in 2022, $22.7 million in 2023, $21.7 million in 2024, $22.7 million in 2025, and $24.4 million in 2026 in MAT 49I for its Distribution Grid Sensor Program.[40]

40 See Exhibit (PG&E-4), WP 4-22, line 18.

1) Line Sensors and cFCIs (MAT 49I, WLDFR-M07A)
(Mark Esguerra)

Line sensors and cFCIs are single phase, conductor mounted devices that continuously monitor electric lines to capture various disturbances, such as overcurrent events. Line sensors harvest power from the conductor and continuously measure current in real-time and report events as they occur, while cFCIs operate on batteries and are placed on low-current sections of circuit, and usually communicate regular data once a day and fault event alerts (excluding waveforms) as they occur. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – Line Sensors (WLDFR-M07A).

When fault events are detected, line sensors and cFCIs generate alerts through to OSISoft PI™ and display in the Distribution Management System. Line sensors provide waveforms of the fault event. Root Mean Square current values can be used in fault locator models like CYME Power Engineering software to estimate the location of the disturbance. Deployment costs should also factor in IT costs for data integration and analytics.

Building from its Smart Grid Pilot Program, in 2019 and 2020 PG&E deployed 801 line sensing devices on 60 circuits in Tier 2 and Tier 3 HFTD areas.[41] Efforts were focused on reducing wildfire risk and improving public safety by monitoring the grid continuously; performing analytics on captured line disturbance data; identifying potential hazards; and, when necessary, dispatching field operations to proactively patrol/maintain/repair failing field conditions or assets.

PG&E plans to expand coverage of the technology first to the highest fire-risk areas, with full coverage to over 600 circuits in HFTD areas over the next 10 years. PG&E currently forecasts installing line sensors/cFCIs on approximately 50 circuits each year.

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[41] In 2019, line sensor deployment work was redirected from reliability improvement efforts to support of wildfire mitigation efforts under the CWSP.

PG&E's forecast in MAT 49I for its Line Sensor/cFCI Program is $7.4 million in 2021, $8.0 million in 2022, $8.3 million in 2023, $6.5 million in 2024, $6.0 million in 2025, and $6.1 million in 2026.[42]

2) Radio Frequency Sensors (MAT 49I, WLDFR-M011) (Mark Esguerra)

RF sensors (also called Early Fault Detection or EFD) are a sophisticated technology that listens for the RF signal that is generated by partial discharge arcing on AC circuits and uses precision time measurement of events to locate the source along the conductors. This program is a wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – EFD (WLDFR-M011).

PG&E conducted a pilot in 2019-2020 of 20 RF Sensors in an HFTD Tier 2/Tier 3 area.[43] In PG&E's pilot of RF sensors, line risks that were detected included a broken conductor strand, a bullet lodged in conductor, a deteriorated cross arm conductor insulator attachment, vegetation contact, failing fuses, failing transformers, a candling fuse, and loose clamps. Since these issues were detected, PG&E was able to repair them with normal maintenance tags before complete failure occurred. The recommendation from the pilot was to continue deployment of this emerging technology.

RF Sensors show great promise in identifying and locating line risks, but still require additional product development and a lower total installed cost before they are ready for full-scale deployment. PG&E's efforts to date have also relied on a single vendor and PG&E plans to explore additional vendors going forward.

PG&E deployed RF Sensors on one additional circuit in 2020 and currently plans to expand RF Sensors to cover an additional

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42 See Exhibit (PG&E-4), WP 4-31, line 16.

43 The recorded costs for the RF and ECCVM sensors are funded through the Electric Program Investment Charge (EPIC) Program, but are shown in this GRC chapter, together with their future cost forecasts, to show the evolution of these sensor programs.

10 circuits in aggregate between 2021-2022 with a forecast of $1.4 million in 2021 and $4.6 million in 2022.[44]

PG&E's proposes to install an RF Sensors on an additional 65 circuits total in 2023-2026 with an annual forecast in MAT 49I for its RF Sensor Program of $5.4 million in 2023, $6.2 million in 2024, 7.5 million in 2025, and $8.8 million in 2026.[45]

3) Event Classification Through Current and Voltage Monitoring Sensors (MAT 49I, WLDFR-M012) (Mark Esguerra)

ECCVM Sensors (also called Distribution Fault Anticipation or DFA) are substation-based devices measuring volts, amps, and arcing conditions. The sensors monitor magnitude, phase, harmonics, real and reactive power, and cycle-to-cycle deltas in these values. They also cluster and categorize events and generate waveforms; these alerts are usable in fault locator models like CYME to estimate disturbance location. The leading vendor of ECCVM Sensors uses more than 20 years of utility data of event signatures to categorize events. The categorizations of events assist with focusing investigations on specific equipment or construction types. This program is a Wildfire mitigation referred to as Situational Awareness and Forecasting Initiatives – DFA (WLDFR-M012).

Examples of line conditions identified by ECCVM Sensors include the following: candled fuses, arcing switches, line slap, and failing transformer/secondary issues.

PG&E conducted a pilot of ECCVM Sensors from 2019 to 2020 on six circuits.[46] The pilot was in one of PG&E's HFTD Tier 2 and 3 areas and was deemed successful. The recommendation from the pilot was to continue deployment of this emerging technology.

PG&E is planning to expand installations of ECCVM Sensors to cover an additional 160 total circuits between 2021-2022 with

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44 See Exhibit (PG&E-4), WP 4-31, line 19.

45 See Exhibit (PG&E-4), WP 4-31, line 19.

46 See Exhibit (PG&E-4), WP 4-113.

annual expenditures of $3.6 million in 2021 and $10.4 million in 2022.[47]

PG&E's proposes to install additional ECCVM Sensors on 116 circuits annually from year 2023-2026 (464 circuits total) with a forecast of $9.0 million in 2023, $9.0 million in 2024, $9.2 million in 2025, and $9.5 million in 2026. [48]

4) Asset Health and Performance Center (MAT FZA, WLDFR-M07A) (Mark Esguerra)

The PG&E Asset Health and Performance Center deploys and operates technologies and applications that provide data for real time grid monitoring and analytics of asset health & performance.[49] These technologies and application predict developing problems on the electric system so PG&E can implement proactive maintenance, reducing wildfire risk and improving public safety. These efforts will be achieved by utilizing a portfolio of new & commercially available monitoring and sensing technologies, in combination with advanced analytical and machine learning tools to monitor in real-time distribution grid disturbances; Identify, locate, and predict developing hazards; and investigate and repair assets prior to failure.

Work conducted by the Asset Health and Performance Center enables grid sensor technologies and, as such, is part of the Situational Awareness and Forecasting Initiatives – Line Sensors mitigation (WLDFR-M07A).

PG&E's forecast for MAT FZA in this chapter for the Asset Health and Performance Center is $3.3 million in 2021, $2.6 million in 2022, and $3.4 million in 2023.[50]

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47 See Exhibit (PG&E-4), WP 4-31, line 22.

48 See Exhibit (PG&E-4), WP 4-31, lines 22 and 23.

49 Maintenance Activity Type (MAT) FZA includes forecast costs for the APC; MAT FZA costs are divided between this chapter and Ch. 17, Electric Distribution Capacity and Engineering. In Ch. 17, PG&E describes the General Engineering work included in MAT FZA.

50 See Exhibit (PG&E-4), WP 4-80.

Expense costs include contract costs for software licenses and communications, and labor cost for monitoring, maintenance, and support of new technologies. Increasing costs can be attributed to the additional maintenance and support costs that will be incurred to maintain the new technologies that have been forecasted to be deployed in this GRC

d. Meter-Based Sensors: Sensor IQ™ (MATs 21A and AB#, WLDFR-M07F) (Mark Esguerra)

The SIQ software works with existing SmartMeter devices to capture and store high-resolution, real time, and granular data on load, voltage, and outages to enable predictive maintenance data analytics. This program is a Wildfire risk mitigation (WLDFR-M07F).

SIQ can decrease overall wildfire ignition risk by detecting early-stage equipment failure, enabling PG&E to conduct repairs before infrastructure fails. PG&E anticipates the additional data source provided by SIQ may provide an analytical methodology to detect: (1) early-stage equipment failure resulting in voltage and other meter-detectable conditions including loose conductor splices and failing or overloaded transformers; and (2) momentary, secondary, and primary vegetation contact.

In addition to providing early awareness of degraded conditions on equipment, the data collected and analyzed by SIQ also supports other wildfire related objectives. For example, the interval voltage and load data collected through SIQ can be used to determine (through machine learning methods) the phase assignment of meters, which is critical for REFCL, which requires feeder phasing to determine the line-earth capacitive imbalance. Another example of a wildfire-related use case for SIQ data is improving PG&E's wires down algorithms to find faults.

In 2020, PG&E deployed SIQ capability to 500,000 SmartMeter devices in Tier 2 and 3 HFTD areas. PG&E expects to have SIQ

capability deployed on all planned meters by October 2021[51] and to complete a full evaluation of potential uses in 2022. If the SIQ technology proves to be effective in the early detection of wildfire risks, PG&E plans to extend the deployment of the SIQ technology to additional meters, including possibly all 5.5 million electric SmartMeter devices across PG&E's service territory.

PG&E's 2023 capital forecast for its SIQ program (in MAT 21A) is $10.5 million.[52] PG&E's expense forecast for its SIQ program (in MAT AB#) is $3.8 million in 2023.[53]

e. Rapid Earth Fault Current Limiter (MAT 49R, WLDFR-M10C) (Mark Esguerra)

REFCL technology mitigates ignitions from line-to-ground faults such as wire down or tree contacts. High-impedance, line-to-ground faults on distribution circuits are difficult to detect with traditional overcurrent protection and can become an ignition source. This program is a Wildfire risk mitigation referred to as Additional System Automation and Protection – REFCL (WLDFR-M10C).

REFCLs are intended to address these risks. REFCL is installed on a substation transformer and provides line-to-ground protection for all circuits served from the substation transformer. REFCL technology uses a component called a Ground Fault Neutralizer that detects high-impedance, line-to-ground faults and limits the fault current below ignition thresholds.

Core REFCL technology has been around for decades and is being used by some European utilities to limit current on their distribution systems to prevent equipment damage. However, the use of REFCLs to mitigate wildfire risk, which has much tighter performance standards

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51 This date differs from the original anticipated completion date of December 31, 2020. The SIQ pilot was delayed due to several issues identified to date and the uncertainty related to further challenges with this new technology. These issues and challenges are described in more detail in PG&E's Revised 2021 WMP Report, R.18-10-007 (June 3, 2021), Section 7.3.2.2.4, and in PG&E's Change Order Report (Sept. 11, 2020).

52 See Exhibit (PG&E-4), WP 4-22, line 12.

53 See Exhibit (PG&E-4), WP 4-5, line 5.

than the European use case, has only been implemented in the past few years, primarily in Australia.

In 2018, PG&E initiated a pilot project under EPIC 3.15 for REFCL technology at PG&E's Calistoga Substation based on wildfire risk in that area and historical line-to-ground outage events.

Based on our initial testing and the successful implementation in Australia, PG&E has developed a short-term strategy to install REFCLs in HFTD areas. PG&E forecasts deploying REFCLs at an additional two substations each year, but these plans could change pending pilot results and integration with other enhanced automation and wildfire mitigation efforts described in this chapter. In coordination with deployments of other technologies, future REFCL deployments will utilize PG&E's 2021 Wildfire Distribution Risk Model in combination with feasibility screens to help prioritize highest-risk locations for installations.

PG&E's MAT 49R REFCL Program forecasts annual expenditures of $8.2 million in 2021, $16.9 million in 2022, $17.3 million in 2023, $17.8 million in 2024, $18.3 million in 2025, and $18.8 million in 2026.[54]

f. Distribution, Transmission, and Substation: Fire Action Schemes and Technology (DTS-FAST) (WLDFR-M10D) (Mark Esguerra)

DTS-FAST is a technology developed internally at PG&E. It is currently in a pilot phase. The technology pilot uses fraction-of-a-second technologies to detect an object (such as a falling branch) approaching an energized power line and respond quickly to shut off power before the object impacts the line. This program is considered a wildfire mitigation (WLDFR-M10D), but PG&E is not forecasting any costs for this work.

In 2020, PG&E completed a proof of concept in San Ramon, California. The proof-of-concept model confirmed the technology would meet the detection, speed, and signal confirmation requirements for subsequent testing through a pilot.

PG&E is currently implementing a pilot program evaluating DTS-FAST on a 115 kV transmission circuit and on a 12 kV distribution

54 See Exhibit (PG&E-4), WP 4-22, line 20.

feeder in locations in HFTD areas. The pilot will assess the technology's efficacy at mitigating PG&E's wildfire and safety risks. Next steps and potential operationalization of this technology is dependent on an assessment of pilot findings.

While PG&E is optimistic about this technology, we are currently not able to provide a forecast in the GRC because DTS-FAST technology is still early in its pilot phases and, unlike REFCL, has not been successfully demonstrated elsewhere. A longer-term DTS-FAST deployment plan will be dependent on findings of pilot. PG&E will include costs for this program in the WMBA.

4. PSPS Impact Reduction Initiatives (Mark Esguerra)

PG&E's most important responsibility is protecting the health, welfare, and safety of our customers and the communities we serve. When severe weather or other circumstances threaten the ability to provide electricity safely, PG&E must take the appropriate steps necessary to protect the public. PG&E's PSPS program proactively de-energizes a portion of the Company's electric system, in the interest of public safety, as the wildfire prevention measure of last resort when there is a potential for a catastrophic wildfire should the lines be left energized. PG&E understands that de-energizing customers causes significant disruption and is actively working to reduce the impact on our customers.

Below, PG&E describes its programs for mitigating the impacts of PSPS on our customers. The two programs described below comprise only a subset of PG&E's PSPS mitigation activities. Other activities described in this chapter (e.g., System Hardening), as well as activities and technologies described in other GRC chapters (e.g., improved weather forecasting tools) also currently contribute to or have the potential to contribute directly or indirectly to PSPS mitigation. In Exhibit (PG&E-6), Chapter 2 of PG&E's opening testimony, PG&E describes customer programs to directly support customers before, during, and after PSPS events. For a more complete

overview of PG&E's PSPS mitigation activities, including activities on transmission lines, please see PG&E's Revised 2021 WMP.[55],[56]

Finally, PG&E continues to explore and evaluate new alternatives to continue to mitigate the impact of PSPS. These include new grid technologies such as DTS-FAST and REFCL as well as options such as transmission rebuild or locally sited permanent generation. PG&E will also continue to explore additional continuous power solutions to support back up power needs for the most vulnerable and impacted customers. Behind-the-meter battery storage and generation solutions we are currently researching may also comprise part of future PSPS mitigation strategy.

a. Generation for PSPS Mitigation (Mark Esguerra)

PG&E has four initiatives designed to support customers with TG during PSPS:

1) Temporary substation microgrids focused on keeping safe-to-energize customers online when a substation serving them is impacted by an upstream de-energization;
2) Temporary distribution microgrids focused on energizing "main street corridors" with shared services and critical facilities;
3) Back-up power for individual critical customer facilities, such as hospitals; and
4) CRCs focused on providing essential services to customers affected by PSPS events.

Each of these initiatives is described in more detail in Section 7.3.3.11.1 of PG&E's Revised 2021 WMP filing.[57] Cost recovery for these initiatives is addressed primarily through the Microgrid Order Instituting Rulemaking proceeding.[58] Below, PG&E

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55 PG&E's Revised 2021 WMP Report, R.18-10-007 (June 3, 2021), Section 7.3.3.11.

56 PG&E is filing its 2022 WMP on February 25, 2022. More information on these programs can be found in the 2022 WMP.

57 PG&E is filing its 2022 WMP on February 25, 2022. More information on these programs can be found in the 2022 WMP.

58 *Order Instituting Rulemaking (OIR) Regarding Microgrids Pursuant to Senate Bill 1339*, R.19-09-009 (Sept. 12, 2019).

describes the two areas within “Generation for PSPS Mitigation” included in the 2023 GRC.

1) Generation Enablement and Deployment (MATs AB# and IG#, WLDFR-M006) (Mark Esguerra)

PG&E established a new Generation Enablement and Development organization whose goal is to procure and deploy TG systemwide across the four generation initiatives supporting PSPS mitigation. The organization will drive improvement and efficiencies by implementing and documenting the actions taken to support reduction of customer impacts during PSPS events. Once scaled, this organization will be comprised of 14 Full-Time Equivalents (FTE). This program is a Wildfire risk mitigation referred to as PSPS Impact Reduction Initiatives – Generation Enablement and Deployment PMO (WLDFR-M006).

In addition to carrying out traditional TG procurement and execution activities, the Generation Enablement and Development organization will work closely with stakeholders, vendors, and regulators to lead an incremental transition toward a cleaner TG portfolio. This team will also examine the operational feasibility of piloting alternative-to-diesel projects for testing and demonstration in future years, and deploy projects if bids meet established cost-effectiveness criteria.

Within the Generation Enablement and Development organization, the TG PMO will provide a single source of reporting to senior leadership on the operational readiness of the four TG initiatives described above. It will also staff, coordinate, and train Emergency Operations Center TG members for PSPS event response and for other major emergency events. Finally, a key function the TG PMO will be to better integrate planning for TG with other system planning activities that might reduce the need of TG for PSPS events.

PG&E forecasts annual expenditures of $2.1 million in 2022, and $2.0 million in 2023 in MAT AB# for its Generation Enablement and Deployment Program.[59]

2) Temporary Distribution Microgrids (MAT 49M, WLDFR-M006) (Mark Esguerra)

PG&E's temporary distribution microgrids are designed to reduce the number of customers impacted by PSPS events and support community resilience by powering a cluster of shared resources (e.g., commercial corridors and critical facilities within the energized zones) so that those resources can continue serving surrounding residents during PSPS events. Though each distribution microgrid varies in scale and scope, the following design features are likely for each:

- Devices used to disconnect the distribution microgrid from the larger electrical grid;
- A pre-determined space for backup generation and equipment to allow for rapid connections (e.g., pre-installed interconnection hub (PIH)); and
- The use of temporary generators allowing PG&E to shorten the design and construction time typically required to ready a permanent microgrid for operation.

This program is a Wildfire risk mitigation referred to as PSPS Impact Reduction Initiatives – Temporary Distribution Microgrids (WLDFR-M006).

To determine the appropriate locations for distribution microgrids, PG&E identifies the distribution circuits most likely to be impacted by PSPS events in the future, based on foundational data analysis of 10 years of historical weather events. This "historical lookback" takes historical weather events and models the associated PSPS events that would have occurred, including both transmission and distribution impacts. PG&E reviews these circuits to identify communities with clusters of shared services (i.e., those

59 See Exhibit (PG&E-4), WP 4-125.

involving food, fuel, healthcare, and shelter) and critical facilities served by electrical infrastructure that would likely be safe to energize during PSPS events. To determine whether distribution microgrids could be a viable, effective near-term mitigation measure for a particular location, PG&E also reviews implementation feasibility (i.e., land availability and construction complexity) and the site's potential to be served by alternative grid solutions.

In 2020, PG&E developed seven distribution microgrids, four of which were operated during actual PSPS events. For 2021, PG&E is planning to develop at least five additional distribution microgrid PIHs by the end of the calendar year. PG&E will continue to follow the methodology described above to select locations for these sites, collaborating with county and local governments to ensure local priorities help shape site selection and design where technically feasible. PG&E is forecasting $16.4 million in 2021 and $13.6 million in 2022.[60] For 2022, PG&E is planning to apply all remaining 2020 GRC MAT 49M (CWSP – Resilience Zones) funds to develop additional temporary distribution microgrids following the targeting methodology described above.

PG&E currently is not forecasting any costs for the construction of new temporary distribution microgrids for 2023-2026. Operating and procuring TG for the completed temporary distribution microgrids will be carried out by the Generation Enablement and Deployment organization described above (Section C.4.1). As PG&E continues to evolve its understanding of the PSPS risk and matures its PSPS Mitigation Program, we will continue to evaluate the need for additional temporary distribution microgrids, as well as permanent generation.

b. Sectionalizing Devices (MAT 49H, WLDFR-M006) (Mark Esguerra)

The installation of remote operated SCADA sectionalizing devices on PG&E's distribution system can support our ability to segment the distribution circuits near HFTD boundaries to reduce the impact and

60 See Exhibit (PG&E-4), WP 4-22, line 19.

scope of PSPS events. PG&E plans to continue enhancing our distribution segmentation strategy to minimize the number of customers impacted during future PSPS events by refining what areas of a circuit to de-energize. This program is a wildfire mitigation referred to as PSPS Impact Reduction Initiatives – Sectionalizer Device Install/Replace (WLDFR-M006).

Distribution sectionalizing device installations have been focused on all circuits that traverse HFTD areas. When wildfire season concludes each year, PG&E integrates lessons learned from actual PSPS events and feedback from county leaders and customers so that we can become more precise on what circuits to de-energize during a PSPS event to minimize customer impact and outage duration. With this data and feedback, PG&E can continue to install new SCADA automated sectionalizing devices closer to the refined meteorological shutoff boundaries and learn what areas of the community to analyze for even further granular sectionalizing.

PG&E installed 232 SCADA sectionalizing devices in 2019 and added 603 more SCADA sectionalizing devices in 2020. In 2021, PG&E plans to install at least 250 more SCADA sectionalizing devices, integrating learnings from 2020 PSPS events and focusing efforts primarily on counties and specific areas that are frequently impacted by PSPS or predicted to be frequently impacted based on the 10-year historical lookback described in Section C.4.a.2 (Temporary Distribution Microgrids) above.

PG&E is also in the process of addressing the ignition risk created by some of the Motorized Switch Operators (MSO) switches that were initially installed on PG&E's distribution system in 2019 as sectionalizing devices. Despite these switches being understood to meet CAL FIRE's exempt criteria for not posing an ignition risk during normal operation, PG&E crews noted that some MSO switches exhibited an arc flash during the opening (de-energizing) operation. Based on this feedback

and subsequent testing, PG&E plans to replace or retrofit MSO switches to address this potential risk.[61]

During 2021, PG&E will be assessing various alternatives to address the identified risk with MSOs. Specifically, PG&E will explore corrective actions to prevent any potential arc flash including retrofitting the MSO with new vacuum-break technology or replacement with either new automated Line Reclosers or new automated SCADAMATE-SD switches. Based on the results of these studies, PG&E will develop a strategy to retrofit or replace all MSO switches used to reduce the scope of PSPS events by 2022.

PG&E plans to install 190 remote operated SCADA sectionalizing devices in 2022 and then 100 sectionalizing devices each year between 2023 and 2026, but these plans could change pending results and integration with other enhanced automation and wildfire mitigation efforts described in this chapter and elsewhere in the GRC. In coordination with deployments of other technologies, future sectionalizing device deployments will utilize historical weather lookback studies in combination with feasibility screens to help prioritize the highest-risk locations for installations.

PG&E's forecast for distribution SCADA sectionalizing devices is $42.9 million in 2021, $20.9 million in 2022, $11.9 million in 2023, $12.6 million in 2024, $12.6 million in 2025, and $12.9 million in 2026.[62]

D. Estimating Methods

PG&E used both a unit cost forecast methodology and program cost estimating methodology to forecast the costs for the work described herein. PG&E describes its basic method for developing unit and program cost estimates in Chapter 2 of this exhibit. PG&E describes below how those methods were used to forecast each of the work types described in this chapter.

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61 Until all installed MSOs can be replaced or retrofitted, PG&E has issued guidance document "Limited Use of Inertia SCADA MSO" (Utility Bulletin, TD-076253-B004, Rev. 0 (May 15, 2020)) which puts controls in place to mitigate the wildfire risk associated with MSOs.

62 See Exhibit (PG&E-4), WP 4-22, line 17.

1. System Hardening

This section has been modified to describe changes in PG&E's forecast as of February 25, 2022.

a. Overhead Hardening (Mark Esguerra)

Costs for system hardening work are based on the number of overhead miles forecast each year and forecast unit costs. Unit costs for overhead system hardening work are based on historic costs for similar work and consider any known differences between completed and planned work.

b. Undergrounding Initiative (Jamie Martin)

Costs for undergrounding are based on the number of underground miles forecast each year and forecast unit costs. Unit costs for underground system hardening work are based on historic costs for similar work and consider any known differences between completed and planned work.

PG&E has seen certain reductions in unit costs. Some drivers of these reductions include utilizing new materials and equipment, obtaining favorable commercial terms with our material suppliers and contractors, partnering with other utilities to share costs where possible, and bundling work into larger blocks to take advantage of economies of scale. PG&E is looking at additional potential cost reduction opportunities to further drive down costs, as described in the Cost Drivers and Reduction Opportunities section above.

2. Expulsion Fuse Replacement (Mark Esguerra)

Costs for expulsion fuse replacement were developed based on the plan to replace approximately 1,200 fuses per year from 2022 through 2026. The unit cost for fuse replacement is based on recorded costs for similar work in previous years. Unit costs for the program using the circuit prioritization approach based on the 2021 Wildfire Distribution Risk Model may be slightly higher. This approach targets replacing all the fuses on a specific circuit instead of just focusing on end-of-line fuses. In executing the work in this way, more complicated switching is required, which increases clearance times and manpower.

3. Enhanced Automation for Wildfire Mitigation (Mark Esguerra)

The enhanced automation work described in Section B.3 includes different types of work estimated using different methods.

- Costs for single Phase Reclosers (MAT 49T) are based on the unit cost to install FuseSavers and TripSavers. Costs are based on the planned estimated number of units and forecast unit costs.
- Distribution Grid Sensors (MAT 49I) includes three types of sensors: (1) Line Sensors and cFCIs, (2) ECCVM/Early Fault Detection Sensors, and (3) RF Sensors/Distribution Fault Anticipation technology. The unit cost for each type of sensor was informed by historic actual costs plus estimated cost adjustments based on the planned volume of work.
- SIQ (MAT 21A and AB#) is a new technology. Costs are based on the estimated amounts to purchase and install the software.
- DTS-FAST: PG&E is not forecasting costs for this program.

4. PSPS Impact Reduction Initiatives (Mark Esguerra)

- Forecast costs for Temporary Distribution Microgrids are based on estimated costs for individual projects including amounts for labor, materials, and contracts. Project costs are informed by recently completed, similar work. Costs are adjusted based on project size and location, plus any factors that are unique to a particular project.
- Costs for the Generation Enablement and Deployment organization are based on the estimated number of FTEs in the organization, multiplied by the fully-loaded cost for each one.
- Costs for Sectionalizing Devices (49H) were developed based on the plan to install approximately 190 devices in 2022 and 100 devices per year from 2023 through 2026.[63] The unit costs for each device are based on recorded costs for similar work in previous years.

E. Cost Tables (Mark Esguerra)

This section has been modified to show changes in PG&E's forecast costs as of February 25, 2022.

Expense and capital forecasts are summarized in the following tables:

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63 Exhibit (PG&E-4), WP 4-30, line 15.

- Table 4.3-12 lists expense MWCs showing 2016 through 2020 recorded adjusted expenses and 2021 through 2023 forecast expenses (in our June 2021 testimony);
- Table 4.3-13 lists capital MWCs showing 2016 through 2020 recorded capital adjusted expenditures and 2021 through 2026 forecast expenditures (in our June 2021 testimony);
- Table 4.3-14 shows the incremental 2022-2026 forecast capital costs as of February 25, 2022; and
- Table 4.3-15 lists capital MWCs showing 2016 through 2020 recorded capital adjusted expenditures and 2021 through 2026 forecast expenditures updated in PG&E's February 2022 GRC testimony.

The threat of wildfire and its harmful consequences are ubiquitous across PG&E's service territory. Through approval of the forecast costs for System Hardening, Expulsion Fuse Replacement, Enhanced Automation for Wildfire Mitigation, and PSPS Impact Reduction Initiatives, the Commission can use PG&E as a powerful tool for wildfire risk reduction in California.

TABLE 4.3-12
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	Workpaper Reference
1	AB	Miscellaneous Expense	–	–	$7	$431	$2,881	$1,528	$3,486	$7,204	WP 4-5 lines 4-7
2	BA	E Dist. Operate System	–	–	–	1	–	–	–	–	WP 4-5 line 26
3	FZ	E Dist. Planning & Ops Engineer	–	705	775	455	1,487	3,256	2,576	3,437	WP 4-5 line 12
4	HG	Dist. Ops Tech[(a)]	–	–	17	201	10	134	–	–	WP 4-5 line 29
5	IG	Manage Var Bal Acct Processes	–	–	–	22	3,494	3,031	–	–	WP 4-5 line 15
6	KA	E Dist. Maint. OH General	–	–	–	–	–	–	617	953	WP 4-5, line 23
7		Total	–	$705	$799	$1,110	$7,872	$7,949	$6,679	$11,595	

(a) Costs recorded and forecast in MWC HG reflect cellular and satellite costs for SCADA reclosers in Tier 2 and Tier 3 HFTD areas.

TABLE 4.3-13
JUNE 30, 2021 GRC FORECAST
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	2024	2025	2026	Workpaper Reference
1	08	E Dist. Replace OH Asset	–	$70	$23,670	$297,884	$484,915	$415,654	$927,949	$908,947	$879,971	$864,454	$817,209	WP 4-22 line 5
2	21	Misc Capital	–	–	–	29	(30)	–	–	10,507	–	–	–	WP 4-22 line 13
3	2A	E Dist. Inst/Repl OH General	–	–	–	9,130	7,847	15,125	15,388	15,752	16,257	16,777	17,314	WP 4-22 line 9
4	49	E Dist. Reliability Ckt/Zone	–	–	8,360	63,986	91,685	89,226	77,153	54,857	54,853	56,803	59,508	WP 4-22 line 22
5		Total	–	$70	$32,030	$371,030	$584,417	$520,005	$1,020,491	$990,063	$951,082	$938,034	$894,031	

TABLE 4.3-14
DIFFERENCE: FEBRUARY 25, 2022 FORECAST – JUNE 30, 2021 FORECAST
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted					Forecast					
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
1	08	E Dist. Replace OH Asset	–	–	–	–	–	–	$102,176	$603,080	$1,661,375	$2,154,196	$2,606,552

TABLE 4.3-15
FEBRUARY 25, 2022 UPDATED GRC FORECAST
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted					Forecast						Workpaper Reference
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
1	08	E Dist. Replace OH Asset	–	$70	$23,670	$297,884	$484,915	$415,654	$1,030,125	$1,512,026	$2,541,346	$3,018,650	$3,423,762	WP 4-22 line 5
2	21	Misc Capital	–	–	–	29	(30)	–	–	10,507	–	–	–	WP 4-22 line 13
3	2A	E Dist. Inst/Repl OH General	–	–	–	9,130	7,847	15,125	15,388	15,752	16,257	16,777	17,314	WP 4-22 line 9
4	49	E Dist. Reliability Ckt/Zone	–	–	8,360	63,986	91,685	89,226	77,153	54,857	54,853	56,803	59,508	WP 4-22 line 22
5		Total	–	$70	$32,030	$371,030	$584,417	$520,005	$1,122,667	$1,593,142	$2,612,456	$3,092,230	$3,500,584	

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony _____x_____ Workpapers _____ SOQ _____

Exhibit Number: __4____ Chapter Number: __4.3___

Chapter Title: System Hardening, Enhanced Automation and PSPS Impact Mitigations

Witness Name: Mark Esguerra

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
4.3-10, Table 4.3-4	1	WLDFR-M002 Risk Drivers	D-Line Equipment Failure, Animal, Natural Hazard, Other PG&E Assets or Processes, Vegetation	Equipment/ facility failure, Contamination, Vegetation Contact, Contact from Object, Other, Unknown
4.3-10, Table 4.3-4	2	WLDFR-M002 Risk Drivers	Equipment Failure	Equipment/facility failure
4.3-11, Table 4.3-4	6	WLDFR-M07A Risk Drivers	Equipment Failure, Vegetation	Equipment/facility failure, Vegetation Contact, Other, Contact from Object, Vandalism/Theft, All Consequences
4.3-11, Table 4.3-4	9	WLDFR-M10B Risk Drivers	Equipment Failure	Equipment/facility failure Vegetation Contact, Contact from Object Vandalism/Theft Unknown, Other
4.3-12, Table 4.3-4	10	WLDFR-M10C Risk Drivers	Equipment Failure	All Drivers
4.3-12, Table 4.3-4	11	WLDFR-M10D Risk Drivers	Equipment Failure, Vegetation	Equipment/facility failure

Page No.	Line No.	Item	As Filed	As Corrected
4.3-12, Table 4.3-4	12	WLDFR-M011 Risk Drivers	Equipment Failure, Vegetation	Equipment/facility failure, Vegetation Contact, Other, Contact from Object, Vandalism/Theft, All Consequences
4.3-12, Table 4.3-4	13	WLDFR-M012 Risk Drivers	Equipment Failure, Vegetation	Equipment/ facility failure Vegetation Contact, Contact from Object, Other, Unknown
4.3-13, Table 4.3-4	14	WLDFR-M017 Risk Drivers	D-Line Equipment Failure, Animal, Natural Hazard, Other PG&E Assets or Processes, Vegetation	Equipment/facility failure, Vegetation Contact, Contact from Object, Contamination, Unknown, Other
4.3-17, Table 4.3-5	6	WLDFR-M017 RSE	30.1	32.2
4.3-17, Table 4.3-5	7	WLDFR-M017 RSE	30.1	32.2
4.3-18, Table 4.3-6	1	WLDFR-M002 RSE	5.6	6.2
4.3-18, Table 4.3-6	3	WLDFR-M004 RSE	1.2	3.6
4.3-18, Table 4.3-6	4	Note (b) was incorrectly included as the RSE for Line No. 4, WLDFR-M006 PSPS Reduction Initiatives – Sectionalizer Device Install/Replace and should be deleted	(b)	12.3
4.3-18, Table 4.3-6	5	Note (b) was incorrectly included as the RSE for Line No. 4, WLDFR-M006 PSPS Reduction Initiatives – Temporary Distribution Microgrids and	(b)	(c)

Page No.	Line No.	Item	As Filed	As Corrected
		should be replaced.		
4.3-18, Table 4.3-6	6	WLDFR-M07A RSE	16.9	17.6
4.3-18, Table 4.3-6	7, 8	Incorrect notes	Line 7, (c) Line 8, (d)	Line 7, (b) Line 8, (c)
4.3-18, Table 4.3-6	9	WLDFR-M10B RSE	20.0	19.4
4.3-18, Table 4.3-6	11	WLDFR-M011 RSE	60.7	71.0
4.3-18, Table 4.3-6	12	Incorrect note	(e)	(d)
4.3-18, Table 4.3-6	Table Notes	Re-label table notes and remove as-filed note (b)	(a), (b), (c), (d), (d)	(a), (b), (c), (d)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4.4

COMMUNITY WILDFIRE SAFETY PROGRAM PMO

[INCLUDES NOVEMBER 5, 2021 ERRATA]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.4
COMMUNITY WILDFIRE SAFETY PROGRAM PMO

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.4
COMMUNITY WILDFIRE SAFETY PROGRAM PMO

A. Introduction

This chapter demonstrates that Pacific Gas and Electric Company's (PG&E or the Utility) expenditures for the Community Wildfire Safety Program (CWSP) Program Management Office (PMO) are reasonable and should be adopted.

Senate Bill (SB) 901 required each California electric corporation to submit an annual Wildfire Mitigation Plan (WMP) to establish the Utility's approach to mitigating wildfire risk caused by its electric equipment, beginning in 2019.[1] Assembly Bill (AB) 1054 and subsequent regulatory activities have further expanded the WMP process.[2] The CWSP delivers on the key facets of PG&E's WMP. The CWSP PMO, in turn, provides the foundational coordination, support, tracking, and governance needed to effectively execute our WMP, and manage the CWSP across multiple functions, internal teams, and work streams.

1. Scope, Purpose, and Support for this Request

Wildfire safety work is complex and multi-faceted. It requires a wide range of internal teams and subject matter experts — including experts in planning, operations, emergency response, external engagement, and communications. Collectively these teams assist with developing and implementing comprehensive solutions and supporting our customers, communities, and other partners. The CWSP PMO aims to:

- Coordinate with the various planning and operational teams to develop cohesive operational plans that maximize wildfire risk reduction and minimize community and customer impacts;
- Monitor, govern, and support wildfire risk mitigation workstreams in delivering the activities to meet our WMP goals and align with plans to aggressively reduce wildfire risk;

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1 Senate Bill (Sen. Bill) No. 901 (2017-2018 Reg. Sess.) § 12.

2 Assembly Bill (Assem. Bill) No. 1054 (2019-2020 Reg. Sess.).

- Coordinate with various outreach teams on communications plans for engaging with customers, agencies, tribes, critical facilities, first responders, and other key stakeholders;
- Maintain accurate and timely data regarding our progress to inform internal tracking, governance, and management and to be shared with external stakeholders;
- Lead and facilitate regulatory reporting and filings on wildfire programs, including the WMP process; and
- Gather and provide feedback from customers and external stakeholders to PG&E planning and operational teams.

Given the increases in the volume of work in our WMP and in regulatory reporting requirements, PG&E has seen growth in the management, oversight, and support needed for the CWSP. This management support spans various functions in Electric Operations (EO), providing leadership and oversight to the various wildfire mitigation activities PG&E is undertaking.

The CWSP PMO supports the continued implementation of CWSP workstreams, which have ramped up to unprecedented levels of activity. The CWSP PMO provides programmatic support and flexible resources across multiple workstreams. Other overall benefits of the CWSP PMO include:

- Improved oversight via a centralized entity that oversees strategy and execution of wildfire risk mitigation activities;
- Alignment of work tracking, quality management, documentation, and other processes through a centralized team;
- Improved accountability through dedicated resources focused solely on the CWSP;
- Improved reporting, communication, external outreach, coordination, and engagement of stakeholders and customers on the full suite of PG&E's wildfire risk mitigation activities; and
- Improved change management and coordination due to the cross-functional nature of the CWSP, which incorporates many lines of business (LOB) across PG&E and multiple functional groups within EO.

The activities of the CWSP PMO and related support functions are applicable across all regions of PG&E's service territory, particularly focused on High Fire Threat District (HFTD) areas.

2. Summary of Request

PG&E requests that the California Public Utilities Commission adopt PG&E's 2023 expense forecast of $13.5 million for the CWSP PMO, which is $20.8 million (or 61 percent) lower than 2020 recorded costs of $34.3 million.[3]

~~PG&E also requests authorization to recover 2020 CWSP-related costs recorded in the Fire Risk Mitigation Memorandum Account (FRMMA), as described in Attachment A of this chapter.~~

Forecasts in this chapter are shown with escalation at the Major Work Category (MWC) level and escalation is included in all expense totals. For more information on escalation, please refer to Chapter 2 of this exhibit.

3. Overview of Recorded and Forecast Costs

CWSP PMO forecasts expense costs in MWC AB, as shown in Table 4.4-1.

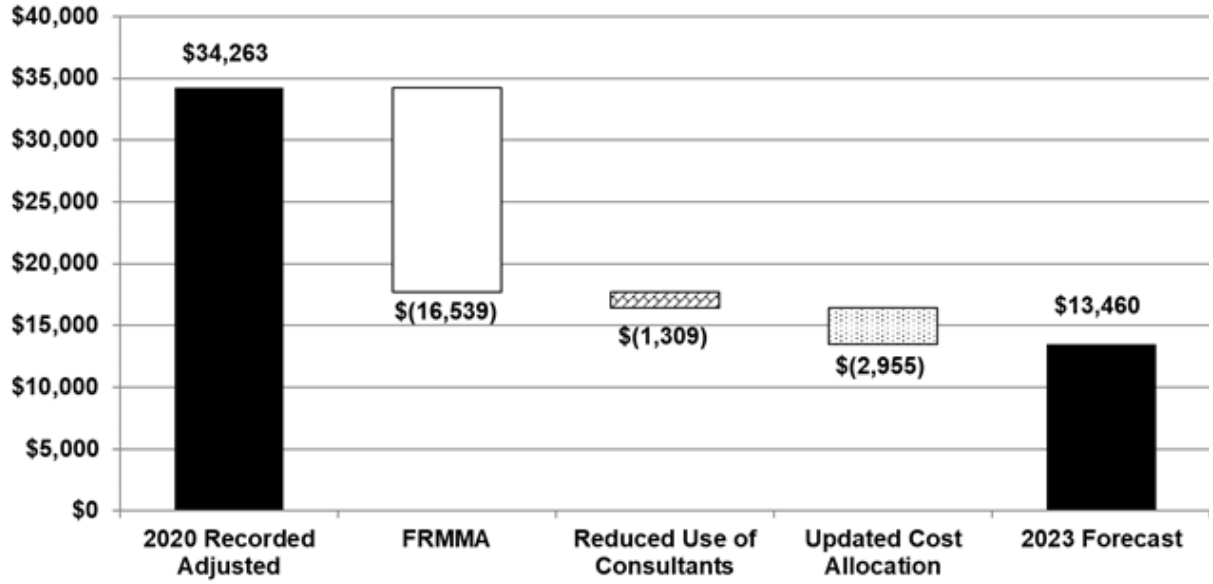
TABLE 4.4-1
CWSP PMO MWC

Line No.	MWCs	Description
1	AB	Miscellaneous Expense

Figure 4.1-1 shows the walk from 2020 recorded adjusted expense amounts to the 2023 forecast for the CWSP PMO. This figure includes costs that are subject to recovery on a recorded basis through the FRMMA.

[3] See Exhibit (PG&E-4), WP 4-9, line 4.

FIGURE 4.4-1
EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



As shown in the figure above, there are three main drivers for the decrease between 2020 recorded adjusted amounts for the CWSP PMO and the 2023 forecast:

1) Fire Risk Mitigation Memorandum Account (FRMMA): CWSP-related costs incurred in 2020 and recorded in the FRMMA are not included in the 2023 General Rate Case (GRC) forecast. ~~Attachment A of Chapter 2 in Exhibit (PG&E-4) summarizes~~ The amounts recorded in the FRMMA in 2020 include $16.4 million in expense costs in MWC AB and $119 thousand of expense costs in MWC IG. The need to record and recover these costs in the FRMMA was unique to the 2020 GRC. These costs have either been incorporated into the 2023 GRC forecast where appropriate, like in PG&E's 2023 forecast for Operational Management & Operational Support as provided in Chapter 22 of Exhibit (PG&E-4), or are no longer continuing into the 2023 GRC period.
2) Reduced use of consultants: PG&E engaged consultants to assist with the ramp-up of the CWSP PMO from its inception in 2018 into 2019 and 2020, as well as to prepare and assist with the regulatory process for the 2019 and 2020 WMPs. As these processes have stabilized, PG&E

has increased its internal staff and reduced the volume and cost of contractors needed to support the CWSP PMO.

3) Updated Cost Allocation: As described below in Section D of this chapter, in the section entitled “Estimating Method”, PG&E has updated the allocation of the CWSP PMO cost forecast starting in 2023.

B. Program and Risk Overview

1. Program Overview

As described above, the PMO leads and facilitates the overall CWSP, including developing and optimizing mitigation programs in conjunction with numerous other teams, facilitating the development of PG&E’s annual WMP filings, and coordinating implementation of wildfire risk mitigation activities across multiple LOBs.

The PMO’s responsibilities also include monitoring progress, handling resourcing needs, and directing workstreams as issues arise. This includes managing and enhancing quality monitoring programs, tracking performance data and metrics, documenting program activities, and coordinating external engagement and communication activities.

To address the significant impact of the CWSP and its new mitigation programs on our customers and the communities we serve, the PMO also supports internal and external engagement efforts, including public affairs and government relations support, local customer outreach support, and program communications. In 2019 and 2020, PG&E’s external outreach for the CWSP program included open houses, webinars and meetings with local agencies to educate communities and customers about wildfire risks, PG&E’s wildfire risk mitigation activities, and PSPS events.

Given the recent occurrence of wildfires associated with utility infrastructure, there is considerable external oversight and interest in PG&E’s wildfire mitigation activities. The CWSP PMO facilitates and leads the reporting, updates, and engagement with regulators, customers, and other outside parties. The PMO leads these external reporting and engagement activities to allow the operational leaders of the CWSP workstreams to focus on executing the wildfire risk mitigation activities they lead.

2. Risk Integration

Chapter 3 of this exhibit describes how EO uses the Enterprise and Operational Risk Management program to manage electric system risks. Table 4.4-2 below shows the EO risk associated with the forecasts discussed in this chapter.

TABLE 4.4-2
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	MAT
1	Wildfire	WLDFR	RAMP	AB#

a. Risk Assessment Mitigation Phase (RAMP) Risk – Wildfire

1) Risk Overview

The Wildfire risk is defined as the potential that PG&E assets or activities may initiate a fire that is not easily contained and endangers the public, private property, sensitive lands, or environment. Wildfire was one of PG&E's 2020 RAMP risks.[4]

In Chapter 3, PG&E describes how management of this risk has changed since it filed the 2020 RAMP Report; provides updated Risk Spend Efficiency (RSE) scores; lists each mitigation and control; and indicates if those mitigations and controls have changed since the 2020 RAMP Report. In this chapter, PG&E provides more information about the mitigation associated with the CWSP PMO and the work needed to implement it.

2) GRC Risk Mitigations and Controls

As shown in the table below, PG&E is forecasting one wildfire risk mitigation associated with the CWSP PMO. A brief description of the mitigation is provided in the table below. More detail is included in the 2020 RAMP Report.[5]

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4 PG&E's RAMP Report, Application (A.) 20-06-012 (June 30, 2020), p. 10-5, lines 14-15.

5 PG&E's RAMP Report, A.20-06-012 (June 30, 2020), p. 10-43, lines 16-27.

TABLE 4.4-3
WILDFIRE FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	WLDFR-M009	CWSP PMO	The CWSP PMO was established in 2018 to oversee and coordinate multiple LOB's implementation of PG&E's wildfire risk mitigation activities. The CWSP PMO is focused on project and program development and management for wildfire mitigation efforts.	Foundational	See Section C.1 for more information	AB#

3) Changes to Mitigations

PG&E did not modify its CWSP PMO mitigation since filing the 2020 RAMP Report. While the work remains the same, the forecast costs for the work have changed. PG&E has reduced its forecast for the CWSP PMO for 2021 to 2026 after submitting the 2020 RAMP Report. The decrease is primarily due to the reduction in consultant/contractor spend discussed in section A.3 above. The GRC portion of these costs has also decreased based on the application of the cost allocation methodology mentioned in section A.3 above and discussed in Section D below.

4) Cost Tables

Table 4.4-4 below shows the forecast costs for the mitigation presented in this chapter.[6] Tables showing the GRC forecast costs compared to the costs estimated in the 2020 RAMP Report are provided in workpapers.[7] There are no controls associated with work in this chapter.

[6] See Exhibit (PG&E-4), WP 3-7, line 34.

[7] See Exhibit (PG&E-4), WP 3-20, lines 64-66.

TABLE 4.4-4
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total	RSE
1	WLDFR-M009	CWSP PMO	$17,724	$15,438	$14,994	$13,460	$61,617	(a)
2		Total	$17,724	$15,438	$14,994	$13,460	$61,617	

(a) PG&E considers this a foundational mitigation and, as such, does not calculate an RSE for it.

C. Activities, Costs, and Forecast Drivers by Risk Mitigation

1. Expense (MWC AB) (WLDFR-M009)

The forecasted costs for the CWSP PMO (aligned with mitigation WLDFR-M009) consist primarily of third-party consultants to support internal and external engagement, including public affairs and government relations, local customer outreach, and marketing and communications for the CWSP program overall and also to provide supplemental support for coordinating the development of the annual WMP filings. As discussed above, Wildfire safety work is complex and multi-faceted and has ramped up substantially since the program inception in 2018. The CWSP PMO organizes and coordinates this work by performing activities including:

- Coordination with the various planning and operational teams to develop cohesive operational plans that maximize wildfire risk reduction and minimize community and customer impacts;
- Monitoring, governing, and supporting wildfire risk mitigation workstreams to meet our WMP goals and align with plans to aggressively reduce wildfire risk;
- Coordinating with numerous outreach teams on communications plans for engaging with customers, agencies, tribes, critical facilities, first responders, and other key stakeholders and supporting the delivery of those communications and engagement;
- Maintaining accurate and timely data regarding our progress to inform internal tracking, governance, and management and to be shared with external stakeholders;

- Leading and supporting the expanding wildfire-related regulatory reporting and filings, including the WMP process; and
- Gathering and providing feedback from customers and external stakeholders to PG&E planning and operational teams.

The CWSP PMO supports the continued implementation of CWSP workstreams, which have ramped up to unprecedented levels of activity and are forecasted to grow as PG&E continues to aggressively reduce wildfire risk to protect the customers and communities we serve.

D. Estimating Method

Forecasted costs in 2021 through 2023 for the CWSP PMO are based on 2020 recorded costs. As noted in the forecast walk in section A.3 above, there are three primary modifications from the 2020 recorded costs to our future year forecasts.

1) Costs recorded to the Fire Risk Mitigation Memorandum Account (FRMMA) in 2020: The primary costs associate with this chapter and recorded to the FRMMA in 2020 were for incremental wildfire work support activities (management support and quality support~~, as discussed in Attachment A of this chapter~~) that were not forecasted in the 2020 GRC. In 2021 those costs have been forecasted again in this chapter but for 2022 and beyond, the forecast for the cost of internal headcount to support wildfire work has been primarily captured in the Operational Management and Operational Support forecasts presented in Chapter 22.
2) Reduced use of consultants: PG&E engaged consultants to assist with the ramp up of the CWSP PMO from its inception in 2018 into 2019 and 2020, as well as to prepare and assist with the regulatory process for the 2019 and 2020 WMPs. As these processes have stabilized, PG&E has increased its internal staff and reduced the volume and cost of contractors needed to support the CWSP PMO.
3) Updated Cost Allocation: After the above two adjustments, the total CWSP PMO forecast for 2023 is $16.4 million.[8] In the 2020 GRC PG&E allocated the full CWSP PMO costs to “common” assets such that the cost of the CWSP PMO was split among different asset groups (including Electric

[8] See Exhibit (PG&E-4), WP 4-9, line 1.

Transmission and Electric Distribution) through ratemaking calculations. With more experience in operating the CWSP PMO and the underlying wildfire risk mitigation activities, for the 2023 GRC PG&E is updating that allocation based on the asset classes supported by the CWSP, which are Electric Distribution and Electric Transmission Assets. This reallocation of the overall CWSP PMO costs resulted in 18 percent of the cost ($2.9 million) being allocated to Electric Transmission assets. That $2.9 million has been excluded from the GRC request included in this chapter.

The proposed allocation of the CWSP PMO costs to electric distribution and electric transmission is based on the ratio of overhead circuit miles in HFTD areas for each asset group to total overhead circuit miles in HFTD areas. As of the end of 2020, the allocation percentage is 18 percent electric transmission and 82 percent electric distribution.[9] These mile amounts are also discussed in the 2021 WMP.[10] Because the CWSP PMO supports wildfire work activities on both distribution and transmission assets, this allocation was used to split the overall CWSP PMO cost forecast between distribution, which is presented here in the GRC, and transmission costs, which will be recorded and recovered directly through PG&E's Transmission Owner rate case process for 2023 and beyond.

If this allocation methodology to directly associate 82 percent of the CWSP PMO forecast to Electric Distribution assets through the GRC is not adopted and the CWSP PMO costs are instead allocated as a "common" cost allocation (as was the case with the 2020 GRC forecast) then then CWSP PMO forecast here would need to be revised back to the total CWSP PMO forecast of $16.4 million.

E. Cost Tables

The expense recorded and forecast amounts and the capital recorded amounts for CWSP PMO related activities are summarized in the following tables:

- Table 4.4-5 shows 2016 through 2020 recorded adjusted expenses and 2021 through 2023 forecast expenses.

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9 Exhibit (PG&E-4), WP 4-9.

10 PG&E's 2021 Wildfire Mitigation Plan – Revised Report, R.18-10-007 (June 3, 2021), Attachment 1, Table 8, lines 16, 18, 32, 34, 48 and 50.

- Table 4.4-6 shows 2016 through 2020 recorded capital adjusted expenditures as there are no forecast expenditures for 2021 through 2026.

TABLE 4.4-5
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted					Forecast			Workpaper Reference
			2016	2017	2018	2019	2020	2021	2022	2023	
1	AB	Misc. Expense	–	–	$4,530	$30,635	$34,144	$27,802	$14,994	$13,460	WP 4-5, line 8
2	IG	Manage Var Bal Acct Processes	–	–	–	–	119	–	–	–	WP 4-5, line 16
3		Total	–	–	$4,530	$30,635	$34,263	$27,802	$14,994	$13,460	

TABLE 4.4-6
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted					Forecast						Workpaper Reference
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
1	21	Misc Capital	–	–	$(1)	$10	$0	–	–	–	–	–	–	WP 4-19, line 9
2		Total	–	–	$(1)	$10	$0	–	–	–	–	–	–	

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony _____X_____ Workpapers _____ SOQ _____

Exhibit Number: __4_____ Chapter Number: __4.4_____

Chapter Title: Community Wildfire Safety Program PMO

Witness Name: ____Matthew Pender_____

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
.4.4-4	7-8	Text correction	the amounts recorded in the FRMMA in 2020, which includes	The amounts recorded in the FRMMA in 2020 include

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4.5

INFORMATION TECHNOLOGY FOR WILDFIRE MITIGATIONS

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CHAPTER 4.5
INFORMATION TECHNOLOGY FOR WILDFIRE MITIGATIONS

A. Introduction

1. Scope, Purpose, and Support for This Request

The purpose of this chapter is to demonstrate that Pacific Gas and Electric Company's (PG&E or the Company) expense and capital forecasts for administering its Community Wildfire Safety Program (CWSP) Information Technology (IT) initiatives and programs are reasonable and should be approved. This chapter describes the CWSP IT programs, initiatives, key metrics, mitigations, and controls to support PG&E's Wildfire mitigation efforts.

IT for Wildfire Mitigations enables and supports wildfire response and mitigation efforts as described in the Company's 2021 Wildfire Mitigation Plan (WMP).[1] The request in this chapter is necessary to improve and maintain the IT systems and applications that support those critical efforts. The benefits associated with these efforts include:

- Improved data quality through the enablement of foundational data management practices and programs, such as Public Safety Power Shutoff (PSPS) Data Quality and Grid Data Analytics Tool, that will support other programs to reduce wildfire risk;
- Risk reduction through continued investments in key technology programs and the development of new and enhanced risk based data models, such as Remote Sensing Data Platform, Risk Assessment & Mapping and Asset Management & Inspections, that will drive more informed decision making related to asset management;
- More agile PSPS event scoping that increases scoping speed and minimizes event scope through the integration and continued enhancement of tools and better coordination and sharing of

[1] PG&E's 2021 Wildfire Mitigation Plan – Revised Report, R.18-10-007 (June 3, 2021) (Revised 2021 WMP).

information, such as PSPS Viewer, PSPS Situational Intelligence Platform and PSPS External Portal;

- Improved customer experiences through enhanced customer notifications and self-service tools to better support customer needs during wildfire and PSPS events;
- Increased efficiency and higher quality execution of field work through the implementation of integrated cross-functional technology solutions; and
- More stable and reliable technology platforms to support critical wildfire and PSPS operations.

2. Summary of Request

Below is a summary of the expense and capital requests for information technology for wildfire mitigations.

a. Expense

PG&E's expense forecast for IT for Wildfire Mitigations is $35.7 million in 2023, which is $8.8 million more than 2020 recorded adjusted expense of $26.9 million.[2] The increase is primarily driven by additional technology program investments, namely in the Data Enablement and Asset Management and Risk Analysis value streams,[3] and the establishment of key Baseline Operations and Maintenance (O&M) activities, resulting from the implementation of continued technology program investments needed to support PG&E's wildfire response and mitigation efforts.

b. Capital

PG&E's forecast of capital expenditures for IT for Wildfire Mitigations is $25.3 million in 2021,[4] $25.3 million in 2022, $25.3 million in 2023, $25.3 million in 2024, $25.3 million in 2025, and $25.3 million in

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2 Exhibit (PG&E-4), WP 4-10, line 13.

3 A value stream represents an ongoing program of technology investments. This concept is further discussed in Section B.1.

4 Values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

2026. Recorded adjusted capital expenditures were $22.7 million in 2020.[5] PG&E's capital request in 2023 is $2.6 million more than 2020 recorded costs, and stays flat each year through 2026. The increase is due primarily to technology program investments, particularly around the Data Enablement, and Asset Management and Risk Analysis, and Event Management value streams that are critical in continuing to improve wildfire response and mitigation efforts.

3. Overview of Recorded and Forecast Costs

PG&E organizes forecasts and recorded costs for the IT for Wildfire Mitigations chapter into two main categories of work: (1) Technology Project Investments, which are further categorized into value streams, and (2) Baseline O&M activities. The forecasts and recorded costs are as follows:

- Figure 4.5-1 shows the expense walk from 2020 recorded to the 2023 forecast; and
- Figure 4.5-2 shows the capital 2020 recorded expenditures and 2021 to 2026 forecast.

These figures include costs that are subject to recovery on a recorded basis through the Wildfire Mitigation Plan Memorandum Account (WMPMA), and these amounts are included for trending purposes because the activity will become GRC funded beginning in 2023.

[5] Exhibit (PG&E-4), WP 4-33, line 7.

FIGURE 4.5-1
IT FOR WILDFIRE MITIGATIONS
EXPENSE WALK (2020-2023)
(THOUSANDS OF NOMINAL DOLLARS)

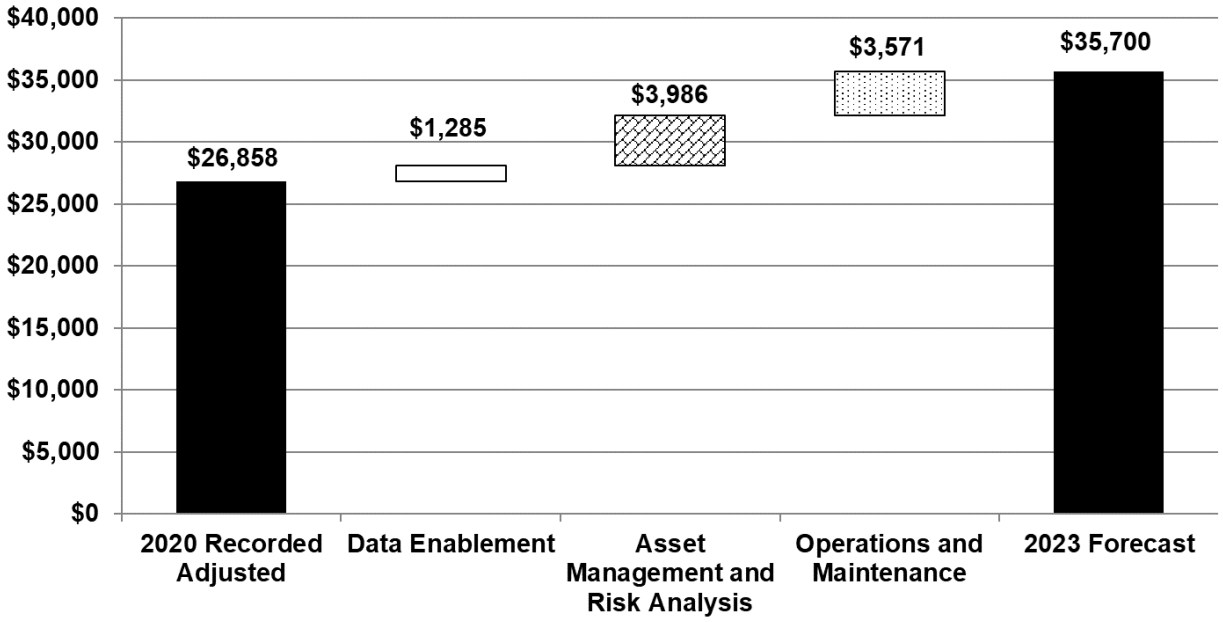
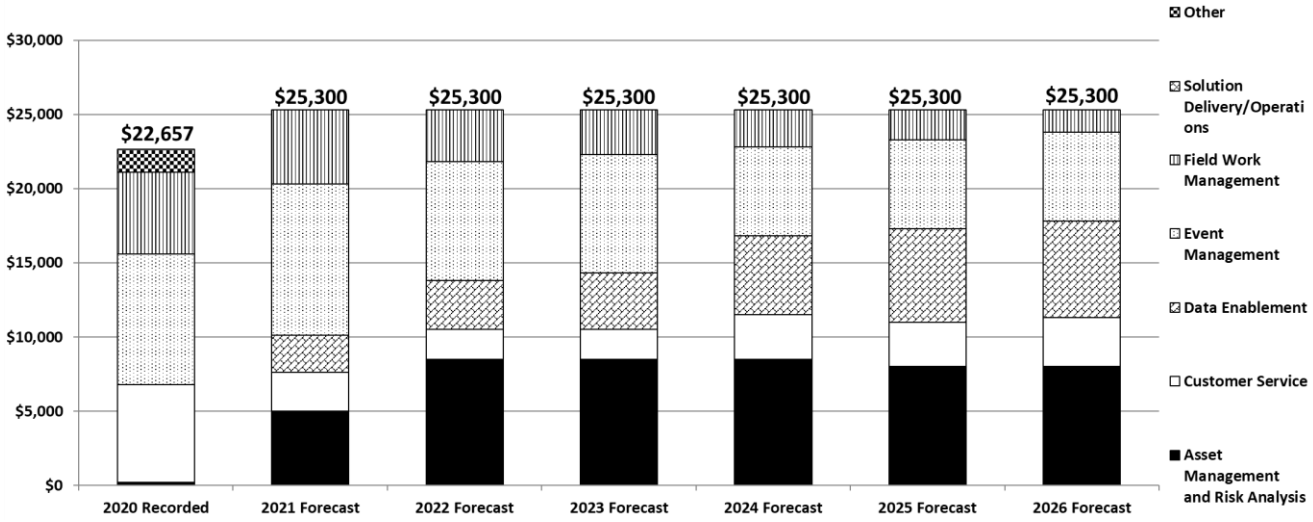


FIGURE 4.5-2
IT FOR WILDFIRE MITIGATIONS
CAPITAL EXPENDITURES (2020-2026)
(THOUSANDS OF NOMINAL DOLLARS)



B. Program and Risk Overview

1. Program Overview

PG&E's IT for Wildfire Mitigations encompasses both Technology Project Investments and a Baseline O&M workstream that supports O&M activities after those technology programs have been put into service and transitioned to operations.

PG&E's IT organization has begun to adopt an IT industry framework for delivering technology investments using agile and Lean principles. Within this framework, called the Scaled Agile Framework (SAFe), technology investments are planned, organized, and managed through logical constructs called "value streams." A value stream, in essence, represents an ongoing program of technology investments that support aspects of Company operations where technology solutions are of long-term strategic importance. Within a value stream, PG&E will continually plan, prioritize, and sequence specific investments based on the value they provide to the associated aspect of Company operations at a given time. Not only does this help ensure consistent investment in critical business and technology capabilities, this also enables specialized, cross-functional delivery teams to adapt more nimbly to emergent customer and business needs, changes in priority or value propositions, and innovation in the technology environment.

The value stream construct provides structure for the Electric Operations (EO) Line of Business (LOB) to deliver Technology Programs that enable the LOB to best meet the needs of its customers. The solutions from these value streams will enable the LOB to identify and implement opportunities to support wildfire mitigation and response efforts, including: more effective risk analysis, enhanced field work enablement capabilities, and improved customer service capabilities.

The IT programs in this chapter form part of value streams supporting Asset Management & Risk Analysis, Event Management, Data Enablement, Field Work Management, and Customer Service.

2. Risk Integration

Risk controls and mitigations are aligned to various Major Work Categories (MWC) and Maintenance Activity Types (MAT) in Electric

Distribution. The work presented in this chapter enables other mitigations and controls though none of the MWCs presented in this chapter corresponds to an individual risk mitigation or risk control.[6]

C. Activities, Costs, and Forecast Drivers by MWC

1. Expense

The primary MWC for all IT for Wildfire Mitigations forecast expense work is MWC IG. PG&E defines this MWC and other expense MWCs that contribute to the CWSP IT forecast as follows:

- MWC IG – (Manage Various Balancing and Memorandum Accounts) is used for work tracked in the WMPMA and Wildfire Mitigation Balancing Account (WMBA) and includes costs for ongoing maintenance, operations and repair for PG&E applications, systems, and infrastructure.

PG&E's IT for Wildfire Mitigations expense forecast is $35.7 million in 2021, $35.7 million in 2022, and $35.7 million in 2023.[7]

PG&E's IT for Wildfire Mitigations expense forecast spans both Technology Project Investments and Baseline O&M. Significant expense cost drivers within these categories are listed below:

a. Technology Project Investments

- Expense activities and costs (such as planning, data migration/conversion, and certain third-party service agreements) associated with capital investments, described in Section C.2, that are necessary to deliver cross-functional technology solutions that support wildfire mitigation efforts as defined in PG&E's WMP.

b. Baseline O&M

- Recurring O&M – Ongoing labor and non-labor costs necessary to manage operate and maintain CWSP-related technology solutions and meet contractual agreements for the support of third-party software and IT Services. Labor costs encompass application support activities,

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6 See Exhibit (PG&E-4), Ch. 3 for more information about risk mitigations and controls, in PG&E's Electric Distribution Risk Management testimony.

7 Exhibit (PG&E-4), WP 4-10, line 13.

including system operations, bug fixes, incident management as well as asset calibration. Non-labor costs include software maintenance renewals and other vendor contract costs, including Amazon Web Services, Environmental Systems Research Institute Managed Services, and various other software maintenance contracts that are needed to provide the level of service to support the systems its stakeholder teams rely on to perform wildfire response and mitigation activities.

- Incremental O&M – Increases in O&M costs—including: vendor contracts, licensing, and cloud service provider agreements—required to support and maintain the technology solutions deployed in support of wildfire response and mitigation efforts over the base year. PG&E assumes an annual increase in O&M costs resulting from the technology solutions delivered as part of the Technology Project Investments. This increase is assumed to be 10 percent of the Technology Project Investments per year.
- Operational Efficiencies – Savings from a variety of sources that partially offset forecast increases. PG&E assumes a 10 percent year-over-year reduction in Baseline O&M and the Company expects to realize these efficiencies largely through renegotiating contracts and leveraging seasonal resources where appropriate.

2. Capital

The primary MWC for all IT for Wildfire Mitigations forecast capital work is MWC 2F. PG&E defines this MWC as follows:

- MWC 2F – (Build Applications and Infrastructure) includes costs to design, develop, and enhance applications, systems, and infrastructure technology solutions.

PG&E's IT for Wildfire Mitigations capital forecast is $25.3 million annually from 2021-2026.[8]

PG&E's IT for Wildfire Mitigations capital forecast falls entirely within the Technology Project Investments category, focused on the value stream concept, and are listed in Table 4.5-1 and described below:

[8] Exhibit (PG&E-4), WP 4-33, line 7.

TABLE 4.5-1
CAPITAL RECORDED AND FORECAST BY VALUE STREAM (2020-2026)
(MILLIONS OF DOLLARS)

Line No.	Value Stream	2020	2021	2022	2023	2024	2025	2026	2020-2026
1	Asset Management & Risk Analysis	$0.2	$5.0	$8.5	$8.5	$8.5	$8.0	$8.0	$46.7
2	Event Management	9.7	10.2	8.0	8.0	6.0	6.0	6.0	53.9
3	Data Enablement	0.0	2.5	3.3	3.8	5.3	6.3	6.5	27.7
4	Field Work Management	4.6	5.0	3.5	3.0	2.5	2.0	1.5	22.1
5	Customer Service	6.6	2.6	2.0	2.0	3.0	3.0	3.3	22.5
6	Other	1.6	0.0	0.0	0.0	0.0	0.0	0.0	1.6
7	Total	$22.7	$25.3	$25.3	$25.3	$25.3	$25.3	$25.3	$174.5

a. Asset Management and Risk Analysis

The Asset Management and Risk Analysis value stream in this chapter is focused on investments in cross-functional technology solutions that capture, manage, and provide access to EO asset-related data in order to understand asset condition and related risks that are fundamental in supporting specific areas of PG&E's 2021 WMP, including:

- Risk Assessment and Mapping;
- Situational Awareness and Forecasting;
- Grid Design and System Hardening; and
- Asset Management and Inspections.

It is important to note that these investments only address IT developed data-related capabilities that are geared to support business requirements identified in the WMP.

The overall technology vision and objective of this value stream is to optimize the use of all asset related data, including SAP, Geographic Information System (GIS), operational data, environmental data (e.g., weather, fuel moisture, wildfire cameras, satellite feeds), three-dimensional data and imagery, for integration into a comprehensive engineering infrastructure model (also referred to as a "digital twin"). The digital twin is a representation of asset structures, framing, attached conductors, and equipment. Three-dimensional data from light detection and ranging (LiDAR) and imagery will also provide information on asset location, proximity and risk of vegetation and

non-PG&E structures. The estimating, design, and construction departments will use the infrastructure model—the evolving digital twin—as the initial basis for asset knowledge and grid design. This model will also be used to optimize asset maintenance and vegetation management using predictive models. Data from the digital twin will also be integrated for real-time operational use cases. This foundational data and the analytical tools will provide capabilities to mitigate risk and manage safety factors. Building the digital twin requires ongoing technology and resources investments to develop and keep the model up to date for reliability, data accessibility and ease of use.

The following provides further details by WMP Plan Area, with the capabilities PG&E expects to enable, as well as the business outcomes it intends to achieve. While objectives span Transmission and Distribution systems and processes, the focus here is on Distribution.

- Risk Assessment and Mapping – This involves the development and use of tools and processes to develop and update risk maps and simulations and to estimate the risk reduction potential of initiatives for a given portion of the grid (at various levels of granularity, e.g., circuit, span, or asset). Note the investments discussed below only address the IT developed data-related capabilities that are geared to support business requirements identified in the WMP.

As it relates to this value stream, PG&E's long-term technology plan for developing and using risk modeling and mapping to estimate the risk reduction potential of initiatives centers around refining data inputs, creating more integrated models, and improving granularity in model outputs. Steady improvement in these areas will serve to better localize areas and more effectively target mitigations that reduce the risk of grid related ignitions. With more data being captured internally as well as by outside parties, PG&E will continue to evaluate the vast amounts of available data to increase the granularity and performance of its models. Modeling capabilities are improving from relative risk models at the circuit level with system level risk reduction and risk spend efficiencies (RSE), to more automated and quantitative risk models that include risk reduction and RSE evaluations at the asset level. These improvements

over the next several years will position PG&E to focus on continually improving the data and granularity of its risk models to enable better decision making.

- Situational Awareness and Forecasting – This involves the collection, recording and analysis of data from weather stations and other sources. Note the investments discussed below only address the IT developed data-related capabilities that are geared to support business requirements identified in the WMP.

As it relates to this value stream, PG&E's long-term technology plan is to continue investment in integrating additional data sources, including data from Electric Operations assets, and developing and optimizing associated models in support of overall asset risk modeling. Specific examples of this technology work are embedded in the projects listed below.[9] It is important to note that the scope described within each of the projects cited in this section only represents the technology investment required to enable PG&E's long-term plan to integrate the data associated with this program into centralized asset data management systems in support of multi-dimensional model development and optimization that will prioritize inspections and maintenance work based on risk. These include:

  - Numerical Weather Prediction: Meteorological models are expected to improve in the future, and PG&E plans to evaluate and incorporate the latest weather model improvements that can increase forecast accuracy. This includes upgrading to newer version of the Weather Research and Forecasting Model in the future and producing more granular forecasts to determine if greater accuracy can be achieved. Ensemble weather prediction is also being evaluated and can be expanded to provide a wider range of outcomes and probabilistic forecasts.
  - Fuel Moisture Sampling and Modeling: PG&E plans to continue working with external experts to evaluate and operationalize

[9] See Exhibit (PG&E-4), Chapters 4.1 and 4.3 for more information about these projects.

new methodologies and models that may contribute to the overall model fidelity and accuracy.

  - Wildfire Cameras: PG&E continues to look for opportunities to pilot emergent technologies such as enhanced Artificial Intelligence (AI) camera software for ignition detection. If the pilots are successful, PG&E expects to invest in these technologies.
  - Continuous Monitoring Sensors (Sensor IQ): If the technology proves to be effective in early detection of fire risks, the deployment of this tool may be extended to continue coverage beyond the currently deployed pilot of 500 thousand meters, including possibly deploying to all 5.5 million electric SmartMeter™ devices across PG&E's service territory.
  - Continuous Monitoring Sensors (Line Sensors): As PG&E continues to evaluate this technology, it is simultaneously building a strategy to deploy the technology on 600-800 High Fire Threat District (HFTD) circuits over the next 8-10 years covering multiple rate case planning cycles. This technology will be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

- Grid Design and System Hardening - This is a broad category of programs that target remediation, adjustments, or installations of new equipment to reduce potential distribution ignition risks, including undergrounding of conductors, installation of insulated conductors, Distribution Line Sectionalizing, and installation of island-able microgrids. Note the investments discussed below only address the IT developed data-related capabilities that are geared to support business requirements identified in the WMP.

  As it relates to this value stream, PG&E's long-term technology plan is to continue investment in integrating additional data sources and developing models that will help identify the highest priority targets for system hardening and update associated asset models in support of overall asset risk modeling. It is important to note that the scope

described within each of the projects cited in this section only represents the technology investment required to enable PG&E's long-term plan to integrate the data associated with this program into centralized asset data management systems in support of multi-dimensional model development and optimization that will prioritize inspections and maintenance work based on risk.

One specific area of relevant focus is the Pole Replacement Program.[10] PG&E is strengthening pole loading model parameters and variables by considering historical data with various meteorological factors (e.g., wind speed). These enhancements include evaluation of advanced wire strength, clearance, and pole loading using acquired imagery; and LiDAR from inspections, drones, and helicopters. In addition, PG&E is working with its pole loading calculation software vendor to enable analysis of multiple pole models together, enabling span linking to structural connectivity.

- Asset Management and Inspections – This is a broad category of programs targeted at improving the effectiveness of asset inspections and asset management work and processes, including preventive and predictive maintenance. Through a combination of ground inspection, intrusive wood pole testing, aerial inspections, infrared assessments, patrols, and advanced predictive modeling capabilities that leverage sensor and operational data, PG&E seeks to identify conditions that require repair or replacement of assets prior to failing. PG&E has undertaken efforts to develop risk-informed models that prioritize preventive asset patrol and inspection activity cycles aligned with the risk of wildfire ignition, including increasing the frequency of such preventive tasks in HFTD Tiers 2 and 3. Note the investments discussed below only address the IT developed data-related capabilities that are geared to support business requirements identified in the WMP.

  As it relates to this value stream, PG&E's long-term technology plan is to continue investment in asset management systems and model development and optimization that will prioritize inspections and

10 See Exhibit (PG&E-4), Ch. 4.3, for more information about Pole Replacement Program.

maintenance work based on risk. It is important to note that the scope described within the projects cited in this section only represents the technology investment required to enable PG&E's long-term plan to integrate the data associated with this program into centralized asset data management systems in support of multi-dimensional model development and optimization that will prioritize inspections and maintenance work based on risk.

One such example is the Pole Loading Assessment Program to Determine Safety Factor.[11] This is a 10-year program that continues the work started in 2020 that focuses on structural desktop review assessments of all poles. Due to the higher risk of potential fire ignition exposure in the HFTD Tier 2 and 3 areas, PG&E's goal for these poles is full implementation of assessments (100 percent poles analyzed) in these areas by 2024. Poles located in PG&E's non-HFTD areas would then follow, with the goal to be fully implemented (100 percent poles analyzed) by 2030.

One key focus of the Asset Management and Risk Analysis value stream is in streamlining the overall data collection, governance, and access for asset related data, ensuring it is fit for use. To this end, there is a tight connection between this value stream and the Data Enablement value stream. PG&E will continue its investment in the Palantir Foundry platform to support data management and access, including providing support for implementing and managing advanced analytics models in support of the digital twin.

Also planned within the Asset Management and Risk Analysis value stream is the development of an enterprise wide remote sensing data platform that will allow for the ingestion, storage, tracking, and access of all imagery (raster, LiDAR, infrared, multispectral, 360-degree spherical, and videos) currently being stored and utilized by various LOBs throughout the Company. By storing and making remote sensing data centrally available, the organization will utilize remote sensing images

[11] See Exhibit (PG&E-4), Ch. 12, for more information about Pole Loading Program.

and derived data to achieve various improvements covered in PG&E's WMP. These improvements include:

- Utilizing data for improved data analytics, vegetation insights, and asset and vegetation inspection;
- Development of asset failure and wildfire ignition risk models, including fire spread models;
- Determining asset conditions through change detection and sharing data with other internal and external systems.

Additionally, the remote sensing platform will be able to provide search and visualization capabilities and ensure organizational alignment with regards to data acquisition, standards, quality assurance, and data access.

b. Event Management

The Event Management value stream focuses on investment in cross-functional technology solutions in support of wildfire response and mitigation efforts. This includes enabling PSPS business processes, and consists of risk identification, event scoping, data sharing with external agencies, field patrol and restoration, and real-time intelligence and reporting. It also covers areas of direct wildfire mitigation and response, including enablement of the Wildfire Safety Operations Center with solutions to monitor PG&E's service territory for wildfire risk and mobilize the organization appropriately in the event of a wildfire through the sharing of intelligence.

The forecast of work is driven by regulatory requirements and evolving commitments defined in separate proceedings—such as the PSPS Order Instituting Rulemaking and WMP—identified post-event improvement opportunities, and feedback from Public Safety Partners.

The Event Management value stream consists of two key areas of technology investment, PSPS Event Management and Wildfire Event Management. Each of these is described below, with the capabilities PG&E expects to enable as well as the business outcomes it intends to achieve.

PSPS is evolving continuously through feedback from customers, its partners, regulators, and stakeholders within PG&E and these learnings

result in new and emerging requirements for execution. PSPS Event Management will enable the following business capabilities:

- Enable PSPS event scoping to include unmitigated Priority 1/ Priority 2 trees and select distribution electric compliance tags and to provide intelligence to prioritize immediate mitigation of these items to minimize scope;
- Enable PSPS event scoping to incorporate PSPS mitigations—such as system hardening—so that areas can be removed from scope if conditions are safe to do so;
- Increase PSPS event scoping agility, through direct integration between systems, including PSPS Viewer, the PSPS Situational Intelligence Platform and meteorology systems;
- Increase PSPS event scoping coordination through inclusion of PSPS meteorology polygons into the Distribution Management System (DMS) map, improving validation of switching scope and the identification of opportunities to reduce customer impact through switching;
- Expand the scope and improve usability of the PSPS Situation Report and the PSPS Portal to support Public Safety Partners;
- Expand PSPS maps for Public Safety Partners with the addition of PDF maps for Tribal entities
- Continue automation and incorporation of additional data sources to improve post-PSPS event reporting required by the California Public Utilities Commission and which supports improvement actions;
- Provide tools that allow for improved restoration speed by enabling forecast and automation of Weather All-Clear status from spatial meteorological forecast to the electric system;
- Partner with cybersecurity to enable mutual aid and contractors to utilize PSPS patrol technology solutions, currently limited to employees, to increase efficiency, and improve consistency of patrols occurring during PSPS restoration;
- Enable the electronic assignment of PSPS patrol scope and capture of PSPS patrol results to improve execution efficiency and record accuracy;

- Begin integration of the PSPS tools and processes with the new Advanced Distribution Management System platform, allowing for the utilization of capabilities such as automated switching plan generation that can save operator time in comparison to the manual switching log process in place today;
- Improve tools used during PSPS events to support situations where other concurrent major hazards may also occur; and
- Deploy public PSPS risk map that provides data for customers and public safety partners to understand future PSPS risk through views of historic PSPS impact and forecasted future PSPS risk.

The second key area of technology investment within the Event Management Value stream is Wildfire Event Management. Wildfire Event Management will enable the following business capabilities:

- Improve the stability and scalability of the Wildfire Incident Viewer (WIV) and Safety and Infrastructure Protection Teams (SIPT) Viewer to support an expanding user base and increasing data streams;
- Expand the Wildfire Active Incidents Dashboard to additional users to increase wildfire situational awareness across PG&E;
- Incorporate new data sources into the WIV, SIPT Viewer, and Active Incident Dashboard to improve situational awareness and response;
- Mature intelligence and situational awareness for large active wildfire response with real-time common operating picture and internal and external Situation Report; and
- Enable integration of wildfire situational awareness data sources into other operations tools—such as the DMS and Maps+—to increase response capability.

c. Data Enablement

Data Enablement is defined as designing, maintaining, hosting, and upgrading a technology platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.

The Data Enablement value stream focuses on investments in foundational technology solutions in support of wildfire mitigation efforts

by focusing on foundational data management activities that will help drive risk reduction and directly supports the 2021 WMP.[12]

PG&E is in the process of implementing and operationalizing a data analytics environment that integrates asset-related information from disparate data sources into a single platform, enabling data-driven approaches to wildfire risk mitigation. To enable and sustain value from this environment, PG&E is also implementing enterprise data management practices. To do this effectively, it is necessary to adopt a practical data integration approach that utilizes data pipelines from source data systems into an integrated data platform. This approach, combined with an effective data management practice, enables access to timely, trusted, and consistent information that can be used for advanced data analytics, thereby enabling the Company to make more effective, data-driven decisions.

Data streams from new technologies, such as remote sensing and LiDAR, introduce emerging data needs for high capacity storage and processing, while advanced analytics—including AI and Machine Learning (ML)—offer the potential to leverage data to better manage risk and predict events before they happen. PG&E is responding to these challenges by developing and implementing strategies for more effective data management, integration, and access.

EO is working with Enterprise Data Management to develop long-term plan milestones that will guide PG&E's efforts to continue building its central data platform, data products and data management capabilities to improve asset and wildfire risk management capabilities through efficient and effective data-driven decision making. Below are several data enablement initiatives PG&E is evaluating for 2021 and beyond.

- Data Schema – In 2021, PG&E will evaluate and decide whether to develop and implement a central data schema for EO to be built on the Common Information Model, developed by the International

[12] See PG&E's Revised 2021 WMP, pp. 774 to 786 (Section 7.3.7, Data Governance, and subsection 7.3.7.1, Centralized Repository for Data).

Electrotechnical Commission, in alignment with the Wildfire Safety Division GIS data schema. Conceptually, this model would align asset, operational, maintenance and other data to PG&E's assets and operations, creating a "digital twin" of the utility that would directly support wildfire mitigation efforts. If PG&E determines that this work should be undertaken, implementation would be a multi-year effort.

- Data Management – PG&E has embarked on an effort to mature its data management capabilities, which will ultimately enhance the Company's abilities to make effective data-driven decisions around wildfire mitigation. Consistent with the Data Management Framework, PG&E will continue to advance its data management maturity using a phased approach, with the focus for the next 2-3 years on Data Architecture, Data Governance, Data Quality and Data Security in direct support of wildfire mitigation efforts. This will entail the development and implementation of new standards, processes, and tools to support the maturation of data management and advanced analytics practices.

d. Field Work Management

This value stream focuses on investments in cross-functional software products that are necessary to increase the efficiency and quality of field activities (such as asset inspections) and enable alignment of work management processes and tools in support of Wildfire mitigation efforts.

The Field Work Management value stream focuses on technology solutions used to plan and execute field work safely and efficiently, to document performed work completely and accurately, and to manage the flow of information between field crews and the back-office. Planned technology project investments in this value stream will build and support technology capability needs shared across LOBs in support of Wildfire Operations. The area of focus is work management technology capabilities for field and back-office personnel to better perform wildfire operational activities. This effort includes:

- Improving technology for SIPTs by enhancing work management systems to assign, execute, and approve work through technology. This will improve the efficiency of system hardening efforts to protect assets against changing conditions;
- Creating an electronic process to facilitate “door-knock” communication with customers during PSPS events to improve customer relations;
- Providing features in which field crews can electronically report fire damage to assets to increase visibility and analysis of assets after fires;
- Enhancing the aerial inspection process (drone and helicopter) for greater visibility into asset health;
- Creating a solution for the capture of electric substation infrared inspections to find unseen issues within electric substations;
- Modernizing the current technology platform to allow legacy systems to be replaced and/or enhanced in order to meet growing demands for technology that will improve efficiencies of field personnel and reduce risk of asset failure;
- Migrating the current IT infrastructure to the Cloud to provide improved system scaling in order to support additional business capabilities and data streams that are enabled;
- Implementing necessary security controls to ensure compliance with cybersecurity requirements;
- Support of regulatory reporting requirements, as well as those from external agencies;
- Investing in system logging and monitoring to ensure a secure, healthy, and efficient IT work process by providing automated and manual system checkpoints for service quality assurance;
- Data clean-up and archival to allow for more data points to be analyzed consistently to form high-fidelity risk models with improved accuracy;
- AI and ML to be used to generate risk scores based on information gathered by preventative maintenance personnel. These models will drive future maintenance plans/schedules; and

- Computer vision models that will enable operations personnel to detect components, leading indicators for potential asset failure, and asset failures in images to may not easily been seen without aid.

e. Customer Service

The Customer Service value stream focuses on investments that provide customer management and self-service tools in support of Wildfire mitigation efforts. Ensuring that website, self-service and notifications continue to meet customer needs is critical to improving the customer experience as it relates to wildfire and PSPS.

In order to keep up with changing conditions and increasing customer expectations, continuous improvement is standard in modern website design. Through feedback and learning, PG&E has been enabling new or improved functionality to address customer pain points.

The PG&E Safety and Alert Center website, also known as Emergency Web, currently used for PSPS events is one such an example. In 2020, substantial improvements were made to PG&E's web experience for wildfire and PSPS, including the development of a new standalone site in the cloud that can scale to handle high traffic, rebuilt maps, and address search tools to improve functionality and making available tools and information to customers speaking languages other than English. The site was also designed with accessibility in mind to ensure those with vision impairments and other needs could get essential safety information.

Since the launch of the new site in 2020, feedback has been positive, but customers have also identified opportunities for improvement. PG&E collects customer feedback through a variety of channels, including the web, contact centers and surveys, and analyzes customer comments for improvement opportunities. For example, customers provided feedback that the zoom level on the maps was too close by default, so PG&E tested an improved zoom level with customers and is working to implement updates based on that finding. PG&E will also be working to improve map functionality, such as the ability to search by city or county in addition to customer address, as well as improving the layout for mobile phone users on smaller screens.

Additionally, in response to feedback that customers wanted greater advance notice of PSPS shutoffs and that the information on pge.com/weather was sometimes different than what was on the primary outage map, PG&E will be moving the 7-day forecast out of pge.com/weather and into the primary outage map. This will help enable more customers see the 7-day forecast, ensure the information is consolidated in one location, and translate the 7-day forecast to the address search functionality customers use most often.

In addition to making improvements to the website, PG&E will also focus on improving its internal operations. This includes optimization efforts to make it easier to publish content to the PSPS website in 16 different languages and to load data simultaneously. These improvements will help shorten execution times, allowing the Company to get critical information to its customers more quickly once de-energization or energization decisions have been made.

PG&E also intends to enable a capability to provide customers with a way to obtain PSPS-related outage updates by sending an SMS text to PG&E. This capability would benefit lower bandwidth customers who may not have sufficient cell coverage to make calls during a PSPS-related event. Another capability includes developing a PSPS chatbot on the PG&E Safety and Alert Center website to be used during PSPS events to help answer the top questions being asked by customers. PG&E is also exploring the appeal of a mobile app for PSPS events to help improve the customer experience.

PG&E maintains a queue of potential improvements that has been developed based on customer feedback and is continuously prioritizing that queue based on additional customer feedback to ensure it is delivering on those items that customers find most valuable.

D. Estimating Method

PG&E discusses its standard estimating methods for technology project investments in Exhibit (PG&E-7), Chapter 8. Historical spend patterns, subject matter expertise, and standard cost factors serve as primary inputs to the IT estimating tools used in this chapter to calculate labor and non-labor costs and document associated assumptions. Forecasts are sequenced to fit within

high-level annual planning targets set by IT and Company leadership to align with strategic priorities. Refer to Project and Program Summary workpapers supporting this chapter for more information on the specific estimating methods used in this chapter.

E. Cost Tables

The expense and capital forecasts for this chapter are summarized in the following tables:

- Table 4.5-2 lists expense MWCs showing 2016 through 2020 recorded adjusted expenses and 2021 through 2023 forecast expenses.
- Table 4.5-3 lists the capital MWC 2F showing 2016 through 2020 recorded capital adjusted expenditures and 2021 through 2026 forecast expenditures.

TABLE 4.5-2
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021[(a)]	2022	2023	Workpaper Reference
1	AB	Misc Expense	–	–	–	–	$5,500	–	–	–	WP 4-5, line 9
2	IG	Manage Var Bal Acct Processes	–	–	$1,102	$5,955	21,358	$35,700	$35,700	$35,700	WP 4-5, line 17
3	JV	Maintain IT Apps & Infra	–	–	(34)	–	–		–	–	WP 4-5, line 20
4		Total	–	–	$1,069	$5,955	$26,858	$35,700	$35,700	$35,700	

(a) Values vary from the values listed in the Results of Operations (RO) Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

TABLE 4.5-3
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021[(a)]	2022	2023	2024	2025	2026	Workpaper Reference
1	2F	Build IT Apps & Infra	–	–	$6,125	$18,349	$22,658	25,300	$25,300	$25,300	$25,300	$25,300	$25,300	WP 4-33, line 7
2		Total	–	–	$6,125	$18,349	$22,658	$25,300	$25,300	$25,300	$25,300	$25,300	$25,300	

(a) Values vary from the values listed in the RO Model due to errata. These amounts do not align to the RO Model provided to the Public Advocates Office at the time of filing. The RO will be updated to incorporate these errata with the Joint Comparison Exhibit submittal.

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 4.6

ENHANCED POWERLINE SAFETY SETTINGS

[FEBRUARY 25, 2022 SUPPLEMENTAL TESTIMONY]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.6
ENHANCED POWERLINE SAFETY SETTINGS

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 4.6
ENHANCED POWERLINE SAFETY SETTINGS

A. Introduction

1. Scope, Purpose, and Support for this Request

The purpose of this chapter is to demonstrate that Pacific Gas and Electric Company's (PG&E) expense forecast for its Enhanced Powerline Safety Settings (EPSS) program is reasonable and should be approved. This chapter describes the components of the EPSS program, which is a new wildfire mitigation.

The EPSS program was not part of PG&E's June 30, 2021 General Rate Case (GRC) testimony. The program is included in this February 25, 2022 GRC update pursuant to the Assigned Commissioner's directive to:

> "serve testimony to seek approval for any revisions to the forecasted expenditures for undergrounding programs that fall within the timeframe covered by this proceeding, including the extent to which the expenditure forecasts for its other wildfire mitigation programs should be revised, along with an explanation of how those forecasted expenditures are consistent with PG&E's 2022 Wildfire Mitigation Plan."[1]

EPSS is a critical element of PG&E's wildfire mitigation program.[2] The purpose of the EPSS program is to reduce wildfire risk by minimizing the probability of an ignition event when a fault occurs on an electric distribution line in high fire-risk areas during periods of elevated fuels and weather-related wildfire risk. EPSS achieves this by increasing the sensitivity and speed of system protective devices on circuits in High Fire Threat District (HFTD) and High Fire Risk Area (HFRA) areas (and select circuits adjacent to those areas) so that if an object contacts a distribution line power is automatically shut off within one-tenth of a second, reducing

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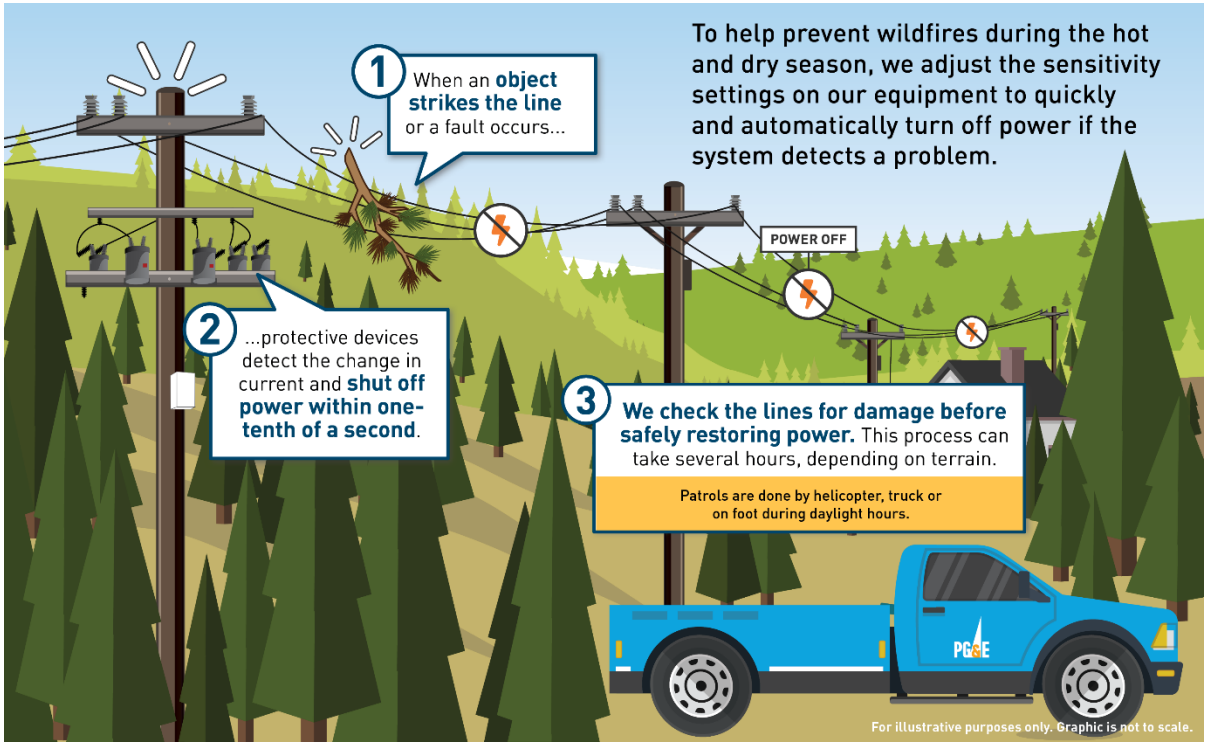
1 Assigned Commissioner's Scoping Memo and Ruling, filed October 1, 2021, in A.21-06-021, pp. 7-8.

2 The EPSS program discussed here is consistent with the EPSS mitigation discussed in PG&E's 2022 Wildfire Mitigation Plan (WMP). See 2022 WMP, Section 7.3.6.8. The 2022 WMP is the first time PG&E has presented the EPSS program in a WMP.

the potential for an ignition.[3] PG&E envisions EPSS as part of an integrated wildfire risk mitigation solution that will protect against vegetation caused and other ignitions while undergrounding work progresses and as the scope of Enhanced Vegetation Management is reduced. Figure 4.6-1 below shows how EPSS works:

FIGURE 4.6-1
EPSS OVERVIEW



While the increased sensitivity of protective devices reduces the flow of current when a fault occurs on circuits where EPSS settings have been activated, and thus reduces the likelihood of ignitions, it can also result in power outages that impact more customers and take longer to restore than when EPSS protective devices are in normal settings. For this reason, PG&E's EPSS forecast includes not only the cost of programming and testing devices to enable EPSS, but also costs related to mitigating the consequences of EPSS outages. To mitigate the impact of EPSS-caused

[3] 2022 WMP, Section 7.3.6.8.

outages, PG&E is proposing additional resources for more extensive post-outage patrols to ensure that the system can be safely and more efficiently reenergized after an outage on an EPSS-enabled circuit. PG&E is also proposing additional customer support including customer notifications, outreach, and funding for both temporary and permanent backup power in areas that will be significantly impacted by EPSS outages.

2. Summary of Request

PG&E requests that the Commission adopt its 2023 EPSS expense forecast of $151.1 million, and subsequent year forecasts of $146.3 million in 2024, $140.8 million in 2025, and $133.7 million in 2026. PG&E's preliminary 2021 recorded cost for EPSS was $18.2 million and its 2022 expense forecast for EPSS is $148.9 million.[4]

The expense forecast is primarily driven by the expansion of the current EPSS program to all circuits within both HFTD and HFRA areas and some circuits within non-HFTD buffer zones. There were no recorded expenses in 2020 for the EPSS program because it is a new program. PG&E's forecast for EPSS decreases each year after 2023 due to expected reductions in the scope of post-outage patrols. The reductions in the outer year forecasts relative to 2023 are: $4.8 million in 2024, $10.3 million in 2025, and $17.4 million in 2026. Attrition adjustment policies and mechanics are addressed in Exhibit (PG&E-11), Chapters 1 and 2.

PG&E anticipates that the EPSS program will require some capital investment but has not yet determined whether (or to what extent) EPSS-related work will require funding beyond the base capital forecast presented in PG&E's June 30, 2021 GRC testimony. Therefore, PG&E is not including a capital forecast for EPSS here. To the extent PG&E's capital needs for certain EPSS-related activities exceed its base forecast for those activities, PG&E proposes to seek recovery of incremental costs through the Wildfire Mitigation Balancing Account (WMBA).

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[4] PG&E will seek cost recovery of its 2021 and 2022 expenses for EPSS on a recorded basis as part of the Fire Risk Mitigation Memorandum Account and/or the Wildfire Mitigation Plan Memorandum Account. PG&E's preliminary 2021 recorded and current forecast of 2022 EPSS expenses is provided here for context.

Forecasts in this chapter are shown at the Major Work Category (MWC) level, and escalation is included in all expense totals. For more information on escalation, please refer to Chapter 2 of this exhibit. PG&E's forecasts for EPSS work in this chapter are incremental to the forecasts for the same MWCs in PG&E's June 30, 2021 testimony, as those previously presented forecasts are for different work than the EPSS work forecast here.

3. Overview of Recorded and Forecast Costs

EPSS program costs consist of: activities directly associated with the engineering and programming of settings on distribution line protective devices to increase the sensitivity to reduce the risk of an ignition from overhead powerline faults; the outreach and education to, and support programs for, customers residing on the circuits where EPSS will be enabled; the operational requirements of enabling devices and conducting patrol activities following outages; and establishing a Program Management Office to provide planning and operational control and governance of the program.

Expenditures for the activities described herein are divided into five expense MWCs, listed in Table 4.6-1 below.

TABLE 4.6-1
ENHANCED POWERLINE SAFETY SETTINGS MWCS

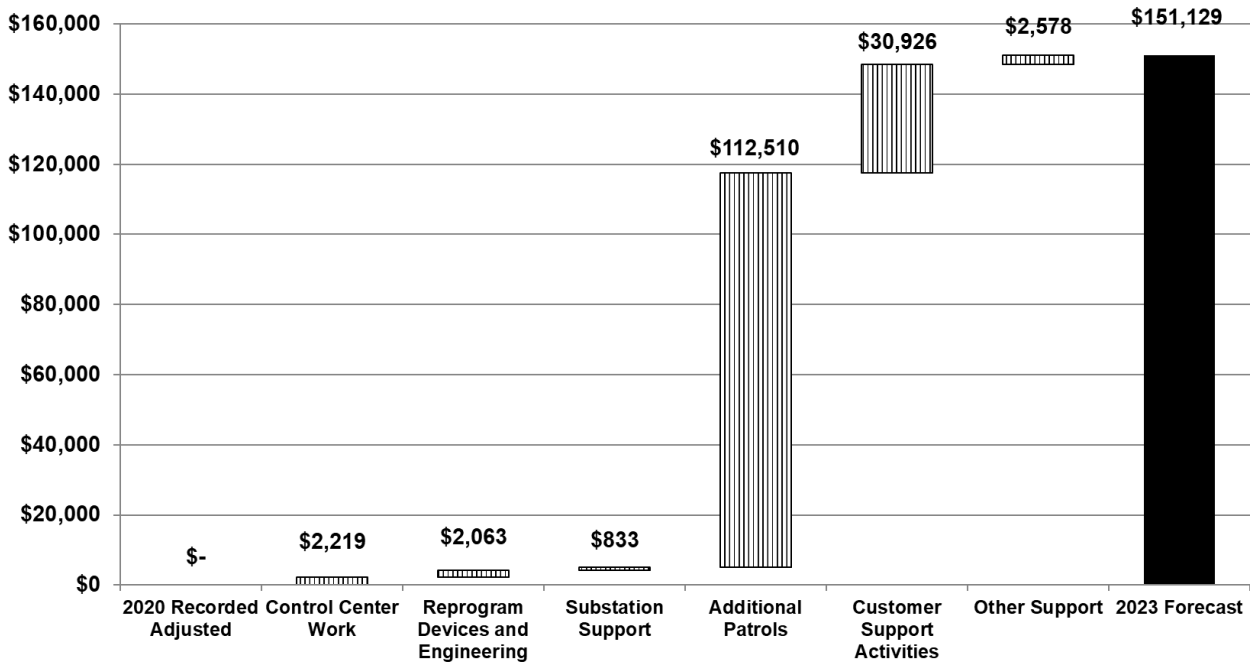
Line No.	MWCs Expense	Description
1	BA	Electric Distribution Operate System
2	BH	Electric Distribution Routine Emergency
3	FZ	Electric Distribution Planning and Operations Engineering
4	GC	Electric Distribution Substation O&M
5	IG	Manage Various Balancing Account Processes

a. Expense

PG&E organizes expense forecasts and recorded costs for the EPSS program into six main categories of work: (1) Control Center Work (MWC BA), (2) Reprogram Devices and Engineering (MWC FZ), (3) Substation Support (MWC GC), (4) Additional Patrols (MWC BH), (5) Customer Support Activities (MWC IG), and (6) Other Program Support (MWC IG).

Figure 4.6-2 shows the expense walk from 2020 recorded to the 2023 forecast for these activities. There were no recorded expenses in 2020 for these activities because EPSS is a new program. The largest driver of the 2023 expense forecast is the additional patrols required for the expansion of the current EPSS program to all circuits within both HFTD and HFRA areas and some circuits within non-HFTD buffer zones, as well as implementation of the Customer Support activities.

FIGURE 4.6-2
EXPENSE WALK BY MWC 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



b. Capital

For the reasons discussed in Section C.1.b below, PG&E is not presenting a capital forecast for EPSS at this time.

B. Program and Risk Overview

1. Program Overview

PG&E launched the EPSS program in late July 2021. PG&E created this program in response to the historic drought and associated fuel conditions to mitigate the risk of an ignition event that could occur when

there is a fault that throws off sparks from overhead electric lines. These incidents occur when vegetation contacts distribution lines and structures; when small animals and birds touch or traverse the lines and structures; and/or when a component fails on the circuit.

The theory behind the EPSS program is simple: when there is a fault on the electric distribution system, the magnitude of current can be reduced by adjusting system protective devices (line reclosers and substation circuit breaker protective relays) to lower the trip settings, which makes the devices more sensitive and able to react to a fault more quickly. PG&E refers to these settings adjustments as Fast Trip Settings (FTS). When these more sensitive FTS are enabled, they provide an additional layer of protection against ignitions when weather or other conditions create a heightened risk of an ignition becoming a large wildfire. By enabling more sensitive trip settings, lines will be de-energized when the relays react to a fault condition; thus, the amount of energy that gets converted into sparks is reduced.

In 2021, PG&E enabled approximately 11,500 HFTD circuit miles across 170 circuits to operate in EPSS mode. This comprised 45 percent of the circuit miles in HFTD areas. These circuits were identified by PG&E's Public Safety Specialist team, who have extensive public safety and fire-fighting experience, in collaboration with Division Superintendents, local District Storm room personnel, Electric Operations Maintenance & Construction, Restoration, Compliance, Meteorology staff and Vegetation Management personnel, with considerations of historical fire and weather data, terrain, potential ignition fuel, and ingress and egress factors.

In July 2021, when EPSS was first established as an urgent wildfire mitigation strategy, devices were adjusted to Hot Line Tag mode to allow for immediate enablement of EPSS. In September 2021, PG&E began optimizing settings for protective devices on both line reclosers and substation circuit breakers to allow for improved coordination amongst the protective devices to reduce the number of customers impacted by EPSS-related outages. These optimized settings are referred to as FTS.

Since its inception to date, the EPSS program has had a dramatic impact on wildfire safety. After EPSS was implemented, ignitions from electrical equipment were approximately 80 percent lower (compared to a

three-year average) in HFRA/HFTD areas on EPSS-enabled circuits and approximately 40 percent lower in HFTD areas overall.[5] During the 2023 GRC period, PG&E anticipates that EPSS will continue to evolve as we gain additional experience with the program, including the opportunity to further optimize device settings to improve customer reliability based on operating experience.

In 2022, PG&E will expand the program to enable EPSS mode in most HFTD and HFRA areas and select circuits in buffer zones immediately adjacent to those areas. All circuits in HFTD and HFRA areas, as well as a limited number of circuits in non-HFTD buffer zone areas have been risk ranked based on the overall wildfire consequence of an ignition occurring on that circuit and forecasted timing of meeting EPSS enablement criteria. Programming of EPSS settings into the protection devices along these circuits will be prioritized based on this risk ranking. Once the devices are programmed, they will be capable of being enabled into EPSS mode. The EPSS program is expected to continue through the 2023 GRC period due to the continuing presence of high fire risk conditions.

The increased sensitivity to faults of EPSS-enabled circuits reduces the likelihood of ignitions, but also can lead to power outages that impact more customers and take longer to restore than when protective devices are in normal settings. PG&E's EPSS forecast includes funding for activities that respond to and/or decrease the effect of outages on EPSS-enabled circuits. For example, PG&E's forecast funds post-outage patrols on EPSS circuits to ensure that the system is safe and power is restored to customers as quickly as possible. The forecast also includes funding for various customer support activities including: outreach and education initiatives to help prepare customers for outages on EPSS-enabled circuits; increased advertising and customer notifications to raise awareness of EPSS and alert customers to EPSS outages; and programs to provide and/or subsidize temporary or permanent backup power to vulnerable residential customers (such as Medical Baseline (MBL) customers) and critical facilities such as

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5 See PG&E's November 24, 2021 response to TURN data request 053, question 3 (GRC-2023-Ph_DR_TURN_053-Q03).

schools in areas likely to experience a significant number of EPSS-related outages.

2. Risk Integration

Chapter 3 of this exhibit describes how Electric Operations (EO) uses the Enterprise and Operational Risk Management program to manage electric system risks. In Chapter 3 of this exhibit PG&E describes how management of the Wildfire risk has changed since the filing of the 2020 Risk Assessment and Mitigation Phase (RAMP) Report; provides updated Risk Spend Efficiency (RSE) scores; and lists each mitigation and control and indicates if it has changed since the 2020 RAMP Report filing. In this chapter, PG&E provides more information about the EPSS mitigation and the work needed to implement it.

Table 4.6-2 below shows the EO risk associated with the forecasts discussed in this chapter.

TABLE 4.6-2
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	MATs
1	Wildfire	WLDFR	RAMP	BAF, BAH, FZA, FZE, GC2, BHE, IG#

a. RAMP Risk – Wildfire

1) Risk Overview

The Wildfire risk is defined as PG&E assets or activities may initiate a fire that is not easily contained and endangers the public, private property, sensitive lands, or environment. Wildfire was one of PG&E's 2020 RAMP risks.[6]

2) GRC Risk Mitigations

As shown in the table below, PG&E is forecasting one mitigation related to work forecast in this chapter. The EPSS program was

[6] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 10.

determined to reduce the frequency or consequences of wildfires. A brief description of this mitigation is provided in Table 4.6 3 below.

TABLE 4.6-3
WILDFIRE
FORECAST MITIGATION

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	WLDFR-M020	EPSS	EPSS consists of adjusting PG&E's overhead powerline protective device settings to be more sensitive, thereby reducing the risk of an ignition from overhead powerline faults.	All Drivers	See Sections C.1 and C.2 for more information.	BAF, BAH, FZA, FZE, GC2, BHE, IG#

3) Changes to Mitigations

EPSS is a new mitigation as of the February 25, 2022 update filing and it was not included in either PG&E's 2020 RAMP Report or in the June 30, 2021 GRC filing.

EPSS (WLDFR-M020): EPSS consists of adjusting PG&E's substation and overhead powerline protective device settings to be more sensitive, thereby reducing the risk of an ignition from overhead powerline faults. PG&E uses a special protection feature in existing field protective devices that trips almost instantaneously for any fault condition, such as damage to the system, animal contact or equipment malfunction. PG&E optimizes settings for the protective devices on both line reclosers and substation circuit breakers to turn off power quickly to reduce the risk of wildfires while reducing the number of customers impacted by an outage.

b. Cost Tables

Table 4.6-4 below shows the forecast costs for this mitigation.[7] Tables showing the GRC forecast costs compared to the costs estimated in the RAMP Report are provided in workpapers.[8]

7 See Exhibit (PG&E-4), WP 3-7, line 30.

8 See Exhibit (PG&E-4), WP 3-20 and 3-21.

TABLE 4.6-4
WILDFIRE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 –EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Recorded Adj.	2021 Recorded	2022 Forecast	2023 Forecast	Total	June 30, 2021 GRC Filing RSE[(a)]	Feb. 25, 2022 GRC Update RSE
1	WLDFR-M020	EPSS	Various	$-	$18,203	$148,921	$151,129	$318,253	N/A	105.7
2		Total		$-	$18,203	$148,921	$151,129	$318,253		

(a) Mitigation not included in June 30, 2021 GRC filing.

C. Activities, Costs, and Forecast Drivers by Risk Mitigation

1. Enhanced Powerline Safety Settings (WLDFR-M020)

a. Expense

PG&E's EPSS expense forecast is $148.9 million in 2022, $151.1 million in 2023, $146.3 million in 2024, $140.8 million in 2025, and $133.7 million in 2026. The forecast is discussed at the MAT Code level below.

1) Control Center Work (MWC BA, MAT BAF and BAH)

Distribution System Operators write, check, and direct switching related to EPSS outages. This work is tracked in MAT BAF. Distribution Operation Engineers provide device setting changes that increase sensitivity and review circuits for EPSS. This work is tracked in MAT BAH. When conditions are present that pose a wildfire risk, Control Center staff are responsible for enabling EPSS mode on those devices and monitoring the system for outages. When outages occur, the Control Center operator must coordinate with field personnel and engineering on the safe patrol and restoration of circuits that experience an outage while in EPSS mode. Patrolling work by field operations is recorded in MWC BH.

PG&E's forecast for MAT BAF work related to EPSS is approximately $1.7 million per year in 2022 and 2023, $1.8 million in 2024, and $1.9 million per year in 2025 and 2026. PG&E's forecast for MAT BAH work related to EPSS is approximately $0.5 million per year from 2022-2026.[9] These forecasts are based on PG&E's 2021 recorded costs and subject matter expert assumptions about the increased amount of work associated with the growth of the number of circuits planned for programming and potential enablement (currently estimated to increase from 170 circuits in 2021 to 988 circuits in 2022).

2) Reprogram Devices and Engineering (MWC FZ, MAT FZA and FZE)

Distribution Engineers within the Asset Planning organization will review the EPSS settings used in 2021 to determine whether they should be used

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9 Note that PG&E's June 30, 2021 testimony contained a forecast for other MWC BA work, unrelated to EPSS. See Exhibit (PG&E-4), Chapter 6. Forecasts in this chapter are incremental to the Ch. 6 forecast.

again in 2022 or whether further optimization is required. Distribution Engineers will also develop optimized settings for EPSS devices that are new in 2022. Further, once this engineering is complete, the Asset Planning engineers will establish protective device settings and coordinate with Control Center personnel on the programming of protective devices. In addition, when a fault occurs on an EPSS-enabled circuit, the engineering team will run fault location analysis to identify the likely fault location to facilitate restoration. Engineering support and programming activities related to EPSS are tracked in MAT FZA. Field circuit setting work related to EPSS is tracked in MAT FZE.

PG&E's forecast for MAT FZA work related to EPSS is $6.2 million in 2022, $2.1 million per year in 2023 and 2024, $2.2 million in 2025, and $2.3 million in 2026. The 2022 forecast for engineering support is based on 2021 costs and an expected increase in work volume associated with the increase in devices that require support from approximately 1,000 in 2021 to more than 4,000 in 2022. The forecast also includes funding for testing, which was not performed in 2021, based on subject matter expert judgment. PG&E's 2023-2026 forecasts are lower than its 2022 forecast because the bulk of initial device programming and testing will be complete and most of the remaining work anticipated will be the fault location analysis described above.

PG&E's forecast for MAT FZE work related to EPSS is $1.0 million in 2022.[10] PG&E anticipates that the EPSS program will also incur some costs in 2023-2026 in MAT FZE for field circuit setting work. However, PG&E has not yet determined the scope of that work or estimated its cost. Therefore, PG&E is not including an expense forecast for MAT FZE for 2023-2026. To the extent PG&E's incurs costs MAT FZE work related to EPSS in 2023-2026, PG&E proposes to seek recovery through the Wildfire Mitigation Balancing Account (WMBA).

10 Note that PG&E's June 30, 2021 testimony contained a forecast for other MAT FZA and MAT FZE work, unrelated to EPSS. See Exhibit (PG&E-4), Chapter 17. Forecasts in this chapter are incremental to the Chapter 17 forecast.

3) Substation Support (MWC GC, MAT GC2)

Some substation circuit breakers with older protective relays cannot be enabled with EPSS until those relays are replaced with modern Integrated Power and Control (IPAC) cabinets. In some of these cases, the circuit breaker must be replaced as well. PG&E's expense forecast for EPSS-related substation work, in MWC GC, covers programming and testing of the newly installed devices so they can be EPSS enabled in addition to adjusting settings on existing equipment.

PG&E's 2022-2026 annual forecast for MAT GC2 work related to EPSS is approximately $0.8 million.[11] This forecast is based on PG&E's 2021 recorded costs and subject matter expert assumptions about the increased amount of work associated with the growth of the number of circuits planned for programming and potential enablement.

4) Additional Patrols (MWC BH, MAT BHE)

When outages occur on PG&E distribution circuits, the portion of the circuit that experienced the outage must be patrolled before power can be restored to customers. A patrol involves a visual examination of applicable overhead facilities to identify obvious structural problems and hazards that may have caused the outage.

When outages occur on EPSS-enabled circuits, the entire circuit downstream from the EPSS-enabled device that operated in response to the fault must be patrolled, including fuses. This contrasts with an outage occurring while devices are configured in normal settings because an outage downstream of a set of fuses would only impact the customers on that fused tap rather than the entire protective zone downstream from an EPSS-enabled device. In other words, the downside of the higher sensitivity of the EPSS-enabled circuits – which reduces wildfire risk – is that outages on EPSS-enabled circuits may impact a larger number of customers and require more extensive post-outage patrols.

The bulk of PG&E's forecast here is for post-outage patrols on EPSS-enabled circuits to ensure the system is safe and to facilitate

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11 Note that PG&E's June 30, 2021 testimony contained a forecast for other MAT GC2 work, unrelated to EPSS. See Exhibit (PG&E-4), Ch. 15. Forecasts in this chapter are incremental to the Ch. 15 forecast.

restoration of the outage as quickly as possible.[12] This will require the deployment of ground and/or aerial assets to provide a full patrol and investigation of the protective zone(s) that experienced the outage. Troublemen perform the bulk of these patrols. The number of outages and size of the zones to be patrolled will drive the specific additional resource requirements for personnel and air assets. Helicopters will be used, when appropriate, to complete patrols and restore power as soon as possible.

PG&E's forecast for MAT BHE work related to EPSS is $109.1 million in 2022, $112.5 in 2023, $106.5 million in 2024, $99.8 million in 2025, and $91.5 million in 2026.[13] PG&E's 2022 and 2023 forecasts are based on PG&E's 2021 recorded costs for post-outage patrols on EPSS-enabled circuits and subject matter expert assumptions about the increased amount of work associated with the growth of the number of circuits planned for programming and potential enablement (currently estimated to increase from 170 circuits in 2021 to 988 circuits in 2022). PG&E's 2024-2026 forecasts include a progressive downward adjustment from the 2023 forecast, based on the assumption that further optimization of EPSS settings and learnings from patrols in 2022 and 2023 will result in cost reductions as the program matures, in addition to undergrounding activities.

5) Customer Support Activities (MWC IG, MAT IG#)

PG&E will engage in several types of activities to support customers who may experience more frequent and/or longer outages as a result of the implementation of EPSS. These activities, described further below, will include increased customer outreach and education in areas likely to be impacted by EPSS; increased marketing and communications around EPSS; and deployment of resiliency and support programs to provide better

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12 Restoration work after an outage is performed as part of Routine Emergency, discussed in Exhibit (PG&E-4), Chapter 6.

13 Note that PG&E's June 30, 2021 testimony contained a forecast for other MAT BHE work, unrelated to EPSS. See Exhibit (PG&E-4), Ch. 6. At the time of this update submission, PG&E is still in the process of confirming that there is no overlap in forecast assumptions between the MAT BHE work presented in PG&E's June 30, 2021 testimony and the EPSS-related MAT BHE work discussed here. PG&E expects to conclude this analysis by the end of March 2022. To the extent PG&E finds any overlap, it will adjust for any duplication of forecast assumptions through a future errata submission.

support to key customers and stakeholders to minimize the impact of EPSS outages.

PG&E's forecast for the Customer Care MAT IG# work related to EPSS is $27.2 million in 2022, and approximately $31.0 million per year from 2023-2026.[14] The forecast is based on subject matter expert judgment informed by the historical costs for other, similar initiatives including PSPS.[15]

a) Customer Outreach and Education

PG&E's forecast includes funding for outreach and education initiatives to help prepare customers for outages on EPSS-enabled circuits outages. Examples of initiatives that PG&E is currently considering include:

- Partnering with our Community Based Organizations (CBOs) on customer outreach and education efforts focused on emergency preparedness.
- Continuing our partnership with 211, a free, confidential calling and texting service available to support PG&E customers 24/7. 211 is available to connect individuals with local social services specific to their community.
- Improving the notifications that we provide to customers during outages, with more accurate information about when they can expect power to be restored.
- Refining our EPSS-dedicated web page with additional information and resources. (pge.com/epss)
- Encouraging customers in high fire-risk areas who are reliant on power for medical or independent living needs to contact their local Disaster Access and Resource Center or

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14 Note that PG&E's June 30, 2021 testimony contained a forecast for other Customer Support Activities in MWC IG work, unrelated to EPSS. PG&E's forecast here is incremental to the previous forecast because EPSS is a new program.

15 PG&E is presenting these Customer Care costs in the Electric Distribution exhibit as part of the EPSS program description. These costs will be moved to Exhibit (PG&E-6) as part of the Joint Comparison Exhibit.

disabilitydisasteraccess.org for assistance with emergency planning and resources.

These initiatives may be modified, and additional initiatives added, as the program progresses.

b) Communications and Marketing

To help improve PG&E's communications to all potentially impacted customers, both before and during outages, our activities will include:

- Increasing our communications to impacted customers, including via email and direct mail.
- Increasing our social media and local media outreach efforts to grow awareness, including posts on social media sites Nextdoor and Facebook.
- Using paid advertising on local radio and social feeds.

These initiatives may be modified, and additional initiatives added, as the program progresses.

c) Customer Resiliency and Support Programs

PG&E is planning to implement three customer resiliency programs for customers impacted by EPSS. Some of these programs are expanded versions of programs that were originally designed for customers in areas impacted by PSPS events.

For example, PG&E offers a Generator and Battery Rebate program. This program provides rebates to MBL, well pump, and essential small business customers located in Tiers 2 or 3 HFTD areas to purchase generators and/or battery storage for use in the event of an outage. Eligible California Alternative Rates for Energy and/or Federal Electric Rates Assistance customers receive an additional $200 rebate. Rebates cannot exceed the price of the product.

Further, to help mitigate the impacts of outages on K-12 schools in areas impacted by EPSS outages PG&E will seek to establish temporary generation solutions that will include interconnection (Automatic Transfer Switches) and either Tier 4 Diesel Generation or Battery Energy Storage Systems for the schools that are forecasted to be most heavily impacted by EPSS-related outages.

Finally, PG&E plans to introduce a new permanent backup power offering, the Fixed Power Solutions (FPS) pilot program, for our most vulnerable customers, critical facilities, and schools. PG&E will provide financial incentives to residential customers that help reduce the cost of permanent solar and storage installations. PG&E plans to focus the residential FPS offering on MBL, low-income, rental, and other customers located in HFTD areas who face financial barriers to installing expensive permanent backup power solutions. The non-residential portion of the FPS pilot will offer technical assistance and financial incentives to help reduce the cost of equipment installations, which will help reduce the number of critical facilities and schools that are negatively impacted by EPSS.

Table 4.6-5 below shows a breakdown of the MWC IG Customer Support Activities forecast into the categories described above.

TABLE 4.6-5
CUSTOMER SUPPORT ACTIVITIES (MWC IG, MAT IG#)
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Customer Support Activities (MWC IG, MAT IG#)	2020 Recorded Adjusted	2021 Recorded	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
1	Customer Outreach and Education (includes customer notifications, website updates, CBO partnerships, and resiliency and support programs outreach)	$-	$492	$5,110	$5,270	$5,431	$5,594	$5,759
2	Customer Communications and Marketing (includes mass marketing campaigns, social and other media outreach)	-	-	7,100	6,188	6,377	6,568	6,762
3	Customer Resiliency and Support Programs	-	7	14,987	19,468	20,063	20,664	21,273
3a	Generator and Battery Rebate Program	-	-	1,200	1,238	1,275	1,314	1,352
3b	Temporary Generation	-	7	6,009	6,197	6,387	6,578	6,772
3c	FPS Pilot Program	-	-	7,778	12,033	12,401	12,772	13,149
4	Total Customer Support Activities (MWC IG, MAT IG#)	$-	$499	$27,197	$30,926	$31,872	$32,825	$33,793

Sum of Lines 1, 2, and 3.

6) Other Program Support (MWC IG, MAT IG#)

In 2022, PG&E plans to establish a Project Management Office (PMO) to oversee all planning and operations associated with EPSS. This will

include development of device engineering and programming workplans, development of associated Standards and Procedures documentation, development of Common Operating Picture virtual dashboard to track progress of all EPSS program workstreams, as well as provide leadership and oversight of matrixed programs that are integral to the success of program execution. Once established, the PMO will be ongoing. Expenses related to the PMO will be recorded in MAT IG#.

PG&E's annual 2022-2026 MAT IG# forecast for the PMO is $2.5 million in 2022, and approximately $2.6 million per year from 2023-2026. This is based on an estimate that 14 new, incremental full-time employees will be needed to staff the PMO.

7) Expense Forecast Summary

Table 4.6-6 below summarizes PG&E's EPSS expense forecast by MAT code:

TABLE 4.6-6
EXPENSE BY MAT
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Work Description	MAT Code	2020 Recorded Adjusted	2021 Recorded	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast
1	Control Center	BAF	$0	$2,998	$1,696	$1,749	$1,803	$1,857	$1,911
2	Work	BAH	-	-	456	470	485	499	514
3	Reprogram	FZA	-	1,396	6,189	2,063	2,126	2,189	2,254
4	Devices and Engineering	FZE	-	651	980				
5	Substation Support	GC2	–	–	808	833	859	884	911
6	Additional Patrols	BHE	–	12,658	109,095	112,510	106,502	99,834	91,510
7	Customer Support Activities	IG#	–	499	27,197	30,926	31,872	32,825	33,793
8	Other Program Support (PMO)	IG#	–	3	2,500	2,578	2,657	2,737	2,817
9	Expense Total		$0	$18,203	$148,921	$151,129	$146,302	$140,825	$133,710

b. Capital

PG&E anticipates making some capital investments for the EPSS program. For example, PG&E has identified some substation circuit breakers with older protective relays that will not support full EPSS enablement. PG&E plans to replace these older protective relays with its current standard protective relay

package, called an IPAC cabinet. In some cases, the substation circuit breaker itself will also need to be replaced. PG&E is also evaluating whether to invest in additional sectionalizing equipment (e.g., line reclosers) to facilitate EPSS operations and reduce the impact of EPSS activation on customers. PG&E may identify additional capital needs as the EPSS program expands and evolves.

As of the time of this update submission, the precise scope and extent of PG&E's capital needs related to EPSS have not yet been determined. In addition, as both "base" work and EPSS work are still being planned, it is not clear how much EPSS-related capital work can be funded out of the base forecast presented in PG&E's June 30, 2021 testimony and how much will require incremental funding. Due to these uncertainties, PG&E did not include a capital forecast as part of this testimony update. Instead, to the extent that PG&E's spending on EPSS-related capital work in a particular MAT causes PG&E's spending to exceed the adopted funding for that MAT during the 2023-2026 period, PG&E proposes to seek recovery of those costs through the WMBA.

D. Estimating Method

The estimating methods used to forecast each of the EPSS activities are discussed, along with those activities, in Section C.

E. Cost Tables

Tables 4.6-7 below shows the forecast costs for the EPSS program.

TABLE 4.6-7
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Recorded 2021	Forecast 2022	2023	2024	2025	2026	Workpaper Reference
1	BA	E Dist Operate System	–	–	–	–	–	$2,998	$2,152	$2,219	$2,287	$2,356	$2,425	WP 4-153
2	BH	E Dist Routine Emergency	–	–	–	–	–	$12,658	$109,095	$112,510	$106,502	$99,834	$91,510	WP 4-156
3	FZ	E Dist Planning & Ops Engineer	–	–	–	–	–	$2,046	$7,169	$2,063	$2,126	$2,189	$2,254	WP 4-154
4	GC	E Dist Subst O&M	–	–	–	–	–	–	$808	$833	$859	$884	$911	WP 4-155
5	IG	Manage Var Bal Acct Processes	–	–	–	–	–	$499	$27,197	$30,926	$31,872	$32,825	$33,793	WP 4-157
6	IG	Manage Var Bal Acct Processes (Other Program Support)	–	–	–	–	–	$3	$2,500	$2,578	$2,657	$2,737	$2,817	WP 4-157
7		Total	–	–	–	–	–	$18,203	$148,921	$151,129	$146,302	$140,825	$133,710	WP 4-152

(PG&E-4)

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 5

EMERGENCY PREPAREDNESS AND RESPONSE

[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022]

PACIFIC GAS AND ELECTRIC COMPANY
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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 5
EMERGENCY PREPAREDNESS AND RESPONSE
[INCLUDES ERRATA THROUGH FEBRUARY 25, 2022]

A. Introduction

1. Scope and Purpose

The purpose of this chapter is to demonstrate that Pacific Gas and Electric Company's (PG&E or the Company) expense and capital forecasts for the enterprise Emergency Preparedness and Response (EP&R) organization are reasonable and should be approved.[1]

This chapter forecasts expenditures for preparing PG&E to respond to catastrophic events by having integrated plans, and the appropriate facilities, logistics, technology, and processes in place prior to the event occurring. EP&R advances the Company's response to emergencies by improving governance, strengthening coordination among PG&E's lines of business (LOB), and improving collaboration with external partners such as the Federal Emergency Management Agency and California Governor's Office of Emergency Services. The EP&R department is mainly responsible for emergency preparedness, prevention, response, mitigation, and recovery to respond to all emergency incidents safely, transparently and with a strong sense of urgency. EP&R's strategy focuses on initiatives to ensure the Company remains prepared to respond to these events for the benefit of customers.

2. Summary of Request

PG&E requests that the California Public Utilities Commission (CPUC or Commission) adopt its 2023 expense forecast for EP&R of $26.5 million. PG&E's 2023 forecast is $18.9 million more than 2020 recorded costs of $7.6 million.[2] The increase is primarily due to multiple programs moving

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1 The forecasts described in this chapter do not duplicate the forecasts described in Chapters (Ch.) 4 and 6 of this exhibit. The forecasts in Ch. 4 are for implementing Wildfire Risk Mitigations. The expenditure forecasts in Ch. 6 are for responding to incidents and outages during Routine and Major Emergencies

2 See Exhibit (PG&E-4), WP 5-1, line 3.

from the Wildfire Mitigation Balancing Account (WMBA) to base EP&R work beginning in 2023 and the initiatives described below.

PG&E further requests that the Commission adopt the following capital expenditure forecasts for EP&R: $2.0 million in 2021, $2.0 million in 2022, $5.5 million in 2023, $5.4 million in 2024, $5.5 million in 2025, and $5.6 million in 2026.[3] PG&E's 2023 forecast is $5.0 million more than 2020 recorded capital expenditures of $0.5 million. Similar to expense, the increase is primary due to multiple programs moving from the WMBA to base EP&R work beginning in 2023.

Forecasts in this chapter are shown with escalation at the Major Work Category (MWC) level and included in all expense and capital totals. For more information on escalation, please refer to Chapter 2 "Electric Distribution Forecast and Investment Planning" of this exhibit.

3. Overview of Recorded and Forecast Costs

PG&E uses MWCs to record expenditures for capital and expense for EP&R. EP&R expense costs are recorded in MWC AB, and EP&R capital expenditures are recorded in MWC 21, as shown in Table 5-1 below.

TABLE 5-1
EP&R MWCS

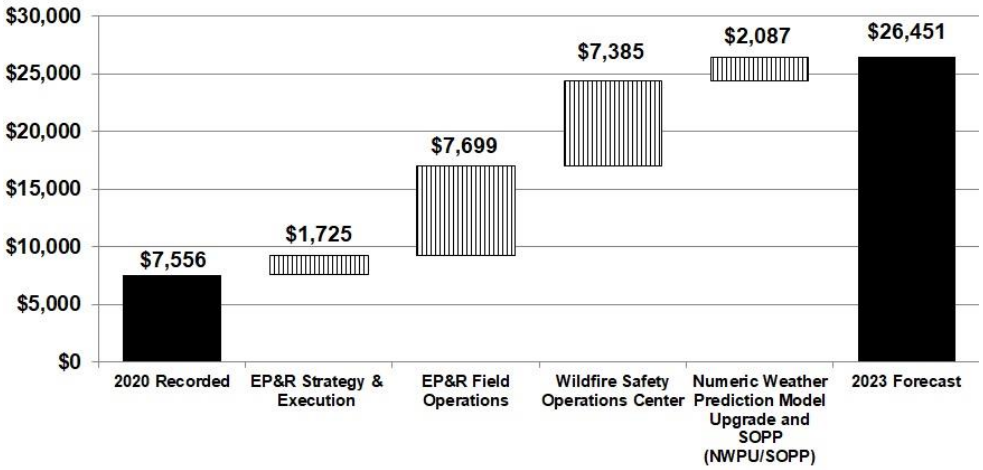
Line No.	MWCs	Description
1	AB	EP&R – Expense
2	21	EP&R – Capital

a. Expense

Figure 5-1 below shows the walk from 2020 recorded adjusted expense amounts to the 2023 forecast.

[3] See Exhibit (PG&E-4), WP 5-6, line 2.

FIGURE 5-1
EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)

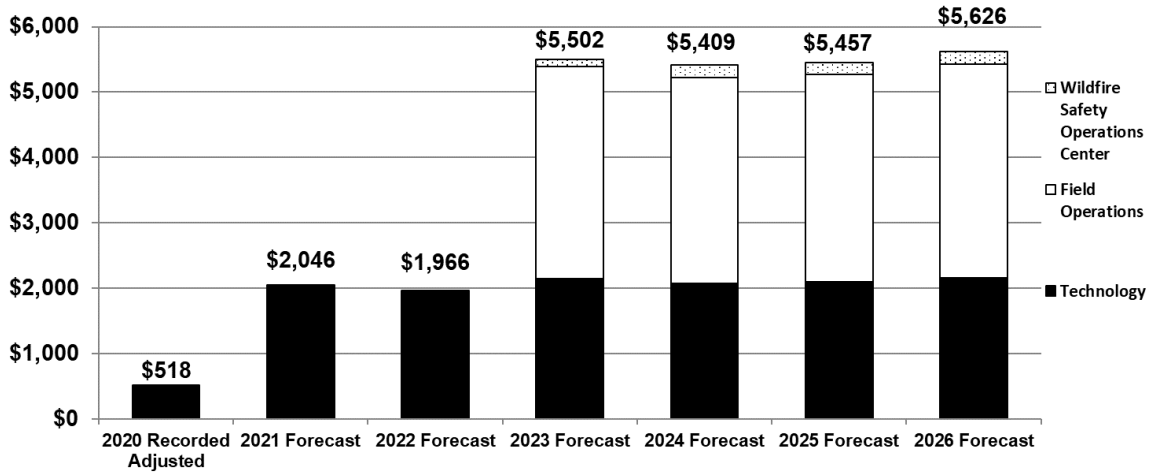


The increase from 2020 recorded to the 2023 forecast is primarily driven by three activities which will no longer be considered wildfire mitigations starting in 2023, and will be moving to wildfire controls. These activities are (1) EP&R Field Operations, which is moving from supporting PSPS events through 2022 as described Chapter 4.2; (2) the Wildfire Safety Operations Center (WSOC), which is expanding from solely monitoring wildfire events as described in Chapter 4.1 to an all-hazards approach; and (3) weather and storm outage prediction models, as described in Chapter 4.1, which will be applicable to all emergencies in addition to wildfires going forward.

b. Capital

Figure 5-2 shows the 2020 recorded adjusted capital expenditures and 2021 to 2026 forecast capital expenditures. Similar to expense, the increase from 2020 recorded to the 2023 forecast is primarily driven by the capital forecast for activities which will no longer be considered wildfire mitigations starting in 2023, and will be moving to wildfire controls: EP&R Field Operations and the WSOC.

FIGURE 5-2
CAPITAL RECORDED AND FORECAST 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



4. Support for Request

Numerous threats from various sources challenge PG&E's ability to provide safe and reliable energy to our customers. Natural hazards affecting our service territory consist of earthquakes, high wind events, wildfires, and various other catastrophic incidents; and can seriously impact PG&E's infrastructure and operations. Other hazards unrelated to nature, such as a physical attack on critical PG&E facilities, cyber-attacks on our digital assets, and unintentional dig-ins on our gas pipelines, also cause significant impacts.

The EP&R organization is PG&E's primary defense against emergent hazards that exceed our extensive resiliency efforts. EP&R has been working with PG&E's LOBs to provide distinct core capabilities that are essential for responding to a catastrophic emergency, including:

- A clearly defined organizational structure for emergency response, with associated secondary roles, staffing plans, operational boundaries, and executive involvement;
- Scalable restoration plans and systems that assist responders with situational awareness;

- Working closely with our Supply Chain and Corporate Real Estate departments to strengthen our logistics and facilities for emergency response;
- Implementation of critical technologies, such as resilient servers and enhanced basecamp communication systems, that enhance our ability to respond and coordinate with our customers and community partners;
- Partnering with our communications groups to develop and disseminate planned proactive communications to our stakeholders;
- Working closely with Human Resources and other groups to train our employees to respond to emergencies and to ensure that appropriate mechanisms are in place to assist employees who are affected by a major disaster; and
- Leading enterprise-wide business continuity efforts, including business impact analysis and the maintenance of business continuity plans. This chapter outlines the need for appropriate maintenance and improvement of these capabilities.

Overall, PG&E's expense and capital forecasts for EP&R are reasonable because they are needed:

- To address any top enterprise risk—a catastrophic emergency incident such as a major earthquake or fire that could affect one or more areas of PG&E's service territory;
- To provide additional fire mitigation actions as precautionary measures to reduce the risk of future wildfire ignitions, including timely detection of wildfires;
- To respond in the event of a global pandemic to coordinate at the highest levels of the company to reduce safety risk and protect critical resources to continue operations;
- To continue developing corporate emergency strategy, preparedness, response, and business continuity policies and procedures for gas, electric, and generation;
- To support compliance with regulation including, General Order (GO) 166; Standards for Operation, Reliability, and Safety During Emergencies and Disasters, GO 112F; State of California Rules

Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems and

- To undertake key technology projects that support PG&E's emergency preparedness to improve public and system safety, employee safety, reliability, and work efficiency.

5. Organization of the Remainder of This Chapter

The remainder of this chapter is organized as follows:

- Section B – Program and Risk Overview
- Section C – Activities, Costs, and Forecast Drivers by MWC
- Section D – Estimating Methods
- Section E – Compliance with Section 5.2 of the 2020 General Rate Case (GRC) Settlement Agreement ("Deferred Work Principles")
- Section F – Cost Tables

B. Program and Risk Overview

1. Program Description

a. Program Overview

The EP&R department is responsible for PG&E's emergency preparedness, prevention, response, mitigation, and recovery activities for addressing all emergent hazard events. Since the 2020 GRC, the expanded EP&R department consists of five organizations, each responsible for a unique EP&R scope of work.

The five organizations are as follows:

- Wildfire Safety Operations Center (WSOC)
- Meteorology and Fire Science
- Field Operations
- Public Safety Power Shutoff Management (PSPS)
- Strategy and Execution

EP&R activities can be categorized as wildfire- or non-wildfire-related work. Activities performed by the WSOC, Meteorology and Fire Science, Field Operations, and PSPS generally are wildfire-related and are discussed extensively in Chapter 4. Activities completed by the Strategy and Execution organization are All

Hazards, include both wildfire and non-wildfire and are discussed in the remainder of this chapter.

Beginning in 2023, certain wildfire mitigations will transition away from the organizations responsible for managing PG&E's wildfire mitigations and move to EP&R. These activities will be converted from wildfire-specific mitigations tracked in the WMBA and will become all hazards controls. Mitigations that are moving out of the WMBA are shown in Chapters 4.1 and 4.2 of this exhibit through 2022 and are then listed as controls in Chapter 5 starting in 2023. For example, the WSOC will transition to become the Hazard Awareness and Warning Center (HAWC)[4] that will serve as a centralized hub for emergency and hazard communications and intelligence to internal stakeholders for all types of emergencies, not just wildfires. Because the center will no longer exclusively support wildfire risk, capital and expense dollars will then shift to this chapter, consistent with the all hazards nature of the center. The wildfire mitigations that will become all hazard controls in 2023 are:

- WSOC – HAWC (transitions from WLDFR-M07C to EPNDR-C002);
- Meteorology: Numerical Weather Prediction/ Storm Outage Prediction Project (SOPP) (transitions from WLDFR-M07H to EPNDR-C001);
- Field Operations Technology (transitions from WLDFR-M006 to EPNDR-C003 and EPNDR-C004);
- Field Operations – All Hazards (transitions from WLDFR-M006 to EPNDR-C005 and EPNDR-C006).

The non-wildfire programs described in the EP&R chapter of the 2020 GRC are performed by the EP&R Strategy and Execution team. This organization is committed to assisting the Company prepare for, respond to, and recover from emergency catastrophic events that could affect one or more areas of PG&E's service territory, including employees, customers, and infrastructure. These types of events are typically rated as severe or catastrophic on the Company's incident level

[4] The control name associated with the WSOC as well as its future state (HAWC) will remain "WSOC" across Ch. 4.1 and Ch. 5.

scale and require significant coordination across all LOBs. Strategy and Execution works to enhance preparedness by continuing to develop best practices, improve response processes, and institutionalize EP&R principles and practices throughout PG&E. The department has evolved and has been restructured into the following subgroups:

- Emergency Planning and Process Improvement;
- Training;
- Exercise;
- Prevention;
- Response; and
- Recovery.

b. Management Structure

EP&R is a department within Electric Operations (EO) and is responsible for company-wide emergency preparedness for all LOBs including Electric, Gas, and Power Generation. The EP&R Department is led by the Senior Director, Grid and Emergency Response, who reports to the Senior Director of Electric Transmission Operations, who in turn reports to the Senior Vice President of Electric Operations.

2. Risk Integration

Chapter 3 of this exhibit describes how EO uses the Enterprise and Operational Risk Management program to manage electric system risks. Table 5-2 below shows the EO risks associated with the forecasts discussed in this chapter.

TABLE 5-2
RISKS DISCUSSED IN THIS CHAPTER

Line No.	Risk Name	Risk ID	Type of Risk	Maintenance Activity Type (MAT)
1	Emergency Preparedness and Response	EPNDR	Cross-Cutting Factor	AB6, 21A

a. Risk Assessment Mitigation Phase (RAMP) Cross-Cutting Factor – EP&R

1) Risk Overview

The EP&R Cross-Cutting Factor is defined as the impact of EP&R controls that affect PG&E's risk drivers and consequences.[5] EP&R influences 19 risk events on PG&E's Corporate Risk Register.[6]

In Chapter 3 PG&E: described how management of the risk has changed since the filing of the 2020 RAMP Report; provided the updated Risk Spending Efficiency; listed each mitigation and control and indicated if it has changed since the 2020 RAMP Report filing. In this chapter PG&E provides more information about the mitigations and controls and the work needed to implement them.

2) GRC Risk Mitigations and Controls

As shown in the tables below, PG&E is forecasting one mitigation and seven controls. These programs were determined to reduce the consequence of various risk events. EP&R is a cross-cutting factor for the following risk events:

- Aviation;
- Hazardous Materials Release;
- Failure of Distribution Underground Network Assets;
- Failure of Distribution Overhead Assets;
- Failure of Distribution Underground Assets;
- Failure of Distribution Substation Assets;
- Information Technology Asset Failure
- Insufficient Capacity to Meet High Demand
- Large Uncontrolled Water Release (Dam Failure)
- Loss of Containment (LOC) on Gas Distribution Main or Service;
- LOC on Gas Transmission Pipeline;

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5 PG&E's RAMP Report, Application (A.) 20-06-012 (June 30, 2020), Ch. 20, p. 20-2, lines 11-15, and 20.

6 Exhibit (PG&E-2), Ch. 1, Attachment B is a table that maps the cross-cutting factors to the risk events.

- Large Overpressure Event Downstream of Gas Measurement and Control Facility;
- LOC on Gas Customer Connected Equipment;
- LOC at Natural Gas Storage Well or Reservoir;
- LOC at Gas Measurement and Control or Compression and Processing Facility;
- LOC on Compressed Natural Gas (CNG) Station Equipment;
- LOC on Liquified Natural Gas/CNG Portable Equipment;
- Real Estate and Facilities Failure; and
- Wildfire.

A brief description of each mitigation provided in Tables 5-3 and 5-4 below. More detail is included in the 2020 RAMP Report.[7]

TABLE 5-3
EP&R
FORECAST MITIGATIONS

Line No.	Mitigation Number	Mitigation Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	EPNDR-M000	EP&R Mitigations	A suite of mitigations that includes: • EOC Enhancements • Base Camp Project • Check-in/Check-out with Salesforce • Secondary Emergency Roles Enterprise-wide • Mutual Aid Enhancements	Consequences Only	See section C.1.a.2 for more information	AB6

[7] PG&E's RAMP Report, A.20-06-012 (June 30, 2020), Ch. 20, starting at p. 20-12.

TABLE 5-4
EP&R
FORECAST CONTROLS

Line No.	Control Number	Control Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
1	EPNDR-C000	EP&R Controls	A suite of controls that includes: • Emergency Planning and Process Improvement • Training • Exercise • Prevention • Response • Recovery	Consequences Only	See section C.1.a.1 for more information	AB6
2	EPNDR-C001	Situational Awareness and Forecasting Initiatives – SOPP Improvements	Develop methodology for forecast of weather conditions relevant to utility operations., forecasting weather conditions and conducting analysis to incorporate into utility making, learning and updates to reduce false positives and false negatives of forecast PSPS conditions.	Consequence only	See section C.1.d for more information Moving from Wildfire in 2023	AB6
3	EPNDR-C002	Situational Awareness and Forecasting Initiatives – WSOC	The WSOC is a physical facility which serves as PG&E's central information hub for all wildfire-related data. The WSOC team monitors, analyzes and initiates wildfire mitigation and response efforts throughout the service area.	Foundational	See section C.1.c for more information Moving from Wildfire in 2023	AB6
4	EPNDR-C003	All Hazard – EP&R Field Ops Tech Expense	The EP&R Field Ops Tech expense allows the Public Safety Specialist (PSS) team to utilize the Salesforce database platform to capture activity and regulatory compliance engagement.	Foundational	See section C.1.b for more information Moving from Wildfire in 2023	AB6

TABLE 5-4
EP&R
FORECAST CONTROLS
(CONTINUED)

Line No.	Control Number	Control Name	Description	Risk Drivers Addressed	Additional Information	MAT Code
5	EPNDR-C004	All Hazard – EP&R Field Ops Tech Capital	The goal of this project is to continue to provide the appropriate complement of Information Technology (IT) solutions enabling a safe, scalable and expedient response posture for planned and unplanned events.	Foundational	See section C.2.b for more information Moving from Wildfire in 2023	21A
6	EPNDR-C005	EP&R Field Operations	The PSS team utilizes the Salesforce database platform to capture activity and regulatory compliance engagement. Additionally, the database is aligned with supporting the First Responder Web Portal (FRP) – Compliance mandate CPUC Decision (D.) 11-07-004, for external public safety partners (first responders).	Foundational	See section C.1.b for more information Moving from Wildfire in 2023	AB6
7	EPNDR-C006	EP&R Distribution Support Headcount	The PSS team serves as an all-hazard response group, to maintain established relationships with external agency partners and to support emergency planning and information sharing during emergencies. In this capacity, the PSS team serves as the PG&E Agency Representative to coordinate and integrate PG&E's response with the Agency Having Jurisdiction (AHJ) during active incidents.	Foundational	See section C.1.a for more information Moving from Wildfire in 2023	AB6

a) Changes to Mitigations

PG&E modified its portfolio of mitigations since filing the RAMP Report by consolidating eight mitigations presented in its RAMP Report into a single mitigation. In addition, there are changes to the mitigations that were included in RAMP as described below.

- Base Camp Project – Is part of the GRC mitigation
- Check In/Out with Salesforce – Is part of the GRC mitigation
- Secondary Emergency Roles Enterprise Wide – Is part of the GRC mitigation

- Emergency Operations Center (EOC)/ICS Training Program Enhancements –Not included in the GRC mitigation. EP&R continues to provide other types of EP&R training as described in this chapter.
- Mutual Assistance Tools and Equipment – Not included in the GRC mitigation.
- Mutual Assistance Improvement – Is part of the GRC mitigation
- New Incident Specific Annexes – Becomes a control in the GRC (EPNDR-C000)
- Early Earthquake Warning (EEW) Enhancements – Becomes a control in the GRC (EPNDR-C000)

b) Changes to Controls

PG&E modified its portfolio of controls since filing the RAMP Report by consolidating twelve controls presented in its RAMP Report into a single control. The EP&R control referred to as EPNDR-C000 consists of six parts: Emergency Planning and Process Improvement; Training; Exercise; Prevention; Response; and Recovery. Below PG&E identifies which controls included in the 2020 RAMP Report are aligned to the GRC EP&R control. .

- Company Emergency Operations Plans and Standards for Response – Included in EPNDR-C000 in the Response area;
- Emergency Response Technology – Included in EPNDR-C000 in the Response area;
- EOC/ICS training program – Included in EPNDR-C000 in the Training area;
- EOC Response – Included in EPNDR-C000 in the Response area;
- EOC Exercises – Included in EPNDR-C000 in the Exercises area;
- Weekly Situational Awareness Call – No longer a control;
- EEW – Included in EPNDR-C000 in the Response area;

- Debris Flow Modeling – Included in EPNDR-C000 in the Response area;
- Gas System Operations Temperature Forecasting – No longer a control;
- Power Gen Hydro Management Forecast – No longer a control;
- Short-Term Electric Supply Forecasting – No longer a control; and
- Diablo Canyon Power Plant Emergency Response Organization Support – No longer a control.

Along with the controls listed above PG&E also identified three new activities that are part of control EPNDR-C000:

- Emergency Planning and Process Improvement;
- Portable Rain Gauge; and
- Dynamic Automated Seismic Hazard (DASH).

b. Cost Tables

Tables 5-5 and 5-6 below show the forecast costs for mitigations.[8] Tables showing the GRC forecast costs compared to the costs estimated in the RAMP Report are provided in workpapers.[9] Forecast costs for controls are shown in supporting workpapers.[10]

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8 Exhibit (PG&E-4), WP 3-18.

9 Exhibit (PG&E-4), WP 3-24.

10 Exhibit (PG&E-4), WP 3-18.

TABLE 5-5
EMERGENCY PREPAREDNESS AND RESPONSE
RECORDED AND FORECAST MITIGATION COSTS 2020-2023 – EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Total	RSE
1	EPNDR-M000	EP&R Mitigations	AB6, AB#	$2,906	$976	$1,894	$4,176	$9,952	(a)
2		Total		$2,906	$976	$1,894	$4,176	$9,952	

(a) PG&E calculated two RSEs for EPNDR M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,346.

TABLE 5-6
EMERGENCY PREPAREDNESS AND RESPONSE
RECORDED AND FORECAST MITIGATION COSTS 2020-2026 – CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Mitigation No. (2023 GRC)	Mitigation Name (2023 GRC)	MAT	2020 Rec. Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Total	RSE
1	EPNDR-M000	EP&R Mitigations	21A	$518	$2,046	$1,966	$2,143	$2,075	$2,093	$2,160	$13,001	(a)
2		Total		$518	$2,046	$1,966	$2,143	$2,075	$2,093	$2,160	$13,001	

(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,346.

C. Activities, Costs, and Forecast Drivers by MWC

The individual mitigations and controls described in the risk integration section above (Section B.2) account for virtually all the work PG&E is forecasting for its EP&R organization. In total, PG&E's 2023 expense forecast and 2021-2026 capital forecast is associated with a risk mitigation or risk control activity. The close alignment between the overall EP&R forecast and the forecast for mitigations and controls demonstrates that the primary driver behind the work EP&R is forecasting is to mitigate or control PG&E's risk. In this section PG&E describes individual groups and activities responsible for implementing this risk control and mitigation work.

1. Expense (MWC AB)

PG&E's 2023 expense forecast for EP&R activities in MWC AB is $26.5 million, which is $18.9 million higher than 2020 recorded costs of $7.6 million.[11] Some items discussed below are programs that move to this chapter beginning in 2023 and will cause an increase in expense forecast compared to 2020 actual recorded costs. The drivers for the increase are described below.

a. EP&R Strategy and Execution

PG&E's 2023 forecast for Strategy and Execution is $9.3 million, $1.7 million more than 2020 recorded costs of $7.6 million.[12] In developing its GRC portfolio, EO was constrained by the targets established in the Plan of Reorganization (POR) when PG&E emerged from bankruptcy on July 1, 2020.[13] Due to the POR constraint, Strategy and Execution's expense forecast in 2021-2022 is lower than normal at $4.2 million per year.

The EP&R Strategy and Execution activities described in this section are associated with both the EP&R mitigations (EPNDR-M000) and the EP&R controls (EPNDR-C000). In 2023, approximately

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[11] See Exhibit (PG&E-4), WP 5-1, line 1.

[12] See Exhibit (PG&E-4), WP 5-5, line 2.

[13] PG&E discusses the POR financial targets in Exhibit (PG&E-2), Ch. 3.

$4.2 million is as with the EP&R mitigation and approximately $5.1 million is associated with controls.

1) EP&R Risk Control (EPNDR-C000)

PG&E is including one EP&R control that consists of six different activities.

Emergency Planning and Process Improvement – The Emergency Planning and Process Improvement team publishes the annual Company Emergency Response Plan (CERP) that provides guidance on managing emergencies and establish processes that are scalable to any hazard. This team works with the LOBs to develop CERP annexes and leads continuous improvement projects that improve emergency response functions.

The development of new hazard specific annexes provides guidance to the LOBs to plan and document their responses to specific disruptions. Current annexes being developed are the Tsunami Annex and the Infectious Disease/Pandemic annex. Other annexes will be developed based on the Threat Hazard Identification Risk Assessment (THIRA) results.

Training – The Training team develops the Company Training Program for emergency preparedness in order to align with State of California Standardized Emergency Management System and National Incident Management System principles for EOC operations and continuous process-improvement for all aspects of the EOC. The activities of the training team also includes, developing roles and responsibilities for the EOC, training curriculum for EOC processes and positions, and supporting curriculum development for line of business emergency management teams. Training plays a crucial role by providing PG&E with a means of attaining, practicing, validating, and improving emergency preparedness capabilities.

EP&R is pursuing several certified[14] training courses, including:

[14] Certified courses provided by California Office of Emergency Services (CalOES) California Specialized Training Institute (CSTI).

- ICS 100 – Introduction to the Incident Command System
- ICS 200 – Basic Incident Command System for Initial Response
- IS 700 – An Introduction to the National Incident Management System
- IS 800 – National Response Framework, An Introduction
- G606 – Standardized Emergency Management System
- ICS 300 – Intermediate ICS for Expanding Incidents;
- ICS 400 – Advanced ICS for Command and General Staff;
- G-775 – EOC Management and Operations;
- G-191 – ICS Field/EOC Interface;
- G-626 – EOC Action Planning;
- G-197 – Integrating Access and Functional needs into Emergency Planning; and
- ICS Position-Specific Workshops.

The expense forecast supports the workload to conduct and manage these trainings.

Exercise – The Exercise team plans, coordinates, and executes emergency preparedness exercises that develop PG&E's emergency response and recovery capabilities through a progressive building-block approach. Using the Homeland Security Exercise and Evaluation Program (HSEEP), the team develops exercises designed to test the effectiveness of current enterprise emergency response plans and procedures. The team leads internal and external emergency preparedness events, including annual company-wide exercises and functional/hazard specific exercises. EP&R conducts, on average, two tabletop exercises and two functional emergency response exercises per year, ranging from Earthquake, PSPS[15] or Cybersecurity exercises. In 2021, PG&E is scheduled to conduct a Cybersecurity tabletop exercise, a Wildfire tabletop exercise, two PSPS tabletop exercises, and two PSPS full scale exercises. PG&E has also participated in external

[15] The PSPS Exercises conducted by this team differ from the PSPS Field Exercises described in Ch. 4.

exercises like the Grid Security Exercise, a 2-day exercise held every two years by the North American Electric Reliability Corporation designed to test the electric sector's ability to respond to grid security emergencies, improve communications among partners, identify lessons learned, and engage senior leadership.

Prevention – The Prevention team leads PG&E's business continuity efforts. In addition, the Prevention team researches and conducts the Threat Hazard Identification Risk Assessment (THIRA) to identify enterprise risks. These efforts will utilize the Fusion software and services to conduct our 3-year Business Impact Analysis (BIA), Business Continuity Planning and keeping the plans accessible. Based on the results of the BIA, the Prevention team will work with the LOBs to draft business continuity plans to ensure that during a catastrophic disruption, PG&E can continue to reliably and safely deliver both gas and electricity to its customers. This program develops the role and responsibility guidelines for the Company's Corporate Incident Management Council, Business Continuity Directors, and Coordinators.

Response – The Response programs range from maintaining the EOC to managing and coordinating the technology platforms used for key initiatives listed below:

- EOC[16]
- EEW
- Debris Flow Modeling
- Portable Rain Gauge
- Mobile Command Vehicle (MCV)
- Base Camp
- DASH Modeling System
- Mass Emergency Notification Systems
- Everbridge
- LiveSafe

[16] The Vacaville Emergency Response Center (VERC) opened in 2019 as PG&E's Alternate EOC. Due to the Company's intention to sell the General Office complex in San Francisco (SFGO) where the EOC currently resides, the VERC will become PG&E's primary EOC facility in 2021.

Recovery – The Recovery program manages the After-Action Reports (AAR) and process improvements to support the development and creation of AARs for All Hazards EOC Incidents. Initiatives include the development of Strategy & Execution's Key Performance Indicators (KPIs), as well as track KPIs for projects tied to safety, compliance, and risk.

2) EP&R Risk Mitigation (EPNDR-M000)

PG&E is including one EP&R mitigation that consists of four different activities.

Base Camp Project – Improve personnel accountability and operations surrounding base camp activations, including check in and check out of employees. Implement IT controls and processes to account for personnel entering and exiting the base camp.

Check in/Check out with Salesforce – Develop and implement processes and tools for the check in and check out function at the EOC.

Secondary Emergency Roles Enterprise wide – Implement secondary emergency role in the event of an activated incident. PG&E will train personnel for multiple emergency response roles so that if one area gets hit by an emergency, staff from other areas are ready to assist.

Mutual Aid Enhancements – Develop guidance for acquiring and training mutual assistance resources. Improve mutual assistance program to onboard, process, track, demobilize and pay mutual assistance resources.

b. EP&R Field Operations (All Hazards, EPNDR-C005, EPNDR-C006)

The Field Operations team consists of the Public Safety Specialist (PSS) team that will serve as an All Hazards response group to maintain established relationships with external agency partners and to support emergency planning and information sharing during emergencies. In this capacity, the PSS team serves as the PG&E Agency Representative to coordinate and integrate PG&E's response with the Authority Having Jurisdiction (AHJ) during active incidents. The Field

Operations activities prior to 2023 are described in Chapter 4.2 (PSPS Operations). Due to the nature of the work intended to support All Hazards, the Expense forecast is detailed in this chapter beginning in 2023.

EP&R Field Operations activities described in this section are associated with the EP&R Field Operations controls. PG&E's 2023 forecast for EP&R Field Operations is $7.1 million,[17] and is associated with the two controls (EPNDR-C005 and EPNDR-C006).

The Field Operations related costs which includes headcount[18], team specific training, support expenditures, and other miscellaneous cost are outlined below:

- Coordinating vegetation management activities between California Department of Forestry and Fire Protection, United States Forest Service, other authorities having jurisdiction, and PG&E;
- PG&E Utility Standard TD-1464S,[19] Fire Prevention and Mitigation training for PG&E personnel;
- Satellite information sharing with external partners;
- Weather station placement input;
- Public Partner Outreach;
- Community Wildfire Safety Program Open Houses;
- Public Safety Liaison Meetings;
- First Responder Workshops;
- Triennial Regulatory Workshops;
- Annual Contingency Plan Meeting;
- Live Fire and Gas Release Training; and
- Public Utility Code Section 768.6 biennial outreach

The PSS team also utilizes the Salesforce database platform to capture activity and regulatory compliance engagement. Support of the

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17 See Exhibit (PG&E-4), WP 5-5, line 5.

18 See Exhibit (PG&E-4), Project Summary – EP&R Strategy and Execution page WP 5-18 and Project Summary – EP&R Field Operations – Core Work pages WP 5-24 and WP 5-25 for additional information on this topic.

19 Standard TD-1464S is the ignition prevention utility standard the PSS team helped write and present on a regular basis to PGE personnel. (PG&E Utility Standard, TD-1464S, Rev. 4 (June 17, 2020).)

Salesforce platform is critical in ensuring regulatory compliance, associated with Gas mandates,[20] Electric mandates,[21] and Wildfire Mitigation Planning outreach and engagement. Costs would support Salesforce licensing fees, database maintenance costs, hosting fees, and non-project application enhancement needs.[22]

c. WSOC/HAWC (EPNDR-C002)

As previously stated, the WSOC will emerge as the HAWC in 2023 and will be recorded in this chapter resulting in a forecast increase. Additional hazards monitored will include debris flow/landslide events, company response to earthquakes, and severe weather events. The center will remain staffed 24/7 with employees monitoring and reporting on broader real-time emergency events. The center will serve as a centralized hub for emergency and hazard communications and intelligence to internal stakeholders. PG&E's HAWC will not replace existing communication processes within the respective lines of businesses, but rather will operate as a centralized resource for real-time situational awareness & intelligence.

All the WSOC/HAWC work described in this section is associated with a risk control (EPNDR-C002).

Core capabilities for the HAWC will include monitoring, assessment, and communication of pertinent information for emergency events. The center will monitor internal and external information sources for issues and emerging risks as well as develop and maintain updates to real time dashboards accessible to all key stakeholders. For communications, the center will produce periodic situational awareness reports and briefing documents, initiate two-way communication processes with key LOB groups to share and receive intelligence information, and initiate notifications per established protocols. Lastly, there will be

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20 Assembly Bill No. 56 (2011); 49 CFR §§ 192.615-192.616; D.11-07-004; and, CPUC GO 112F.

21 Pub. Util. Code, § 768.6.

22 See Exhibit (PG&E-4), Project Summary – EP&R Strategy and Execution; Project Summary – EP&R Field Operations – Core Work; Project Summary – EP&R Field Operations - Technology for additional information on this topic.

communications requirements with external entities. Based on criteria established by EP&R, the HAWC will escalate issues for resolution as appropriate by engaging with the EOC Duty Officer, Execution Director, and other key points of contact.

PG&E's 2020 recorded expense for the WSOC was $4.3 million,[23] which mainly represented staffing costs. The 2023 expense forecast for the WSOC/HAWC is $7.4 million in 2023.[24]

d. Numerical Weather Prediction and SOPP Model Automation (EPNDR-C001)

The SOPP Model is a storm damage prediction system developed, maintained and operated by PG&E's Meteorology Department. The SOPP Model is the primary tool utilized to forecast the magnitude and timing of unplanned outage activity on the distribution and transmission system that may occur due to weather events (wind, rain, snow, heat, etc.). The SOPP program's state and details prior to 2023 can be found in Chapter 4.1 listed under Meteorology Weather Forecasting, Fire Potential Index and Fire Detection Projects (Section C.1.c.2). Due to the nature of the work intended to support All Hazards, the Expense forecast is in this chapter beginning in 2023.

In addition, this model provides input to PG&E's operational staffing and logistical decisions to support PG&E's planning for upcoming weather/storm emergency events. The primary goal of this program is to be prepared for storms and reduce customer outage duration to the extent possible. For example, the model informs PG&E's decisions regarding whether to open the EOC, and if the storm is severe enough, execute PG&E's mutual assistance agreements in advance of storms. SOPP mitigates operational risk and reduces customer outage times arising from weather events that create high unplanned outage volumes.

In 2023–2026, PG&E plans to continue the SOPP model program and plans to upgrade modules of the SOPP forecast, such as the

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23 2020 recorded and 2021-2022 expense forecasts are described in Chapter 4.1, Section C.1.a (Situational Awareness Forecasting).

24 See Exhibit (PG&E-4), WP 5-5, line 7.

snow-outage model and heat-outage model. PG&E also plans to continue improving its analog forecasting techniques by exploring machine learning or other statistical techniques.

This overall initiative will improve PG&E's weather prediction capabilities, help PG&E make better risk informed decisions, and be better positioned and staffed to respond to any storm event. PG&E's 2023 expense forecast for this work is $2.1 million.[25] [26]

e. MWC AB Forecast Summary

Table 5-7 summarizes the expense forecast in MWC AB.

TABLE 5-7
MWC AB EXPENSE SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Description	2020 Recorded Adjusted	2021 Forecast	2022 Forecast	2023 Forecast	WP Reference
1	EP&R Strategy and Execution	$7,556	$4,209	$4,208	$9,281	WP 5-5, line 2
2	All Hazards	–	–	–	15,084	WP 5-5, lines 5-7
3	NWPU/SOPP	–	–	–	2,087	WP 5-5, line 8
4	Total	$7,556	$4,209	$4,208	$26,451	

2. Capital (MWC 21)

In 2020, EP&R recorded capital expenditures of $0.5 million. EP&R is forecasting capital expenditures of $2.0 million in 2021, $2.0 million in 2022, $5.5 million in 2023, $5.4 million in 2024, $5.5 million in 2025, and $5.6 million in 2026.[27] The drivers for the higher capital expenditures relative to 2020 recorded are described below.

a. EP&R Strategy and Execution Capital Projects (EPNDR-M000)

The capital expenditures associated with Strategy and Execution – are split among the following programs. All the Strategy and Execution capital work is associated with EP&R mitigation (EPNDR-M000).

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25 See Exhibit (PG&E-4), WP 5-5, line 8.

26 2020 recorded and 2021-2022 Expense forecasts are under Chapter 4.1, Section C.1.c.2 (Situational Awareness Forecasting).

27 See Exhibit (PG&E-4), WP 5-6, line 1.

1) MCVs, Base Camp, Emergency Communications Equipment

The Information Technology Emergency Communications (ITEC) Program continues to support the EP&R organization, ensuring that the Company is positioned to support all-hazards emergencies and planned events. To effectively support this strategy, the ITEC Program employs a vast array of technology to ensure there are communications solutions for all responding Incident Management teams, field personnel and aviation assets.

Future enhancements and improvements include a prescribed lifecycle of the mobile command vehicle fleet, microwave tower trailer enhancements and refinements to satellite network connectivity, including a lifecycle of aging satellite assets. The lifecycle of the MCV fleet will begin in 2023, lasting until 2026.

This work provides for the continuation of technology necessary to permit communication under catastrophic conditions, including PG&E's ability to provide voice, data, and printing capabilities to temporary base camp locations throughout its service territory.

2) Earthquake Early Warning

The PG&E EEW Program, in cooperation with the United States Geological Survey and the University of California (UC) Berkeley Seismology Lab, has been beta testing EEW products, including Shake Alert and the UC Berkeley Smartphone application MyShake, for use throughout the PG&E service territory. Using sophisticated computational algorithms with input from seismic sensor networks along the West Coast, EEW technology can provide the user anywhere from a few seconds to tens of seconds advance notice before ground shaking occurs at their location.[28] PG&E has also been pilot-testing an EEW based elevator recall system at the SFGO, and is currently evaluating installation of EEW based Public Address system notification and elevator recall at the 300 Lakeside Drive headquarters in Oakland.

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[28] There are instances (e.g., in the immediate earthquake area) where little or no notification is possible.

In addition to the implementation of the capability to issue EEW alerts, PG&E also plans to develop and integrate EEW education and response training into employee safety programs. This encompasses the roll out of the EEW Program to other critical locations throughout PG&E's service territory.

The EP&R Strategy and Execution Capital Projects forecast is $2.0 million in 2021, $2.0 million in 2022, $2.1 million in 2023, $2.1 million in 2024, $2.1 million in 2025, and $2.2 million in 2026.[29]

b. EP&R Field Operations (All Hazards, EPNDR-C004))

The capital expenditures associated with the PSS team in EP&R Field Operations includes the utilization of the Salesforce database platform to capture activity and regulatory compliance engagement. Additionally, the database is aligned with the Commissions' decision related to safety phase protocols and procedures that requires PG&E to provide first responders information about PG&E's systems, for external public safety partners (first responders).[30] PG&E's forecast is $3.1 million in 2021, $3.0 million in 2022, $3.3 million in 2023, $3.1 million in 2024, $3.2 million in 2025, and $3.3 million in 2026.[31] Capital forecasts for 2021-2022 are shown in Chapter 4.2, Section C.2.h.

All the EP&R Field Operations capital work is associated with the EP&R control (EPNDR-C004).

c. WSOC/HAWC (EPNDR-C002)

The capital expenditures associated with the WSOC/HAWC include costs for establishing a physical monitoring site outside of San Francisco to a new or upgraded facility, which is projected to take place in 2021. Equipment costs (new laptops or other technical upgrades) are also included in the forecast. PG&E's forecast is

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29 See Exhibit (PG&E-4), WP 5-12, line 2, for 2023 to 2026 forecast.

30 D.11-07-004, Decision on the Safety Phase Protocols and Procedures Adopted for Pacific Gas and Electric Company, July 5, 2011, Ordering Paragraph 1.

31 See Exhibit (PG&E-4), WP 5-12, line 4, for 2023 to 2026 forecast; see Exhibit (PG&E-4), WP 4-17, line 14, for 2021 and 2022.

$1.5 million in 2021, $0.1 million in 2022, $0.1 million in 2023, $0.2 million in 2024, $0.2 million in 2025, and $0.2 million in 2026.[32] [33]

All the EP&R WSOC/HWAC capital work is associated the EP&R control (EPNDR-C002).

d. MWC 21 Forecast Summary

Table 5-8 summarizes the capital forecast in MWC 21.

TABLE 5-8
MWC 21 CAPITAL SUMMARY
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Work Description	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	WP Reference
1	EP&R Strategy and Execution Technology	$518	$2,046	$1,966	$2,143	$2,075	$2,093	$2,160	WP 5-12, line 2
2	All Hazards – Field Operations and WSOC/HAWC	–	–	–	3,359	3,334	3,364	3,465	WP 5-12, lines 3-4
3	Total	$518	$2,046	$1,966	$5,502	$5,409	$5,457	$5,626	

D. Estimating Methods

PG&E's Strategy and Execution expense 2023 forecast for EP&R was developed based on estimating staffing and work needs as described in this chapter. The costs associated with the WSOC/HAWC were derived based on the estimated staffing requirements to support the expansion and transition to serve as a centralized hub for emergency and hazard communications. The costs associated with the EP&R Field Operations were derived based on the estimated staffing requirements to continue to build out core capabilities including monitoring, assessment, and communication of pertinent information for all emergency events. These recorded expenses were adjusted for escalation, consistent with rates described in Chapter 2 of this exhibit.

PG&E's capital forecast for EP&R Strategy and Execution Technology from is based on estimates for each individual project. Field operations used 2020

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32 See Exhibit (PG&E-4), WP 5-12, line 5, for 2023 to 2026 forecast; see Exhibit (PG&E-4), WP 4-18, line 2, for 2021 and 2022.

33 Capital 2020 recorded and forecasts for 2021-2022 are shown Chapter 4.1, Section C.1.b.

recorded cost as the proxy for the annual forecast including escalation for 2023-2026. The capital for WSOC/All Hazards is estimated by any needed equipment needs or costs that may still be outstanding related to relocation or back-up facilities.

E. Compliance With Section 5.2 of the 2020 GRC Settlement Agreement ("Deferred Work Principles")

The 2020 GRC Settlement Agreement requires PG&E to include testimony in this GRC on deferred work if the following criteria are met:

(a) The work was requested and authorized based on representations that it was needed to provide safe and reliable service (Check 1);

(b) PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work (Check 2); and

(c) PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service (Check 3).

Work that was authorized in the 2020 GRC for MWCs is this chapter is needed to provide safe and reliable service, however there was not work that met the criteria for deferred work as described in the Settlement Agreement. This analysis is presented in the workpapers supporting Chapter 2 of this Exhibit.[34]

F. Cost Tables

The capital and expense forecasts for EP&R related activities are summarized in the following tables:

- Table 5-9 lists the expense MWCs, showing 2016 through 2020 recorded expenses and 2021 through 2023 forecast expenses.

Table 5-10 lists the capital MWC, showing 2016 through 2020 recorded expenses and 2021 through 2026 forecast expenditures.

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34 See Exhibit (PG&E-4), WP 2-13.

TABLE 5-9
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	WP Reference
1	AB	Misc Expense	$6,296	$4,740	$5,574	$6,045	$7,556	$4,209	$4,208	$26,451	WP 5-1, line 1
2	JV	IT	(73)	–	–	–	–	–	–	–	WP 5-1, line 2
3		Total	$6,223	$4,740	$5,574	$6,045	$7,556	$4,209	$4,208	$26,451	

TABLE 5-10
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	2024	2025	2026	WP Reference
1	21	EPR Capital	$3,595	$1,640	$219	$715	$518	$2,046	$1,966	$5,502	$5,409	$5,457	$5,626	WP 5-6, line 1
2		Total	$3,595	$1,640	$219	$715	$518	$2,046	$1,966	$5,502	$5,409	$5,457	$5,626	

PACIFIC GAS AND ELECTRIC COMPANY
2023 GENERAL RATE CASE

Testimony: ☒ **Workpapers:** ☐ **SOQ:** ☐

Exhibit Number: 4 **Chapter Number:** 5

Chapter Title: Emergency Preparedness And Response

Witness Name: Angie Gibson

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of November 5, 2021				
5-1	26	2023 forecast delta from 2020 recorded	$19.0	$18.9
5-3	Figure 5-1	EP&R Strategy & Execution	$1,759	$1,725
5-3	Figure 5-1	EP&R Field Operations	$7,721	$7,699
5-3	Figure 5-1	Wildfire Safety Operations Center	$7,405	$7,385
5-3	Figure 5-1	Numeric Weather Prediction Model Upgrade and SOPP (NWPU/SOPP)	$2,093	$2,087
5-3	Figure 5-1	2023 Forecast	$26,534	$26,451
5-15	Table 5-5, lines 1 & 2	2020 Rec. Adj., 2022 Forecast, 2023 Forecast, Total	$2,782, $1,897, $4,192, $9,874	$2,906, $1,894, $4,176, $9,952
5-15	Table 5-5 Table Notes	Note (a)	No footnote	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,334.
5-15	Table 5-6	Forecast Headers	20234 Forecast 20235 Forecast	2024 Forecast 2025 Forecast

Page No.	Line No.	Item	As Filed	As Corrected
5-15	Table 5-6 Table Notes	Note (a)	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 360; and, Mutual Aid Enhancements has an RSE of 21,219.	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,334.
5-16	13	2023 forecast delta from 2020 recorded	$19.0	$18.9
5-16	20	2023 forecast delta from 2020 recorded	$1.8	$1.7
5-24	Table 5-7, Line 1	2022 Forecast, 2023 Forecast	$9,315	$9,281
5-24	Table 5-7, Line 2	2023 Forecast	$15,127	$15,084
5-24	Table 5-7, Line 3	2023 Forecast	$2,093	$2,087
5-24	Table 5-7, Line 4	2022 Forecast, 2023 Forecast	$4,215, $26,534	$4,208, $26,451
5-29	Table 5-9, lines 1 & 3	2022 Forecast, 2023 Forecast	$4,215 $26,534	$4,208 $26,451

Page No.	Line No.	Item	As Filed	As Corrected
Errata as of February 25, 2022				
5-15	Table 5-5 Table Notes	Note (a)	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 360; and, Mutual Aid Enhancements has an RSE of 21,219.	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,346.
5-15	Table 5-6 Table Notes	Note (a)	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 360; and, Mutual Aid Enhancements has an RSE of 21,219.	(a) PG&E calculated two RSEs for EPNDR-M000: EOC Enhancements has an RSE of 308; and, Mutual Aid Enhancements has an RSE of 21,346.

PACIFIC GAS AND ELECTRIC COMPANY

CHAPTER 6

ELECTRIC EMERGENCY RECOVERY

[INCLUDES NOVEMBER 5, 2021 ERRATA]

PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 6
ELECTRIC EMERGENCY RECOVERY

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PACIFIC GAS AND ELECTRIC COMPANY
CHAPTER 6
ELECTRIC EMERGENCY RECOVERY

A. Introduction

1. Scope and Purpose

This chapter demonstrates the reasonableness of Pacific Gas and Electric Company's (PG&E) expense and capital forecasts for the Electric Emergency Recovery (EER) Program and catastrophic event straight-time (ST) labor previously recovered in the Catastrophic Event Memorandum Account (CEMA). The EER forecast is for the following activities: (1) responding to incidents and outages during Routine and Major Emergencies; (2) performing equipment repairs and replacements related to Routine and Major Emergencies; (3) staffing the Emergency Operations Center (EOC), Regional Emergency Centers (REC) and Operations Emergency Centers (OEC) during Major Emergencies; and (4) ST labor expenses when responding to CEMA-eligible events.

The cost forecasts described in this chapter are unique and do not duplicate the cost forecasts described in any other chapter in this exhibit. Forecasts in this chapter are shown with escalation[1] at the Major Work Category (MWC) level and include expense and capital.

~~In addition, this chapter demonstrates the reasonableness of 2020 EER program costs recorded in the Wildfire Mitigation Plan Memorandum Account (WMPMA). Attachment A to this chapter provides this showing.~~

2. Summary of Request

PG&E requests that the California Public Utilities Commission (Commission) adopt PG&E's 2023 expense forecast of $136.5 million for the EER program.[2] The 2023 expense forecast is $38.4 million more than the 2020 recorded adjusted expenses of $98.0 million.

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1 See Exhibit (PG&E-4), Ch. 2 for more information on escalation.

2 See Exhibit (PG&E-4), WP 6-1, line 3. The forecast amount includes Electric Operations' CEMA ST labor cost, which is also included in WP 6-28, CEMA ST workpaper.

PG&E further requests that the Commission adopt the following capital expenditure forecasts for EER: $269.6 million for 2021; $311.4 million for 2022; $319.2 million for 2023; $328.4 million for 2024; $337.9 million for 2025; and $347.7 million for 2026.[3] The 2023 capital forecast is $7.4 million more than 2020 recorded adjusted capital expenditures of $311.8 million.

PG&E's also requests the Commission adopt total company expense and capital forecast for ST labor costs associated with CEMA-eligible events, and approve a new two-way balancing account, the Catastrophic Event Straight-Time Labor Balancing Account (CESTLBA). For further discussion on Catastrophic Event Straight-Time Labor, refer to Section F.2 below.

PG&E proposes continuing the Major Emergency Balancing Account (MEBA)[4] to account for the actual costs incurred from responding to major emergencies events that are not eligible for recovery through the CEMA or the proposed CESTLBA, if approved by the Commission in the 2023 General Rate Case (GRC).

Forecasts in this chapter are sub-divided into three programs, each with corresponding expense and capital forecasts: (1) Routine Emergency, (2) Major Emergency and (3) Catastrophic Event Straight-Time Labor for Electric Operations.

a. Routine Emergency

PG&E requests that the Commission adopt PG&E's 2023 expense forecast of $73.7 million for Routine Emergency.[5] The 2023 expense forecast for Routine Emergency is $6.6 million (or 10 percent) higher than PG&E's 2020 recorded costs of $67.1 million.

PG&E further requests that the Commission adopt the following capital expenditure forecasts for Routine Emergency: $193.2 million for

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3 See Exhibit (PG&E-4), WP 6-9, line 3. The forecast amount includes Electric Operations' CEMA Straight time labor cost, which is also included in WP 6-28, CEMA Straight-time workpaper.

4 The purpose of MEBA is to account for and recover the actual expenses and capital revenue requirements resulting from responding to major and catastrophic emergencies, that are not eligible for recovery through the CEMA or the proposed CESTLBA.

5 See Exhibit (PG&E-4), WP 6-1, line 1.

2021; $233.4 million for 2022; $239.2 million for 2023; $246.1 million for 2024; $253.3 million for 2025; and $260.6 million for 2026.[6] The 2023 capital forecast for Routine Emergency is $8.3 million (or 3 percent) lower than PG&E's 2020 recorded costs of $247.5 million.

b. Major Emergency

PG&E requests that the Commission adopt PG&E's 2023 expense forecast of $42.7 million for Major Emergency.[7] The 2023 expense forecast for Major Emergency is $11.7 million (or 38 percent) higher than the 2020 recorded costs of $31.0 million.

PG&E further requests that the Commission adopt the following capital expenditure forecasts for Major Emergency: $60.8 million for 2021; $62.1 million for 2022; $63.6 million for 2023; $65.5 million for 2024; $67.4 million for 2025; and $69.3 million for 2026.[8] The 2023 capital forecast for Major Emergency is $0.6 million (or 1 percent) less than PG&E's 2020 recorded costs of $64.3 million.

c. Catastrophic Event Straight-Time Labor Costs

PG&E proposes to recover ST labor costs associated with CEMA-eligible events through a new two-way balancing account referred to as the CESTLBA.[9] PG&E's total company 2023 expense forecast is $23.2 million.[10,11] PG&E's total company capital forecast is $18.6 million for 2023, $19.1 million for 2024, $19.6 million for 2025, and $20.1 million for 2026.[12,13]

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6 See Exhibit (PG&E-4), WP 6-9, line 1.

7 See Exhibit (PG&E-4), WP 6-8, line 10.

8 See Exhibit (PG&E-4), WP 6-18, line 9.

9 For a discussion on the CEMA ST labor costs, see Section F.2 below.

10 The total company ST labor cost forecast includes Electric Operations' portion, which is also captured as part of EER program's total forecast. See Table 6-1, lines 3 and 5 for the ST labor forecast breakdown of Electric and Other Lines of Business (LOB) respectively.

11 See Exhibit (PG&E-4), WP 6-28, line 11.

12 The total company ST labor cost forecast includes Electric Operations' portion, which is also captured as part of EER program's total forecast. See Table 6-2, lines 3 and 5 for the ST labor forecast breakdown of Electric and Other LOBs respectively.

13 See Exhibit (PG&E-4), WP 6-28, line 6.

Tables 6-1 and 6-2 summarize the expense and capital forecasts for EER by sub-program and the total company CESTLBA.[14]

TABLE 6-1
TOTAL EXPENSE FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No	Description	2020 Recorded	2021 Forecast	2022 Forecast	2023 Forecast
1	Routine Emergency – Expense	$67,075	$59,274	$59,361	$73,678
2	Major Emergency– Expense	30,973	41,465	41,501	42,708
3	EER CESTLBA Expense	–	18,737	19,397	20,079
4	EER Total Expense	$98,049	$119,477	$120,259	$136,466
5	Other LOB CESTLBA Expense	–	2,899	3,001	3,106
6	Total Expense	$98,049	$122,375	$123,260	$139,571

TABLE 6-2
TOTAL CAPITAL FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No	Description	2020	2021	2022	2023	2024	2025	2026
1	Routine Emergency – Capital	$247,499	$193,244	$233,354	$239,188	$246,137	$253,271	$260,615
2	Major Emergency – Capital	64,253	60,810	62,069	63,621	65,470	67,367	69,321
3	EER CESTLBA- Capital	–	15,541	15,945	16,375	16,817	17,271	17,738
4	EER Total Capital	$311,752	$269,595	$311,368	$319,184	$328,424	$337,910	$347,674
5	Other LOB CESTLBA Capital	–	2,133	2,170	2,220	2,275	2,327	2,380
6	Total	$311,752	$271,727	$313,538	$321,404	$330,698	$340,237	$350,054

3. Overview of Recorded and Forecast Costs

As shown in Table 6-3, PG&E records EER Program expenditures in four MWCs – both Routine Emergency and Major Emergency each have an expense MWC and a capital MWC. Electric CEMA-eligible costs are also recorded in the Major Emergency MWCs and are separated from MEBA costs using planning orders assigned to the respective cost types. For the purpose of the PG&E's 2023 GRC, all CEMA-eligible costs, except for the

[14] 2021 and 2022 expense and capital forecasts for CESTLBA shown in Table 6-1 and 6-2 are shown for trending purposes, and actual costs will be recorded in the CEMA.

CEMA ST labor costs, have been removed from the recorded and forecast costs.

Routine Emergency work is recorded in MWC BH – Routine Emergency Expense and MWC 17 – Routine Emergency Capital.

Major Emergency (MEBA) work is recorded in MWC IF – Major Emergency Expense and MWC 95 – Major Emergency Capital.

Electric CEMA Straight-time work is recorded in MWC IF – CEMA Straight-Time Expense and MWC 95 – CEMA Straight-Time Capital.

TABLE 6-3
MAJOR WORK CATEGORIES

Line No.	MWCs	Description
1	Expense MWCs	
2	BH	Routine Emergency – Expense
3	IF	Major Emergency – Expense Electric CEMA Straight-Time - Expense
4	Capital MWCs	
5	17	Routine Emergency – Capital
6	95	Major Emergency – Capital Electric CEMA Straight-Time – Capital

a. Expense

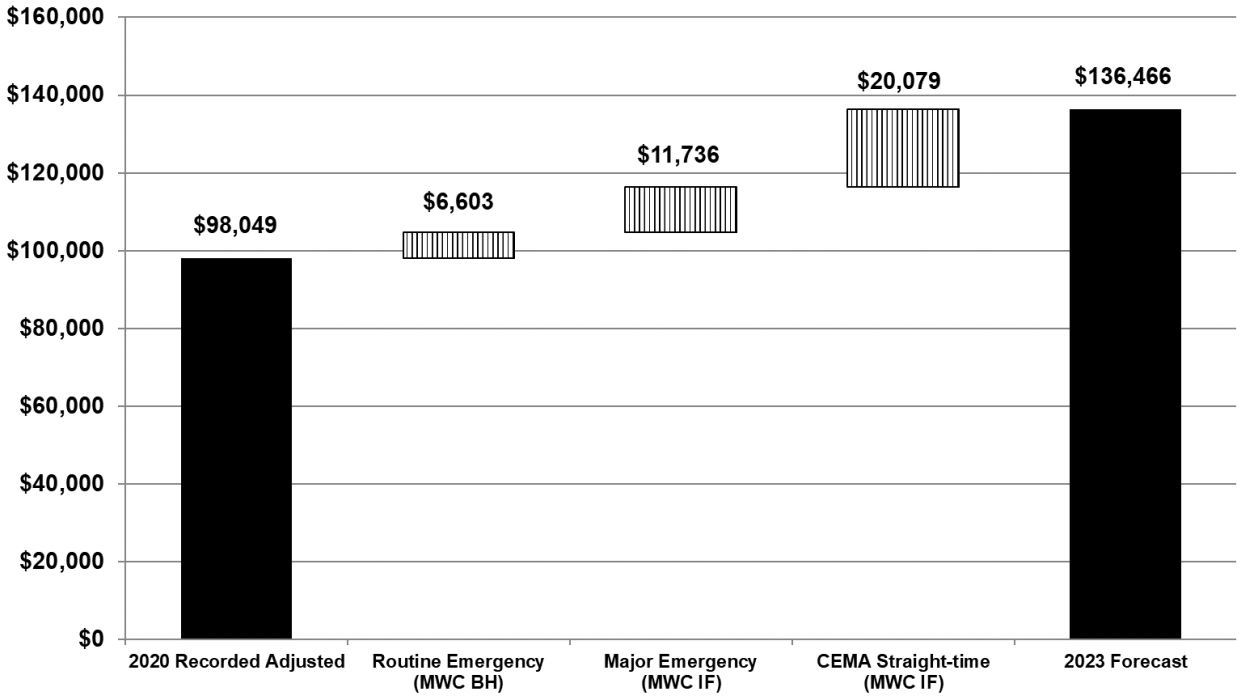
Figure 6-1[15] shows the walk from 2020 recorded adjusted expense amounts to the 2023 forecasts for Routine Emergency, Major Emergency and Electric CEMA Straight-Time Labor. Because emergency recovery work is primarily driven by weather events and weather patterns that vary from year-to-year and are difficult to predict, PG&E used averages of historical data to develop its forecast—three years (2018-2020) for Routine Emergency and CEMA ST,[16]

[15] This figure includes costs that are subject to recovery on a recorded basis through the CEMA memo account; these amounts are included for trending purposes because the activity will become GRC funded beginning in 2023.

[16] Refer to Section F.2 for details on Catastrophic Event Straight-Time Labor forecast methodology.

five years (2016-2020) for Major Emergency (MEBA).[17] The 2023 forecasts for EER, as based on these historical averages, are higher than recorded expenditures in 2020. A forecast based on historical averages is appropriate given the year-to-year variability in EER costs. PG&E's forecast methodology is discussed further in Section D of this chapter.

FIGURE 6-1
EER PROGRAM MWC EXPENSE WALK 2020-2023
(THOUSANDS OF NOMINAL DOLLARS)



b. Capital

Figure 6-2 shows the 2020 recorded adjusted capital expenditures to 2026 forecast capital expenditures for Routine Emergency, Major Emergency and Electric CEMA Straight-Time Labor. Similar to the expense forecast, PG&E used an average of historical data to develop its capital forecast.[18] The 2023 capital expenditure forecasts for EER,

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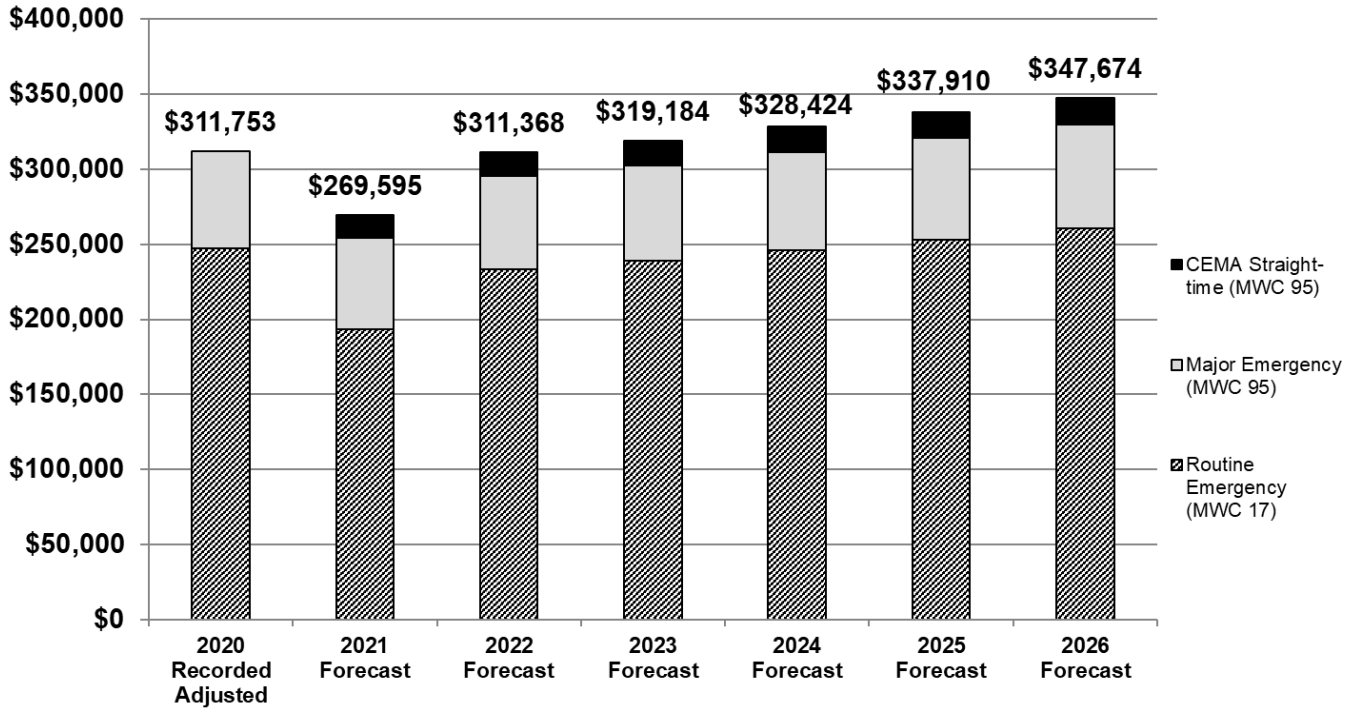
17 All CEMA-eligible costs have been removed from the recorded costs used to develop the MEBA forecast.

18 *Ibid*.

as based on these historical averages, are higher than recorded expenditures in 2020.

FIGURE 6-2
EER PROGRAM CAPITAL RECORDED AND FORECAST 2020-2026
(THOUSANDS OF NOMINAL DOLLARS)



4. Support for Request

PG&E's Routine and Major Emergency expense and capital expenditure forecasts are reasonable and should be approved. The EER Program allows PG&E to comply with General Order (GO) 166 – Standards for Operation, Reliability, and Safety during Emergencies and Disasters – by providing effective outage restoration efforts in response to Routine Emergencies caused by equipment failures and Major Emergencies that are mainly caused by major weather-related events. PG&E successfully maintains the effectiveness of the EER Program while controlling overall expenditures by:

- Maintaining an effective operational plan designed to support the safe and reliable delivery of power to customers while striving to minimize outage impacts;

- Maintaining a clear, well-defined electric emergency process to guide incident assessment and response;
- Reviewing labor and material charges to correctly classify them as Routine or Major Emergencies; and
- Maintaining key operational performance measures to assess EER's effectiveness and identify areas for further improvement.

5. Organization of the Remainder of This Chapter

The remainder of the chapter is organized as follows:

- Section B – Program and Risk Overview;
- Section C – Activities, Costs, and Forecast Drivers by MWC;
- Section D – Estimating Methods;
- Section E – Compliance with Section 5.2 of the 2020 GRC Settlement Agreement ("Deferred Work Principles");
- Section F – Balancing and Memorandum Accounts;
- ~~Section G – WMPMA : Reasonableness Review of Electric Emergency Costs;~~
- Section H – Cost Tables.
- ~~Attachment A – Recovery of Electric Emergency Recovery Costs Recorded in the Wildfire Mitigation Plan Memorandum Account.~~

B. Program and Risk Overview

1. Program Description

Electric emergencies are created when outages occur and require immediate response by PG&E to restore customer service and protect the community from potential safety hazards. Emergency outages can range from Routine Emergencies resulting from equipment failures to Major and Catastrophic Emergencies arising from storms and other natural disasters.[19] PG&E's response to electric emergencies is a fundamental part of operating an electric distribution system and is subject to the requirements of GO 166. PG&E has developed a proactive approach to prepare for all emergencies and reduce response times to restore service to customers. PG&E prepares an electric emergency response plan that

[19] The distinction between Routine and Major Emergencies is discussed in greater detail below.

defines staffing levels, roles and responsibilities, emergency incident assessment guidelines, and communication plans. The response plan supports PG&E's activation of emergency centers and mobilization of crews and other resources to respond to routine and major emergencies. PG&E's top priority when responding to emergencies is the safety of the public and its employees. PG&E's next priority is the timely restoration of service to its customers experiencing any outages.

Weather-related emergencies are the leading driver of major and catastrophic emergency response costs for PG&E. As shown by the list below, from resources such as National Climate Data Center (NCDC), Geographic Area Coordination Center, National Oceanic and Atmospheric Administration, and North American Drought Monitor, in the past five years, the weather impacting PG&E's service area has been extreme; this extreme weather has resulted in an unusually high number of major emergency and catastrophic declared emergency (CEMA) events.

- The five-year period from January 2016 through December 2020 was the warmest five-year period on record for California (rank 1 of 126).
- Every year between 2016 through 2020 except 2019 was a top-3 warmest year on record for that time.
- The 2016-2017 water year was the wettest on record for the Northern 6 Sierra index (rank 1 of 100), and second wettest on record for the San Joaquin index (rank 2 of 108).
- The 2018-2019 water year was also a wet year and featured a top 5 wettest and top 10 coldest February (NCDC) when many monthly snowfall records were broken across the Sierra.
- The heavy rains in 2016-2017 and again in 2018-19 (NCDC) promoted extensive vegetation growth that dried-up during the normally dry summer and became fuel for numerous fires throughout PG&E's service territory during the fall.
- October and November 2019 saw many Diablo wind events including a very strong and damaging wind event for Central and Northern California on October 26th.

During 2020, there were even more weather extremes:

- Calendar year 2020 was the third driest and third warmest on record. (NCDC)
- February 2020 was the first time on record (back to 1921) that the California Data Exchange Center weather stations comprising the Northern Sierra 8-station precipitation Index measured 0.00" of rainfall.
- The three-month period August 2020 through October 2020 during the peak of fire season was the driest and warmest on record (out of 126 years). (NCDC)
- By the middle of fall of 2020, approximately 65 percent of California was experiencing drought conditions and approximately 35 percent was rated as having severe or extreme drought conditions.
- 2020 also saw the largest number of acres burned across the state including 5 of the 6 largest wildfires on record, with most ignited by a lightning storm in mid-August when over 7,500 cloud-to-ground strikes were observed.
- The weather in 2020 included three Level 4 events (see below for a description of PG&E's Incident Levels), during which 400-750 thousand customers lost service. EER leveraged basecamps, staging areas, communication plans, and incident command processes established by PG&E's Emergency Preparedness and Response (EP&R) organization to deploy an effective response effort to these events.

a. Electric Emergency Recovery Process Overview

PG&E's Distribution System Operations (DSO) monitors the distribution grid to identify outages and direct the scheduling and dispatching of field personnel to address identified abnormal conditions. PG&E typically identifies outages through alarms from field devices such as circuit breakers or reclosers, SmartMeter™ data, notifications from police and fire departments, preventive maintenance patrols and inspections, and calls from customers' reporting an outage. Once outages have been identified, personnel are deployed to address them.

PG&E also proactively attempts to anticipate potential outage events by using the DSO Storm Outage Prediction Project (SOPP) forecasting model. This model evaluates potential impacts to the

electric system from adverse weather forecasts, translates this data into expected outage activity, and estimates the resources required to respond effectively. The model is a key component of PG&E's EER Program. Using the detailed information that the DSO SOPP model provides, PG&E can mobilize resources several days in advance of an anticipated major adverse weather event.

PG&E follows a defined process to ensure emergency priorities are addressed by field personnel and system operators:

- Make Safe: Addressing hazardous conditions first to support public and employee safety;
- Assess: Assessing the outage location to identify the cause (if possible), determine the necessary resources to address the situation (material, equipment, and personnel), and estimate the time necessary to make repairs;
- Communicate: Coordinating various technologies to provide customers and public agencies with outage information, such as the cause of an outage and Estimated Time of Restoration; and
- Restore: Coordinating work activities to restore service. This is completed by reconfiguring the distribution grid and repairing damaged facilities, depending on the nature of the event.

1) Distinguishing Between Routine Emergency and Major Emergency

PG&E has five incident levels, which are further described in the next section. Level 1 incidents are classified as Routine Emergencies. Level 3 through 5 incidents are classified as Major Emergencies. A Level 2 emergency can be categorized as either a Routine Emergency or Major Emergency, depending on whether an OEC is fully activated. OECs are positioned within each region. They provide oversight and support at the divisional level by directing and coordinating the personnel necessary to assess damages, secure hazardous situations, restore service, and communicate status information internally and externally. OECs report to their region's REC, which coordinates the activities of all OECs.

An OEC may be activated if any one of the following criteria is met:

Criteria 1: A division meets the outage trigger presented in Table 6-4 below.[20] The outage triggers[21] (and underlying outage numbers) vary by division due to the differences in geographical size, electric infrastructure design (i.e., overhead versus underground, urban versus rural), outage history, and resource availability.

[20] A qualifying outage is one that continues for at least 30 minutes, at the transformer level or above.

[21] The Outage Trigger is derived by taking the 6-hour period's stable outage average (i.e., outages that continue for at least 30 minutes) and multiplying it by 50 percent.

TABLE 6-4
OEC ACTIVATION CRITERIA BY DIVISION

Line No.	Division	Real Time Outage Management Tool Outage Trigger (Transformer and Above)
1	Central Coast	9
2	De Anza	5
3	Diablo	5
4	East Bay	5
5	Fresno	8
6	Humboldt	7
7	Kern	5
8	Los Padres	6
9	Mission	5
10	North Bay	5
11	North Valley	8
12	Peninsula	5
13	Sacramento	6
14	San Francisco	5
15	San Jose	5
16	Sierra	9
17	Sonoma	5
18	Stockton	6
19	Yosemite	8

Criteria 2: A predicted major emergency event in which either:

a) A PG&E division's DSO SOPP forecast is at Category 2[22] or above and PG&E predicts that the event will ultimately meet the requirements of Criteria 1 above; or

b) There is a wildfire event that does not meet the requirements of Criteria 1 above, but where:

i) PG&E de-energizes electric distribution facilities to mitigate public safety risk and/or first responder risk, including at the request of responding agencies, such as the California Department of Forestry and Fire

[22] DSO SOPP Category 2 indicates that adverse weather is possible, and that there should be a staffing plan in place for possible escalation.

Protection, U.S. Forest Service, and/or city or county government; and

ii) PG&E mobilizes resources from outside the affected district to address the wildfire event.

Once an OEC is activated, the incident is considered a Major Emergency. If PG&E does not activate an OEC to respond to the incident, it is considered a Routine Emergency.

When PG&E forecasts that a major weather event is likely to occur, work orders are created under MWCs IF and 95 for crews to record their restoration and recovery activities. All costs charged to these work orders are reviewed monthly by a group consisting of the EER Business Finance Lead, and the EER Manager. The group determines whether the work was correctly charged to each order, and whether the order covers an event that meets the criteria for a Major Emergency. If the group determines that an event did not meet the criteria of a Major Emergency, the costs are charged as Routine Emergency costs to MWC BH for expense and MWC 17 for capital.

a) PG&E Incident Levels

PG&E's Company Emergency Response Plan defines incident levels that function as part of a decision support tool which determines PG&E's actions to coordinate and deploy the needed resources to respond to emergency incidents. The five incident levels are described below:

- Level 1 – Routine: A Level 1 emergency is typically at the local level, involving a limited number of customers with an anticipated restoration response time of within 24 hours. In a Level 1 emergency, PG&E can respond adequately using standard operations and resources. The local operating departments coordinate resource deployment in a Level 1 emergency. This level does not require the activation of an OEC.
- Level 2 – Elevated: Level 2 emergencies are defined as a pending potential incident or a local emergency that may

require more than routine operations response. Resources are mainly provided by the impacted division, but there is a possibility that outside division resources may need to move within the region. For Level 2 emergencies, an OEC may be activated for communications only or fully activated to provide oversight and support at a divisional level.

- Level 3 – Serious: Level 3 emergencies are serious incidents involving large numbers of customers. Divisional resources mainly move within the region, but may need to move between regions. In Level 3 emergencies, OECs are activated to direct and coordinate the personnel necessary to assess damages, secure hazardous situations, restore service, and communicate status information internally and externally. REC and EOC activations are possible. The REC provides oversight and support to the OEC(s) at a regional level. As an event escalates, the REC becomes the point of contact for assessing information and for managing escalated OEC issues.
- Level 4 – Severe: Level 4 emergencies are very serious incidents with company-wide impact or extended multiple emergency incidents that impact large number of customers. Resources move between regions, general contractors are utilized, and mutual aid may be needed. During a Level 4 emergency, the OEC, REC, and EOC are activated. Additionally, the EP&R team assumes incident command.
- Level 5 – Catastrophic: Level 5 emergencies involve a catastrophic event that includes multiple emergency incidents, impacts large number of customers, extensive infrastructure risk and damage. This emergency level affects the entire Company's ability to conduct normal business operations. Full mobilization of Company resources is needed to respond, and mutual aid resources are needed. During a Level 5 event, all emergency centers

are fully activated, and the EP&R team assumes incident command.

b. Management Structure

EER management personnel are located throughout the service territory to assist with emergency preparedness, response, financial support, and oversight. These personnel reside in the Emergency Management Department. The Emergency/Restoration process within PG&E's Electric Distribution Operations utilizes a centralized-process ownership model that aims for end-to-end accountability for various emergency work streams. The Emergency/Restoration process owner oversees the Emergency Management Department, including centrally managing the emergency response and restoration process, and coordinate related activities. The process owner reports to the Senior Director of Distribution Grid Operations, who reports to the Vice President of Distribution Operations.

c. Key Metrics and Other Performance Measures

PG&E employs key measures and metrics to evaluate and determine if its distribution restoration work processes are effective. For instance, DSO is responsible for monitoring the distribution grid, identifying issues and directing work that is ultimately executed by Troublemen and crews in EER. By employing key metrics, PG&E ensures that the organizations handling emergency response are efficiently working together to meet the same goals to safely restore power. For this reason, EER and DSO use the same metrics.

A primary performance metric used to evaluate PG&E's commitment to public safety is PG&E's time to respond to 911 calls (or 911 standby response) once they have been received. Since even short distances can take considerable travel time, depending on traffic and/or geography, the emergency-response-time metric focuses managers' efforts to identify and distribute resources so that prompt response occurs. There is a direct link between public safety and a utility's timely response to emergency situations, which is why PG&E selected emergency response time for this element of the performance metric.

PG&E began benchmarking its 911 standby response times against other utilities in 2012. In the past several years, PG&E has significantly improved its call response time from third quartile to first decile. PG&E is a leading utility in 911 response and is often benchmarked by other utilities. PG&E measures 911 standby performance every day without exception. This includes both major and catastrophic event days and routine day-to-day operations.

The emergency response time metric measures the percentage of electric emergency calls to which PG&E personnel respond within 60 minutes of the time the call is received. Measurement begins with the receipt of the call from a 911 public safety agency to PG&E's dedicated 911 Agency phone number. Upon receiving the 911 call, a 911 standby tag is generated in the Outage Information System (OIS). Electric Dispatch dispatches the 911 standby tag to the closest Troubleman or 911 standby resource for response.[23] Once the Troubleman or resource arrives on site, the OIS is updated either directly by the employee via the Field Automation System or by phone to Electric Dispatch, which then updates OIS. The metric measures the time between the initiation of the 911 standby tag and the arrival of the Troubleman or 911 standby resource arriving on site, and is captured directly in OIS as the system of record.

911 Standby performance is reviewed daily by PG&E's Electric Dispatch organization and audited quarterly by the Internal Auditing team to validate the accuracy of the performance results.

Table 6-5 shows the percent of 911 electric emergency calls with response times less than 60 minutes for the past five years.

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23 A Troubleman is a qualified electrical worker used as the first responder to electric emergencies. A Standby Resource is a resource that has been trained to stand by energized electric equipment during an emergency to protect the public. These Standby Resource employees come from other departments and can include Gas Service Representatives, Meter Technicians, Estimators, and Meter Readers.

TABLE 6-5
911 RESPONSE PERFORMANCE

Line No.	Year	# 911 Request	# Within One Hour	% Compliant
1	2016	8,693	8,544	98.29%
2	2017	12,615	12,183	96.58%
3	2018	8,743	8,561	97.92%
4	2019	11,435	10,897	95.30%
5	2020	8,527	8,287	97.19%

2. Risk Controls and Mitigations

Risk controls and mitigations are aligned to various MWCs and MATs in Electric Distribution. None of the MWCs presented in this chapter correspond to a risk mitigation or risk control that address a risk on EO's Corporate Risk Register. Electric Emergency Recovery work is considered work performed post unplanned failure, and the costs associated with this work are included in the financial consequences of equipment failures. As such, the emergency recovery work is embedded in the quantification of the equipment failure risks, and not a risk control or mitigation. More information about risk mitigations and controls is in PG&E's Electric Distribution Risk Management testimony (Exhibit (PG&E-4), Chapter 3).

C. Activities, Costs and Forecast Drivers by MWC

This section describes the major expense and capital drivers to the Routine and Major Emergency forecasts provided in Figures 6-1 and 6-2. The CESTLBA forecast is discussed in Section F below.

1. Routine Emergency

The 2023 expense and capital forecasts for Routine Emergency are based on a three-year (2018-2020) average of recorded costs, adjusted for escalation. PG&E has also incorporated a cost-savings initiative into the expense forecast (MWC BH) for years 2021 and 2022, and in the capital

forecast (MWC 17) for 2021.[24] The 2023 expense forecast is higher and the 2023 capital forecast is lower than PG&E's 2020 recorded costs.

a. MWC BH – Routine Emergency Expense

During routine conditions, overhead- or underground-related outages occur for many reasons. In response to these outages, Troublemen and crews make the situation safe, restore power to customers, and isolate the trouble location so repairs can be made. PG&E records costs for these activities in MWC BH.

b. MWC 17 – Routine Emergency Capital

The work in MWC 17 is similar to that of MWC BH and involves routine emergency work that meets capital accounting criteria, such as replacing equipment instead of repairing it.

c. Routine Emergency Forecast Summary

See Tables 6-6 and 6-7 for Routine Emergency expense and capital expenditure forecasts.

TABLE 6-6
SUMMARY OF RECORDED AND FORECAST FOR ROUTINE EMERGENCY EXPENSE WORK
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Description	2020 Recorded Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Workpaper Reference
1	BH – Routine Emergency	$67,075	$59,274	$59,361	$73,678	WP 6-1, line 1

[24] As explained in Exhibit (PG&E-2) Ch. 3, PG&E prepared its 2023 GRC forecast, starting first with the Plan of Reorganization forecast for the work included in the 2023 GRC and then adding updates to address company-wide work needs and priorities, risk mitigations, and cost-savings initiatives. Through the process of prioritizing the Electric Distribution portfolio and in accordance with the 2023 GRC forecast guidelines outlined in Exhibit (PG&E-2) Ch. 3, this forecast prioritizes funding for the most critical work and incorporates a cost-savings initiative which is identified as a reduction to the forecast. EO's work portfolio planning and prioritization process is discussed further in Exhibit (PG&E-4) Ch. 2.

TABLE 6-7
SUMMARY OF RECORDED AND FORECAST FOR ROUTINE EMERGENCY CAPITAL WORK
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	2020 Recorded Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Workpaper Reference
1	17 – Routine Emergency	$247,499	$193,244	$233,354	$239,188	$246,137	$253,271	$260,615	WP 6-9, line 1

2. Major Emergency

2020 was a significant year in terms of Major Emergencies. Major Emergencies can be expected to occur on all Major Event days, and in 2020 PG&E experienced a higher than average number weather-related Major Event Days (MED)[25] in its service territory. In 2020, PG&E recorded 14 Major Event days; the average number of MEDs per year for the 2000-2020 was 9.8, with a range of 3-31 days.

PG&E's 2023 MEBA expense forecast, and its annual capital expenditures forecast for 2021-2026 are all based on five-year historical averages (2016-2020).[26]

a. MWC IF – Major Emergency – Expense

The work in MWC IF is identical to the work in MWC BH, except that the work is performed in response to a Major or Catastrophic Emergency.

b. MWC 95 – Major Emergency – Capital

The work in MWC 95 is the same as the work in MWC 17, except that the work is performed in response to a Major or Catastrophic Emergency.

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25 MED is a day in which the daily System Average Interruption Duration Index (SAIDI) exceeds a MED threshold value. Statistically, days having a daily system SAIDI greater than T_{MED} are days on which the energy delivery system experienced stresses beyond that normally expected (such as during severe weather).

26 Major Emergency forecasts are developed after excluding costs that are eligible for CEMA, including CEMA ST Labor.

c. Major Emergency Forecast Summary

See Tables 6-8 and 6-9 for Major Emergency expense and capital expenditure forecasts. The forecast summaries below exclude the CESTLBA labor cost forecast.

TABLE 6-8
SUMMARY OF RECORDED AND FORECAST FOR MAJOR EMERGENCY EXPENSE WORK
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	Expense/Revenues by MWC	2020 Recorded Adj.	2021 Forecast	2022 Forecast	2023 Forecast	Workpaper Reference
1	IF – Major Emergency	$30,973	$41,465	$41,501	$42,708	WP 6-8, line 10

TABLE 6-9
SUMMARY OF RECORDED AND FORECAST FOR MAJOR EMERGENCY CAPITAL WORK
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	2020 Recorded Adj.	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	Workpaper Reference
1	95 – Major Emergency	$64,253	$60,810	$62,069	$63,621	$65,470	$67,367	$69,321	WP 6-18, line 9

D. Estimating Methods

1. Routine Emergency

Due to the variability of EER costs, PG&E used a three-year average (2018-2020) to forecast both capital and expense for Routine Emergency expenditures. Historic costs are escalated to accurately depict historical costs in Base Year dollars in order to calculate test year costs. Base Year costs are escalated using the escalation rates outlined in Chapter 2 of this exhibit.[27]

2. Major Emergency

Since the number and severity of Major Emergencies are unpredictable from year-to-year, PG&E used a five-year average (2016-2020) of recorded costs to forecast Major Emergency costs. A longer average period was

[27] See Exhibit (PG&E-4), WP 6-7 and WP 6-17, for details on forecast calculations for MWCs BH and 17.

used for Major Emergencies than for Routine Emergencies because Major Emergencies are more variable from year-to-year. Recorded costs have been adjusted to remove authorized CEMA-related recovery costs. In order to present a forecast that properly reflects the current and future cost structure view of MEBA, the average basis of using 2016-2019 costs to develop the MEBA expense forecast was adjusted to remove certain overhead costs that no longer reflect the current cost model structure, which became effective in 2020. Furthermore, the historical costs are escalated to Base Year dollars for averaging purpose to derive the test year forecast.[28]

E. Compliance With Section 5.2 of the 2020 GRC Settlement Agreement ("Deferred Work Principles")

The 2020 GRC Settlement Agreement requires PG&E to include testimony in this GRC on deferred work if the following criteria are met:

1) The work was requested and authorized based on representations that it was needed to provide safe and reliable service (Check 1);
2) PG&E did not perform all of the authorized and funded work, as measured by authorized (explicit or imputed) units of work (Check 2); and
3) PG&E continues to represent that the curtailed work is necessary to provide safe and reliable service (Check 3).

Work that was authorized in the 2020 GRC for MWCs in this chapter is needed to provide safe and reliable service, however there was no work that met the criteria for deferred work as described in the Settlement Agreement. This analysis is presented in the workpapers supporting Chapter 2 of this Exhibit.[29] Emergency response work is conducted on an as-needed basis, and PG&E's forecast is based on historical averages. The actual amount of work completed depends on the emergency work that is required during the rate case period.

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28 See Exhibit (PG&E-4), WP 6-8 and WP 6-18, for details on forecast calculations for MWCs IF and 95.

29 See Exhibit (PG&E-4), WP 2-13.

F. Balancing and Memorandum Accounts

1. Major Emergency Balancing Account

PG&E's two-way MEBA was established in PG&E's 2014 GRC by Decision 14-08-032. PG&E proposes to continue to book Major Emergency costs to the MEBA. Most major emergencies are directly related to major weather events. Recent years have shown the high degree of variability in the number of major weather events from year to year. As described above, between 2000 and 2020 there were on average approximately ten Major Event Days per year (ranging from 3-31). In 2020, there were 14 Major Event Days, 30 percent higher than the average of the previous 20 years. This variation means that PG&E's response costs for weather-driven major emergencies will also vary widely from year to year, due to factors beyond PG&E's control that are difficult to forecast. All these factors reinforce the need for continuing the MEBA. PG&E's electric emergency operations are subject to GO 166 – Standards for Operation, Reliability, and Safety During Emergencies and Disasters. The MEBA ensures that PG&E will be able to recover costs when it deploys the resources needed to comply with GO 166 and effectively respond to major emergencies.

Some major emergency response costs are recovered as part of the CEMA in a separate proceeding outside the GRC. Costs are considered eligible for CEMA when there is a state-of-emergency or disaster declaration from a competent state or federal authority with respect to the event causing the emergency response, and the costs are deemed to be incremental.[30] PG&E employs the criteria and guidance from Resolution (Res.) E-3238 and Public Utilities Code Section 454.9 to determine the costs eligible for CEMA recovery. Res.E-3238 authorizes PG&E to record in its CEMA incremental catastrophic event repair and restoration costs, as well as costs associated with complying with government orders in connection with declared state and federal disasters. PG&E reviews all major emergency response costs to determine if they are eligible for recovery through CEMA. Only those major emergency costs (MWCs IF and 95) deemed ineligible for CEMA recovery are recorded to MEBA for recovery in the GRC.

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30 "Incremental" costs are costs not funded through existing rates.

2. Catastrophic Event Straight-Time Labor Costs

a. Background

Historically, intervenors have argued against the recovery of ST labor through the CEMA filing due to the incorrect assumption that ST labor associated with CEMA-eligible events is already funded via base rates. As noted above, however, the GRC and Gas Transmission and Storage (GT&S) Rate Case historically have included forecast costs based on activities, not specific people or positions. Those activity-based forecasts— which were reduced to remove the costs of CEMA activities—take into account various cost components such as the replacement of assets and tools, and labor rates, which include a combination of ST, overtime, and double-time labor. Had CEMA activities been included in prior GRCs and GT&S Rate Cases, the forecasts would have been higher. Accordingly, cost components associated with CEMA activities, including CEMA straight-time labor costs, are incremental to base rates. To the extent those costs are determined to not be recoverable in PG&E's CEMA proceedings, as argued by intervenors, those costs should be deemed to be recoverable on a forecast basis in the GRC. Otherwise, PG&E's CEMA expenses would be underfunded.

When a CEMA-eligible event occurs, PG&E may have to deprioritize non-event response work to devote as many resources as possible to repair damaged electric and gas facilities and restore service as quickly as possible. In performing this work, PG&E crews often work around the clock, incurring not only ST, but also overtime and double-time labor costs.

Once the repair and restoration activities have concluded, PG&E crews return to their routine duties, including activities that had been postponed due to the CEMA-eligible event. Completing the postponed activities requires incremental overtime labor as well as significant incremental contract resources to offset resources diverted to the CEMA event response work. Yet, PG&E does not rely on quantifying those incremental costs to serve as a proxy for CEMA ST time labor. The costs are not charged to CEMA specific orders, but rather are incurred

to replace the labor (ST and overtime) originally intended for executing base work.

Hence, the test of incrementality is not whether a cost is ST or overtime. If that were the test, PG&E would book overtime costs to CEMA specific orders for work unrelated to the catastrophic event such as incremental overtime required for reprioritized base work. Similarly, PG&E would exclude from CEMA-specific orders costs directly related to a catastrophic event only because the costs were incurred during normal working hours. PG&E does neither. CEMA ST labor is incremental for the simple reason that the GRC and GT&S forecasts are reduced commensurate with the cost of CEMA activities.

In this GRC, no activity forecast includes funding for CEMA activities during the 2023 GRC period. To avoid any future misunderstanding around the incrementality and recovery of CEMA ST labor costs, to simplify future CEMA recovery applications, and to account for the variability of CEMA-eligible catastrophic events occurrences, PG&E proposes to recover CEMA ST labor costs through the proposed CESTLBA beginning in 2023.

b. Summary of Request

PG&E proposes to recover ST labor costs associated with CEMA-eligible events through a new two-way balancing account referred to as the CESTLBA. For a discussion on the CEMA, see PG&E's 2020 WMCE, Chapter 3.[31] PG&E's total company test-year expense forecast for CEMA ST labor is $23.2 million. PG&E's total company test year capital forecast for CEMA ST labor is $18.6 million for 2023, $19.1 million for 2024, $19.6 million for 2025, and $20.1 million for 2026.[32,33] For a forecast breakdown by line of business, please see Tables 6-10 and Table 6-11 below. PG&E proposes that all CEMA ST

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31 See A.20-09.019, PG&E 2020 Wildfire Mitigation and Catastrophic Events Prepared Testimony, Chapter 3.

32 Total company ST labor cost forecast includes Electric Operations' portion, which is also captured as part of EER program's total forecast. See Table 6-2, lines 3 and 5 above for the ST labor forecast breakdown of Electric and Other LOBs respectively.

33 See Exhibit (PG&E-4), WP 6-28, line 6.

labor costs be eligible for recovery through the new CESTLBA. If this proposal is approved, PG&E would stop recording CEMA ST labor costs to the CEMA. PG&E is proposing this change to simplify cost recovery in future CEMA applications that seek recovery of recorded incremental costs beginning in 2023.

c. Forecast

PG&E CEMA ST labor expense and capital forecasts are as follows:

TABLE 6-10
CATASTROPHIC EVENT ST LABOR EXPENSE FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	LOB	MWC	2023
1	Customer Care	IG	$144
2	Electric Distribution	IF	20,079
3	Gas Operations	LX	2,878
4	Generation	LX	84
5	Total		$23,186

TABLE 6-11
CATASTROPHIC EVENT ST LABOR CAPITAL FORECAST
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	LOB	MWC	2023	2024	2025	2026
1	Electric Distribution	95	$16,375	$16,817	$17,271	$17,738
2	Gas Operations	3Q	2,098	2,151	2,200	2,251
3	Generation	3Q	121	124	127	129
4	Total		$18,595	$19,092	$19,598	$20,118

See Exhibit (PG&E-4) WP 6-28 for additional forecast details for all LOB CESTLBA forecasts.

d. Forecast Methodology

The CESTLBA forecast is the average of the most recent three years of recorded CEMA ST labor costs (2018-2020), escalated to 2020 base year recorded dollars using the escalation factors provided in Exhibit (PG&E-12) Chapter 3. That amount is then escalated to future

forecast year dollars using the escalation factors presented in Exhibit (PG&E-12), Chapter 3.[34,35]

e. Catastrophic Events Memorandum Account Straight-Time Labor Balancing Account

PG&E proposes the new CESTLBA be applicable to ST labor for all CEMA eligible events beginning in 2023. PG&E proposes the CESTLBA to be trued up annually through PG&E's annual electric and annual gas true up advice letters. The CESTLBA would refund to customers any overcollections should CEMA activities not materialize at the forecasted level. Likewise, the CESTLBA would allow PG&E to recover any under-collections should CEMA activities materialize at a level greater than the forecast level in this GRC. For further discussion on the mechanics of the balancing account, see Exhibit (PG&E-12), Chapter 7.

~~**G. WMPMA: Reasonableness Review of Electric Emergency Costs**~~

~~In this GRC application, PG&E is also requesting recovery of certain costs for work performed in 2020 and recorded in the WMPMA. Attachment A of Chapter 2 in Exhibit (PG&E-4) summarizes the amounts recorded in the WMPMA in 2020, which includes $5.5 million of capital expenditures in MAT Code 17B. PG&E's showing to demonstrate the reasonableness of costs incurred for emergency incremental equipment repairs and replacements and recorded in the WMPMA is found in Attachment A to this Chapter.~~

H. Cost Tables

The expense and capital forecasts for EER-related activities are summarized in the following tables:

- Table 6-12 lists the expense MWCs showing 2016 through 2020 recorded expenses and 2021 through 2023 forecast expenses; and
- Table 6-13 lists the capital MWCs showing 2016 through 2020 recorded expenditures and 2021 through 2026 forecast expenditures.

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34 See Exhibit (PG&E-12) Ch. 3, Table 3-1, Expense.

35 *Id.,* Table 3-2, Capital.

TABLE 6-12
EXPENSE
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted 2016	2017	2018	2019	2020	Forecast 2021	2022	2023	Workpaper Reference
1	BH	Routine Emergency – Expense	$60,812	$57,422	$59,196	$71,327	$67,075	$59,274	$59,361	$73,678	WP 6-1, line 1
2	IF	Major Emergency – Expense	44,184	52,362	28,836	117,555	30,973	41,465	41,501	42,708	WP 6-8, line 10
3	IF	EER CESTLBA Expense	–	–				18,737	19,397	20,079	WP 6-21, line 8[(a)]
4		Total	$104,996	$109,784	$88,032	$188,882	$98,049	$119,477	$120,259	$136,466	

(a) See Exhibit (PG&E-4), WP 6-28 lines 7,9,10 for other LOBs.

TABLE 6-13
CAPITAL
(THOUSANDS OF NOMINAL DOLLARS)

Line No.	MWC	Description	Recorded Adjusted					Forecast						Workpaper Reference
			2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	
1	17	Routine Emergency – Capital	$171,406	$183,903	$187,744	$212,620	$247,499	$193,244	$233,354	$239,188	$246,137	$253,271	$260,615	WP 6-9, line 1
2	95	Major Emergency – Capital	46,303	62,705	33,078	72,935	64,253	60,810	62,069	63,621	65,470	67,367	69,321	WP 6-18, line 9
3	95	EER CESTLBA Capital	–	–				15,541	15,945	16,375	16,817	17,271	17,738	WP 6-28, line 2[(a)]
4		Total	$217,709	$246,608	$220,822	$285,555	$311,753	$269,595	$311,368	$319,184	$328,424	$337,910	$347,674	

(a) See Exhibit (PG&E-4), WP 6-28, lines 3,4,5 for other LOBs.