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U.S. Department of Energy
Office of Electricity
1000 Independence Avenue, S.W.
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Via Electronic Mail: grid.resilience@hq.doe.gov and oilandgas.resilience@hq.doe.gov

RE: Response to Requests for Information Regarding Codes, Standards, Specifications, and Other Guidance for Enhancing the Resilience of Electric, Oil and Natural Gas Infrastructure Systems Against Severe Weather Events

Dear Assistant Secretary Bruce Walker:

On behalf of PG&E Corporation, and its subsidiary Pacific Gas and Electric Company (PG&E), PG&E appreciates the opportunity to submit information on energy system severe weather resilience in response to the two Notices of Request for Information (RFI) issued by the Department of Energy (DOE) and published in the *Federal Register* on July 9, 2019.

PG&E is one of the largest combined natural gas and electric energy companies in the United States. Based in San Francisco, with more than 23,000 employees, the company delivers some of the nation's cleanest energy to nearly 16 million people in Northern and Central California. As both an electric and natural gas provider, PG&E is submitting one set of comments to the DOE regarding its approach to enhancing the resilience of our electric and natural gas infrastructure systems.

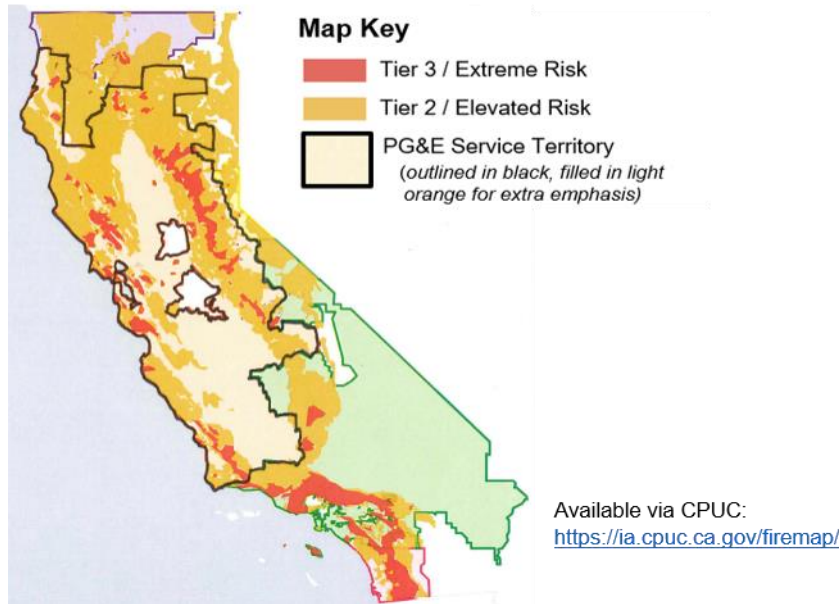
Defining the Risks in PG&E's Service Area

PG&E operates across 70,000 square miles in Northern and Central California. Given the large, geographically diverse service area in which PG&E operates, the company's infrastructure is exposed to multiple severe weather hazards, as well as other impacts from climate change.

The most significant weather hazard currently facing PG&E is the continued and growing threat of wildfires. As a precautionary measure, we are enhancing and expanding our Community Wildfire Safety Program (CWSP) to further reduce wildfire risks and help keep our customers and the communities we serve safe.

One key foundational component informing our work is that wildfire risks are differentiated across California. Our plans are intended to reflect that differentiation given the unique design and geography of PG&E’s service area, as well as the fact that more than half (52 percent) of PG&E’s service area is identified as extreme (Tier 3) or elevated (Tier 2) fire-threat areas according to the California Public Utilities Commission’s (CPUC) High Fire-Threat District Map, as shown below.

CPUC Fire-Threat Map and PG&E Service Area



Additionally, as part of our commitment to addressing climate change, PG&E has identified the primary climate change hazards to our business, including flooding from storm events, sea level rise, land subsidence, heat waves, changes in precipitation patterns and wildfire danger.

The table below outlines key climate change hazards and potential impacts.

Hazards	Potential impact
Increased frequency and severity of storm events	Increased risk of infrastructure damage, customer outages and operational costs due to weather factors such as flooding, high winds and heavy snow.
	Potential to significantly impact operations, create the need for emergency response from PG&E crews and require investments in infrastructure to make the system more resilient.
Sea level rise	Higher inundation and flooding potential at coastal and low elevation facilities due to sea level rise when combined with high tides, storm runoff and storm surges.
	Levee erosion or failure, putting assets at risk.
	Risk of damage to substations and other gas and electric infrastructure.

Change in temperature extremes	Increased electricity demand and loads from more extreme and prolonged hot weather events.
	Risk that certain electrical assets may fail, become less efficient or less reliable, and may need to be modified or replaced as a result of higher temperatures, including warmer daytime maximums and night time minimums, for prolonged periods.
	Increased stress and management of electricity on the transmission system due to higher electrical loads.
	Increased customer outages during extreme heat wave events.
Change in mean (average) temperatures	Higher annual electricity demand if average temperatures increase at the rate global climate models currently predict.
	Lower annual customer natural gas demand.
Change in precipitation patterns and drought	Reduced hydroelectric output, which can increase costs for customers.
	Increased wildfire frequency and intensity due to extreme drought.
	Increased water temperatures in rivers and streams that sustain critical habitats, including for endangered species. Reduction in cold water pools in PG&E’s hydroelectric storage reservoirs, limiting the company’s ability to comply with regulatory requirements and other mandated license conditions.
	Increased risk to infrastructure from land subsidence that occurs as a result of increased groundwater extraction during extreme drought conditions.
Increased wildfire frequency and intensity	Threat from wildfires to customers as well as PG&E assets such as electric transmission and distribution lines, gas infrastructure and hydroelectric assets—also creating the need for emergency response from PG&E crews.
	Increased customer outages.
	Increased risk of erosion and landslides in affected areas, putting assets at risk.

Source: Pacific Gas and Electric Company’s Climate Change Vulnerability Assessment and Resilience Strategies report, November 2016.

How PG&E Assesses and Implements Resilience Measures to Mitigate Severe Weather and Other Climate Change Risks

Nothing is more important to PG&E than the safety of our customers, employees and the public. In keeping with that focus, PG&E’s long-term objective for managing risk is to conduct data-driven decision-making to support safe, reliable and efficient electric and gas service that is integrated into our planning process and becomes the foundation for our regulatory rate cases.

Addressing the Immediate Threat of Wildfires

Wildfires present the most immediate risk to PG&E's electric operations in our service area. PG&E takes seriously the critical role we play in preventing wildfires caused by electrical equipment and we understand the urgency of addressing this risk. As such, in 2019, PG&E has expanded and accelerated our CWSP to enhance, accelerate and implement new programs to help prevent wildfires in 2019 and beyond.

The CWSP includes accelerating inspections of our electric infrastructure; upgrading our electric system in the highest fire-risk areas over the next 10 years; enhancing our vegetation management work, meeting and exceeding current state vegetation and fire safety standards for electric distribution lines in high fire-threat areas; increasing focus on vegetation that poses a higher potential for wildfire risk; adding weather stations to provide improved awareness of fire danger conditions; installing new high-definition cameras to enhance real-time monitoring across high fire-risk areas; and opening a Wildfire Safety Operations Center to monitor conditions 24/7 during wildfire season and coordinating prevention and response efforts.

To address increasing wildfire risk, in addition to aggressively implementing new approaches to manage it, PG&E believes shutting off power will likely be necessary and may need to be performed more frequently due to the extreme weather events and dry vegetation conditions. To that end, PG&E is expanding its Public Safety Power Shutoff (PSPS) program to prevent wildfires from occurring and is implementing new ways to reduce its impacts to first responders and vulnerable customers, including those with medical needs.

CWSP activities include:

- Improving our real-time intelligence and monitoring by:
 - Adding approximately 1,300 weather stations by 2022 to provide improved awareness of fire danger conditions. As of June 30, 2019, we have installed 285 weather stations.
 - Installing approximately 600 cameras by 2022 to enhance real-time monitoring across high fire-risk areas. As of June 30, 2019, we have installed 46 high-definition cameras.
 - Opening a Wildfire Safety Operations Center to monitor conditions 24/7 during wildfire season and coordinating prevention and response efforts.
- Upgrading our electric system in the highest fire-risk areas over the next 10 years by installing approximately 7,100 miles of stronger poles and covered power lines. As of June 30, 2019, we have upgraded and strengthened 51 miles of our system in the highest fire-risk areas.
- Meeting and exceeding current state vegetation and fire safety standards for electric distribution lines in high fire-threat areas, and increasing focus on vegetation that poses a higher potential for wildfire risk. As of June 30, 2019, we have inspected 1,942 miles and cleared 523 miles.

- Conducting accelerated safety inspections of approximately 50,000 transmission structures, 685,000 distribution poles and 200 substations across high fire-threat areas in advance of wildfire season. As of June 30, 2019, we have completed:
 - Visual or aerial inspections of approximately 97 percent of the nearly 50,000 transmission structures in, or adjacent to, high fire-threat areas as defined by the CPUC’s High Fire-Threat Map.
 - Inspections of approximately 99 percent of nearly 700,000 distribution poles in, or adjacent to, high fire-threat areas.
 - Inspections of all 222 substations in high fire-threat areas.

- Addressing and repairing conditions that pose an immediate safety risk, while completing other high-priority repairs on an accelerated basis. As of May 31, 2019, we have identified:
 - Approximately 53,000 corrective actions on transmission structures with nearly 100 conditions identified as highest priority. One hundred percent of these highest-priority conditions have been repaired or made safe.
 - Approximately 207,000 corrective actions on distribution poles with nearly 1,000 conditions identified as highest priority. Ninety-seven percent of these highest-priority conditions have been repaired or made safe and the remaining high-priority conditions are currently in the process of being repaired.
 - Approximately 3,000 corrective actions within substations with approximately 100 conditions identified as highest priority. One hundred percent of these highest-priority conditions have been repaired or made safe.

- Expanding our PSPS program to include piloting new resilience zones to provide electricity to community resources and help reduce the potential impact of a PSPS event.
 - This work involves installing equipment that will enable temporary generation to connect to the larger grid, installing devices that can isolate certain circuits, and other system hardening efforts such as stronger poles and covered power lines to improve resiliency.

PG&E has also enhanced controls in several areas. For example, in 2019, PG&E will add Supervisory Control and Data Acquisition (SCADA) capability to allow for remote reclose blocking. The expanded SCADA capability will enable remote operation of 100 percent of the line reclosers in Tiers 2 and 3 of the high fire-threat areas.

PG&E has also introduced other measures to prevent potential ignitions, including strengthened personnel work procedures, deploying Safety and Infrastructure Protection Teams with firefighting capabilities, and operating heavy-lift helicopters for enhanced fire suppression and restoration efforts, available at CAL FIRE’s discretion.

Supporting Our Communities’ Efforts to Bolster Resilience

Many of the customers and communities PG&E serves in California are already experiencing the consequences of climate change, including more frequent extreme weather, rising sea levels, increased drought and longer, more severe wildfire seasons. PG&E is working to design,

influence and implement policies that measurably and demonstrably increase the resilience of the company's assets and operations, and support climate resilience in the communities we serve. As part of our efforts to promote local resilience to climate change, PG&E is investing \$2 million in shareholder funding over five years through the Better Together Resilient Communities grant program to support local climate resilience initiatives.

PG&E's Better Together Resilient Communities grant program provides eligible local governments, educational institutions and non-profits with \$100,000 for projects that increase community resilience to various climate risks, including heat waves and wildfires. The competitive process evaluates applications by the below criteria:

- **Demonstrated partnership:** the proposal reflects a collaborative effort among multiple organizations or stakeholders.
- **Replicability:** the proposal identifies how others will be able to learn from and adopt resulting strategies and solutions.
- **Assistance to environmental and social justice communities:** the proposal is community-focused and addresses climate resilience needs relevant to environmental and social justice populations, including designated disadvantaged communities.
- **Measurable impact:** the proposal includes practical, measurable and innovative ways to address community needs and climate risks.

PG&E's grant program is already seeing success in building resilience in communities threatened by wildfire risks and extreme heat. In 2017, PG&E awarded Ag Innovations a grant to partner with the Sonoma County Water Agency to create a coalition to develop solutions to protect the local water supply and forest health from erosion and wildfire risks. The project is developing collaborative solutions for managing vegetation, improving watershed health and reducing wildfire risk in the Lake Sonoma Recreation Area, a critical source of water for more than 600,000 people. Ag Innovations has plans to replicate this community-based land management effort based on demand in neighboring North Bay communities.

Another example comes from the Chinatown Community Development Center, which earned a grant from PG&E to develop a neighborhood community resilience strategy for the low-income, monolingual Chinese speaking immigrant community. Many residents and businesses in the Chinatown area of San Francisco do not have air conditioning and face risks from the heat waves increasingly occurring in the Bay Area. This project will identify gaps and recommendations to improve building performance during heat waves and engage community-based groups and local youth leaders to identify opportunities to reduce the risk of urban heat island effects.

In 2019, PG&E is requesting grant proposals to fund four projects that build community capacity to reduce wildfire risk and support healthy and resilient forests and watersheds. Priority will be given to projects located in elevated or extreme fire risk areas and to those that address the needs of environmental and social justice communities.

Addressing the Full Range of Long-Term Possibilities throughout the Business

In addition to meeting the immediate threat of severe wildfire risk driven by climate change, PG&E is working to incorporate long-term climate resilience into the company's core processes.

In 2017, PG&E established a Climate Resilience Officer Committee to direct and take accountability for the company's climate resilience programs. This multidisciplinary governing body is overseeing a multi-year action plan to close gaps in our approach to addressing the impacts of PG&E's priority climate risks. The Committee is co-chaired by PG&E Corporation's Vice President, Federal Affairs and Chief Sustainability Officer and Vice President, Internal Audit and Chief Risk Officer and includes senior representatives from gas operations, electric operations, power generation, enterprise risk management, the Community Wildfire Safety Program, information technology, supply chain management, and corporate real estate.

A critical aspect of PG&E's climate resilience activity is the incorporation of long-term climate projections into infrastructure planning. PG&E's climate resilience team is working with the lines of business to translate high-quality climate data, downscaled to California, into formats that engineers can use to better plan for expected future conditions. By planning today for the projected changes in heat, precipitation, sea level rise and other conditions that will occur in California in the coming decades, PG&E can avoid increased maintenance or replacement costs and be better prepared to continue providing safe, reliable, affordable, clean energy into the future. While PG&E is still exploring and learning from the application of climate data to utility planning processes, the goal is to eventually develop infrastructure standards that address expected future climate conditions.

PG&E is also planning to conduct a revised vulnerability assessment to examine the exposure and sensitivity of PG&E assets to climate-driven threats. This assessment will build upon the company's 2016 Climate Change Vulnerability Assessment conducted as part of DOE's Partnership for Energy Sector Climate Resilience and will complement PG&E's 2017 quantitative Risk Assessment Mitigation Phase (RAMP) filing with the CPUC. The vulnerability assessment will analyze expected climate impacts, the exposure and sensitivity of PG&E infrastructure, and an estimation of how the failure of vulnerable infrastructure could impact customers. PG&E expects the results of the study will help PG&E identify and prioritize climate resilience investments that will be needed in the coming years.

How the State of California is Addressing Severe Weather and Climate Change Resilience

The State of California is taking a number of actions to support energy sector climate resilience. This includes the state's investment in the state-of-the-art, geographically granular Cal-Adapt tool (<https://cal-adapt.org>), which allows users to examine forward-looking climate data under different models and scenarios, and also provides visualizations of climate data for geographic analysis and presentation. PG&E has relied on this state-led repository of California-specific climate information when assisting operational partners with climate analysis of new infrastructure projects.

While Cal-Adapt is a powerful tool, the interpretation and utilization of climate data is complex. Climate models are inherently uncertain and making decisions based on forward-looking projections requires making critical determinations about acceptable levels of risk. Recognizing the complexity and importance of climate resilience planning, the CPUC opened an Order Instituting Rulemaking in 2018 to address five key questions related to climate resilience:

- How should the CPUC define climate adaptation for investor-owned utilities (IOUs)?
- What climate-related data sources, scenarios, tools and other resources should be used to inform CPUC activities and utility planning?
- What climate parameters should the CPUC use to determine climate-driven risks and resilience for electric and natural gas utilities?
- How should climate scenarios, climate-relevant parameters, and resilience metrics be used in electric and gas utility planning and operations, and in CPUC proceedings, to address climate adaptation in a consistent matter?
- How can electric and natural gas utilities identify climate impacts specifically relevant to disadvantaged communities, and address those impacts?

Through this proceeding, stakeholders, including the CPUC and California's IOUs, have advanced their thinking about building utility resilience. PG&E recommends that the DOE review the final decision in this proceeding, which is expected in late 2019.

Recommendations for the Department of Energy and Other Federal Agencies to Consider in Supporting Energy Companies' Efforts to Bolster Resilience

Severe weather and climate change resilience are very much regionally focused, as different regions face different risks. As a company that operates exclusively in California, PG&E believes that the State of California is best suited to determine and implement any standards affecting the resilience of PG&E's electric and gas systems, notwithstanding efforts by the North American Electric Reliability Corporation (NERC) and adopted by the Federal Energy Regulatory Commission (FERC) that affect resilience of the bulk power system.

However, PG&E believes there are supportive actions the Federal Government can take to assist energy companies, other critical infrastructure sectors, state and local governments, communities and others to increase their resilience to severe weather and other climate-change impacts.

First, DOE should continue to prioritize its Partnership for Energy Sector Climate Resilience. PG&E is an active participant in the Partnership and has benefited significantly from the dialogue that the Partnership has created amongst the participating energy companies.

One of the notable objectives of the Partnership is to better assess the interdependencies that exist between energy systems and other critical infrastructure, such as telecommunications, water and transportation. The Department of Homeland Security has designated the energy sector as one of 16 critical infrastructure sectors. The energy sector provides the power and fuel necessary to support the other 15 critical infrastructure sectors, and this interdependency becomes even

more critical during severe weather. The DOE – through the Partnership and other means – can play a greater role to examine this interdependence and collaborate with other agencies and sectors to assess and communicate regional best practices to ensure broader, economywide resilience in the face of a changing climate.

The Partnership is also planning to develop and deploy tools for energy companies to better assess vulnerabilities to extreme weather and other climate impacts and evaluate the effectiveness of certain resilience investments. Guidance for analyzing the economic costs and benefits of resilience investments is needed to help utilities and others make more informed decisions on whether, when and how to invest in the resilience of their systems.

Finally, the Partnership has been helpful in making data from multiple federal agencies more accessible to energy companies. PG&E relies on various sources of government-provided data such as the Federal Emergency Management Agency (FEMA) flood maps, National Oceanic and Atmospheric Administration (NOAA) sea level rise inundation maps, National Aeronautics and Space Administration (NASA) ground subsidence mapping, and more. The Partnership plays a helpful role in synthesizing and communicating this information.

However, the Federal Government could better utilize its vast resources and expertise to provide energy companies and other infrastructure planners more sophisticated climate data and analysis. Real-time data, such as from satellite resources, can be helpful in identifying current threats, such as wildfire outbreaks. For example, PG&E has been discussing opportunities with federal policymakers to potentially leverage Department of Defense aerial and satellite surveillance systems to more quickly identify wildfire outbreaks at the point of ignition and share this information with appropriate federal, state and local emergency response agencies to accelerate response times. While PG&E is currently utilizing data from NOAA satellites to provide greater situational awareness about wildfire risks, PG&E believes other existing federal monitoring systems, such as those operated by the Department of Defense, could be of value.

The Federal Government, however, must recognize the limitations of real-time data for long-term climate resilience planning and also invest in research and analytical tools that focus on long-term forecasts. Real-time and historical data does not provide an accurate outlook of the future challenges electric and natural gas system infrastructure may face from climate change. The State of California has recognized this gap in information and has invested significantly to develop and publicly share its system, Cal Adapt, with tools, data and other resources to assist infrastructure planners, such as PG&E, with conducting research and developing adaptation plans.

Finally, the Federal Government, particularly the DOE, can play a critical role in advancing research, development and deployment of the technologies that can allow utilities to better plan for and increase their resilience. Such technologies could include:

- Hardware, software, materials advances and other technologies to harden electric infrastructure in the face of wildfire risks, such as faster, more intelligent reclosers and improved “downed line” technologies;

- Improved sensor technology for electric transmission and distribution lines;
- Analytical tools to better model the impacts of climate changes on electric and gas infrastructure; and
- Long-duration energy storage systems and other advanced, mobile generation systems that can provide power during outages.

PG&E appreciates the opportunity to submit this information in response to the RFIs and looks forward to continuing to work with DOE and others on opportunities to build greater climate resilience.

Sincerely,

A handwritten signature in black ink, appearing to read "Jm C Hogle". The signature is fluid and cursive, with the first letters of each word being capitalized and prominent.

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PG&E Corporation