

Supplemental Data Request (SDR)

Summary Tables and Comments



February 28th, 2020

Pacific Gas and Electric (PG&E)

San Francisco, California

Supplemental Data Request (SDR)
Summary Tables and Comments
February 28th, 2020

Pacific Gas and Electric (PG&E)
San Francisco, California

TABLE OF CONTENTS

<u>Contents</u> (Section numbers created to match CPUC's SDR)	<u>Page</u>
Section 1.1.....	3
• Summary Table 1.....	3
• Comments Table 1.....	5
Section 1.2.....	11
• Summary Table 2.....	11
• Comments Table 2.....	13
Section 1.3.....	16
• Summary Table 3.....	16
• Comments Table 3.....	16
• Summary Table 4.....	17
• Comments Table 4.....	17
• Summary Table 5.....	20
• Comments Table 5.....	23
Section 1.4.....	26
• Summary Table 7.....	26
• Comments Table 7.....	27
• Summary Table 8.....	29
• Comments Table 8.....	29
Section 1.5.....	30
• Summary Table 9.....	30
• Comments Table 9.....	30
Section 1.6.....	32
• Summary Table 10.....	32
• Comments Table 10.....	33
Section 2.1.....	35
• Summary Table 11.....	35
• Comments Table 11.....	35
Section 2.2.....	36
• Summary Table 12.....	36
• Comments Table 12.....	36

Section 2.3.....	37
• Summary Table 13.....	37
• Comments Table 13.....	37
Appendix List.....	38

SECTION 1.1:

Summary - Table 1 Recent performance on progress metrics, last 5 years

#	Program metric name	Annual performance					Notes
		2015	2016	2017	2018	2019	
1	Extreme weather prediction accuracy	N/A	N/A	N/A	-	-	Similar data provided. Please see the comments section below for more information.
2	Equipment operating load above nameplate capacity	5 circuits (as measured at circuit breaker)	2 circuits (as measured at circuit breaker)	22 circuits (as measured at circuit breaker)	2 circuits (as measured at circuit breaker)	13 circuits (as measured at circuit breaker)	Similar data provided. Please see the comments section below for more information.
3	Risk-spend efficiency of resources deployed towards wildfire mitigation	-	-	-	-	43.43 MAVF / \$million dollars	Similar data provided. Please see the comments section below for more information.
4	Extent of hardening across grid	N/A	N/A	N/A	N/A	113% (Program Specific Distribution) 0.67% (General Distribution)	Please see the comments section below for more information.
5A	Community engagement activity and effectiveness	N/A	N/A	N/A	N/A	For PSPS, 76% (Wave 2). For emergency response procedures, 29%-51% recall various messages	Similar data provided. Please see the comments section below for more information.
5B	Community engagement activity and effectiveness <i>Units: Percent of residents</i>	Routine: 99.63% EVM: N/A	Routine: 99.72% EVM: N/A	Routine: 99.75% EVM: N/A	Routine: 99.64% EVM: N/A	Routine: 99.78% EVM: 40%	

	<i>agreeing to participate in utility wildfire risk-reduction activities (e.g., allowing access to property for utility hazard tree remediation)</i>						
--	--	--	--	--	--	--	--

Progress Metric	Comments
Extreme weather prediction accuracy	<p>PG&E cannot provide the data requested as PG&E's PSPS program is not dependent on a binary over/under threshold determination. PG&E's meteorology team and decision makers carefully review a suite of data to determine PSPS including: internal and external weather model data, PG&E's Fire Potential Index (FPI) and Outage Producing Winds (OPW) models, the timing and areal extent of NWS Red Flag Warnings, High Risk wind triggers that indicate significant fire growth potential issued from the Northern and Southern Geographic Area Coordination Center, forecasts of elevated, extreme, and critical fire weather from the NOAA Storm Prediction Center, observations from field personnel, the location of existing fires, any new fire alerts from the PG&E fire detection and alert system or other sources, any alternatives to de-energization, and meteorological subject matter expertise. During every PSPS that has been executed, Red Flag Warnings and/or High Risk wind triggers were issued by federal agencies indicating significant fire growth potential. One of the main sources of PSPS guidance is PG&E's combination of FPI and OPW model output, but aforementioned input data are considered as well.</p> <p>In order to track the onset and strength of weather events, PG&E meteorologists track wind speeds in real-time as well as observed vs forecast pressure gradients from multiple forecast models using an automated tool. In the attached SDR Excel spreadsheet there are outputs from the tools for 3 PSPS events this year as an example. Black dots represent weather station observations while solid lines represent forecast model data. Note that ECM is the ECMWF model, NAM is the American mesoscale model, HRRR is the High-Resolution Rapid Refresh model, POMMS is the PG&E high resolution forecast model, and GFS is the American global model. Pressure gradients are a proven meteorological metric to track, are closely tracked by operational meteorologists in the National Weather Service and have proved very useful for PG&E as the pressure gradient force is what ultimately drives wind speeds. This tool allows PG&E meteorology to determine if a weather event is materializing under or over forecasted predictions. In addition, PG&E's meteorologists track wind</p>

	<p>speeds in real time via internally developed tools and/or publicly available web applications like Mesowest and the National Weather Service Weather and Hazards data viewer.</p> <p>Please see SDR Excel spreadsheet (Sheet “Table 1, metric1”) for similar data’s snapshot of real-time pressure gradient tracking tool taken 2/24/2020 as described.</p> <p><i>Please note: PG&E first implemented PSPS in 2018.</i></p>
Equipment operating load above nameplate capacity	<p><i>Number of circuit hours operated above nameplate capacity in HFTD areas:</i> PG&E is unable to provide hours over nameplate rating, only peak annual load is recorded, not number of hours above capacity.</p> <p><i>Average % above nameplate capacity when equipment operated above nameplate capacity in HFTD areas:</i> PG&E is unable to provide average load as a percent of nameplate capacity for the hours operated above nameplate capacity, only peak annual load is recorded, not number of hours above capacity.</p> <p>PG&E is providing the number of circuits in each year that had peak load measured at the substation circuit breaker that was above the substation nameplate capacity of the circuit.</p>
Risk-spend efficiency of resources deployed towards wildfire mitigation	<p><i>Dollars per incremental life saved & dollars invested per estimated dollars of rebuilt structures avoided:</i> PG&E takes a more holistic approach when looking at risk-spend efficiencies for wildfire mitigation and will continue to do so in the future. Therefore PG&E is providing different data than requested. PG&E is providing the RSE of 2019 spent towards wildfire mitigation efforts.</p> <p>The risk-spend efficiency deployed towards wildfire mitigation efforts in 2019 was 43.43 based on the methodology agreed upon in CPUC SMAP Settlement Agreement D18-12-014*. PG&E’s 2019 Wildfire Risk Score was 18,742, taking into account the preliminary CPUC reportable ignitions, and PG&E’s mitigation efforts, including the negative reliability impact of PSPS. Absent of these activities, PG&E’s unmitigated 2019 Wildfire Risk Score was 61,197. Hence, PG&E’s wildfire mitigation efforts’ risk reduction was 42,455 [61,197 - 18,742]. After taking into account the 2019 costs of \$977 Million for the previously listed activities, the RSE of</p>

	<p>resources deployed towards wildfire mitigation in 2019 = 43.43/\$million spent [42,455 / \$977M].</p> <p>PG&E’s risk model included the following mitigations:</p> <table><tr><th>Program</th><th>Units</th><th>\$</th></tr><tr><td></td><th>2019 Actuals</th><th>2019 Actuals</th></tr><tr><td>EVM # Miles</td><td>2,533</td><td>\$443,098,894</td></tr><tr><td>System Hardening # Miles</td><td>171.2</td><td>\$287,429,265</td></tr><tr><td>Surge Arrestor #Units</td><td>4,611</td><td>\$21,767,351</td></tr><tr><td>PSPS - Expense</td><td>8</td><td>\$225,559,224</td></tr></table> <p>*Per the CPUC’s Safety Model Assessment Proceeding (S-MAP) D18-12-014 and Risk Assessment Mitigation Phase (RAMP), a Multi-Attribute Value Function (MAVF) is constructed with Safety (50%), Reliability (25%), and Financial Attributes (25%). Risk Spend Efficiency is based on the Risk Reduction calculated through the MAVF function divided by the Total Cost of the program, with discounting applied.</p> <p><i>Dollars per customer hour of PSPS avoided:</i> PG&E’s goal when implementing PSPS is to prioritize customers’ safety and understands the hardships caused by implementing PSPS - PG&E explores, and will continue to explore, several avenues to keep customers energized. However, at this time, PG&E is not able to answer the dollar amount of PSPS hours avoided.</p> <p><i>Please note: PG&E first implemented PSPS in 2018.</i></p>	Program	Units	\$		2019 Actuals	2019 Actuals	EVM # Miles	2,533	\$443,098,894	System Hardening # Miles	171.2	\$287,429,265	Surge Arrestor #Units	4,611	\$21,767,351	PSPS - Expense	8	\$225,559,224
Program	Units	\$																	
	2019 Actuals	2019 Actuals																	
EVM # Miles	2,533	\$443,098,894																	
System Hardening # Miles	171.2	\$287,429,265																	
Surge Arrestor #Units	4,611	\$21,767,351																	
PSPS - Expense	8	\$225,559,224																	
Extent of hardening across grid	<p><i>Percent of all grid assets in HFTD areas using proven and demonstrated wildfire-resistant equipment:</i> <u>Distribution</u> –</p> <p><i>General overview of system hardening</i> In 2019, PG&E started system hardening to manage wildfire risk. To ensure lines have been hardened and standards met, a quality control check is done to ensure the work is complete. During the quality control check, 171.16 miles were confirmed hardened in 2019 of the total 25,597 HFTD tier 2 and tier 3</p>																		

	<p>miles. This provides a general insight to the HFTD system.</p> <p><i>Project Specific Standards</i> In 2019, PG&E replaced 706 non-exempt fuses under MAT CODE 2AP in HFTD areas. The commitment target was to replace 625 non-exempt fuses. PG&E exceeded the target of equipment hardening.</p> <p><u>Transmission</u> -</p> <p>PG&E is assuming hardening is being referenced as asset replacements with the specific goal to improve wildfire management with respect to PG&E's distribution system. Assets on the transmission side are typically replaced through specific capital projects from multiple major work categories or routine maintenance.</p> <p>Asset replacements are based on company standards or specific engineering designs where needed.</p>
Community engagement activity and effectiveness	<p><i>Percent of residents made aware of PSPS and emergency response procedures in advance of events, according to post-event surveys:</i> The only available data that PG&E is able to leverage are pre-event surveys as it is currently completing comprehensive post-event surveys.</p> <p>For "Percent of residents made aware of PSPS", customer surveys were done in two waves. Wave 1 was fielded May 3-20, 2019 (at the beginning of the coordinated statewide campaign). Wave 2 was fielded Aug 15-28, 2019 (during the end of the campaign). Both surveys were conducted prior to the Oct/Nov 2019 PSPS events. Wave 2 was conducted after one minor PSPS event (June 8-9). The delta shows the progress made as a result of the coordinated statewide campaign in the summer of 2019.</p> <p>The survey <i>2019 Wildfire Safety Awareness Survey</i> asked, "Before today, had you ever heard of PG&E's Public Safety Power Shutoff program?" In wave 1, 60% of those surveyed answered yes. In wave 2, the answer yes increased to 76% answering yes.</p> <p>For "Percent of residents made aware of emergency response procedures", PG&E thought it best to use Total Awareness</p>

(recall) of Past 30-60 day messaging from Wave 2 (based on the total population). Recall ranged from 29% (*Plan for needs of pets and livestock*) to 51% (*PG&E proactively shutting off power when wildfire risk is high*). Below is the recall matrix, showing the percentage of those recalling emergency response procedures:

2019 Wildfire Safety Awareness Survey, Wave 2	
Awareness of Emergency Response Procedures (Recalled Messaging)	Total Population
<i>Base Total Population: (n=3,340)</i>	
PG&E proactively shutting off power when wildfire risk is high	51%
Prepare an emergency supply kit	46%
Have a personal safety plan in place	42%
Create a defensible space on your property	40%
PG&E's Public Safety Power Shutoff (P-S-P-S) program	38%
How to prepare for a wildfire	35%
Plan for any medical needs (e.g., meds needing to be refrigerated, devices requiring power)	34%
Steps to prevent/mitigate wildfires on your property	33%
PG&E is conducting safety inspections of electric poles in high fire-threat area	32%
Conditions that cause/contribute to wildfires	32%
What to do in the event of a wildfire	31%
Update your contact information with your utility	30%
Plan for the needs of pets and livestock	29%

Please note: PG&E first implemented PSPS in 2018. No surveys were conducted in 2018.

Percent of residents agreeing to participate in utility wildfire risk-reduction activities (e.g., allowing access to property for utility hazard tree remediation):

The percentages shown represents property owner participation rates separated between Routine and EVM operations.

Routine operations are compliance driven and backed by state and federal regulations that govern PG&E's ability to enforce said compliance.

EVM operations have a large component of processes outside of regulated compliance and PG&E has less legal authority to complete them if a property owner does not cooperate.

This is the explanation of the substantial disparity between the two participation rates.

EVM Participation Rate for 2019 only. EVM was not in effect during 2015-2018.

<p>Emergency planning and preparedness</p>	<p><i>Number of emergency response deficiencies reported by Cal OES, suppression agencies, and other emergency response personnel when plans tested or activated:</i></p> <p>Although feedback of all types, including deficiencies, is welcomed by our agency partners, PG&E is not aware of the number of deficiencies reported by Cal OES, suppression agencies, and other emergency response personnel when plans have been tested or activated.</p> <p>Collecting data of the number of deficiencies reported by external agencies will be a priority going forward.</p>
---	--

SECTION 1.2:

Summary - Table 2 **Recent performance on outcome metrics, last 5 years**

#	Outcome metric name	Annual performance					Notes
		2015	2016	2017	2018	2019	
2A	Percent of customers experiencing PSPS given 95th percentile fire weather conditions along entire grid using utility PSPS decision protocols	0.35%	0.10%	0.71%	0.60%	0.76%	Similar data provided. Please see the comments section below for more information.
2B	Percent of customers experiencing PSPS given 99th percentile fire weather conditions along entire grid using utility PSPS decision protocols	0.06%	0%	0.27%	0.21%	0.21%	Similar data provided. Please see the comments section below for more information.
3A	Increase in electric costs to ratepayer due to wildfires (total)	\$131,478,328	\$69,853,989	\$205,996,528	\$551,754,692	\$375,545,119	Similar data provided. Please see the comments section below for more information.

3B	Increase in electric costs to ratepayer due to wildfires (normalized)	2077	778	437	1055	1042	Similar data provided. Please see the comments section below for more information.
3C	Increase in electric costs to ratepayer due to wildfire mitigation activities (total)	\$143	\$71	\$404	\$272,224	\$1,308,065	<i>\$Thousands</i>
4	Electricity procured from renewable sources	29.5%	32.9%	33.0%	38.8%	29.7%	
7A	GHG emissions from utility-ignited wildfires (total)	4,405,155 MT	N/A	10,493,478MT	10,295,934MT	N/A	See explanation in the comments section for how the estimate is being achieved.
7B	GHG emissions from utility-ignited wildfires (normalized)	40	N/A	22	20	N/A	See explanation in the comments section for how the estimate is being achieved.

Comments - Table 2
Recent performance on outcome metrics, last 5 years

Metric Type	Comments
Risk spend efficiency of WMP programs	<i>Average risk spend efficiency of all WMP programs being undertaken by utility:</i> PG&E does not have the data to satisfy the request at this time.
	<i>Average risk spend efficiency of wildfire-only WMP programs being undertaken by utility:</i> PG&E does not have the data to satisfy the request at this time.
Customer hours of PSPS based on stress test conditions	<p>One of PG&E's main sources of PSPS guidance is a combination of FPI and OPW. In 2019, PG&E determined through historical analysis that a guidance value of ≥ 0.08 will be utilized to inform PSPS decision making. As stated in the response to Table 1, metric 1, this is one of the inputs into the ultimate decision to de-energize for public safety. This analysis does not consider the other inputs mentioned and does not consider the dynamic nature of event in real-time. The 0.08 guidance value was derived through PG&E's 30 yr historical climatology to determine the frequency and magnitude of PSPS events. Over this 30 year history, PSPS would have been executed at the ≥ 0.08 guidance 163 times, which is $\sim 1\%$ of all days (99th percentile conditions). PSPS executed at the ≥ 0.05 FPI*OPW guidance represents 95th percentile conditions. This analysis assumed that each Fire Index Area (FIA) that contained guidance at or meeting levels above were de-energized.</p> <p>Data provided for 2015 – 2018 were determined from analysis of the climatology while 2019 represents actuals as it pertains to 2.b. For 2.a, 2019 was estimated using a historically derived ratio of customer hours between the 99th and 95th percentile conditions from 2015 – 2018.</p> <p><i>Please note: PG&E first implemented PSPS in 2018.</i></p>
Electricity Cost to Ratepayers	<p>At this time, PG&E is able to provide a list of all CEMA fire related activities for capital (MWC 95) and expenses (MWC IF). This total was also normalized. PG&E is able to provide additional information on increase in electric costs to rate payer due to wildfires, but more time will be needed to submit this information.</p> <p>See the SDR Excel spreadsheet attachment ("Table 2, Metric 3a,</p>

	3b, and 3c”) for a more detailed breakdown.
Actual renewable energy procurement	<p><i>Electricity procured from renewable sources:</i></p> <p>The 2019 actual procurement value of 29.7% is based on the latest data from the Renewable Portfolio Standards (RPS) Report. This data still has some preliminary adjustments for November/December, although remaining meter adjustments are not expected to be significant.</p>
Impact of utility ignitions based on ignition simulation	<p>PG&E cannot answer this question based on a lack of data and understanding of the question. It is unclear what is being asked regarding metric 5 in terms of the definition of evacuation zones - are these the actual evacuation zones from historical fires (e.g., Tubbs) or the projected fire spread area from the fire spread model? PG&E has attempted to acquire historical evacuation GIS data from external agencies, but the data has not been forthcoming. In addition, it would need to be clarified if the question is asking about every ignition simulated or only the actual ignitions reported to the CPUC. With critical assumptions that the request is aimed at understanding metrics based on the fire spread footprint and CPUC reportable ignitions, an outside vendor was consulted on the cost to produce the data requested.</p> <p>To simulate approximately 5000 ignitions from 5 years of climatology data would cost ~\$800,000. Due to ambiguities of the request and the cost associated, PG&E is not providing the data at this time but is willing to work with the CPUC to refine the request and generate the data.</p>
Public impacted by utility-ignited wildfire evacuation	PG&E is not aware of evacuation zones data. Technosylva also estimated this to cost PG&E approximately \$53,000 to perform.
Estimated GHG emissions from utility-ignited wildfire	Based on research of various resources, PG&E compared four methodologies in estimating GHG emissions associated with wildfire. Among these four methodologies, the most conservative GHG emission factor for wildfires is 62.16 MT CO ₂ e/acre (metric tons per carbon dioxide equivalent per acre) of wildfire. This factor was derived from the analysis on four California wildfires that burned in forests (as opposed to shrub or grassland fires) and not strictly utility ignited wildfires. Please also note that this factor only includes emissions from biomass combustion and excludes subsequent emissions associated with the decay of the forest after the wildfire.

	<p>PG&E is providing data in this answer for wildfires (fires 10 acres or more) that CAL FIRE concluded were caused by PG&E equipment. As of Feb. 7, 2020, CAL FIRE is still conducting its investigations and has not concluded that any wildfires were ignited by PG&E facilities in 2019.</p>
<p>Transportation impacted by PSPS</p>	<p><i>Critical transportation infrastructure impacted due to PSPS:</i> PG&E is not aware of any significant impact on rider/driver hours lost due to PSPS events. Prior to PSPS de-energization, PG&E identifies critical social facilities that, if de-energized, would cause potentially more harm. Many of these facilities would affect divers and riders (tunnels, bridges, trains, etc.) if de-energization were to occur. As such, PG&E will keep power on through the use of temporary generation, sectionalization, or other mitigating efforts.</p> <p><i>Please note: PG&E first implemented PSPS in 2018.</i></p>
	<p><i>Major roads impacted due to PSPS (normalized):</i> PG&E is not aware of any significant impact on rider/driver hours lost due to PSPS events. Prior to PSPS de-energization, PG&E identifies critical social facilities that, if de-energized, would cause potentially more harm. Many of these facilities would affect divers and riders (tunnels, bridges, trains, etc.) if de-energization were to occur. As such, PG&E will keep power on through the use of temporary generation, sectionalization, or other mitigating efforts.</p> <p><i>Please note: PG&E first implemented PSPS in 2018.</i></p>

SECTION 1.3:

Summary Table - Table 3 Annual evacuations for utility-ignited wildfire, last 5 years

PG&E is not able to answer this table at this time.

Comments - Table 3 Annual evacuations for utility-ignited wildfire, last 5 years

Comments
PG&E is not aware of evacuation data. As such, no table can be answered at this time.

Summary Table - Table 4**Spreadsheet columns for lists of events, last 5 years**

See attached SDR Excel spreadsheet (all “Table 4” sheets) for a list of ignitions and wires down events.

Comments - Table 4**Spreadsheet columns for lists of events, last 5 years**

Comments
<p>1) List of all occurred events per type listed as an “incident type”:</p> <p>PG&E defines “incident type” as ignitions. As such, an ignition report is attached.</p> <p>2) Wires Down Events Response (Distribution):</p> <p>The following information applies to the distribution wire down events that are contained in Table 4.2D. In response to this request, PG&E has utilized its outage database to provide the number of sustained outages on its distribution system reported with a wire down or contact with a foreign object; including both primary and secondary distribution or overhead services as well as those events that occur on “Major Event Days” (typically due to severe storm events and as defined in the IEEE 1366 standard).</p> <ul style="list-style-type: none">• Type of event – The Outage Level, Basic Cause and Supplemental Cause are contained in Columns M, N and O, respectively.• Date - The date of when the outage started is found in Column G.• Time - The time of day when the outage started is found in Column H.• Latitude and Longitude – The latitude and longitude of the device that operated and/or was used to isolate the outage is contained in Columns R and S.• Circuit Name - The circuit name (or Feeder Name) is provided in Column C.• Land use (rural/urban) - PG&E’s outage data does not provide the Land Use designation, but this file contains the High Fire Threat District (HFTD) in Column AA based on the latitude and longitude of the device that opened and/or was used to isolate the outage (Columns R and S).• Enhanced inspections and maintenance conducted according to 2019 WMP at location prior to event (Yes / No) - PG&E’s outage database is not linked to the maintenance records or the 2019 WMP.• Enhanced vegetation management conducted according to 2019 WMP at location prior to event (Yes / No) - PG&E’s outage database is not linked to the vegetation maintenance records or the 2019 WMP.• Type of Equipment involved – The Failed Equipment and Failed Equipment Condition are contained in Columns V and W, respectively.• Facility identification – The type of device and operating number (if applicable) is contained in Columns E and F, respectively.

- Voltage - The voltage of the involved circuit is contained in the Feeder Name as noted in Column C. A circuit number of 21XX represents a 21 kV Circuit, a 17XX is a 17 kV circuit, a 11XX is a 12 kV circuit, and a 04XX represents a 4 kV circuit.
- Age of involved equipment - PG&E's outage database is not readily linked to the age of the involved equipment.
- Overhead or underground - The Construction Type (OH for Overhead and UG for Underground) is contained in Column Y.
- Covered conductor or other - PG&E's outage database is not readily linked to the conductor attributes.
- Other companies' equipment involved (or N/A) – The closest field similar to this would be those events reported with a Basic Cause of 3rd Party in Column N, with more information noted in the Supplemental Cause in Column O.
- Local temperature at time of event and Local wind speed at time of event - A Weather field with temperatures and other weather attributes is contained in Column U.
- Nearest weather station by weather station ID - PG&E's outage database does not readily identify the nearest weather station ID.
- Last inspection data of involved equipment - PG&E's outage database does not readily identify the last inspection data of the involved equipment.
- Time-to-expected failure of involved equipment on date of incident (in number of days until the involved equipment was expected to fail) - PG&E does not currently estimate the number of days that an involved equipment is expected to fail.
- Overcapacity history of involved equipment (percent of time equipment operated over nameplate capacity) - PG&E's outage database does not readily identify the percent of time equipment operated over nameplate capacity.

When pulling data, PG&E cannot easily pull the following under current time constraints:

- Land use (rural/urban)
- Enhanced inspections and maintenance conducted according to 2019 WMP at location prior to event (Yes / No)
- Enhanced vegetation management conducted according to 2019 WMP at location prior to event (Yes / No)
- Age of involved equipment
- Covered conductor or other
- Nearest weather station by weather station ID
- Last inspection data of involved equipment
- Time-to-expected failure of involved equipment on date of incident (in number of days until the involved equipment was expected to fail)
- Overcapacity history of involved equipment (percent of time equipment operated over nameplate capacity)

2) Wires Down Events Response (Transmission):

The same information prepared for electric distribution wire down events applies to transmission records for ET-WD.

PG&E will continue to work on gathering all the data as part of a future report.

Summary Table - Table 5 Spreadsheet columns for information reported by circuit, last 5 years and historical average

See attached SDR Excel spreadsheet (all “Table 5” sheets) for a comprehensive list by circuit for information not displayed on the summary table below.

Column groups	Columns	2015	2016	2017	2018	2019	5 Year Historical Average	Notes
Service territory location	HFTD rating (i.e., whether the circuit is in non-HFTD, HFTD Zone 1, HFTD Tier 2, or HFTD Tier 3)	-	-	-	-	-	-	See Excel attachment as noted above.
Fire weather, last 5 years and historical average	Number of Red Flag Warning days	63,304	89,832	471,375	522,855	360,281	301,529	Similar data provided. Please see the comments section below for more information.
	Average annual proprietary fire potential index or similar fire risk index measure	-	-	-	-	-	-	Similar data provided. Please see the comments section below for more information.
	Annual maximum value reached in utility’s proprietary fire potential index or similar fire risk index measure (i.e., the highest FPI that circuit experienced in a given year)	-	-	-	-	-	-	Similar data provided. Please see the comments section below for more information.

Number and impact of PSPS deenergizations, last 5 years and historical average	Number of PSPS de-energizations	N/A	N/A	N/A	40 Total	1460 Total	751	See comments section below for explanation of data provided. See attached SDR Excel spreadsheet for every circuit.
	Number of customers located on de-energized circuit	N/A	N/A	N/A	60,086 Total	1,137,584 Total	698,835	See comments section below for explanation of data provided. See attached SDR Excel spreadsheet for every circuit.
	Customer hours of PSPS (i.e., the number of customers affected times the number of hours they were affected by PSPS)	N/A	N/A	N/A	1,517,371	98,617,112	50,067,241	Similar data provided. Please see the comments section below for more information.
	Customer hours of PSPS per RFW circuit mile day	N/A	N/A	N/A	3	247	125	Similar data provided. Please see the comments section below for more information.
Recent overcapacity, last 5	Hours operated above nameplate capacity	-	-	-	-	-	-	Similar data provided. Please see

years and historical average	Average load as a percent of nameplate capacity for the hours operated above nameplate capacity	-	-	-	-	-	-	the comments section below for more information. Similar data also provided in SDR Excel spreadsheet (sheet "Table 5", Table 5a)
Extreme weather near circuit	95th percentile wind conditions (average of all weather stations within 10 miles of a circuit)	-	-	-	-	-	-	Similar data provided. Please see comments below for more information.
	99th percentile wind conditions (average of all weather stations within 10 miles of a circuit)	-	-	-	-	-	-	Similar data provided. Please see comments below for more information.

Comments - Table 5 Spreadsheet columns for information reported by circuit, last 5 years and historical average

Column Groups	Comments
Service territory location	<p><i>HFTD rating (i.e., whether the circuit is in non-HFTD, HFTD Zone 1, HFTD Tier 2, or HFTD Tier 3):</i></p> <p>If column “HFTDMILES” has a 0 in the circuit row, that means the line is not in a HDFT location.</p>
Fire weather, last 5 years and historical average	<p>PG&E leveraged its historical climatology to answer all parts of Table 5 relating to meteorology aside from Red Flag Warnings, which are actuals. At the time of this analysis, PG&E had not yet completed the climatological analysis for all of 2019, which is underway and should be completed in Q2 2020. Thus, data are provided for 2015, 2016, 2017, and 2018.</p> <p>PG&E currently assesses the outage and fire potential on an areal basis; thus, circuit by circuit data does not exist and can not be provided at this time. An areal approach was chosen as PG&E’s current formulation of OPW was constructed with an areal approach and many PG&E circuits are ≥ 10 miles and experience varying wind and fire potential conditions. Please see the PDF attachment “4.3, Table 5, Weather”.</p> <p><i>Number of Red Flag Warning days:</i></p> <p>PG&E is not able to provide this data by circuit at this time. PG&E is providing similar data on the RFW days of RFW circuit mile days per year (broken out for the previous five years) and five year historical average. This information is also found in the WMP (Table 10, page 3-2).</p>
Number and impact of PSPS deenergizations, last 5 years and historical average	<p><i>Note on Average column:</i></p> <p>Average figures listed are 2 year averages given first PSPS event occurred in 2018.</p> <p><i>Number of PSPS de-energizations:</i></p> <p>PG&E is providing the customer count by circuit number based on the unique SPIDs de-energized at any point in time in 2019 and 2018. In other words, it doesn’t double count people impacted by multiple events for the given year. The circuit data is</p>

	<p>provided in the SDR Excel spreadsheet attachment (“Table 5, Number of PSPS de-energizations 2019, 2018”). The total of all circuits is totaled in the summary table above.</p> <p><i>Number of customers located on de-energized circuit:</i> PG&E is providing the customer count by circuit number based on the unique SPIDs de-energized at any point in time in 2019 and 2018. In other words, it doesn’t double count people impacted by multiple events for the given year. The circuit data is provided in the SDR Excel spreadsheet attachment (“Table 5, Number of customers on circuit 2019, 2018”). The total of all circuits is totaled in the summary table above.</p> <p><i>Number of affected customers on other circuits:</i> PG&E is unable to interpret the request in regards to how there could be affected customers on “other” circuits that are not the circuits de-energized.</p> <p><i>Customer hours of PSPS (i.e., the number of customers affected times the number of hours they were affected by PSPS):</i> PG&E is providing this data at an aggregated and not circuit level given time constraints. Instead, PG&E is providing the same info provided in Table 12 of the WMP (page 3-14).</p> <p><i>Customer hours of PSPS per RFW circuit mile day:</i> PG&E is providing this data at an aggregated and not circuit level given time constraints. Instead, PG&E is providing the same info provided in Table 12 of the WMP (page 3-14).</p>
Recent overcapacity, last 5 years and historical average	<p><i>Hours operated above nameplate capacity:</i> PG&E is unable to provide hours over nameplate rating, only peak annual load is recorded, not number of hours above capacity.</p> <p><i>Average load as a percent of nameplate capacity for the hours operated above nameplate capacity:</i> PG&E is unable to provide average load as a percent of nameplate capacity for the hours operated above nameplate capacity, only peak annual load is recorded, not number of hours above capacity.</p> <p>PG&E is providing the name of each circuit in each year that had peak load measured at the substation circuit breaker that was above the substation nameplate capacity of the circuit. The</p>

	similar data being provided is in the SDR Excel spreadsheet (sheet "Table 5", Table 5a).
Extreme weather near circuit	PG&E leveraged its historical climatology to answer all parts of Table 5 relating to meteorology aside from Red Flag Warnings, which are actuals. At the time of this analysis, PG&E had not yet completed the climatological analysis for all of 2019, which is underway and should be completed in Q2 2020. Thus, data are provided for 2015, 2016, 2017, and 2018. Please see the PDF attachment called "4.3, Table 5, Weather".

SECTION 1.4:

Summary Table - Table 7 Map file requirements for recent and modelled conditions of utility service territory, last 5 years

Layer name	Measurements	Units	Notes
Recent weather patterns	Average annual number of fire risk ratings equal to the top 30% of proprietary fire potential index or similar fire risk index measure	Area, days, square mile resolution	Similar data provided. Please see the comments section for more information. Also see attached zip called "3.1 Table 7 FIA" and "Table 7, Recent weather" in the attached SDR Excel spreadsheet.
	Difference between forecast and actual wind when either is projected to be or is at 95th percentile wind conditions	Area, miles per hour, at a square mile resolution or better, noting where measurements are actual or interpolated	
Implemented 2019 WMP initiative activity	Location of completed 2019 WMP initiative activity for each activity	Line, quarter mile resolution, one layer per initiative	See attached zipped map file called "3.4 Table 7 Weather stations", "3.4 Table 7 HD Camera", "3.4 Table 7 Sectionalizers", "3.4 Table veg", and "3.4 Table 7 System hardening"

Comments - Table 7 Map file requirements for recent and modelled conditions of utility service territory, last 5 years

Layer Name	Comments
Recent weather patterns	<p>PG&E's utility FPI is available as a daily rating for each FIA from a R1 to R5 scale. At R4 and above conditions, operational work restrictions go into effect that mitigate the potential for ignitions. R4 and above ratings occur on average ~28% of days in more wildfire prone FIAs (i.e., non-coastal areas or areas influenced by diurnal winds and fog) and ~11% of days averaged across all FIAs. The table in the SDR Excel Attachment (Sheet "Table 7, Recent Weather") represents a count of days per year that the utility FPI was at an R4 or higher value. See the map (Sheet "Table 7 Recent Weather") and attached shapefile ("3.1 Table 7 FIA.zip") that show the geographic extent for each FIA. The shapefile can be linked to the FIA table in the SDR Excel Attachment (Sheet "Table 7, Recent Weather") to produce custom GIS maps per FIA per year if desired.</p> <p>Please see the SDR Excel spreadsheet attachment and "3.1 Table 7 FIA.zip" for similar data provided.</p>
Recent fuel Recent fuel measurements	<p><i>Average distribution and mass of fuel, average distribution and mass of fuel below 62% live fuel moisture content each month, and average distribution and mass of fuel below 5% live fuel moisture content:</i></p> <p>PG&E does not have the distribution and mass of fuel on the monthly basis to provide at this time. For wildfire spread modeling, PG&E worked with an outside vendor to update the USFS LANDFIRE with recent fire disturbances and burn severity modeling for vegetation regrowth after a disturbance. This model is based on the Scott and Burgan fire behavior models that have a dynamic live herbaceous component. PG&E consulted with an external vendor to create these GIS layers, which would approximately cost \$100,000 and require 5 years of historical weather and fuel moisture data as input from PG&E.</p>

<p>Potential impact of ignitions</p>	<p><i>Date of recent ignitions and potential impact measured in number of people in evacuation zone of modeled fire spread:</i></p> <p>PG&E will need additional clarification to answer this question, similar to table 2, metric 5 regarding the evacuation zone. See cost to model the last 5 years of ignitions in table 2, metric 5 response. PG&E is willing to create and provide this data as requested at a later time.</p>
<p>Implemented 2019 WMP initiative activity</p>	<p><i>Location of completed 2019 WMP initiative activity for each activity:</i></p> <p>PG&E is providing maps to show various WMP initiatives completed in 2019. The initiatives PG&E is providing maps include: weather station, HD cameras, sectionalizers, and system hardening. Please see the attached zip files called “3.4 Table 7 Weather stations”, “3.4 Table 7 HD Camera”, “3.4 Table 7 Sectionalizers”, “Table 3.4 Veg” and “3.4 Table 7 System hardening” for the maps.</p>

Summary Table - Table 8 Map file requirements for baseline condition of utility service territory projected for 2020

Layer name	Measurements / variables	Units	Attachment Location
Current baseline risk maps	Wildfire consequence to communities	Area, number of people affected, square mile resolution	See attached zipped map file “3.5a Table 8 wildfire consequences” and “3.5b Table 8 wildfire consequences”
Result of stress test as defined in Section 2	Number of ignitions and near misses	Line, circuit mile resolution	See attached zipped map file “3.6 Table 8 Ignitions”

Comments - Table 8 Map file requirements for baseline condition of utility service territory projected for 2020

Layer Name	Comments
Current baseline risk maps	<i>Ignition probability per year given 5-year historical average conditions:</i> At this point in time, PG&E, nor their third-party vendor Technosylva, are able to provide a map file illustrating ignition probability.
	<i>Wildfire consequence to communities:</i> Please find this data displayed in the attached zipped file labeled “3.5a Table 8 wildfire consequences” and “3.5b Table 8 consequences”.
Result of stress test as defined in Section 2:	<i>Duration of PSPS events and area of the grid affected in customer hours per year:</i> At this time, PG&E cannot provide this data.
	<i>Number of ignitions and near misses:</i> PG&E is able to provide a map of ignitions. Near misses are not able to be mapped at this time. Please note, identifying the exact ignition site is not always possible. As such, the map should be used as an estimate to the general location. Please see attached zipped map file “3.6 Table 8 Ignitions”

SECTION 1.5:

Summary Table - Table 9

Fuel density and moisture, last 5 years

Fuel measurement	2015	2016	2017	2018	2019	Notes
Live fuel moisture	96	90	91	89	95	Similar data provided. Please see the comments section below for more information.
Dead fuel moisture	9	12	11	10	12	Similar data provided. Please see the comments section below for more information.

Comments - Table 9

Fuel density and moisture, last 5 years

Comments
<p>For live and dead fuel content measurement, PG&E's relies on public sources of data. For the moisture content in Live Fuels, PG&E automatically downloads and processes observations in the Wildland Fire Assessment System (WFAS), National Fuel Moisture Database (NFMD). From the WFAS-NFMD site: "The National Fuel Moisture Database is a web-based query system that enables users to view sampled and measured live- and dead-fuel moisture information. The system utilizes a database that is routinely updated by fuels specialists who monitor, sample and calculate fuel moisture data". The average LFM database and stations utilized in the average are presented (stations displayed on "Table 9" of the attached spreadsheet).</p> <p>Live fuel moisture: Data provided represents live fuel moisture average.</p> <p>Dead fuel moisture: For dead fuels, PG&E has automated FireFamily+, which is a software package used to calculate fuel moistures and indices from the US National Fire Danger Rating System (NFDRS) using hourly or daily fire weather observations primarily from Remote Automated Weather Stations (RAWS). PG&E has provided requested data for 10 hour dead fuel moisture (DFM) for each of the 9 geographic zones PG&E monitors for this</p>

purpose. This information and a map of the 9 geographic zones is also provided in the SDR Excel spreadsheet (Sheet "Table 9", Table 9B). The information populating the above summary table is the average DFM across all 9 zones per years 2015-2019.

Live and dead fuel density:

PG&E does not annually average live fuel and dead fuel density to provide at this time. An external vendor was consulted to generate the data for this request and the approximate cost was \$100,000.

SECTION 1.6:

Summary Table - Table 10

Directional vision for evolution of risk drivers

Rank order 1-15	Incident type by ignition probability driver	Detailed risk driver	Change in risk impact by end-2022	Change in risk impact by year 10
3	Contact from object	All types of object contact	moderately decrease risk	moderately decrease risk
13		Animal contact	moderately decrease risk	moderately decrease risk
15		Balloon contact	have limited or no impact	have limited or no impact
1		Vegetation contact	moderately decrease risk	significantly decrease risk
14		Vehicle contact	have limited or no impact	have limited or no impact
8	Equipment / facility failure	All types	moderately decrease risk	moderately decrease risk
2		Capacitor bank failure	moderately decrease risk	moderately decrease risk
5		Conductor failure—all	have limited or no impact	have limited or no impact
4		Conductor failure—wires down	moderately decrease risk	moderately decrease risk
12		Fuse failure—all	moderately decrease risk	moderately decrease risk
9		Fuse failure Operation—conventional blown fuse	have limited or no impact	have limited or no impact
14		Lightning arrestor failure	have limited or no impact	have limited or no impact
10		Switch failure	moderately decrease risk	moderately decrease risk
7		Transformer failure	moderately decrease risk	moderately decrease risk
11	Wire-to-wire contact / contamination		Moderately decrease	moderately decrease risk

6	Other	Moderately increase	moderately decrease risk
---	-------	---------------------	--------------------------

Comments - Table 10

Directional vision for evolution of risk drivers

Comments
<p>Rank order 3: Due to vegetation contact being the significant driver in this category, the change in risk impact for this line item is aligned to that.</p> <p>Rank order 13: Avian protection program and animal protection in standards, but significant overall exposure will persist in territory.</p> <p>Rank order 15: Rates will not change unless Mylar balloons banned.</p> <p>Rank order 1: Since Oct 2017, PG&E has been mitigating (overhang clearing etc.) for this driver. The 10 year change is assuming that forest patterns do not change significantly. Forest health (drought or pests infestations) beyond PG&E's control could make significant decreases less likely. In these cases simply preventing increases is a significant signal of mitigation effectiveness. Overarching goal would be to never see increases in this category.</p> <p>Rank order 14: No specific mitigations are in place for this driver. There are no current overlapping location trends.</p> <p>Rank order 8: No comment</p> <p>Rank order 2: Testing and maintenance enhancements and/or maintaining firebreaks at sites with surface fuel ignition risks can drastically decrease reportable ignition at these sites.</p> <p>Rank order 5: Further confirmation can done with WD data, based on conductor change program</p> <p>Rank order 4: Reclosing disable results in less fault current stress on conductors, connections and splices.</p> <p>Rank order 12: Equipment exemptions relate to normal operation and not failures. As PG&E abandons firebreaks due to exempt equipment installation, firebreak maintenance will cease which eliminates ancillary benefits that firebreaks provide regarding fuse failures regardless of exemption status.</p> <p>Rank order 9: Not much change is expected here, however, if the fire break is not present, then this driver becomes stronger.</p>

Rank order 14: Considered a weak driver. The new exempt equipment should further reduce failure risks, but it still is in the first years of deploying new technology in the field. History of ignitions in this category historically low.

Rank order 10: Historical low frequency driver, initial increase in SCADA enablement needs to be monitored in initial years. Technology expected to continuously improve.

Rank order 7: Due to aging inventory. As PG&E abandons firebreaks due to exempt equipment installation, firebreak maintenance will cease, which eliminates ancillary benefits that firebreaks provide regarding fuse failures regardless of exemption status

Rank order 11: Increased focus on inspection and corrective action program, as well as a monitoring and mitigating contamination trends likely to result in decrease over time.

Rank order 6: As PG&E abandons firebreaks due to exempt equipment installation, firebreak maintenance will cease, which eliminates ancillary benefits that firebreaks provide regarding fuse failures regardless of exemption status.

SECTION 2.1:

Summary Table - Table 11 Stress test estimate of PSPS required to manage wildfire ignition probability of current baseline system

PSPS characteristic	95th percentile wind conditions	99th percentile wind conditions	Unit(s)	Notes
Frequency of PSPS events (total)	19	5.2	Estimated average events / year	Similar data leveraged. Please see comments below for more information.
Scope of PSPS events (total)	14,215,639	3,878,013	Estimated customers impacted / year	Similar data leveraged. Please see comments below for more information.
Duration of PSPS events (total)	238,127,322	71,355,047	Customer hours / year	Similar data leveraged. Please see comments below for more information.

Comments - Table 11 Stress test estimate of PSPS required to manage wildfire ignition probability of current baseline system

Comments
<p>PG&E used the dataset and methods described in the response to Table 2 to support this data set. As mentioned previously, this dataset is a historical analysis of PG&E's FPI and OPW guidance at the 0.08 and 0.05 levels, which represent 99th and 95th, respectively, daily percentile conditions. It was combined with actuals observed for 2019 to represent 2019 actuals at the 99% level. 2019 data for the 95% were estimated using average ratios from the 2015-2018 historical analysis of potential PSPS events.</p> <p>Data provided are at the service territory level.</p>

SECTION 2.2:

Summary Table - Table 12 Stress test modelled ignitions and near misses assuming 95th and 99th percentile conditions over the 3-year plan term

Stress test output	2019 estimated	2020	2021	2022	Notes
# of ignitions avoided by PSPS	56*	13	13	13	Similar data provided. As such, the table layout has been updated to reflect new measurements. Please see the comments section below for more information.

Comments - Table 12 Stress test modelled ignitions and near misses assuming 95th and 99th percentile conditions over the 3-year plan term

Comments
<p>PG&E does not collect 95th and 99th percentile wind conditions. PG&E interprets these conditions to be similar to conditions triggering a PSPS event and provides the following modeled ignitions (per the S-MAP aligned model) avoided by PSPS events. As such, PG&E is providing similar data. The data provided is displayed in the summary table above.</p> <p>*2019 PSPS avoided Ignitions are significantly higher compared to projected ignitions avoided from 2020-2022. PG&E modeled the 2020-2022 to average weather conditions. If PG&E removes Oct 26th, 2019 PSPS event damages & hazards, in 2019 PG&E would have seen 12 ignitions, which is in the same range as projected ignitions avoided in the years 2020-2022.</p>

SECTION 2.3:

Summary Table - Table 13 Stress test modelled use of PSPS assuming 95th and 99th percentile conditions over the 3-year plan term

PSPS characteristics	95th Observed	99th Observed	Unit(s)	Notes
	2019	2019		
Frequency of PSPS events (total)	29	8	Estimated average events / year	Similar data leveraged. Please see comments below for more information.
Scope of PSPS events (total)	8,261,006	2,040,531	Estimated customers impacted / year	Similar data leveraged. Please see comments below for more information.
Duration of PSPS events (total)	358,152,116	98,617,112	Customer hours / year	Similar data leveraged. Please see comments below for more information.

Comments - Table 13 Stress test modelled use of PSPS assuming 95th and 99th percentile conditions over the 3-year plan term

Comments
<p>PG&E used the dataset and methods described in the response to Table 2 to support this request. As mentioned previously, this dataset leverages PG&E's FPI and OPW guidance at the 0.08 and 0.05 levels, which represent 99th and 95th, respectively, daily percentile conditions. Actuals for 2019 were utilized to represent 2019 actuals at the 99% level. 2019 data for the 95% were estimated using average ratios from the 2015-2018 historical analysis of potential PSPS events.</p> <p>Note that the 2020 – 2022 expectation meeting 95% and 99% conditions will be dependent on the frequency and magnitude of weather events, which is impossible to forecast at this time. If the same exact weather pattern were to unfold in 2020 compared to 2019 with the same exact state of the fuels, PG&E expects some reduction in customer impacts due to measures described at length in the 2020 PG&E WMP.</p>

APPENDIX:

The following attachments are mentioned throughout this response:

- SDR Excel spreadsheet
- Technosylva Estimate
- 3.1 Table 7 FIA.zip
- 3.4 Table 7 HD Camera
- 3.4 Table 7 Sectionalizers
- 3.4 Table 7 System hardening
- 3.4 Table 7 Weather stations
- 3.4 Table 7 Veg
- 3.5a Table 8 wildfire consequences
- 3.5b Table 8 wildfire consequence
- 3.6 Table 8 Ignitions
- 4.3 Table 5, Weather