

**PACIFIC GAS AND ELECTRIC COMPANY  
Wildfire Mitigation Plans Discovery 2023  
Data Response**

PG&E Data Request No.:	TURN_004-Q002		
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Date Sent:	April 17, 2023	Requesting Party:	The Utility Reform Network
DRU Index #:		Requester:	Tom Long

**SUBJECT: SYSTEM HARDENING**

**QUESTION 002**

Regarding Table PG&E-22-35-1 (PSPS Events Lookback Analysis) on page 972 of PG&E's 2023-2025 WMP:

- a. For each column with numerals, provide a verbal description of all input data and of how the numerals in each column were calculated.
- b. Provide the table in live Excel format.

**ANSWER 002**

a.

**Input Data:** the columns in Table PG&E-22-35-1 used the following input data:

**2022 PSPS Five-Year Lookback Analysis (2018-2022):** this is an analysis which shows the hypothetical PSPS events created by applying 2022 PSPS guidance to the weather from 2018-2022. This is our most accurate method of estimating PSPS impacts based on our latest PSPS guidance, and results in a dataset identifying the list of customers impacted per hypothetical event.

This list of customers is used in this WMP to calculate projected PSPS customer impacts. Customers whose PSPS impact is prevented due to existing mitigations (as-of the end of 2022) are not included in this dataset. Some customers in this dataset may experience short-duration outages due to use of a downstream MSO device in the hypothetical PSPS events.

When scoping PSPS events, we also add areas to scope based on the presence of certain asset and vegetation tags, if those areas also meet Minimum Fire Potential Conditions. This results in an incremental expansion of the PSPS scope. The number and location of these asset and vegetation tags on our system varies day-by-day and cannot be accurately forecasted in future PSPS events. This expansion in scope due to asset and vegetation tags is incorporated as a 10.2% multiplier. The asset and vegetation tag multiplier was calculated using 2021 actual PSPS events, excluding the January 19, 2021 PSPS Event (which used the 2020 PSPS guidance and thus did not have a scope increase due to tags).

Since we cannot determine which specific customers will be added to scope due to asset and vegetation tags, this 10.2% increase can only be applied to the aggregated customer count for each PSPS event.

In this table specifically, this dataset is used in conjunction with the other input data to identify customers mitigated by MSO device replacements and undergrounding. This dataset also serves as the baseline or denominator for calculating the columns showing the percentage of customers mitigated.

**MSO Device Replacement Workplan (2023-2024):** this dataset identifies the list of MSO devices that are planned to be replaced with non-MSO devices in 2023 and 2024. This dataset was used in conjunction with the 2022 PSPS Five-Year Lookback Analysis described above to identify customers whose PSPS outages would be mitigated by planned MSO device replacements.

**Scoped Undergrounding Projects:** this dataset identifies the undergrounding projects scoped for future work. An analysis was performed using this dataset to determine the average expected PSPS customer mitigation per mile of undergrounding completed, among the scoped projects. The expected PSPS customer mitigation is calculated relative to hypothetical PSPS events in the 2022 PSPS Five-Year Lookback Analysis described above.

#### **Table Columns:**

##### **Column: Incremental Customers Mitigated:**

This column indicates the number of incremental customer-events mitigated per category (year and type of mitigations), relative to the hypothetical PSPS events generated in the 2022 PSPS Five-Year Lookback Analysis.

“Incremental” means that this column reports the additional customer-events mitigated (removed from PSPS impact) due specifically to this year and type of mitigation and indicates that these customers would otherwise have been de-energized for PSPS if this year and type of mitigation had not been implemented. All earlier mitigations (either already existing in 2022 or planned to be completed in earlier years) are assumed to be in place. For example, the value reported for “2024 UG” is calculated through the comparison of customer counts from “the 2022 PSPS Five-Year Lookback Analysis with all 2023 planned mitigations installed”, and “the 2022 PSPS Five-Year Lookback Analysis with all 2023 planned mitigations and 2024 planned undergrounding installed”.

“Customer-events” refers to the count of customer impacts over the Five-Year Lookback. If the same customer is mitigated from PSPS for three PSPS events in the Five-Year Lookback, this is reported as “three customer-events mitigated” instead of “one unique customer mitigated”. The count of customer-events reported in this column are totaled over the Five-Year Lookback: to calculate the per-year average, this must be divided by five.

The exact calculation method depends on the type of mitigation. Please see the descriptions below for MSO, UG, and Year Total:

## **MSO for Incremental Customers Mitigated:**

The Five-Year Lookback Analysis identifies the customers who would experience short-duration outages due to use of a downstream MSO device during the hypothetical PSPS events. If these MSO devices are replaced with non-MSO devices, the associated customer impacts will no longer occur (and thus these customers will be “mitigated” by the replacement of the MSO device).

The number of customer-events mitigated by MSO device replacements is calculated using the comparison of three customer counts, each based on the Five-Year Lookback Analysis:

Customer Count 1: Count of customer-events impacted in the Five-Year Lookback Analysis, before any of the 2023-2026 WMP planned mitigations are applied.

Customer Count 2: Count of customer-events impacted in the Five-Year Lookback Analysis, after replacement of the MSO devices planned for replacement in 2023.

Customer Count 3: Count of customer-events impacted in the Five-Year Lookback Analysis, after replacement of the MSO devices planned for replacement in 2023 and 2024.

The difference between Customer Count 1 and Customer Count 2 is used as the basis for calculating the “Incremental Customers Mitigated” for “2023 MSO”. This initial count of customer-events is then increased by 10.2% to represent the asset and vegetation tag multiplier described in the Input Data section above. By applying this multiplier, we assume that as overall PSPS scope increases due to scoping with asset and vegetation tags, new MSO devices will also come into use for the PSPS event, resulting in a proportional 10.2% increase in the number of customers with short-duration outages due to use of an MSO device. Thus, when these MSO devices are replaced with a non-MSO device to mitigate these short-duration impacts, the number of customers mitigated by this replacement is also 10.2% higher than initially indicated by the Five-Year Lookback analysis.

The difference between Customer Count 2 and Customer Count 3 is used as the basis for calculating the “Incremental Customers Mitigated” for “2024 MSO”. As with the calculation for “2023 MSO”, the same 10.2% increase is also applied here.

## **UG for Incremental Customers Mitigated:**

The number of customer-events mitigated by each year’s planned undergrounding is found from multiplying the number of undergrounding miles planned each year by the average expected PSPS customer mitigation per mile of undergrounding completed. The calculation for average expected PSPS customer mitigation per mile of undergrounding completed is described in the Data Input section above.

The number of scoped undergrounding miles exceeds the number of target undergrounding miles per year. This means we cannot determine at this time which exact undergrounding projects (out of the total scoped projects) will be completed in each year, and thus cannot identify the exact list of customer-events that would be

mitigated in each lookback event like we could with MSO replacements. Instead, we performed the calculation described here to determine the overall count of customer-events mitigated by undergrounding.

This count of customer-events is then increased by 10.2% to represent the asset and vegetation tag multiplier described in the Input Data section above. By applying this multiplier, we assume that as overall PSPS scope increases due to scoping with asset and vegetation tags, additional sections of undergrounded circuits will come into scope and result in a proportional increase in the number of customers mitigated by undergrounding.

**Year Total for Incremental Customers Mitigated:**

This is calculated as the sum of the “MSO” and “UG” categories for each year. For instance, “2023 Year Total” is a sum of “2023 MSO” and “2023 UG”. This calculation assumes that the populations of customer-events mitigated by MSO and UG do not overlap.

**Column: Cumulative Customers Mitigated:**

This is the running or cumulative total of the customer-events mitigated by each mitigation category (MSO, UG, or Year Total). This is calculated as the sum of the “Incremental Customers Mitigated” for the relevant year and the “Cumulative Customers Mitigated” for the previous year. For example, 2024 MSO Cumulative Customers Mitigated (1,295) is the sum of 2023 MSO Cumulative Customers Mitigated (1,090) and 2024 MSO Incremental Customers Mitigated (205). For 2023 (the first year considered in this analysis), the Cumulative Customers Mitigated is equal to the “Incremental Customers Mitigated” for each mitigation category.

The 10.2% increase due to asset and vegetation tags is not applied again here: this increase was already applied when calculating the “Incremental Customers Mitigated” column, and thus will have a proportional impact on this column.

The count of customer-events reported in this column are totaled over the Five-Year Lookback: to calculate the per-year average, this must be divided by five.

**Column: Incremental Mitigated (%):**

This is calculated using “Incremental Customers Mitigated” per category (year and mitigation type) as the numerator and the count of customer-events which would have been impacted if that year's planned mitigations had not been implemented (but all prior years' planned mitigations have been implemented) as the denominator.

The 10.2% increase due to asset and vegetation tags is not applied here: this increase was already applied to both the numerator and denominator, and thus has no impact on the percentage calculated here.

**Column: Cumulative Mitigated (%):**

This is calculated using “Cumulative Customers Mitigated” per category (year and mitigation type) as the numerator and the count of customer-events which would have been impacted if none of the 2023-2026 planned mitigations had been implemented as the denominator. The denominator assumes that past and existing mitigations (as-of 2022) are being used to mitigate customers, and thus represents the PSPS impact prior to the implementation of the 2023 WMP mitigation initiatives.

The 10.2% increase due to asset and vegetation tags is not applied here: this increase was already applied to both the numerator and denominator, and thus has no impact on the percentage calculated here.

**Column: Incremental Customers Mitigated Per Event:**

This is calculated as “Incremental Customers Mitigated” per category (year and mitigation type) divided by the total number of PSPS events (19 events) in our 2022 PSPS Five-Year Lookback Analysis (2018-2022).

The 10.2% increase due to asset and vegetation tags is not applied again here: this increase was already applied when calculating the “Incremental Customers Mitigated” column, and thus will have a proportional impact on this column.

**Column: Incremental Customer Hours Mitigated:**

This is the sum of the customer outage duration hours (customer-hours) mitigated due to the Incremental Customers Mitigated per category (year and mitigation type). For example, if 100 customers each would have experienced 20 hours of PSPS outage duration prior to their mitigation and are expected to experience no PSPS outage (0 hours) after mitigation: this mitigation will result in a total of  $20 \times 100 = 2,000$  customer-hours mitigated. Consistent with the other columns calculated in this table, these mitigations are relative to the hypothetical PSPS events generated in the 2022 PSPS Five-Year Lookback Analysis.

The hypothetical PSPS events generated in the 2022 PSPS Five-Year Lookback Analysis include weather start and end times, assigned at the Time-Place (TP) level of granularity. These times can be used to calculate the weather outage duration for each customer-event impacted by the TP, which represents the number of hours in which the weather conditions directly require a customer to be de-energized for PSPS.

Beyond the weather duration, customers fully impacted in real PSPS events will also experience additional hours of outage. The first of these periods occurs prior to the weather arrival: de-energization will start prior to weather arrival to ensure that all customers in the TP have been safely de-energized prior to weather arrival. The second of these occurs after the weather “All Clear” has been issued, and represents the time needed to patrol and safely restore customers.

For the 2022 PSPS Five-Year Lookback Analysis, the following assumptions were used for the non-weather outage duration:

- For the pre-weather switching time, customers were each assumed to

experience 1 additional hour of outage.

- For the post-weather patrol and restoration process, customers were each assumed to experience 10 additional hours of outage. This value was calculated using the approximate average restoration time from 2020 and 2021 PSPS events.

Together, these two periods of non-weather outage duration will add 11 hours of outage to the weather outage duration for each customer fully impacted by PSPS events in the 2022 PSPS Five-Year Lookback Analysis.

In addition to the customers fully impacted by the lookback PSPS events, a number of customers will also experience shorter duration outages due to use of a downstream MSO device. These customers were each assumed to experience a total outage duration of 30 minutes (0.5 hours) for each event in which they were impacted in this way.

If a customer is considered to be mitigated (using the methodology described for other columns above), the outage duration they would have experienced if they hadn't been mitigated is then added to the sum of mitigated customer-hours.

Please see the description of the "Incremental Customers Mitigated" column for an explanation of what "incremental" indicates for this analysis.

The sum of mitigated customer-hours reported in this column are totaled over the Five-Year Lookback: to calculate the per-year average, this must be divided by five.

The exact calculation method depends on the type of mitigation. Please see the descriptions below for MSO, UG, and Year Total:

### **MSO for Incremental Customer Hours Mitigated:**

The Five-Year Lookback Analysis identifies the customers who would experience short-duration outages due to use of a downstream MSO device during the hypothetical PSPS events. If these MSO devices are replaced with non-MSO devices, the associated customer impacts will no longer occur (and thus these customers will be "mitigated" by the replacement of the MSO device). As explained above, this mitigated duration is assumed to be 0.5 hours per customer per event in which the customer would have been impacted in this way prior to the MSO device replacement.

The sum of customer-hours mitigated by MSO device replacements is calculated using the comparison of three outage customer-hour sums, each based on the Five-Year Lookback Analysis:

Outage Customer-Hours Sum 1: Sum of outage customer-hours due to the PSPS events in the Five-Year Lookback Analysis, before any of the 2023-2026 WMP planned mitigations are applied.

Outage Customer-Hours Sum 2: Sum of outage customer-hours due to the PSPS events in the Five-Year Lookback Analysis, after replacement of the MSO devices planned for replacement in 2023.

Outage Customer-Hours Sum 3: Sum of outage customer-hours due to the PSPS events in the Five-Year Lookback Analysis, after replacement of the MSO devices planned for replacement in 2023 and 2024.

The difference between Outage Customer-Hours Sum 1 and Outage Customer-Hours Sum 2 is used as the basis for calculating the “Incremental Customer Hours Mitigated” for “2023 MSO”. This initial sum of customer-hours is then increased by 10.2% to represent the asset and vegetation tag multiplier described in the Input Data section. By applying this multiplier, we assume that as overall PSPS scope increases due to scoping with asset and vegetation tags, new MSO devices will also come into use for the PSPS event, resulting in a proportional 10.2% increase in the number of customers with short-duration outages due to use of an MSO device. Thus, when these MSO devices are replaced with a non-MSO device to mitigate these short-duration impacts, the number of customers (and thus the sum of customer-hours) mitigated by this replacement is also 10.2% higher than initially indicated by the Five-Year Lookback analysis.

The difference between Outage Customer-Hours Sum 2 and Outage Customer-Hours Sum 3 is used as the basis for calculating the “Incremental Customer Hours Mitigated” for “2024 MSO”. As with the calculation for “2023 MSO”, the same 10.2% increase is also applied here.

#### **UG for Incremental Customer Hours Mitigated:**

Due to the limitations described in the “UG for Incremental Customers Mitigated” section above, we can calculate the count of customer-events mitigated by each year’s planned undergrounding but cannot determine which exact list of customer-events will be mitigated.

Since the outage duration is dependent on the weather and thus differs per customer and lookback event, this means we cannot determine the exact outage duration of each customer-event prior to its mitigation by undergrounding. Instead, this analysis assumes that the population of customer-events mitigated by undergrounding has the same average outage duration as the total population of customer-events impacted by the PSPS lookback analysis.

Thus, the incremental sum of outage customer-hours mitigated by undergrounding (for each year) is calculated as the count of customer-events mitigated by UG multiplied by the average outage duration (in hours) of the customers impacted prior to implementation of that year’s mitigations.

Note that because MSO device replacements exclusively mitigate customers who had short-duration (0.5 hour) outages prior to their mitigation, this will slightly increase the average outage duration of the remaining un-mitigated customers.

Undergrounding does not have any impact on the average outage duration of the remaining un-mitigated customers due to the assumption that the average outage duration of the mitigated customers is equal to the general impacted customer population.

Together, these effects mean that the value of average outage duration used for calculating the incremental customer-hours mitigated by undergrounding will increase slightly in 2023 and 2024 (the years when MSO device replacements are planned to occur), then stay constant for 2025 and 2026 (when no MSO device replacements are planned to occur).

Because a 10.2% increase due to asset and vegetation tags is applied to the calculation for UG for “Incremental Customers Mitigated”, the incremental sum of customer-hours mitigated by undergrounding is also increased by 10.2%. For the rationale, please see “UG for Incremental Customers Mitigated”.

**Year Total for Incremental Customer Hours Mitigated:**

This is calculated as the sum of the “MSO” and “UG” categories for each year. For instance, “2023 Year Total” is a sum of “2023 MSO” and “2023 UG”. This calculation assumes that the populations of customer-events mitigated by MSO and UG do not overlap, and thus their sum of mitigated customer-hours also do not overlap.

**Column: Incremental Customer Hours Mitigated Per Event:**

This is calculated as “Incremental Customers Hours Mitigated” per category (year and mitigation type) divided by the total number of PSPS events (19 events) in our 2022 PSPS Five-Year Lookback Analysis (2018-2022).

The 10.2% increase due to asset and vegetation tags is not applied again here: this increase was already applied when calculating the “Incremental Customer Hours Mitigated” column, and thus will have a proportional impact on this column.

- b. Please see attachment WMP-Discovery2023\_DR\_TURN\_004-Q002Atch01.