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2023 PSPS Consequence Risk Model Whitepaper Version 1.0

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Contents

Abbreviations, Definitions, and Conventions

List of abbreviations/definitions, conventions used in whitepaper

PSPS – Public Safety Power Shutoff

RAMP - Risk Assessment and Modeling Phase

WMP – Wildfire Mitigation Plan

SMAP - Safety Modeling Assessment Proceeding

CMIN – Customer Minutes Interrupted

EF – Effective Fatalities

CoRE – Consequence of Risk Event

LoRE – Likelihood of Risk Event

MAVF - Multi-Attribute Value Function

Dx – Distribution

Tx – Transmission

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1 Introduction

1.1 Background

The purpose of the PSPS Consequence Model is to represent the spatial/circuit variation in PSPS risk, to prioritize PSPS mitigation efforts in high-risk locations based on frequency, customer, and duration of PSPS impact. This more granular, circuit level model will help assess the impacts of PSPS de-energizations in support of making PSPS mitigation planning decisions based on lookback analysis.

Public Safety Power Shutoff (PSPS), a wildfire mitigation program that is used as a measure of last resort, is called as a proactive and protective measure to prevent potential ignitions which could cause catastrophic wildfires. As a result of a PSPS event, circuits are de-energized for a period, meaning that some customers will be without power for potentially extended periods. The PSPS Consequence Model quantifies these consequences and aggregates from the customer to circuit level, differentiating between the consequence driven by distribution system scoped impact or transmission system scoped impact.

The PSPS Consequence Model addresses the 2021 WMP Commitment ID A.06*: "Develop a more granular, circuit level model, to assess PSPS customer impacts."*

1.2 2023 Model Updates

2023 PSPS Consequence model updates include the distribution of PSPS risk to 641K customers who were not identified in the 12-year lookback but have PSPS exposure due to their relationship with the HFRA and system configuration. The overall enterprise risk was calibrated to distribute risk to these customers.

1.3 PSPS Consequence Model Overview

Table 1 describes three primary data elements that enable development of the PSPS Consequence Model (herein referred to as "the Model"). Following, Figure 1a **Model Inputs and Outputs**provides a flow diagram of the data elements and model outputs.

Table 1: PSPS Consequence Model Data Elements

Data Element	Description
2021 PSPS 12-year Historical Lookback	Dataset that provides a 12-year historical lookback (2010-2021) of possible PSPS events determined based off 2021 PSPS protocols. These protocols represent the guidelines from meteorology[1] on the criteria to initiate PSPS, as well as the representation of the system configuration (e.g., sectionalization devices) at that point in time. Information includes circuits, customers impacted and duration for specific events. This primary data is used to estimate the risks at the customer, isolation zone, circuit, and substation level. This information drives: • The distribution and customer level risk in the PSPS Consequence Model

[1] This "historical lookback" evaluates actual weather events and models the associated PSPS events that would have occurred, including both transmission and distribution system impacts. This analysis identifies 30 weather events across the past 10 years that would have triggered a PSPS event under the 2020 PSPS decision-making protocols. See 2021 WMP page 920 "Efforts to Make PSPS Smaller in 2021".

	• 12-year lookback used for planning applications of 2024 and beyond
Enterprise PSPS MAVF Consequence Risk Score	The 4-year lookback is the same dataset as the 12-year lookback with the exception it only includes data from 2018-2021. The 4-year lookback was applied to the Enterprise PSPS System model to calculate the overall Corporate PSPS Risk. The Enterprise System Level Model is used to report corporate risk through our GRC Filing.
Customer Classification and Weighting	Weighting assessment by customer classifications to adjust risk and prioritization for critical customers based on the Subject Matter Expert feedback. Data set includes customer classifications from customer care & billing (CC&B), aggregated to at the circuit level.
Risk Scenario: Potentially Impacted Customers	Additional 641K customers who were not identified in the lookback, however, have potential PSPS exposure given their relationship with the HFRA and configuration of the system. These additional customers are included in the overall distribution of enterprise risk.

Figure 1a Model Inputs and Outputs

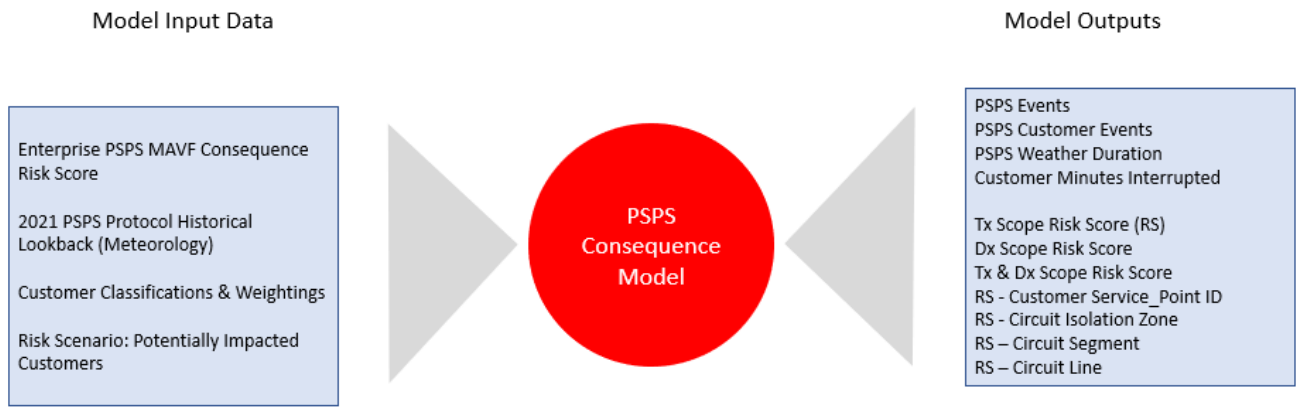
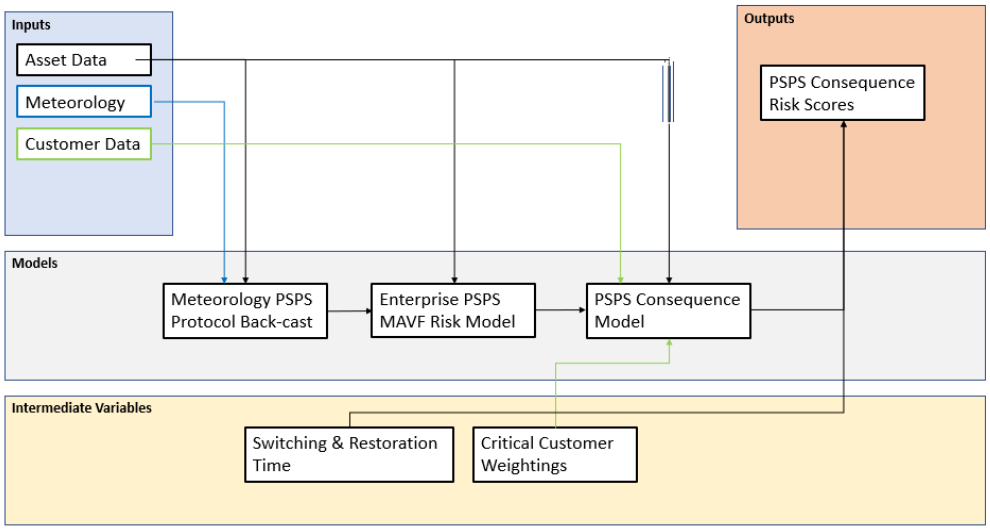


Figure 1b PSPS Risk Model Schematic



1.4 Foundry and PSPS Historical Lookback

In 2022, the PSPS Consequence model transitioned from an Excel based tool to Palantir Foundry, a big data analytics tool to accommodate a more granular risk analysis at the customer level. The 2021 version of the PSPS Consequence model evaluated risk at the circuit level for each forecasted PSPS event (~20,000 circuit-events). The 2022 version of the PSPS Consequence model evaluated risk impacts at the customer level for over 2.1M customer-events and numerous attributes tying the event to customers, event types, and system. New in 2023, an additional 641K customers who have exposure to PSPS risk, but not identified in the lookback were also included. In order to leverage this detail more processing power was required to build-out, evaluate and catalogue results.

The foundation of the analysis is built on the PSPS Lookback Dataset and the incremental customers identified to have PSPS Exposure (Event 641 PSPS Potentially Impacted Customers). These foundational datasets combine Meteorology weather polygons and historical weather data to identify locations most likely impacted by a PSPS based on 2021 Protocol at the customer level. This "historical lookback" evaluates actual weather events and models the associated PSPS events that would have occurred, including both transmission and distribution system impacts. This analysis identifies approximately 36 weather events for 2.7M customer-events between 2010-2021, that would have triggered a PSPS event under the 2021 PSPS decision-making process.

Figure 2, summarizes the 36 weather events that were forecasted based on 2021 PSPS Protocol.

Figure 2 is an aggregation of SPID level customer minutes to the event-level and Figure 3 provides a snapshot of the Foundry dataset. **Figure 1**

Figure 2: 12-Year Lookback Event Roll-Up

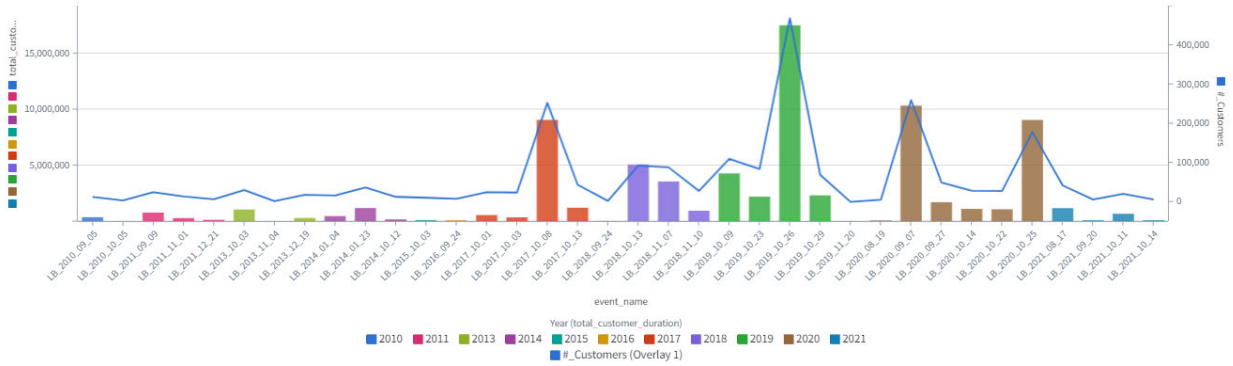


Figure 3: Snapshot of 12-year lookback rolled up to isolation device at the event level

	event_name String	time_place_name String	circuit_name String	isolation_device String	#_Customers_Impacted Long	total_Customer_outage_dur... Double	dx_only_event String	tx_only_event String	dx_tx_event String
1									
2	LB_2021_10_14	LB_2021_10_14_TP_08	HIGHLANDS 1103	287766	50	450	Yes	No	No
3	LB_2021_10_14	LB_2021_10_14_TP_04	TYLER 1105	8087	88	792	Yes	No	No
4	LB_2021_10_14	LB_2021_10_14_TP_09	CALISTOGA 1101	1843	4	28	Yes	No	No
5	LB_2021_10_14	LB_2021_10_14_TP_13	WYANDOTTE 1103	1481	5	50	Yes	No	No
6	LB_2021_10_14	LB_2021_10_14_TP_17	TEJON 1102	3751	598	21,528	Yes	No	No
7	LB_2021_10_14	LB_2021_10_14_TP_06	MADISON 2101	7887	29	232	Yes	No	No
8	LB_2021_10_14	LB_2021_10_14_TP_09	CALISTOGA 1101	122350	123	861	Yes	No	No
9	LB_2021_10_14	LB_2021_10_14_TP_01	CEDAR CREEK 1101	CB	209	1,881	Yes	No	No
10	LB_2021_10_11	LB_2021_10_11_TP_16	OILFIELDS 1103	8855	144	3,744	Yes	No	No
11	LB_2021_10_11	LB_2021_10_11_TP_02	DESCHUTES 1101	5409	30	300	Yes	No	No

The PSPS Lookback Dataset includes event information, system details, and customer information that includes:

- Event name, event type (Dx-only, Tx-only, Dx/Tx), duration, and time-places
- Associated substation, circuit, transformer, protection-layer information
- Customer account, type, classification, location, and meter information

This dataset enables the PSPS Consequence tool to:

- Quantify customer level risk and understand who is being impacted (i.e. critical customer type)
- Understand where highest risk locations are and impacted systems
- Type of event to understand risk reduction impact for different mitigation strategies

2 Methodology: Circuit Level Risk Calculations

This section aims to provide a comprehensive guide to the quantitative analysis involved in estimating the 1) Potential PSPS Risk at the System Level; 2) PSPS Consequence at the customer level; 3) Customer Weightings and risk adjustments.

2.1 Potential PSPS Enterprise Risk

The PG&E Enterprise PSPS Risk Model (System Level Risk Model) utilizes the Multi-Attribute Value Function (MAVF) framework, as defined through the Safety Modeling Assessment Proceeding (SMAP). The tool's calculations for risk use an industry-wide standard MAVF, with a non-linear scaling of consequences reflecting PG&Es focus on low-frequency/high-consequence risk events without neglecting high-probability/low-consequence risk events. The MAVF is a unitless number that captures the safety, reliability, and financial impact of identified potential risk events. Once the consequence values (safety, reliability, financial) are estimated, they are converted into MAVF

risk scores as defined through our RAMP and GRC[2] filings. Figure 4 and Figure 5 provide a high-level overview of the MAVF risk attributes and non-linear scaling approach.

Figure 4: MAVF Framework Risk Attributes

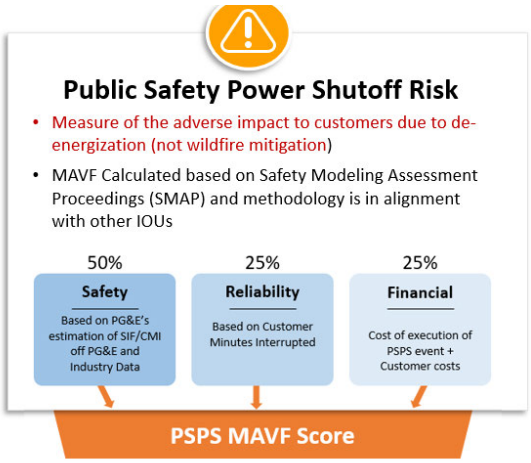
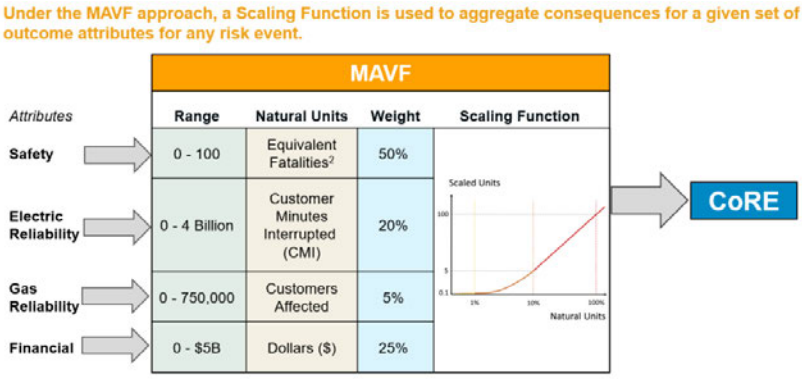


Figure 5: MAVF Non-Linear Scaling



PG&E Enterprise System Model

The potential PSPS Annual risk is calculated using the Enterprise PSPS System Model. The enterprise system model applies the MAVF framework and is used to establish and report corporate risk in our GRC and WMP filings. This model incorporated the 4-year lookback (2018-2021 forecasted events) to establish the annualized PSPS risk. It should be noted that this **overall** risk score was used in substitute of the 12-year overall lookback because it is considered more representative of risk moving forward given existing climate and vegetation scenarios.

Table 2 summarizes the MAVF risk for each of the attributes as calculated by the enterprise system mode.

[2] Full details of the MAVF methodology are provided through the Risk Assessment and Modeling Phase (RAMP) Report RAMP Report, pp. 3-3 to 3-15 and General Rate Case (GRC) workpapers in response to Energy Division GRC-2023-PhI_DR_ED_001_Q01Supp01.

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Table 2: Potential PSPS Risk

Component	Units	Percentage
Baseline MAVF Risk Score - Safety	133.32	6%
Baseline MAVF Risk Score - Reliability	2,010.34	93%
Baseline MAVF Risk Score - Financial	26.80	1%
Total	2,170.46	100%

The following subsections describe how PSPS safety, reliability, and financial risk attributes are calculated.

2.1.1 Safety Consequence

Safety Consequence is calculated from an estimate of Equivalent Fatalities (EF) per Million Customer Minutes Interrupted (MCMI)[3]. Based on the number of customers and the outage duration:

$$MCMI = [Duration\ of\ Outage] * [Number\ of\ Customers\ Impacted]$$

Equation 1

$$EF_{PSPS} = \frac{(MCMI) * \left(\frac{Equivalent\ Fatalities}{MCMI}\ ratio^{4}\right) * \left(\frac{Number\ of\ Customer\ Meters}{Population\ Impacted}\ ratio^{5}\right)}{1,000,000}$$

Equation 2

This natural unit consequence value is the input for the MAVF risk score calculation function for PSPS Potential Safety Risk.

2.1.2 Electric Reliability Consequence

PSPS Electric Reliability Risk is calculated directly from the potential number of customers impacted and outage duration, which multiply to form the Million Customer Minutes Interrupted (MCMI). The calculation for MCMI is shown above in Equation 1. This natural unit consequence value is the input for the MAVF risk score calculation function for PSPS Potential Electric Reliability Risk.

2.1.3 Financial Consequence

PSPS Financial Risk is represents the cost of executing PSPS. The financial estimate is based off the cost of historical 2019-2020 PSPS event costs and fits a curve for a deterministic component as a fixed cost and an exponential distribution based on customers per event. These costs represent EOC support, IT, aviation services, ground

[3] Equivalent Fatalities (EF) is derived from Million Customer Minutes Interrupted (MCMI) through a ratio of EF/MCMI that is calculated as a weighted average of this same ratio from previous PG&E PSPS events and other large external outage events (see Appendix 4.1)

[4] The EF/MCMI ratio is used to convert MCMI to Equivalent Fatalities (see Appendix 4.1)

[5] The [Number of Customer Meters Impacted]:[Population] ratio is used as a constant to convert from customer meters impacted to population impacted. This ratio is currently set to 1 (see Appendix 4.1)

patrols, customer outreach, electric distribution operations of de-energization, recovery, and restoration, mutual assistance, customer resource centers, in-event vegetation management, and others (hydro support, etc.).

$$WF\ Financial\ Cost\ (Projected) = \frac{Cost\ of\ Execution}{Number\ of\ Circuits\ in\ PSPS\ Event} + ((Number\ of\ Customers) * (Projected\ Cost/Customer))$$

Equation 3

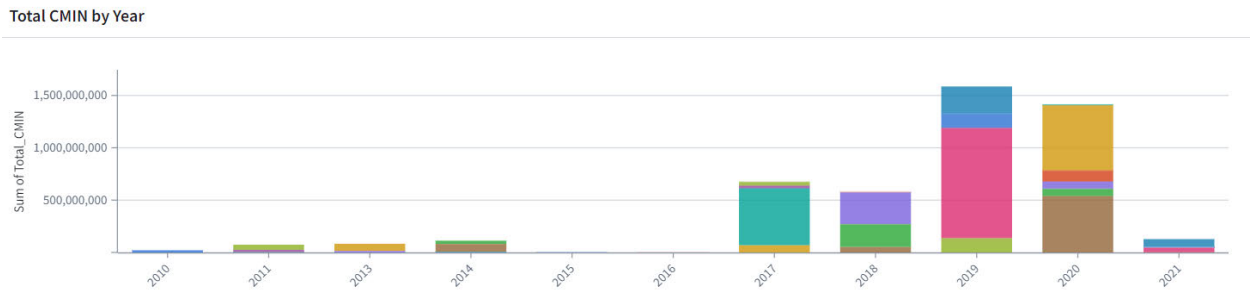
This natural unit consequence value is the input for the MAVF risk score calculation function for PSPS Potential Financial Risk.

2.2 PSPS Consequence Risk

The following section goes into detail on the process to estimate risk scores for events at the customer, isolation zone, circuit, and substation level. This analysis enables the ability to rank and prioritize circuits.

To estimate PSPS risk for a specific customer, the enterprise risk score (defined in Section 2.1) was distributed amongst the customers forecasted using the 12-year lookback. The 4-year lookback risk score was used in substitute of the 12-year lookback as it was considered more representative of risk moving forward. As can be seen in Figure 6, the PSPS impact between 2017-2021 (~880,000,000 CMIN) is roughly 15x greater than the average outage duration between 2010-2016 (~60,000,000CMIN). The team concluded that using the most recent 4-year lookback was most representative of risk moving forward given the existing climate and vegetation scenarios. And in-order to not exclude customers that have PSPS risk, the 4-year lookback risk score was distributed amongst the customer-events identified in the 12-year lookback. This distribution is described in section 2.2.1.

Figure 6: 2010-2021 PSPS Total Outage Duration



This overall process in estimating customer risk scores included:

1) Calculating the overall PSPS Risk Score based on the 4-year lookback as defined in section 1.3.
2) Allocating the overall PSPS risk score from Step 1 to each customer events based on the total customer minute interrupted using the 12-year lookback
3) Applying the customer weighting to get the adjusted PSPS Risk Score
4) Differentiating Tx-only, Dx-only and Tx/Dx-only risk score
5) Rolling up customer events risk score to the defined level of granularity (SPID, Circuit, Isolation Zone-level)

Please note, PSPS is a program that is wildfire mitigation and the risks represented in

Table 2 only represents the consequence of PSPS and does not show the benefits of wildfire mitigation in this view.

2.2.1 Customer Event Risk Score and Distribution

The overall PSPS Enterprise risk score is distributed to the customers forecasted in the twelve-year lookback. Since customer outage duration is the primary driver of risk, this datapoint was used to distribute the overall MAVF risk

score to each customer-event using Equation 5. This calculation is then completed for each SPID-Event to allocate risk between Dx-only, Tx-only, and Dx/Tx risk.

$$\textbf{Customer Event Risk Score} = \frac{\textbf{Total Duration}}{\Sigma\ \textbf{Total Duration}} * \textbf{Annualized Risk}$$

Equation 4

The overall annualized risk the enterprise risk score of 2,170. The total duration is weather duration plus pre-weather switching and restoration time as described in Equation 5. The current assumptions used for pre-weather switching & restoration times are *1 hour and 10 hours* per customer per event, respectively.

$$\textbf{Total Duration} = \textbf{Weather Duration} + \textbf{PreWeather Switching Time} + \textbf{Restoration Time}$$

Equation 5

By calculating risk at the most granular level of data and having each customer-event mapped to a specific system component, enables the aggregation and roll-up of to the desired granularity of choice.

Critical Customer Weighting and Customer Event Risk Score

Equation 4 is how the customer risk score is calculated that does not account for critical weighting. Critical customer weighting is a means to prioritize critical and at-risk customers that could be impacted more by a PSPS Event. Each customer is assigned a weighting based on customer type that is documented through customer care and billing data. To estimate a weighted customer risk score, these weighting are applied to Equation 4 as seen in Equation 6. As can be seen comparing these two equations, the difference is the % customer-event risk is adjusted based on the weighting factor at the event level and re-calculating the overall customer weighted duration in-order to redistribute the risk. The weighting values are more thoroughly explained in section 0.

$$\textbf{Adjusted Customer Event Risk Score}: \frac{\textbf{Total Duration} * \textbf{Customer Weighting}}{\Sigma\ \textbf{Total Duration} * \textbf{Customer Weighting}} * \textbf{Annualized Risk}$$

Equation 6

2.2.2 Tx-only, Dx-only and Tx/Dx-only Risk Score

The 2021 PSPS Historical Lookback provides the types of event the customer experience, such as Distribution-only, Transmission-only and both Distribution & Transmission events. This data is available at the customer-event level.

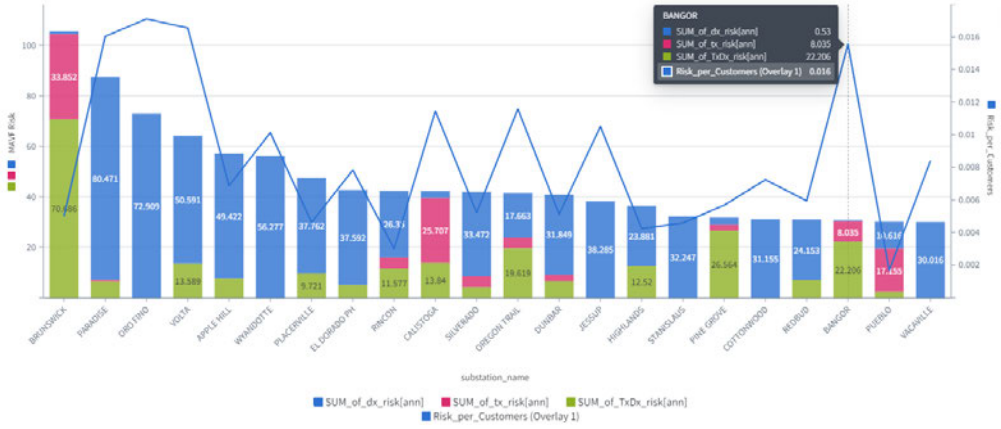
The risk scores for the customers are categorized based on the types of events and this quantification will inform the effectiveness of a mitigation strategy.

When a customer experiences Tx or Dx-only event, 100% of the risk score goes to the event category (Tx or Dx-only). However, when a customer experiences both Tx and Dx events, the risk score is allocated 50-50 to Transmission and Distribution. The event's risks are driven by Transmission impacts and Distribution impacts, hence the 50-50 risk scoring.

2.2.3 Aggregated Risk Score

From this point, the adjusted risk scores can be aggregated and disaggregated at a few different levels, to satisfy the needs of different situations. For example, SPID-level Risk Scores can be used to target mitigations for specific customers while Substation-level Risk Scores can be utilized to prioritize work on substations. Figure 7 is an example of aggregation of risk scores to substations with an overlay of risk/customer at those substations. Within each substation risk, foundry can also aggregate the make-up of events that contribute to the overall risk score.

Figure 7: Highest Substation Ranked Circuits with Event Type



Below are the varying levels of risk scores available:

- SPID-level Risk Score
- Isolation Zone-level Risk Score
- Circuit-level Risk Score
- Substation-level Risk Score

Customer Type and Weighting

Customer types used in the Model are defined as Extreme, Significant, Elevated and Regular Customer with the weightings of 100, 5, 2, and 1 respectively. While these weightings were carefully vetted by the Customer Care and internal subject matter experts, there are many perspectives on integrating customer criticality, which includes more granular weightings per customer type. This weighting was also used in the incremental undergrounding prioritization effort that was presented to the Wildfire Steering Governance Committee in 11/2021. For the time being, the customer weightings were kept at high level buckets and will continue to be refined based on stakeholder feedback.

The objective of setting a customer type system is to weigh customers that will be impacted more than others higher in the PSPS Consequence Model, recognizing and prioritizing those customers/circuits. Customers classified as Extreme are customers with a higher priority such as CC1, who provides emergency services such as fire & police stations, emergency hospitals.

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Table 3: Customer Classification

Customer Type	Customer Weighting	Customer Category
Extreme	100	CC1
Significant	5	Life Support, Medical Baseline & Low Income, Life Support & Low Income
Elevated	2	CC2, CC3, CE1, CE2, CE3, EE, PR1, SC1, SC2, SC3, SE1, SE2, SE3, TE1, TE2, TT1, TT2, Medical Baseline, Self-Identified Vulnerable, Self-Identified Disabled, Low-Income
Regular Customer	1	Regular Customer

For each customer identified in the PSPS lookback, they are assigned the critical weighting score based on information from the customer care a billing database and are applied as described in section 2.2.1. Overview of the weighted vs unweighted risk score results can be found in Appendix 7.2.

Weighting Impact on Risk Score

The critical customer weighting does not change the overall risk score, but prioritizes customers identified in the 12-year lookback based on customer classification. Figure 8 represents the distribution of critical-customer events. Roughly all customer-events forecasted in the 12-year lookback impacted critical-customers. When the weighting methodology described in Equation 6 was applied, the overall critical-customer risk score increased from 28% of the overall risk to 54%. Similarly, customers classified as "regular" customers overall risk reduced from 72% to 46% as described in Figure 9.

Figure 8: 12-Year Lookback Critical Customer Count

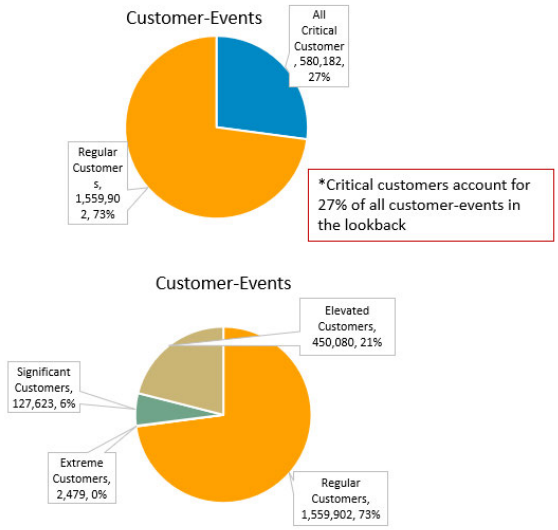


Figure 9: Critical Customer Weighting Risk Change

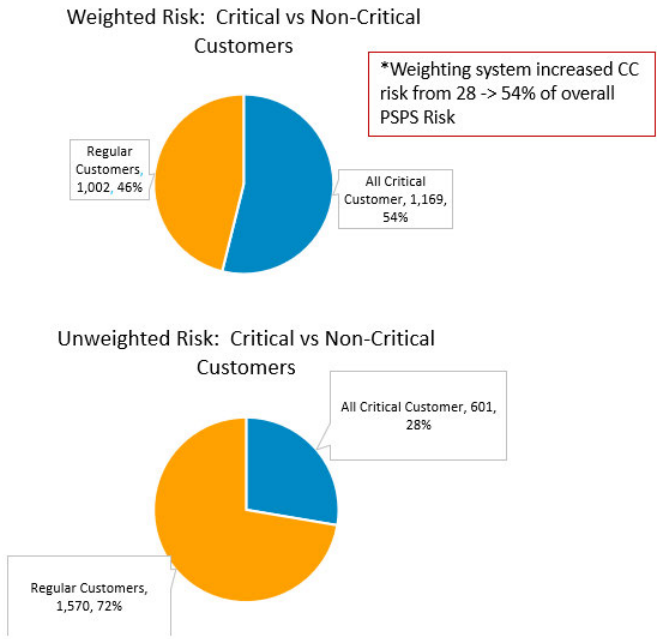
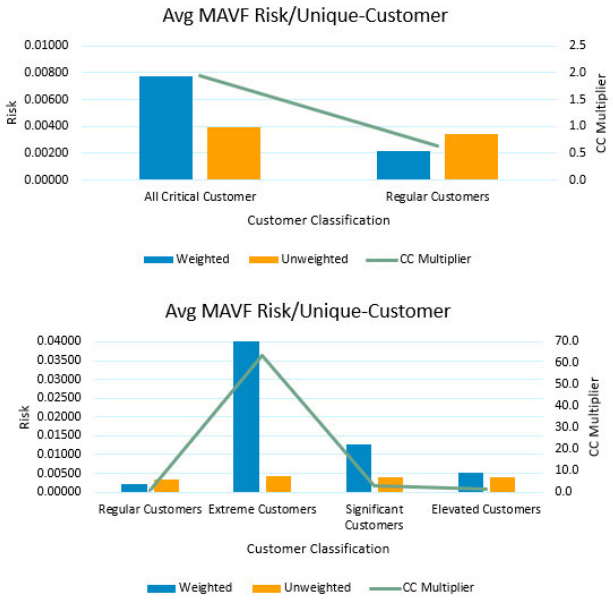


Figure 10 double clicks into how the weighting system impacted the risk score based on customer classification. This weighting system on averaged resulted in the critical-customer risk score doubled and regular-customer risk score dropped in half. Looking deeper into the type of critical customers, Extreme customers (i.e. CC1) risk increased on average by 70x.

Figure 10: Critical Customer Risk Multiplier



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3 Foundry Details

This section aims to provide a walk-through on the Foundry steps to generate the model outputs from customer -> isolation zone – circuit ->to substation level risk.

3.1 12-Year PSPS Lookback

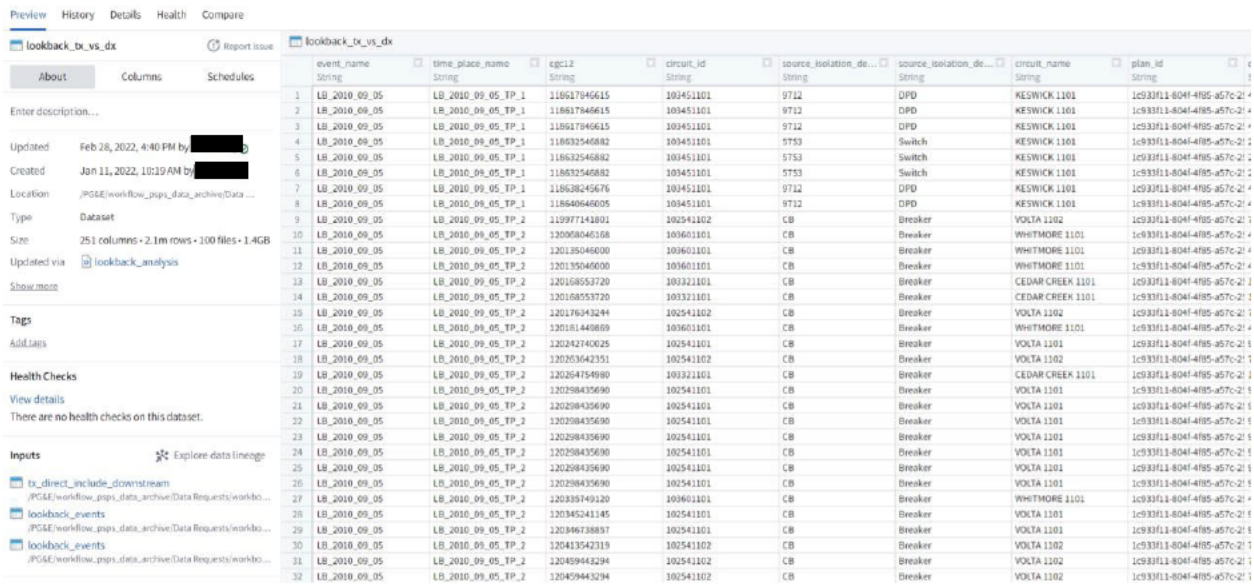
To reiterate, the PSPS Consequence model is built on the 12-year lookback. This foundational dataset was created by the PSPS PMO and Meteorology. Meteorology created the weather polygons and determined the locations on where they expected PSPS events to occur based on 2021 PSPS protocol. The PSPS PMO analyzed this data to determine which customers would be impacted by each weather event predicted by meteorology. This foundational dataset provides the information required to evaluate risk at the customer-event level and enables the development of the PSPS Consequence Model to better understand and forecast how our customers are impacted by PSPS events.

Figure 11 presents the foundry lookback dataset used in the PSPS consequence model. It consolidates event information, system details, and customer information described below.

- Event name, event type (Dx, Tx, Dx/Tx), duration, and time-places
- Associated substation, circuit, transformer, protection-layer information
- Customer account, type, classification, location, and meter information

This above information provides the inputs to estimate risk at the customer level that can be aggregated then to the circuit-segment, circuit, and substation level. Additionally, understanding the event types allow for risk to be delineated between distribution only, transmission only, and distribution/transmission events which is helpful in evaluating different risk mitigation strategies. Finally, the customer information allows PG&E to better understand specifically who could be impacted the PSPS forecast and if they are deemed higher risk customers (i.e. life support, medical baseline, low-income, and CC1).

Figure 11: PSPS Lookback



3.2 Isolation Zone Mapping

The 12-year PSPS lookback is joined with the consolidated PSPS dataset to join the isolation level zones to the lookback. This is so that the customer risk can be mapped and aggregated to the isolation zone-level and mapped to the circuit-segment, circuit, and substation level.

3.3 Assigning Critical Customer Weighting

Once the lookback is joined with the isolation level zones each SPID is mapped to a customer classification in-order to assign a weighting to adjust the risk score for that customer. Many of the customer classifications were already identified through the Customer Care and Billing database (i.e. CC1, CC2, TE1 etc .) and could immediately be mapped to the desired weighting as described in Table 3. However, additional steps were required to assign customer weightings to 1) low-income customers and 2) medical baseline and life support customers who were also low-income. Low-income customers are defined as "FERA" or "Care" in the CC&B database, where these identifiers needed to be mapped to a "low-income" tag in the PSPS consequence model. Additionally, low-income combined with medical baseline or life support is not an identifier in the CC&B database. Since these types of customers are weighted as "significant" (weighting 5), customers who are both low-income and are medically susceptible needed to be mapped as a "significant" customer with a customer weighting of 5.

Figure 12: Critical Customer Assignment in Foundry

CriticalCustomerType

```
1
2   CASE
3       WHEN "priority" IS NOT NULL THEN "priority"
4       WHEN "life_support_person"= 'Y' AND ("fera"='FERA' OR "care" = 'YES') THEN 'Life_Support_Low_Income'
5       WHEN "medical_baseline"= 'YES' AND ("fera"='FERA' OR "care" = 'YES') THEN 'Medical_Baseline_Low_Income'
6       WHEN "life_support_person" = 'Y' THEN 'Life_Support'
7       WHEN "medical_baseline" = 'YES' THEN 'Medical_Baseline'
8       WHEN "self_identified_vulnerable" = 'Y' THEN 'Self_Identified_Vulnerable'
9       WHEN "fera"='FERA' OR "care"='YES' THEN 'Low_Income'
10      ELSE 'Regular_Customer'
11  END
```

3.4 Risk Scenario: Potentially Impacted Customers

While the PSPS Lookback is a good representation of customers impacted based on prior weather events, PG&E sees a gap in customers in HFTD and HFRA that do not show up in the PSPS lookback. In order to capture this, PG&E identified the customers that are within HFTD and HFRA and its relationship to the system configuration and identified an additional 641K customers that could be impacted in light of a PSPS event. Because these customers did not show up in the 12-year lookback, to normalize against the existing customers that do show in the PSPS lookback, PG&E assigns these customers as a customer that may experience an event the following year, or more simply 1 event in 13 years. Note, this is not to say that PG&E expects all additional 641K customers to experience a PSPS event at the same time, but just the to include these customer likelihood to see an event itself. Additionally, while calibrating the PSPS enterprise MAVF scoring, the overall MAVF risk score itself does not go up, but each customer's allocation of the risk changes due to the inclusion of the potentially impacted customers. Another way to state this is that existing customers in the PSPS lookback will see a smaller contribution to the overall enterprise PSPS MAVF risk score, while customers that previously had 0 risk has a contribution to the overall enterprise PSPS MAVF risk score.

3.5 Total Duration of Outage

The duration of outage assigned in the 12-year lookback is the duration of the weather event. The risk associated with the PSPS outage is the total duration that includes pre-weather switching time (1hr) + the time to restore power (10hr) as described in section 2.2.1.

The Foundry tool continues to calculate the customer level risk score using the formula below.

$$\textit{Adjusted Customer Event Risk Score}: \frac{\textit{Total Duration} * \textit{Customer Weighting}}{\Sigma\, \textit{Total Duration}} * \textit{Unadj. Isolation Zone Score}$$

Equation 7

3.6 Tx-only, Dx-only and Tx/Dx-only Risk Score

As described in section 2.2.2, 12-year PSPS Historical Lookback provides the types of event the customer experience, such as Distribution-only, Transmission-only and both Distribution & Transmission events. This data is available at the customer-event level. The risk scores for the customers are categorized based on the types of events and this quantification will inform the effectiveness of a mitigation strategy.

This is achieved in Foundry by assigning a customer risk-event to appropriate event category. For example, if the customer-event is identified as a transmission only event, the event is defined as the overall risk, else there are no transmission risk on that customer for that specific event (described in Figure 13.

Figure 13: Expression allocating Risk to Tx-Only Event

Furthermore, when a customer experiences both Tx and Dx events, the risk score is allocated 50-50 to Transmission and Distribution. The event's risks are driven by Transmission impacts and Distribution impacts, hence the 50-50 risk scoring.

Figure 14: Expression allocating Risk to Tx/Dx Event

3.7 PSPS Risk Score SPID Event Dataset

After the completion of these steps, the PSPS_Risk_Score_SPID_Event dataset is created with parameters for roughly 2.1M customer-events that can be used to roll-up prioritization of PSPS risk from the customer to substation level. Key parameters include:

- SPID
- Critical Customer Type (Extreme, Significant, Elevated, Regular)
- Substation, Circuit, Circuit Segment, Isolation Zone Mapping
- Event Name, duration of outage, Year
- Total PSPS, Dx-only, Tx-only, Dx/Tx Risk
- Total events, Dx-only, Tx-only, Dx/Tx Event

Figure 15: PSPS Risk Score SPID Event Dataset

Previewing 1,000 rows, 18 of 18 columns

	service_point_id String	CriticalCusto... String	substation_na... String	circuit_name String	circuit_segment String	isolation_zone String	event_na... String	Tot_Dur Double
1	[redacted]	Regular_Customer	SAN JOAQUIN #3	SAN JOAQUIN #3 1...	SAN JOAQUIN #3 1...	252531102-10339-...	LB_2013_10...	41.
2		Elevated	PARADISE	PARADISE 1104	PARADISE 11042206	102831104-17245-...	LB_2019_10...	38.
3		Regular_Customer	STILLWATER	STILLWATER 1101	STILLWATER 1101...	103561101-6485-S...	LB_2021_08...	26.
4		Regular_Customer	PUEBLO	PUEBLO 1105	PUEBLO 1105637242	043291105-637242...	LB_2019_10...	29.
5		Elevated	KING CITY	KING CITY 1103	KING CITY 11037038	182031103-9971-F...	LB_2020_09...	38.
6		Regular_Customer	OILFIELDS	OILFIELDS 1103	OILFIELDS 110383...	182391103-9847-F...	LB_2021_10...	37.
7		Elevated	JOLON	JOLON 1102	JOLON 1102CB	182981102-96707-...	LB_2021_10...	37.
8		Regular_Customer	TASSAJARA	TASSAJARA 2113	TASSAJARA 2113M...	014662113-72624-...	LB_2020_09...	27.
9		Regular_Customer	JOLON	JOLON 1102	JOLON 11027004	182981102-9235-F...	LB_2021_10...	37.
10		Elevated	JOLON	JOLON 1102	JOLON 11027068	182981102-7751-S...	LB_2021_10...	37.
11		Regular_Customer	JOLON	JOLON 1102	JOLON 11027002	182981102-9889-F...	LB_2020_08...	23.
12		Regular_Customer	OREGON TRAIL	OREGON TRAIL 1104	OREGON TRAIL 11...	103521104-11153-...	LB_2019_10...	39.
13		Regular_Customer	CLARKSVILLE	CLARKSVILLE 2105	CLARKSVILLE 2105...	153612105-39253-...	LB_2019_10...	34.
14		Elevated	VACA DIXON	VACA DIXON 1101	VACA DIXON 11011...	063591101-795681...	LB_2019_10...	41.
15		Regular_Customer	OTTER	OTTER 1101	OTTER 1101187705	182941101-1275-F...	LB_2017_10...	14.
16		Regular_Customer	WYANDOTTE	WYANDOTTE 1107	WYANDOTTE 1107...	102911107-517-Fuse	LB_2020_09...	44.
17		Regular_Customer	SAN ARDO	SAN ARDO 1102	SAN ARDO 110289...	182191102-7107-F...	LB_2017_10...	23.

4 PSPS Risk Score Report

The PSPS Risk Score Report, is a consolidated report where the user can input and filter the following parameters to view PSPS Risk Statistics. These modifiable parameters include:

- Year (between 2010-2021)
- SPID
- Isolation Zones
- Circuit
- Circuit Segment

Figure 16: PSPS Risk Score Report Filters

Following include tables aggregated to different granularity to evaluate risk. Each one of these tables risk score will adjust based on the modifiable parameters shown in Figure 16.

Figure 17: Annualized PSPS Risk Score and Statistics

Annual PSPS Risk Score Summary

	number_of_years Double	psps_risk[ann] Double	dx_risk[ann] Double	tx_risk[ann] Double	TxDx_risk[ann] Double	event_count[... Double	cust_count[ann] Double	Tot_Dur[ann] Double
1	12.000	2,170.46	1,316.49	348.75	505.220	3.00	178,340.33	6,591,585.667

Figure 18: Annualized Outage Duration by Event/Year

Figure 19: Yearly PSPS Risk Score

PSPS Risk Score by Year

Displaying 11 rows

Year	count_distinct_of_even	sum_of_psps_risk[ann]	sum_of_dx_risk[ann]	sum_of_tx_risk[ann]	sum_of_TxDx_risk[ann]	count	sum_of_Tot_Dur
2010	2	13.388	7.792	4.230	1.365	18415	491,073.000
2011	3	38.476	31.747	0.014	6.715	48141	1,375,030.000
2013	3	41.392	38.524	0.001	2.867	53397	1,517,043.000
2014	3	58.221	49.463	7.296	1.462	69340	2,004,855.000
2015	1	4.973	4.973	0.000	0.000	11730	175,950.000
2016	1	4.232	4.232	0.000	0.000	8884	157,964.000
2017	4	307.640	189.030	45.905	72.704	348307	11,339,523.000
2018	4	273.742	158.153	45.036	70.553	215307	9,744,648.000
2019	5	704.949	406.707	86.569	211.673	734231	26,440,069.000
2020	6	656.479	358.903	159.695	137.881	553086	23,602,738.000
2021	4	66.968	66.968	0.000	0.000	79246	2,250,135.000
Grand total	**36**	**2,170.459**	**1,316.493**	**348.746**	**505.220**	**2140084**	**79,099,028.000**

Figure 20: Event Level Risk Score

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PSPS Event Risk Score

Displaying 36 rows

event_name	sum_of_psps_risk[ann]	sum_of_dx_risk[ann]	sum_of_tx_risk[ann]	sum_of_TxDx_risk[ann]	count	sum_of_Tot_Dur
LB_2017_10_03	11.370	11.370	0.000	0.000	24983	413,763.000
LB_2017_10_08	247.817	138.104	37.774	71.939	252956	9,035,918.000
LB_2017_10_13	32.630	29.255	3.251	0.124	44703	1,270,813.000
LB_2018_09_24	2.529	2.529	0.000	0.000	3705	89,111.000
LB_2018_10_13	142.710	73.532	21.276	47.902	93627	5,048,329.000
LB_2018_11_07	100.888	65.597	15.588	19.703	88835	3,602,224.000
LB_2018_11_10	27.615	16.496	8.172	2.948	29140	1,004,984.000
LB_2019_10_09	119.098	94.633	12.383	12.082	110762	4,318,587.000
LB_2019_10_23	63.234	46.800	5.200	11.234	84810	2,254,719.000
LB_2019_10_26	456.094	227.742	56.457	171.896	467638	17,481,246.000
LB_2019_10_29	65.919	36.930	12.529	16.460	69930	2,369,152.000
LB_2019_11_20	0.603	0.603	0.000	0.000	1091	16,365.000
LB_2020_08_19	3.565	3.394	0.000	0.172	6520	136,382.000
LB_2020_09_07	283.470	128.450	115.151	39.869	259704	10,331,657.000
LB_2020_09_27	51.446	41.473	3.237	6.737	50449	1,761,670.000
LB_2020_10_14	33.547	29.369	0.508	3.669	29296	1,166,480.000
LB_2020_10_22	32.571	24.327	0.252	7.992	28842	1,131,440.000
LB_2020_10_25	251.878	131.890	40.547	79.442	178275	9,075,109.000
LB_2021_08_17	35.388	35.388	0.000	0.000	42951	1,223,255.000
LB_2021_09_20	4.304	4.304	0.000	0.000	7232	140,912.000
LB_2021_10_11	22.142	22.142	0.000	0.000	21929	731,649.000
LB_2021_10_14	5.134	5.134	0.000	0.000	7134	154,319.000
Grand total	**2,170.459**	**1,316.493**	**348.746**	**505.220**	**2140084**	**79,099,028.000**

Figure 21: Substation Level Risk Score

Substation PSPS Risk Score (Annualized)

	substation_na... String	psps_risk[ann] Double	dx_risk[ann] Double	tx_risk[ann] Double	TxDx_risk[ann] Double	event_count[... Double	cust_count[ann] Double	Tot_Dur[ann] Double
28	FORESTHILL	25.14	0.240	6.147	18.750	0.83	2,021.33	72,561.167
29	LUCERNE	24.92	2.636	9.815	12.472	0.42	1,520.17	69,840.167
30	MIDDLETOWN	23.39	18.143	1.102	4.146	2.17	2,074.75	75,980.250
31	ALLEGHANY	21.89	3.702	0.492	17.700	1.42	1,372.83	55,830.250
32	CLARK ROAD	21.64	13.414	0.713	7.512	1.92	1,714.58	65,809.917
33	DESCHUTES	21.05	14.403	2.785	3.861	1.08	2,128.58	69,004.750
34	KONOCTI	20.46	14.173	0.000	6.285	0.58	1,175.42	58,249.250
35	CEDAR CREEK	20.16	7.530	0.000	12.626	2.00	1,441.17	57,416.500
36	HIGGINS	19.65	19.647	0.000	0.000	0.33	1,323.08	61,242.833
37	WEIMAR	19.50	0.000	14.656	4.847	0.75	1,701.00	62,748.000
38	CHALLENGE	18.92	2.085	0.595	16.244	1.42	1,341.42	60,529.500
39	COLUMBIA HILL	18.89	0.124	15.892	2.873	0.92	948.75	43,568.083
40	CLOVERDALE	17.34	4.994	10.068	2.273	1.50	1,390.50	55,084.583
41	TEJON	17.13	17.131	0.000	0.000	1.67	965.33	32,995.917
42	DOBBINS	15.55	4.267	0.139	11.141	1.33	1,039.00	42,354.083
43	ANDERSON	15.15	10.128	2.400	2.620	0.83	1,200.17	41,673.417
44	MONTICELLO	15.09	4.280	4.907	5.901	2.25	1,275.50	43,751.583
45	SALT SPRINGS	14.53	5.814	0.062	8.659	1.17	1,561.33	51,182.417
46	SHINGLE SPRINGS	13.05	13.048	0.000	0.000	0.25	1,249.75	41,631.917
47	CURTIS	13.04	13.037	0.000	0.000	0.33	1,161.33	38,478.667
48	RED BLUFF	12.97	12.970	0.000	0.000	0.83	1,262.00	39,620.917
49	CLARKSVILLE	12.94	12.936	0.000	0.000	0.08	1,348.83	45,860.333

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Figure 22: Circuit Level Risk Score

Circuit PSPS Risk Score (annualized)

	circuit_name String	psps_risk[ann] Double	dx_risk[ann] Double	tx_risk[ann] Double	TxDx_risk[ann] Double	event_count[… Double	cust_count[ann] Double	Tot_Dur[ann] Double
28	CALISTOGA 1101	18.48	2.687	9.246	6.549	2.17	1,689.500	66,870.750
29	APPLE HILL 1104	18.48	16.122	0.000	2.357	0.92	1,587.250	54,506.333
30	SHADY GLEN 1101	17.78	0.000	14.419	3.362	0.75	1,378.333	54,521.083
31	STILLWATER 1102	17.56	7.172	0.000	10.392	1.33	1,700.833	53,907.000
32	GIRVAN 1101	17.32	15.890	0.000	1.427	1.92	1,773.250	53,041.917
33	WEST POINT 1102	17.30	2.795	0.044	14.465	0.67	1,498.417	50,430.583
34	JESSUP 1101	17.15	17.155	0.000	0.000	1.25	1,468.583	49,013.250
35	TEJON 1102	17.10	17.095	0.000	0.000	1.67	960.000	32,825.167
36	PARADISE 1103	17.06	15.340	0.499	1.223	1.25	1,307.917	54,522.083
37	BRUNSWICK 1110	17.03	0.000	14.376	2.658	0.33	1,040.667	49,171.500
38	REDBUD 1102	15.96	11.669	0.000	4.286	0.67	1,023.917	45,194.167
39	RINCON 1101	15.61	11.470	0.000	4.140	0.83	1,215.333	50,173.333
40	DOBBINS 1101	15.55	4.267	0.139	11.141	1.33	1,039.000	42,354.083
41	LUCERNE 1106	15.47	2.636	3.046	9.787	0.42	985.583	44,715.333
42	BRUNSWICK 1103	15.34	0.000	3.571	11.770	0.33	1,071.000	50,604.750
43	REDBUD 1101	15.11	12.484	0.000	2.626	1.75	1,189.750	43,572.000
44	MONTICELLO 1101	15.09	4.280	4.907	5.901	2.25	1,275.500	43,751.583
45	VACAVILLE 1111	15.06	15.057	0.000	0.000	0.75	1,286.333	43,977.917
46	DESCHUTES 1104	14.96	10.539	1.854	2.572	1.00	1,521.417	49,407.833
47	NARROWS 2105	14.66	0.000	10.187	4.472	0.25	986.583	47,684.250
48	KONOCTI 1102	14.63	10.941	0.000	3.688	0.58	842.583	41,441.167
49	BRUNSWICK 1107	14.16	0.000	3.297	10.866	0.33	896.667	42,367.500

Figure 23: Circuit Segment Level Risk Score

Circuit Segment PSPS Risk Score (annualized)

	substation_na… String	circuit_name String	circuit_segment String	psps_risk[ann] Double	dx_risk[ann] Double	tx_risk[ann] Double	TxDx_risk[ann] Double	event_count[… Double	cust_cou Double
1									
2	ORO FINO	ORO FINO 1101	ORO FINO 11012022 ***	20.07	20.07	0.00	0.000	1.08	
3	ORO FINO	ORO FINO 1101	ORO FINO 1101CB	15.66	15.66	0.00	0.000	1.08	
4	WYANDOTTE	WYANDOTTE 1110	WYANDOTTE 1110… ***	14.37	14.37	0.00	0.000	0.75	
5	HIGHLANDS	HIGHLANDS 1102	HIGHLANDS 11027… ***	12.17	9.26	0.00	2.904	0.42	
6	TEJON	TEJON 1102	TEJON 1102732836	11.63	11.63	0.00	0.000	1.67	
7	PARADISE	PARADISE 1104	PARADISE 11042206 ***	10.77	10.04	0.00	0.726	1.50	
8	ORO FINO	ORO FINO 1102	ORO FINO 11022090 ***	10.07	10.07	0.00	0.000	1.17	
9	REDBUD	REDBUD 1101	REDBUD 1101323962 ***	9.91	9.25	0.00	0.665	1.75	
10	OREGON TRAIL	OREGON TRAIL 1103 ***	OREGON TRAIL 11… ***	9.31	4.01	1.28	4.015	1.08	
11	WYANDOTTE	WYANDOTTE 1103	WYANDOTTE 1103… ***	9.03	9.03	0.00	0.000	0.75	
12	PLACERVILLE	PLACERVILLE 2106	PLACERVILLE 2106… ***	8.85	7.60	0.00	1.254	0.58	
13	CALISTOGA	CALISTOGA 1102	CALISTOGA 1102706 ***	8.84	0.00	6.30	2.541	0.83	
14	RINCON	RINCON 1101	RINCON 1101576	8.66	6.32	0.00	2.338	0.58	
15	WYANDOTTE	WYANDOTTE 1107	WYANDOTTE 1107… ***	8.41	8.41	0.00	0.000	0.75	
16	BANGOR	BANGOR 1101	BANGOR 11017446	8.37	0.52	0.96	6.894	1.33	
17	FORESTHILL	FORESTHILL 1101	FORESTHILL 1101… ***	8.31	0.00	2.11	6.192	0.75	
18	VACAVILLE	VACAVILLE 1104	VACAVILLE 11046542 ***	8.30	8.30	0.00	0.000	1.42	
19	EL DORADO PH	EL DORADO PH 2101 ***	EL DORADO PH 21… ***	8.16	7.11	0.00	1.046	0.67	
20	ORO FINO	ORO FINO 1101	null	8.13	8.13	0.00	0.000	1.08	
21	APPLE HILL	APPLE HILL 1104	APPLE HILL 11041… ***	7.90	6.84	0.00	1.055	0.67	
22	DUNBAR	DUNBAR 1101	DUNBAR 11011377… ***	7.79	6.08	0.00	1.710	0.50	
23	PARADISE	PARADISE 1105	PARADISE 11052214 ***	7.53	6.96	0.00	0.577	1.25	

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Figure 24: Isolation Zone Level Risk Score

Isolation Zone PSPS Risk Score (annualized)

	substation_na... String	circuit_name String	isolation_zone String	psps_risk[ann] Double	dx_risk[ann] Double	tx_risk[ann] Double	TxDx_risk[ann] Double	event_count[... Double	Tot_Dur[Double
1									
2	SILVERADO	SILVERADO 2101	043432104-3245-S... ***	4.65	4.33	0.00	0.321	1.58	
3	VOLTA	VOLTA 1101	102541101-965-Fuse ***	3.37	2.73	0.00	0.639	1.33	
4	CEDAR CREEK	CEDAR CREEK 1101	103321101-1664-D... ***	2.78	1.03	0.00	1.741	2.00	
5	COLUMBIA HILL	COLUMBIA HILL 1101 ***	152471101-879-S... ***	2.72	0.00	2.46	0.260	0.83	
6	TEJON	TEJON 1102	252931102-14922-... ***	2.55	2.55	0.00	0.000	1.67	
7	ORO FINO	ORO FINO 1102	103011102-3827-F... ***	3.48	3.48	0.00	0.000	1.08	
8	REDBUD	REDBUD 1101	043191101-4343-F... ***	2.41	2.26	0.00	0.154	1.67	
9	MIDDLETOWN	MIDDLETOWN 1102	043141102-3675-F... ***	2.31	1.82	0.00	0.490	0.50	
10	CALISTOGA	CALISTOGA 1102	042711102-5107-S... ***	2.29	0.00	1.63	0.659	0.83	
11	DUNBAR	DUNBAR 1103	043071103-4633-S... ***	2.29	1.84	0.00	0.451	0.50	
12	REDBUD	REDBUD 1101	043191101-7887-F... ***	2.26	2.11	0.00	0.154	1.58	
13	STILLWATER	STILLWATER 1102	103561102-4667-F... ***	2.26	0.97	0.00	1.293	1.33	
14	VOLTA	VOLTA 1101	102541101-5217-F... ***	2.25	1.95	0.00	0.294	2.00	
15	SILVERADO	SILVERADO 2104	043432104-1385-F... ***	2.23	2.06	0.00	0.162	1.50	
16	VOLTA	VOLTA 1101	102541101-2875-F... ***	2.17	1.89	0.00	0.283	2.00	
17	VOLTA	VOLTA 1101	102541101-65533-... ***	2.03	1.57	0.00	0.463	1.08	
18	VACAVILLE	VACAVILLE 1104	063661104-40935-... ***	1.94	1.94	0.00	0.000	1.08	
19	BONNIE NOOK	BONNIE NOOK 1101	152361101-5903-S... ***	1.90	0.54	0.00	1.359	1.08	
20	ORO FINO	ORO FINO 1101	103011101-539109... ***	1.87	1.87	0.00	0.000	1.08	
21	VOLTA	VOLTA 1101	102541101-1516-D... ***	1.86	1.51	0.00	0.352	1.33	
22	ORO FINO	ORO FINO 1101	103011101-2775-F... ***	1.86	1.86	0.00	0.000	1.08	
23	BIG BEND	BIG BEND 1102	103751102-1497-F... ***	1.82	1.82	0.00	0.000	1.00	

Figure 25: SPID Level Risk Score Snapshot

SPID PSPS Risk Score (annualized)

	service_point_id String	CriticalCusto... String	substation_na... String	circuit_name String	circuit_segment String	isolation_zone String	psps_risk[ann] Double	dx_risk[ann] Double	TxDx_ris Double
1	[redacted]	Extreme	CEDAR CREEK	CEDAR CREEK 1101	CEDAR CREEK 110... ***	103321101-1619-F... ***	1.67	0.62	
2		Extreme	BIG BEND	BIG BEND 1101	BIG BEND 1101CB	103751101-649501... ***	1.46	1.46	
3		Extreme	CALISTOGA	CALISTOGA 1101	CALISTOGA 11013... ***	042711101-35588-... ***	1.43	0.67	
4		Extreme	KANAKA	KANAKA 1101	KANAKA 1101CB	103221101-813829... ***	1.38	0.71	
5		Extreme	MONTICELLO	MONTICELLO 1101	MONTICELLO 1101... ***	043051101-130412... ***	1.37	0.78	
6		Extreme	BIG BEND	BIG BEND 1102	BIG BEND 1102884... ***	103751101-884340... ***	1.34	1.34	
7		Extreme	BUCKS CREEK	BUCKS CREEK 1103	BUCKS CREEK 110... ***	102211103-18507-... ***	1.29	1.29	
8		Extreme	WHITMORE	WHITMORE 1101	WHITMORE 11011... ***	103601101-2105-S... ***	1.26	0.21	
9		Extreme	BUCKS CREEK	BUCKS CREEK 1102	BUCKS CREEK 110... ***	102211102-3155-F... ***	1.21	1.21	
10		Extreme	KANAKA	KANAKA 1101	KANAKA 110183288	103221101-83288-... ***	1.18	0.51	
11		Extreme	KANAKA	KANAKA 1101	KANAKA 110183288	103221101-435875... ***	1.18	0.51	
12		Extreme	SILVERADO	SILVERADO 2104	SILVERADO 21047... ***	043432104-250695... ***	1.17	1.09	
13		Extreme	SILVERADO	SILVERADO 2104	SILVERADO 21047... ***	043432104-4281-F... ***	1.17	1.09	
14		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-88911-... ***	1.17	1.17	
15		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-14923-... ***	1.17	1.17	
16		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-18602-... ***	1.17	1.17	
17		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-14960-... ***	1.17	1.17	
18		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-14922-... ***	1.17	1.17	
19		Extreme	TEJON	TEJON 1102	TEJON 1102732836	252931102-14922-... ***	1.17	1.17	
20		Extreme	WHITMORE	WHITMORE 1101	WHITMORE 11011... ***	103601101-1594-D... ***	1.15	0.10	
21		Extreme	SILVERADO	SILVERADO 2104	SILVERADO 2104726 ***	043432104-3245-S... ***	1.15	1.07	
22		Extreme	ALLEGHANY	ALLEGHANY 1101	ALLEGHANY 1101978 ***	151101101-3227-F... ***	1.13	0.33	

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5 Future Improvements and Model Adjustments

Inclusion of Transmission Line Ranking. With the inclusion of Power Flow analysis in the future PSPS Lookback, substation to transmission line mapping will be available. This will enable the calculation of transmission line risks & ranking.

Critical Customer Weighting. The critical weightings defined through the 2023 incremental undergrounding process will continue to go through revisions and updates based on new information and feedback from stakeholders.

Critical Customer Weighting Scoring Approach. The model adjusts risk to prioritize for critical customers based on an established weighting criterion. These risk adjustments are being prioritized by customer type and currently locations are not accounted for in the distribution model. Consideration is being given to adjusting the methodology to prioritize based on customer location in addition to customer-type.

Risk Adjustments based on Frequency of PSPS vs outage duration. Reliability risk is calculated based on the duration of an outage. Recently there has been focus on customer who have been impacted by PSPS multiple times vs the total duration of the outage. Consideration is being given to modifying our risk scoring approach to account for 1) frequency instead of outage duration or possibly 2) include both frequency and outage duration to estimate reliability risk.

6 Version Change Log

Version	Description	Useage	Change Log
2021	10-year Lookback (2010-2019) Circuit Level Granularity 2,195 MAVF Risk Score Excel Based	High level understanding of PSPS vs Wildfire risk Input to Incremental Undergrounding mile selection	
2022	12-year Lookback (2010-2021) Circuit Segment Granularity 2,170 MAVF Risk Score Foundry Based	Input to Undergrounding program selection Customer oriented program prioritization Input to PSPS mitigation plans	- Incorporated updated 2021 PSPS Protocol - Moved from excel to foundry and improved granularity - Added Critical Customer Weightings
2023	12-year Lookback (2010-2021) Circuit Segment Granularity 2,170 MAVF Risk Score Foundry Based	Input to PSPS mitigation plans	- Potentially Impacted Customer inclusion

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7 Appendix

7.1 PSPS Risk Attributes Assumptions

7.1.1 PSPS Safety Calculation Assumptions

EF/MCMI Ratio = 0.002175

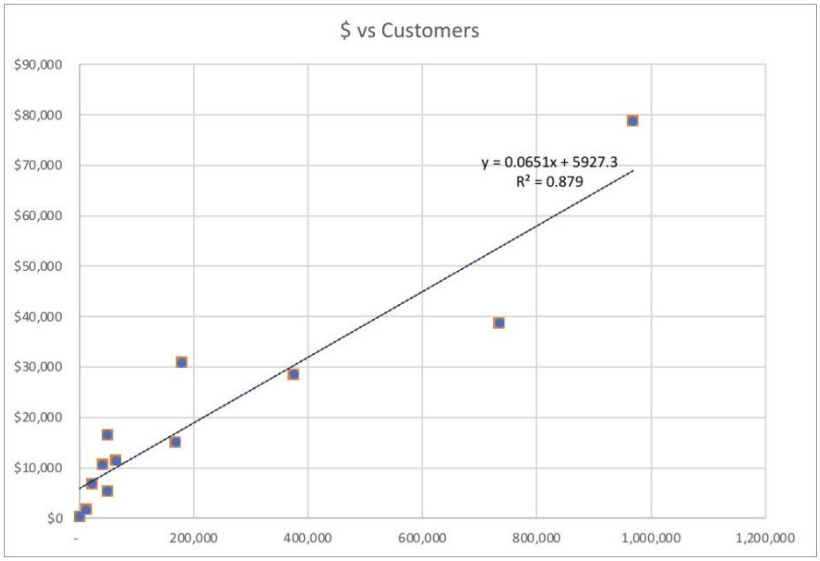
Calculated using previous PG&E PSPS events including 2019-2020 events, and other large external outage events include 2003 Northeast Blackout in New York City, 2011 Southwest Blackout in San Diego, 2012 Derecho Windstorms, 2012 Superstorm Sandy, and 2017 Hurricane Irma.[6]

[Number of Customer Meters Impacted]:[Population Impacted] Ratio = 1

7.1.2 PSPS Financial Calculation Assumptions

Cost of Execution = $5,927,323.12; Cost per Customer = $65.14

Based on regression analysis of 2019-2020 PSPS Event data that includes cost per event and # customers[7]



7.1.3 Wildfire Safety Calculation Assumptions

[Population Impacted]: [Equivalent Fatalities] Ratio = 2000

[6] Workpaper is General Rate Case on July 20, 2021. Please see PG&E response to Energy Division GRC-2023-PhI_DR_ED_001-Q01Supp01, workpaper EO-WPSPS-6_Safety Impacts from Widespread Unplanned Outage Events .pptx.

[7] Workpaper is General Rate Case on July 20, 2021. Please see PG&E response to Energy Division GRC-2023-PhI_DR_ED_001-Q01Supp01, workpaper EO-WPSPS-5_PSPS Event Financial Cost 2019-2020.xlsx.

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Calculated based on maximum population impacts derived from Technosylva wildfire simulation models and a fatality ratio based on National Fire Protection Association (NFPA) data.

7.1.4 Wildfire Financial Calculation Assumptions

Cost per Structure = $1,000,000

Previously evaluated in 2020 RAMP A.20-06-012 report

7.2 Critical Customer Weighting Results

The below figures are to highlight the difference in results between weighted and unweighted customer scoring.

8 References and Data Sources

Data Source

2021 12-Year Lookback: Foundational dataset used that enables the quantification of risk at the customer level

PSPS Risk Score Report: PSPS Consequence Model Risk Report. Report allows for filtering and views of risk at different granularity. This report also contains link to the Foundry analysis

PSPS Risk Score SPID Event: PSPS Consequence Model Output dataset. Dataset includes SPID Risk mapped from isolation zone to substation, along with other system and customer attributes

Event 641 PSPS Potentially Impacted Customers): Dataset that identifies all customers that have potential PSPS exposure given their relationship with the HFRA and configuration of the system.