Follow-up Questions and Responses to 2022 PSPS Post-Season Workshop on April 18, 2023

On April 18, 2023 Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), PacifiCorp, Liberty Utilities, and Bear Valley Electric Service (BVES) presented to the CPUC and the public in the Joint IOU 2022 Public Safety Power Shutoff (PSPS) Post Season Workshop. Some questions that were raised during the workshop necessitated follow-up responses. PG&E, SCE, and Liberty Utilities subsequently provided their responses to the questions. See below for the follow-up questions and the IOUs' responses.

Follow-up Questions for PG&E and PG&E Responses

Question 01

(President Reynolds) Please provide a list of academic weather research areas such as the Diablo wind patterns by San Jose State University and climate data in partnership with Argonne National Laboratory. Please describe in detail the weather research work and the current outcome of the research.

Response to Question 01

Below is a list of projects that PG&E had/has going with SJSU in 2022 and 2023 (highlighted).

Research projects with SJSU

The Wildfire Interdisciplinary Research Center at SJSU will help Pacific Gas and Electric (PG&E) analyze their ~32-year 2-km WRF model output (1989 – 2022) to better understand the fire weather conditions associated with extreme wildfire to help inform Public Safety Power Shutoffs (PSPSs). The analyses will be conducted by two tenure-track faculty, one post-doctoral scholar, and two graduate students. The 4 main goals of this project are as follows:

1. Yield research insights that PG&E can utilize to help inform their decision-making frameworks around wildfire, such as PSPS.
2. Make PG&E weather model data visualizations available publicly.
3. Publish research findings in peer-reviewed academic journals and post additional insights on sjsu.edu/wildfire and fireweather.org.
4. Continue live fuel moisture field sampling program.

2022 Project Tasks

1.1 analyses using PG&E's new 32-year climatology of 2 km WRF model.

Deliverables: Conference presentation and journal publication

This data will allow for in depth analyses on critical fire weather conditions using a combination of *high spatiotemporal resolution* and *long duration* data. We plan to continue our current tasks from 2021 and finalize some our analyses including the Diablo wind metric development and red flag criteria sensitivities using the climatology.

1.2.Visualizations of PG&E's operational WRF model data for public consumption

Deliverable: Webpage portal: http://www.met.sjsu.edu/weather/wirc-prod/

We will develop an operational data pipeline and front-end visualization system to ingest and display PG&E's operational WRF model data and derived products. PG&E's WRF model is run at 2 km resolution across Northern and Central CA providing 129 hours of forecast output and is updated 4 times daily. Operational weather forecasters and the general public across Northern and Central CA can benefit from having access to outputs from PG&E's operational model. Model output will include the standard fire weather parameters such as wind speed, wind gusts, relative humidity, surface pressure gradients, temperature, and derived fire weather indices, including a Fire Potential Index (FPI). This work will be coupled with our wildfire research on the critical patterns, indices and variables that contribute to catastrophic fires to develop and deploy key operational products that can help forecasters understand when these conditions may develop.

1.3 Assessing shifts of Extreme Wildfire Behavior under Climate Change Scenarios

Deliverable: Conference presentations and journal publication (resulted in a paper under review at Nature: Preprint version - Brown et al., 2023).

The goal of this research will be to understand where future wildfire risk be greatest spatially, so that long-term investments made by utilities and the state can mitigate the most wildfire risk with climate change in mind. We will use a data-driven approach where the relationship between various environmental determinants (temperature, humidity, fuel moisture, wind) and extreme wildfire behavior is quantified with machine learning models while controlling for topography and land use. Once these statistical models are trained, long term changes in the environmental determinants, obtained from climate models, can be fed in, creating high spatial resolution projections of changes in risk of extreme fire behavior. In addition, we will quantify the influence of climate change on extreme wildfire events that have taken place historically, like the California Camp Fire, Creek Fire, and August Complex. The goal will be to fractionally attribute various aspects of these fires (e.g., their size and mean spread rate) to particular ingredients of climate change. This will help partition the influence of climate change from other influences like the buildup of fuel from long term fire suppression. This partitioning is practically useful because it would indicate the degree to which changes in forest management practices will have a mitigating effect on wildfire activity.

1.4 WRF-SFIRE Simulations of Large Wildfire Events (operational)

The importance of the fire-atmosphere interactions and the potential of wildfires to "create their own weather" has been recognized in fire-atmosphere simulations (Clark et al. 1996, Coen et al. 2018, Peace et al. 2011, and observed during experimental fires (Clements et al. 2007) as well as observed during wildfire events (Lareau and Clements 2017). Recent observations of the micrometeorology of the fire front passage, indicate

significant fire-induced surface flow acceleration even at the ambient winds as high as 10 m/s (Clements et al. 2019). The fact that even during a fire that can be classified as wind-driven, local circulation may be modified by the fire-induced buoyancy and increase local winds is troublesome as according to the general belief fire-atmosphere coupling processes can be ignored in wind-driven fires and are important only plume dominated cases. As the fires become more intense their potential to modify local near-fire circulations increases. Both the 2020 and 2021 fire seasons provided multiple examples of very large and intense fires experiencing extreme fire growth.

1.5 Live Fuel Moisture Field Sampling

This task is to continue fuel sampling at our three field sites twice per month. The project will include data quality assurance and comparison analysis with other regional sites.

Deliverable: Updated dataset for analyses and inclusion into national fuels moisture database. Data to be shared with the public through https://www.wfas.net/nfmd/public/index.php.

2023 Projects:

1. **Application of Validated Wildfire Risk Models for Informing Actionable Climate Change Adaptation Decisions**

The goal of this research will be to expand upon the climate change work done by Dr. Patrick Brown in 2022 and build upon the research paper submitted to Nature. One area for exploration is presented below.

1) Spatial Distribution and Changes in Extreme Wildfire Growth Risk Due to Warming

Climate change is often decomposed into a thermodynamic and a dynamic component where thermodynamic changes refer to the influence of warming alone and dynamic changes take into account all shifts in atmosphere and ocean circulation patterns that may arise from that warming. Thermodynamic changes are well-constrained and have relatively low uncertainty, whereas there is often not an expert or model consensus on even *whether* a given dynamic change will occur or, if it does, what its sign will be (e.g., there is not a consensus on a sign change in the frequency of downslope wind events). This means that the most certain influence of climate change on wildfire risk comes via the thermodynamic component. Thus it is useful to assess historical extreme wildfire days under future scenarios where only the temperature and the temperature's influence on fuel aridity has been altered (i.e., assessing the influence of the thermodynamic change while assuming no dynamic changes, Brown et al., 2023). In this application, we will investigate the spatially explicit extreme wildfire growth risk during the 25 days from 2003-2021 with the highest statewide burned area and

consider how these same days' extreme wildfire growth risk will change under future warming scenarios. Results will be broken down in terms of different synoptic weather regimes (e.g., high-pressure heat dome vs. downslope wind events). A major theme will be to quantify risk integrated over the next several decades in order to help reduce the risk for assets of, e.g., utilities over their full lifetime.

1.1 Questions this application may answer

- What do spatially-explicit risk and changes in risk look like, and how do these overlap with societally-relevant assets like human structures and transmission lines?
- What does a map of ranked risk integrated over the next 50 years look like and what does that mean in terms of prioritization of infrastructure hardening?
- How do changes in risk depend on the synoptic weather regime?

i. Visualizations of PG&E's operational WRF model data for public consumption (Voss)

Deliverable: Maintain existing webpage portal, develop new products, run operation FPI model

Part I: Maintain existing operational data pipeline and front-end visualization system developed in 2022 to ingest and display PG&E's operational WRF model data and derived products. PG&E's WRF model is run at 2 km resolution across Northern and Central CA providing 129 hours of forecast output and is updated 4 times daily. Operational weather forecasters and the general public across Northern and Central CA currently benefit from having access to outputs from PG&E's operational model.

Part II: Add new products to existing product catalog as requested by PG&E and public partners such as NWS, CWSU, and GACC. The main focus here will be on contextualizing forecasts as percentiles in relation to the 30-year climatology.

Part III: Operationalize an FPI model based on Holt Hanley's master's thesis model, which predicts large fire potential based on recent weather and fuel moisture levels. Work would include 1) the backend data systems to ingest and process required input data, including live and dead fuel moisture model data from PG&E; 2) recoding the model to recast results as probabilities to make user friendly to the fire weather community of users; 3) a frontend webpage portal.

2. Diablo Wind Climatology Analysis (Clements/Kochanski)

This task would provide funding for a graduate student to continue exploring Diablo Wind spatial structures and climatology using the reanalysis data set and potentially new observations using the SJSU Fire Weather Wind Profiler Network. The previous work conducted under this task would be leveraged, but will likely be independent from this work. We will use the reanalysis data to determine wind critical wind corridors and then use Doppler lidar observations to characterize the actual wind field during events. The study would also lead to improve siting of profiler locations to be used for the network.
Deliverable: Peer-reviewed paper submission to a reputable journal. Seminar with PG&E staff at the end of the project with a summary of project results. GIS layer data of the climatology of Diablo winds and high-risk corridors.

3. **WindNinja Analysis (Clements/Kochanski)**
This task will investigate WN for operations and determine the feasibility of its use for very complex terrain. We will use the California Canyon Fire Experiment data to test the model's accuracy. We will work with USFS who developed the model and, in addition, work with PGE staff to use WN from WRF output. A graduate student will be funded on this task for 6 months and if results are promising, the student will be funded for the remainder of the project.
Deliverable: Seminar with PG&E staff at the end of the project with a summary of project results.

4. **Live Fuel Moisture Sampling (Clements)**
This task will include FMC sampling of chaparral species at three sites. SJSU may relinquish the third site in the Santa Cruz Mountains and discuss with PG&E about taking that site over.

   Deliverable: Monthly samples of LFM at three sites uploaded to the NFMD.

5. **RAWS: Install new weather station in Mt. Diablo state park (Clements)**
This task will include upgrading current communications equipment at Mt. Diablo summit to be more robust and withstand power interruptions and planning and installing a new RAWS in the southern region of Mt. Diablo. The first step will be to initiate conversations with the park staff and get a feasibility study and site survey completed. Equipment is budgeted for a complete RAWS (CSI or FTS).

   Deliverable: More robust SJSU station on the top of Mt. Diablo and installation of a new weather station.

Question 02

(Commissioner Reynolds) Do customers who have experienced PSPS events in the past have different feedback about communication from the 2022 survey result? Are you able to segment the data that you collected in the PSPS survey by customer account number and whether or not

the customers have experienced PSPS events? Are there any insights you can share about the segmentation? Can you collaborate on the methodology?

Response to Question 02

PG&E provided the response in PowerPoint slides which are screenshotted below.

Follow-up Response

Question from Commissioner Reynolds:
Do customers who have experienced PSPS events in the past have different feedback about communication? Are you able to segment the data that you collected in the PSPS survey by customer account number and whether or not the customers have experienced PSPS events? Are there any insights you can share about the segmentation? Can you collaborate on the methodology?

PG&E Response:
PG&E matched 2022 survey respondent IDs with customers who experienced one or more PSPS outages in 2019, 2020, or 2021 (there were no de-energizations in 2022). By this definition, PSPS-Impacted customers comprised 28% of the Pre-Season wave, and 32% of the Post-Season wave.

Results for PSPS-Impacted customers were comparable to the High Fire Threat Districts (HFTD) Tiers 2 & 3. The percentage of PSPS Awareness, Communication Recall, and "Feeling Prepared for PSPS" were all high (greater than two-thirds of the sample in each wave). Percentages were somewhat lower in the Pre-Season waves among PSPS-Impacted customers due primarily to the wider scope of the 2019 events. Current outreach is heavily targeted to Tiers 2 & 3, where the majority of impacted customers reside.

	Aware of PSPS		Recalled Communication		Feel Prepared for PSPS (Top-2-Box %)	
	HFTD Tiers 2 & 3	PSPS Impacted 2019-21	HFTD Tiers 2 & 3	PSPS Impacted 2019-21	HFTD Tiers 2 & 3	PSPS Impacted 2019-21
2022 Pre-Season	96%	92%	88%	79%	84%	79%
2022 Post- Season	90%	87%	69%	68%	85%	83%

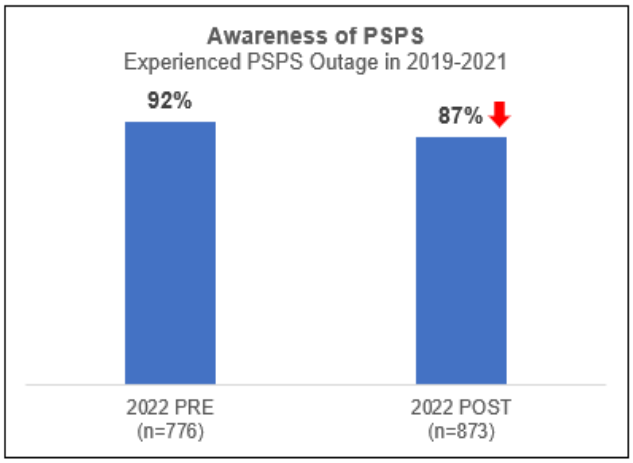
2

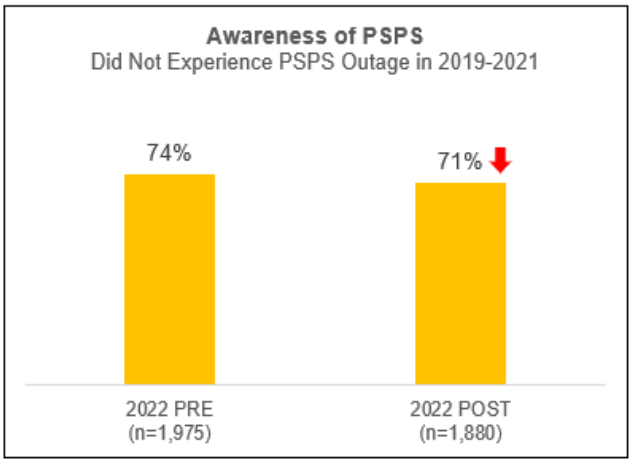
Awareness of PSPS is higher among customers who have experienced a PSPS outage in 2019-2021

Awareness of PSPS
By Outage Status

Among those who have experienced a PSPS outage, Post-Season awareness declined to 87% from 92% in the Pre-Season.

Awareness also declined from Pre to Post-Season for customers who have not experienced a PSPS outage.





Bold text signifies statistical difference at the 95% confidence level compared to other audience

Arrows signify statistical difference at the 95% confidence level compared to the previous wave

Q16. Public Safety Power Shutoff, or PSPS, is a precautionary safety measure where PG&E may proactively turn off power lines when extreme fire danger conditions are forecasted, in order to reduce the risk of wildfires. Before today, had you ever heard of the Public Safety Power Shutoff program? Base: Total Respondents

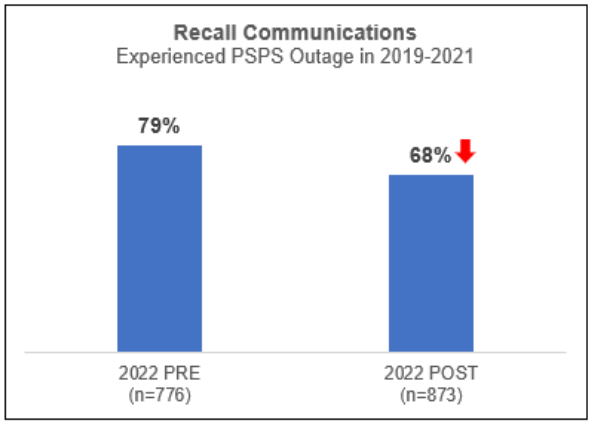
3

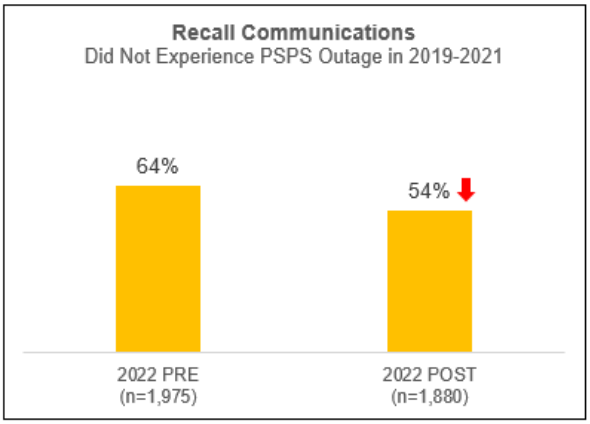
Recall of wildfire communications is higher among customers who have experienced a PSPS outage

Communication Recall
By Outage Status

Among those who have experienced a PSPS outage, Post-Season communication recall declined to 68% from 79% in the Pre-Season.

Communication recall also declined for customers who have not experienced a PSPS outage.



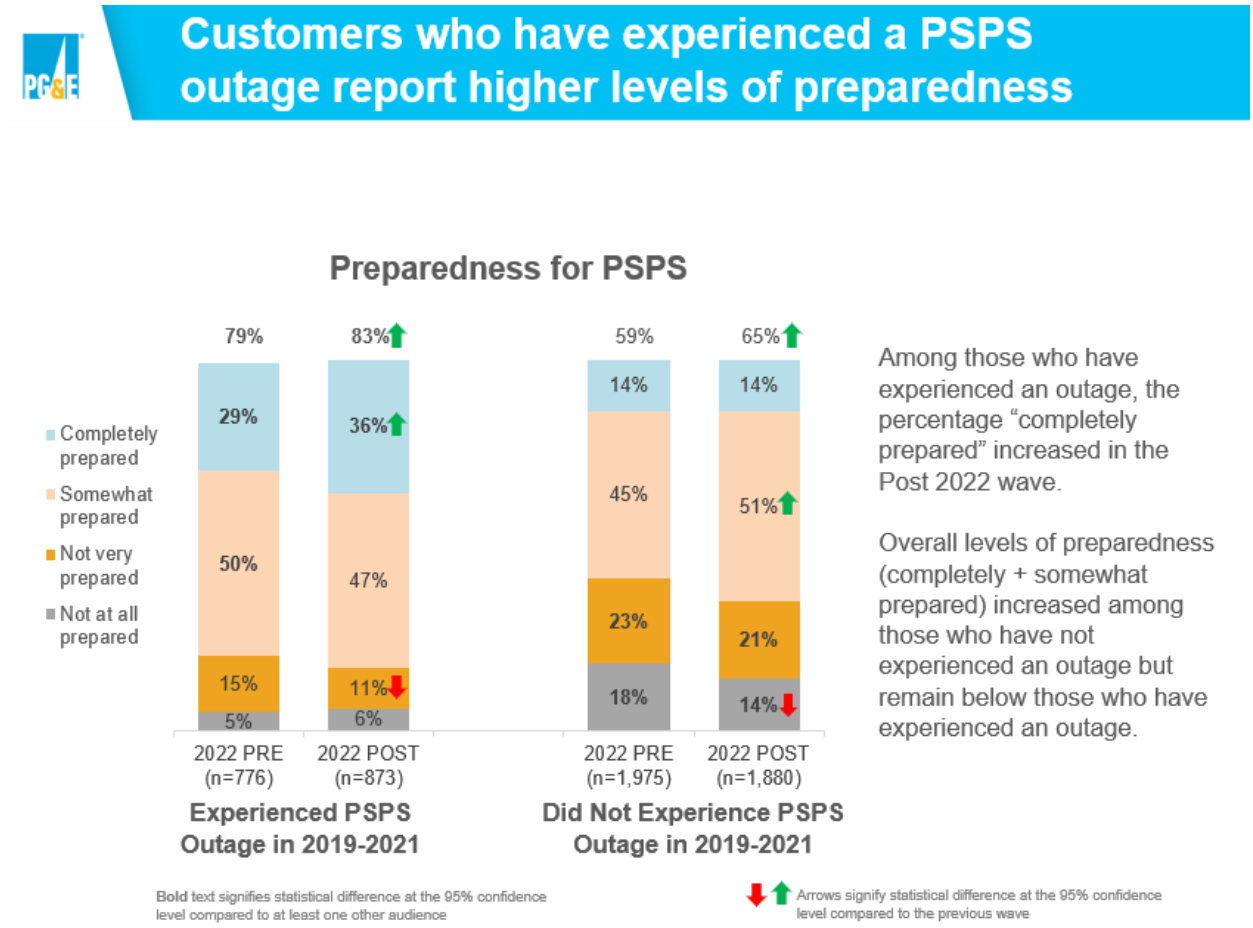


Bold text signifies statistical difference at the 95% confidence level compared to other audience

Arrows signify statistical difference at the 95% confidence level compared to the previous wave

Q1. In the past few months do you recall any communications of any type (i.e. mail, TV, radio, social media, etc.) from PG&E about the threat of wildfires and how you can prepare for them? Base: Total Respondents

4



Follow-up Questions for SCE and SCE Responses

Question 01

(President Reynolds) SCE's survey results disclose an increase in overall satisfaction to 60% in 2022. There is a need to get a balance between over-notification and under-notification. Regarding the 60% of overall satisfaction rate, do you have any idea of what the concerns were of the other 40% of customers who are not satisfied with the notifications? What were the reasons for that dissatisfaction? SCE staff responded that it will dig into the verbatims to look at the different flavors of detraction and will provide some perspective.

Response to Question 01

The 60% overall satisfaction rate is based on customer responses to SCE's survey question "How satisfied are you OVERALL with all of the Public Safety Power Shutoff communications that you received from SCE?"

Table 1 below shows the responses to the above-quoted survey question, ranging from 1 as "Very dissatisfied" to 5 as "Very Satisfied." In analyzing survey results, SCE interpreted responses of 1 or 2 as dissatisfied, 3 as neutral, and 4 or 5 as satisfied.

Table 1 – Survey Question Responses1	Response Rate
Responses	
1 - Very Dissatisfied	7%
2	13%
3	20%
4	26%
5 - Very Satisfied	33%

Based on SCE's interpretation of the survey results, about 60% of respondents were satisfied, 20% were neutral, and 20% were dissatisfied. To gain additional insight into expressions of dissatisfaction, SCE asked survey respondents to answer this follow-up question: "In your opinion, what can SCE do to improve their communications regarding Public Safety Power Shutoffs? Please be specific. We welcome your suggestions." The majority of dissatisfied customers who responded to this question (approximately 63%) suggested various improvements to SCE's notifications and outage maps, as well as more real-time updates during events. Table 2 below summarizes suggestions for improvement provided by 20% of survey respondents who indicated they were dissatisfied:

Table 2 – PSPS Communication Improvement Suggestions

No	Improvement Suggestion	%
	Request improvements or changes to Notification	
	Customers want notification alerts on phone or mobile.	13%
	Customers desire more frequent notifications and updates.	9%
	Communications should be clear, accurate, and concise.	4%
	Customers want notification alerts available online or by email.	1%
	Customers suggest SCE to use something similar to Amber alerts for PSPS	2%
	Total	**29%**
2	**Customers request additional advance Notification, including real time update on the PSPS event and duration.**	**18%**
3	**Customer would like SCE to provide accurate outage maps during PSPS events.**	**16%**
4	**No suggestions provided or suggestions unrelated to Notification (e.g., infrastructure maintenance/upgrades)**	**37%**

Follow-up Questions for Liberty Utilities and Liberty Utilities Responses

Question 01

(Commissioner Houck) Where are the circuits with sensitive relay profile program/settings? Are they in the southern part of the IOU territory? Could you be more specific on the geographic regions? In responding to the questions, Liberty promised to provide the circuits and their location on a map.

Response to Question 01

Included in Appendix C of Liberty's 2023 WMP is a map of Liberty's Sensitive Relay Profile (SRP) program. That same map is attached to this email. The list of Liberty circuits with SRP planned in 2023 includes the following:

1. TPZ1261
2. MEY3300
3. MEY 3400
4. MEY3500
5. BKY5200
6. GLS7400
7. MEY3100
8. MEY3200
9. MULLER1296
10. SQV7201
11. SQV8200
12. STL3101
13. TAH5201
14. TAH7300

Appendix C – Sensitive Relay Profile Map