BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Examine Electric Utility De-Energization of Power Lines in Dangerous Conditions.	Rulemaking R.18-12-005 (Filed December 13, 2018)

DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE

PG&E ORDER TO SHOW CAUSE

Diane Conklin, Spokesperson
Mussey Grade Road Alliance
P.O. Box 683
Ramona, CA 92065
Telephone: (760) 787-0794
Facsimile: (760) 788- 5479
Email: dj0conklin@earthlink.net

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INTRODUCTION

Q. Please state your name, address, company and qualifications.

A. My name is Dr. Joseph W. Mitchell. My business address is 19412 Kimball Valley Road, Ramona, CA 92065. I am the owner of M-bar Technologies and Consulting, LLC in Ramona, CA. I have been an expert witness at the CPUC since 2007 on issues of wildland fire. I have a Ph. D. in physics, and have been working in the area of wildland fire since 2002, and have several publications in this field. Additionally, I worked in software engineering in both engineering and management roles for two major corporations (Sony, Inc. and Intuit, Inc.) from 1996 to 2019. My full qualifications are provided in Appendix A of this testimony.

Q. On whose behalf are you submitting this testimony?

A. I am submitting this testimony on behalf of the Mussey Grade Road Alliance (MGRA or Alliance).

Q. What is the purpose of your testimony?

A. The purpose of this testimony is to examine issues with the PG&E website that occurred during the Public Safety Power Shutoff Event, October 9 to 12th 2019. This testimony will address the specific issue raised in the assigned Commissioner's and assigned administrative law judge's ruling to show cause (OSC).[1]

[1] R.18-12-005; ASSIGNED COMMISSIONER AND ASSIGNED ADMINISTRATIVE LAW JUDGE'S RULING DIRECTING PACIFIC GAS AND ELECTRIC COMPANY TO SHOW CAUSE WHY IT SHOULD NOT BE SANCTIONED BY THE COMMISSION FOR VIOLATION OF PUBLIC UTILITIES CODE SECTIONS 451 COMMISSION DECISION 19-05-042 AND RESOLUTION ESRB-8; November 12, 2019 (OSC Ruling). On page 3, the first item listed among PG&E's potential violations of ESRB-8 and D.19-05-042 is: "PG&E's website was unavailable during most of the time of the PSPS event. This meant that customers and government agencies were unable to obtain information on the outage or other important data."

Q. What is your interest in this proceeding?

A. I have been involved as an expert for the Mussey Grade Road Alliance in the area of utility power shutoff since 2008, when San Diego Gas and Electric Company (SDG&E) first proposed using electrical power shutoff as a tool to prevent wildfire ignitions. I provided expert comment on the considerations that needed to be taken into account when balancing the benefits of power line ignited wildfire risk reduction against the harm and risk caused by the loss of electrical power. We proposed and the Commission adopted a cost/benefit requirement. MGRA was also the sole intervenor opposing SDG&E's application that supported SDG&E's request for an exception that would allow them to shut off power in the case of extreme conditions likely to cause wildfire. This exception later became formalized in ESRB-8. I continue to believe strongly in an analytical and data-driven approach to this problem which will lead utilities to set their shutoff thresholds at the point where real and potential customer and resident harm is minimized, and which will help identify cost-effective measures that utilities can put in place to minimize the need for shutoff. We are not residents of the PG&E service area and were not impacted by the PG&E shutoffs. However, it is very important to me professionally, and to the Mussey Grade Road Alliance organization, that utility shutoff, if it must happen, is done right.

Regarding our interest in this phase of the proceeding, and PG&E's website, my "day job" for over two decades was in the software industry, which has allowed me to become familiarized with a number of the tools and technologies that PG&E used and is using to provide its web services. In its OSC Ruling, the Commission expressed its concern with the unavailability of PG&E website functions during PG&E's power outage. MGRA's spokesperson, Diane Conklin, raised the issue of PG&E's website failure during the December 5, 2019 pre-hearing conference, and recommended that the scope of the OSC be expanded to include an evaluation of PG&E website capabilities.[2]

[2] R.18-12-005; December 4, 2019 Pre-hearing Conference Transcript; pp. 30-31. (PHC Transcript)

Q. What is the relation of your expertise to the issues of this proceeding?

A. In my career in technology and the software industry, I had the opportunity to become familiarized with and gain direct working experience with some the of technologies and tools used to provide web services and other software applications. My most recent position and experience was as a staff engineer in "DevOps", a sub-field of software engineering that is dedicated to the assembly, deployment, and operation of software applications and services. My particular expertise was in the tools and infrastructure used to assemble or "build" software and deploy it. I worked with a team that developed the first enterprise-wide, cloud-based build and deployment system at Intuit, and were responsible for migrating most of Intuit's build services for products such as TurboTax, Mint, and QuickBooks onto this system.

Experience that I gained that is directly relevant to the questions at issue in this proceeding include the following:

- Using Amazon Web Services (AWS) cloud-based architecture and tools to build and run "scalable" applications and services, in other words that could add more computing resources as needed.
- Installing, configuring, running, and debugging high-volume applications on Linux-based servers.
- Capacity planning and resource allocation for AWS-based services, including cost reduction.
- Performance and capacity testing of applications and services through web interfaces.
- Techniques for providing high-availability services, and their importance. The engineers at Intuit provide applications such as TurboTax that must service requests from many millions of users during a brief tax season. The Intuit engineers are likewise very demanding regarding the availability of internal IT and support infrastructure.
- Analysis and debugging of application service outages.

Q. What are the limitations of your testimony?

A. This testimony will rely primarily on the testimony provided by PG&E in response to the Order to Show Cause,[3] as well as responses received to MGRA data requests, which are included in Appendix B.

This testimony is intended to give a high-level critical overview of the PG&E outage by someone with two decades of information technology experience. I am not an architect of web services or infrastructure, and I have not designed or built a multi-tier web application for use by millions of people, as the PG&E IT team have done. This testimony is not intended to be used to provide criticisms of the choice of any specific hardware or software by PG&E, or of the design or implementation of its website. Neither should the absence of such criticism in this testimony imply that I think that PG&E's design choices and implementation were correct or optimal. Instead, I will be applying general IT principles, general principles of high availability and cloud infrastructure, as well as logic to the testimony and responses from PG&E in order to reach conclusions regarding the PG&E website outage and how it might have been avoided.

SUMMARY OF MGRA TESTIMONY

Q. What is the scope of the MGRA testimony?

A. The Mussey Grade Road Alliance has coordinated with other intervenors, and its testimony is designed to supplement the testimony of other experts. This testimony will specifically address availability issues with the PG&E website that occurred between October 8th and October 12th related to heavy website usage arising from the "Public Safety Power Shutoff" (PSPS) event occurring at that time.

[3] R.18-12-005; PACIFIC GAS AND ELECTRIC COMPANY PUBLIC SAFETY POWER SHUTOFF EVENT ORDER TO SHOW CAUSE OPENING TESTIMONY;

Q. What basic facts does this testimony seek to establish?

A. This testimony is intended to lay out the following facts:

- From October 8th through 12th, 2019, the PG&E website was unable to provide key information related to its pre-emptive power shutoff, which started on October 9th.
- PG&E did not anticipate the volume of web traffic that its servers would be subjected to.
- PG&E did not test functions of its web service related to PSPS with a volume of traffic equivalent to that seen during October 8th through 12th.
- PG&E fails to justify its assertion that its website failure was due largely to unpredictable exogenous events such as third-party redirection and traffic from outside of California.
- Between September 23rd and 25th, 2019, smaller scale power shutoff events caused a significant spike in PG&E's web traffic as measured by page requests per hour.
- Between October 9th and October 23rd, PG&E undertook major changes to their web service to increase its capacity.
- Between October 23rd and November 1st, additional PSPS events created a large amount of web traffic, with the peak number of page requests exceeding the maximum seen during the October 9th – 12th event.
- Had PG&E applied the fixes that stabilized its system after the October 9th PSPS event prior to that PSPS event, the website outages would likely have been averted.
- Had PG&E done adequate capacity or load testing prior to October, it would have identified the issues that caused the October 8th – 12th website issues.
- Had PG&E used the size of the spike in web traffic that occurred from September 23rd to 25th to estimate the web traffic that would be generated by a major shutoff event, it would have known that this would exceed its tested capacity.

- Based on the aforementioned facts, the outages experienced by users could have been avoided had PG&E done adequate capacity / load testing, estimated load traffic based on the September 23-25 PSPS event, and put in place the measures it used to increase the capacity of its website between October 9th and 23rd.

THE OCTOBER 8TH TO 12TH WEBSITE FAILURE

Q. What happened to the PG&E website during the October 9th to 12th PSPS event?

A. According to the OSC Ruling:[4] "*PG&E's website was unavailable during most of the time of the PSPS event. This meant that customers and government agencies were unable to obtain information on the outage or other important data*." The October 14th, 2009 letter from Commission President Marybel Batjer to PG&E CEO William Johnson stated that "*A major failure was PG&E's public website crashing and becoming unusable during the most critical times in their event. A cornerstone of the PG&E PSPS public information effort was to drive the public and government agencies to its website for all information, including maps of outages and other important data. This site was highlighted to provide real-time, life-saving information. Unfortunately, the website crashed within the first 24 hours and company representatives struggled to provide necessary information to their customers, the public, and frontline safety officials with affected state, county and tribal governments*."

An account of PG&E website issues during this period is provided by PG&E's Lori Geoffroy and Rajesh Arora in Chapter 4 of the PG&E testimony. Mr. Arora contests the OSC Ruling's assertion and states that "the extent of the website outage was narrower than described" and that: "Third-party analytics show that almost 3 million unique visitors successfully visited PGE.com between October 9 and 12 – including 1.4

[4] Page 3.

million on October 9, the day of the de-energization."[5] However, as noted by President Batjer, many other PG&E customers failed to access the PG&E site or successfully use some of its features. Mr. Arora states that on "the morning of Tuesday, October 8, PGE.com experienced severe performance issues which caused some customers to experience longer wait times or to see 'site not found.'"[6]

A feature created by PG&E for customers at risk of a PSPS event was an "Address Look-up Tool" (ALT), which Ms. Geoffroy explains "allowed customers to input the address of a specific residence or business in order to determine whether that address was within the scope of a PSPS event."[7] She noted that this tool was especially useful to customers who might not receive direct PG&E notifications, such as apartment dwellers. According to Mr. Arora's testimony, however, the Address Look-up Tool was unavailable during the outage, and was taken out of service at 8:34 a.m. on October 8th. It was replaced by an "Area Map Lookup Tool" hosted on an external partner (ESRI) website at 3:00 pm on October 9th. This was a general area map and did not have circuit-level detail.[8]

Attempts to switch traffic over to PG&E's backup website also failed, because according to Mr. Arora "the site did not scale up as quickly as necessary to support additional uploads."[9] PG&E notes that the design of the backup site did not take into account tools that would be used during PSPS, such as the Address Lookup Tool and Google Maps rendering of shapefiles.[10]

In response to MGRA data requests, PG&E provided additional detail regarding the nature of its website failure. The primary problem experienced by PG&E was the

[5] PG&E Testimony; p. 4-8.
[6] Id. p. 4-11.
[7] PG&E Testimony; p. 4-4.
[8] Appendix B; DR Response MGRA_002-Q35. See also PG&E Testimony; p. 4-12.
[9] PG&E Testimony; p. 4-11.
[10] Appendix B; DR Response MGRA_002-Q06.

saturation of its "static content" servers, which were hosted in a PG&E data center. As described in PG&E testimony, its website recorded nearly 200,000 page requests per hour,[11] a number which does not include unsuccessful attempts to reach the website.[12] According to PG&E, its servers experienced performance issues when page requests per hour exceeded 150,000,[13] and when CPU usage on their servers exceeded 80% of capacity.[14]

RECOVERY OF THE PG&E WEBSITE

Q. How did PG&E re-establish website reliability?

A. According to Mr. Arora's testimony, PG&E took a number of steps to re-establish reliable services:

- Reconfiguring servers by adding memory and additional CPU and optimizing resource utilization.[15]
- Blocking website access for specific external user addresses (IP addresses) that were causing the greatest load on the server.[16]
- PG&E reached out to Second Watch, its vendor servicing its backup website *pgealerts.com* for assistance, and to migrate data files for its Public Safety Partners from the PG&E website onto a cloud-based infrastructure (AWS).[17] Second Watch was engaged at around noon on October 8th to analyze performance bottlenecks, improve network bandwidth (IOPS), and increase

[11] PG&E Testimony; p. 4-14; Figure 4-5.
[12] Appendix B; DR Response MGRA_002-Q22.
[13] Appendix B; DR Response MGRA_002-Q24.
[14] Appendix B; DR Response MGRA_002-Q12.
[15] PG&E Testimony; p. 4-11 and PG&E February 24th Report; p. 3.
[16] PG&E Testimony; p. 4-11 and Appendix B; DR Response MGRA_002-Q32.
[17] Id.; p. 4-12.

available storage (EBS).[18] File download was moved onto AWS by October 9th, 8:20 am.[19]

- PG&E partnered with ESRI to create a webpage that approximated its outage maps and offered an address lookup function without circuit-level detail.[20]

By October 12, 2019, PG&E had re-energized its system and web traffic dropped back to normal values.

Since the October 9-12th PSPS event, Mr. Arora explained that PG&E has taken additional measures to increase the capacity of its website, specifically:

- "PG&E has moved the load related to its website's three core information sources-maps and downloads of the affected areas, the Address Look-up Tool, and power restoration information-to a web-based cloud in AWS"[21] This was completed by October 21, 2019.[22]
- PG&E partnered with Akamai to move much of the website's content onto a "content delivery network" (CDN), which offers a more robust infrastructure and faster response times.[23] It moved its infrastructure to the CDN on October 21, 2019.[24]
- PG&E has enabled its backup servers to handle PSPS-related functions.[25]
- PG&E intends to migrate all remaining website functions related to PSPS out of its data center and onto cloud-based providers prior to the 2020 wildfire season.[26]

[18] Appendix B; DR Response MGRA_002-Q33.
[19] Appendix B; DR Response MGRA_002-Q34.
[20] Appendix B; DR Response MGRA_002-Q35 and PG&E Testimony; p. 4-12.
[21] PG&E Testimony; p. 4-13 and PG&E February 24th Report; p. 3. The Address Lookup Tool moved onto AWS was a new version ("version 2") of the ALT. See MGRA_002-Q35.
[22] Appendix B; PG&E Data Request Response MGRA_002-Q38.
[23] PG&E Testimony; p. 4-13 and PG&E February 24th Report; pp. 3-4.
[24] Appendix B; PG&E Data Request Response MGRA_002-Q38.
[25] PG&E February 24th Report; p. 4.
[26] Appendix B; PG&E Data Request Response MGRA_001-Q17 and MGRA_001-Q19.

- PG&E intends to engage an outside vendor to test its server capacity and invite the California Department of Technology to participate in this review.[27]

Q. Were PG&E's efforts to increase its website capacity successful?

A. Between October 23rd and November 1st, PG&E conducted other PSPS events. The total number of customers affected by this shutoff was estimated to be 941,000, a larger number than those affected by the October 9-12th event. Measured peak website traffic was 10% larger than that measured during the October 9-12th event,[28] and the testimony reports no failures similar to those seen during the earlier shutoff event.

PG&E now also conducts stress-testing as part of its event preparation process.[29] It tests its website at a level of 2.6 million transactions per hour, a number it determined based on October 9th transaction counts.[30]

Q. Are the measures that PG&E has taken sufficient to ensure adequate website performance during future PSPS events?

A. As late as its February 24, 2020 report, PG&E continues to be subject to the fundamental "past performance guarantees future results" fallacy. It states that: "The October 2019 PSPS events, however, provide a good proxy for the potential web traffic associated with a maximum PSPS event because those events were the largest PSPS events experienced in the history of California."[31] The fact that the October 9th event was the largest PSPS event in history does not necessarily mean it will be the largest event in

[27] PG&E February 24th Report; p. 4.
[28] PG&E Testimony; p. 4-14. Note that measured traffic does not include unsuccessful attempts to reach the PG&E website, so the number of page requests reported by PG&E during the October 9th to October 12th PSPS event represents a lower limit of actual traffic.
[29] Id.
[30] Appendix B; PG&E Data Request Response MGRA_001-Q16 and BI-WEEKLY REPORT OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E) IN COMPLIANCE WITH JANUARY 30, 2020 ASSIGNED COMMISSIONER'S RULING; February 24, 2020. (PG&E February 24 Report); p. 4.
[31] PG&E February 24 Report; p. 3.

PG&E's future. PG&E should instead use the largest *conceivable* event for its baseline planning.

Fortunately, PG&E has adopted a very high safety margin, testing its website at a server transaction rate that is factor of 3 above that observed during the October 9th event, and its backup site at a factor of 10 above this transaction rate.[32] Nevertheless, it would be more appropriate to adopt a baseline value that would scale the October 9th traffic to a larger event. If PG&E were to apply a more rigorous analysis of its potential traffic, and reduce its uncertainty, it might be able to reduce its safety margin, in which case the current load testing may be adequate. PG&E should supply information on the largest conceivable event to the outside vendor that it will engage for external review and to the California Department of Technology.[33]

CAUSES OF THE PG&E WEBSITE OUTAGE

Q. What does PG&E claim were the main factors leading to its website issues?

A. PG&E points to a number of factors that contributed to website outages during the October 9th-12th event that delayed its recovery. Mr. Arora's testimony states that some of the contributing causes are:

- There were almost a million page requests from users outside of California during the event.
- PG&E.com traffic was "multiplied" by third party websites such as news organizations.
- 50-60% of transactions were by "repeat users". [34]
- Downloads of PSPS maps put an additional "strain" on the system.[35]

[32] Id.; p. 4.
[33] Id.
[34] PG&E Testimony; p. 4-9.
[35] PG&E Testimony; p. 4-11 and Appendix B; PG&E Data Request Response MGRA_002-Q08.

Q. Did PG&E's IT division believe its website had adequate capacity for a major "PSPS" event?

A. According to the testimony of Mr. Arora, yes, PG&E believed it had adequate capacity for a major PSPS event. Among the reasons he cites for this belief are that 1) The average annual availability of the PG&E website in 2018 was 99.94% 2) server capacity in percentage of available CPU that was utilized was under 5%,[36] and 3) PG&E had a backup site capable of handling "100 times the normal traffic of PGE.com".[37]

Q. Was PG&E's belief that its website had adequate capacity correct?

A. No. The fact that PG&E's site failed under the load caused by the October 9th – 12th shutoff event demonstrates that its website was not adequately prepared for the traffic generated by the outage event. PG&E admits that "at peak times, the capacity was not sufficient."[38]

Q. Was PG&E's belief that its website had adequate capacity well-founded?

A. No. The basic error in PG&E's premise (as stated by Mr. Arora) was to assume that averages can be reliably used to predict extrema. PG&E's website availability for 2018 of 99.94% is considered reasonable by industry standards, and is comparable to or better than that guaranteed by many Amazon Web Services, or Microsoft's Azure cloud platform,[39] but not quite "excellent", which would be 99.99% or better.[40] However, PG&E's failure was not due to lack of rigor in designing and operating a high-availability

[36] PG&E Testimony; p. 4-7.
[37] PG&E Testimony; p. 4-6.
[38] Appendix B; PG&E Data Request Response MGRA_002-Q08.
[39] Microsoft; "SLA summary for Azure services"; February 2020; Downloaded February 15, 2019. https://azure.microsoft.com/en-us/support/legal/sla/summary/
[40] Atlassian; "Four nines and beyond: A guide to high availability"; Blake Thorn; June 20, 2018; Downloaded February 15, 2019. https://www.atlassian.com/blog/statuspage/high-availability

website that could cope with normal traffic loads, but rather it failed to anticipate peak traffic loads and adequately test for them.

Likewise, the fact that PG&E's static content servers operated on average at less than 5% of their CPU capacity during normal operation does not indicate how they will perform under an extraordinary load. PG&E seeks to keep CPU usage at less than 60% of capacity.[41] Naively, an 18-fold increase in web traffic would begin to exceed this level. This is in fact very approximately the level of web traffic at which PG&E claims performance issues were observed.[42]

Mr. Arora's testimony states that the October shutoff events "were not the first events in PG&E's history that would drive customers (and others) to the PG&E website."[43] However, he presents no example comparable to an event that confronted millions of people with power loss, that would require that they visit the PG&E website for critical information regarding their safety and convenience.

As to how PG&E estimated what its expected website traffic would be during a PSPS event: ***PG&E didn't estimate PSPS-related website traffic***.[44] In their own words: "PG&E's IT group did not utilize a specific estimation prior to October 2019, as to the number of customers that it anticipated would be affected by future PSPS outages."[45] Its claimed reasons for not doing so are 1) they did not know the number of customers that would be affected by PSPS events and 2) even if they did know, this has no direct correlation

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[41] R.18-12-005; BI-WEEKLY REPORT OF PACIFIC GAS AND ELECTRIC COMPANY (U 39 E) IN COMPLIANCE WITH JANUARY 30, 2020 ASSIGNED COMMISSIONER'S RULING; February 10, 2020; p. 5. (February 10 Bi-Weekly Report)

[42] Data regarding website traffic is provided in Appendix B; PG&E Data Request Response MGRA_002-Q20 and accompanying attachment. The general background level of page requests serviced by the PG&E website is less than 10,000 per hour. PG&E reports that its servers began to experience performance issues when website traffic exceeded 150,000 per hour (Appendix B; PG&E Data Request Response MGRA_002-Q24). This represents a 15-fold increase in web traffic.

[43] PG&E Testimony; p. 4-7.

[44] Appendix B; PG&E Data Request Response MGRA_001-Q09, MGRA_001-Q10, MGRA_002-037.

[45] Appendix B; PG&E Data Request Response MGRA_002-Q09 and MGRA_002-Q10.

to website traffic. PG&E again: "Each PSPS event is unique and the scope is dependent upon constantly changing weather conditions and other factors, all of which influence the number of customers that will be affected during a PSPS outage. Further, the website traffic experienced during a PSPS event does not directly correlate with the total number of customers that are de-energized over the course of a PSPS event."[46] As to the first claim that they had no estimation of affected users, this could have easily been remedied by a discussion with PG&E's operations team, and failure to have this discussion demonstrates a lack of due diligence. Regarding the second claim that website traffic is not correlated to the extent of the PSPS event, analysis of PG&E's website data from September and October 2019 shows that this claim is false, as I demonstrate on page 20.

Finally, PG&E claims that the excess website traffic it observed was due to the exogenous causal factors it listed, such as third-party traffic.

Q. Do the exogenous causal factors listed by PG&E adequately account for PG&E's website being overwhelmed by web traffic?

A. PG&E does not provide evidence that the web traffic produced by the exogenous circumstances it lists were responsible for the bulk of web traffic or could not be reasonably anticipated.

The million page requests that came from outside of California represent a substantial volume of traffic but still constitute a fraction of the overall load on the servers. The PG&E testimony states that there were over 3 million visits to the website ***from unique users.*** PG&E also states that 50-60% of web traffic was ***from repeat users***. All repeat users are unique users, so all repeat users will have visited the website more than once. Hence, the total number of page requests is substantially larger than 3 million, and the overall fraction of visits by users outside of California is significantly smaller than 30%.

[46] Id.

As to the "multiplier" effect due to redirection from third-party websites, such as news sites, PG&E provides no data to quantify this "multiplier" effect. Furthermore, since the PG&E website was the "point of truth" for information regarding its power shutoff, this redirection of traffic by third-party sites to the PG&E website was legitimate and should have been anticipated by the PG&E team.

Likewise, the "repeat users" that PG&E states were responsible for half or more of its web traffic were also legitimate web traffic that should have been anticipated by PG&E. Leading up to and during a "PSPS" event, the typical user will need to know if they are in the planned shutoff area. As more information becomes available as the weather event approaches and arrives, PG&E updates its plans and schedule for de-energization. Therefore, the information the customers require is dynamic, and only by repeat visits to the website can they have up-to-date information that they can use to plan for their safety, protection, and comfort. PG&E acknowledges that PSPS events are dynamic and that their "scope is dependent upon constantly changing weather conditions and other factors…"[47] This naturally implies that in order to have up-to-date information a user may need to revisit PG&E's website periodically in order to see whether there have been any changes to the geographic area or timing of power shutoff. Regardless, PG&E made no estimation of the number of times that users would repeatedly visit their website.[48] PG&E's apparent surprise that users would re-visit their website indicates a lack of customer empathy and understanding of how its customers would use the website during a PSPS event. This oversight contributed to their underestimation of website traffic during major PSPS events.

With regard to the "strain" placed on the system by download of PSPS maps: 1) PG&E provides no documentation or quantification of how the extra downloads affected

[47] Appendix B; PG&E Data Request Response MGRA_002-Q23.
[48] Appendix B; PG&E Data Request Response MGRA_002-Q18.

the performance of their web servers,[49] and 2) PG&E should have anticipated that tech-savvy users would desire access to these maps during a major outage if they were exposed with a public interface.

FORESEEABILITY AND PREVENTABILITY OF THE PG&E WEBSITE OUTAGE

Q. How could PG&E have anticipated the web traffic it would encounter during the October 9-12th PSPS event and its effect on their website infrastructure?

A. There are several ways in which PG&E could have obtained information that would have warned it that its website would be at risk of failure during a major PSPS event.

As mentioned in the previous answer, predicting how many customers would reach out to the PG&E website during a major PSPS event, understanding how they would behave and the number of times they would visit the website should have been used to plan capacity.

Once the required capacity was known, and the appropriate computing resources were committed, the next step would have been performance testing. Performance testing (also known as "stress testing" or "load testing") uses automated tools to test the website itself or a test or "pre-production" copy of the website. The load used in the simulation is usually somewhat larger than the maximum load anticipated in order to ensure a safety factor and because surprises happen. This is considered a best practice and is essential for high-availability software and web services.

[49] Appendix B; PG&E Data Request Response MGRA_002-Q26, MGRA_002-Q27, and MGRA_002-Q31.

PG&E has now tested its content delivery servers to triple the web traffic experienced during the October 9th-12th shutoff, and its cloud-based backup server at capacities four times larger still.[50]

Finally, PG&E could have used data that it had been collecting to predict the level of web traffic it could anticipate during a major PSPS event. Specifically, data from the September 23 and 25th outage events showed that a PSPS event affecting a moderate number of customers would result in a significant spike in web traffic.

Q. Did PG&E conduct performance or stress testing on web infrastructure related to PSPS prior to the October 9th-12th shutoff?

A. PG&E states that it had load tested its Address Lookup Tool prior to October 9th. However, it did not conduct performance tests on its Static Content Servers,[51] and therefore did not identify a maximum page request rate that would impact performance.[52] According to PG&E's narrative, both Static Content Servers and the Address Lookup Tool experienced issues that blocked customer access during the October 9th to 12th PSPS event.

Q. How could have PG&E used the September 23-25 data to estimate web traffic from a major PSPS event?

A. Mr. Arora's testimony displays website traffic data collected by PG&E since January 2019,[53] showing "page requests" per hour. These figures show the standard number of page requests per hour did not exceed 10,000 for most of 2019. The number of page requests for the October shutoff events show up as large spikes in the data that reach 200,000 or more. However, there is also one event in late September which shows that

[50] February 10th Bi-Weekly Report; p. 4.
[51] Appendix B; PG&E Data Request Response MGRA_002-Q04.
[52] Appendix B; PG&E Data Request Response MGRA_002-Q25.
[53] PG&E Testimony; Figure 4-4; p. 4-10 and Figure 4-5; p. 4-14.

the number of page requests could reach 50,000. This occurred coincident with PG&E's September 23rd and 25th de-energization events.

A figure showing only the September and October events is displayed below:

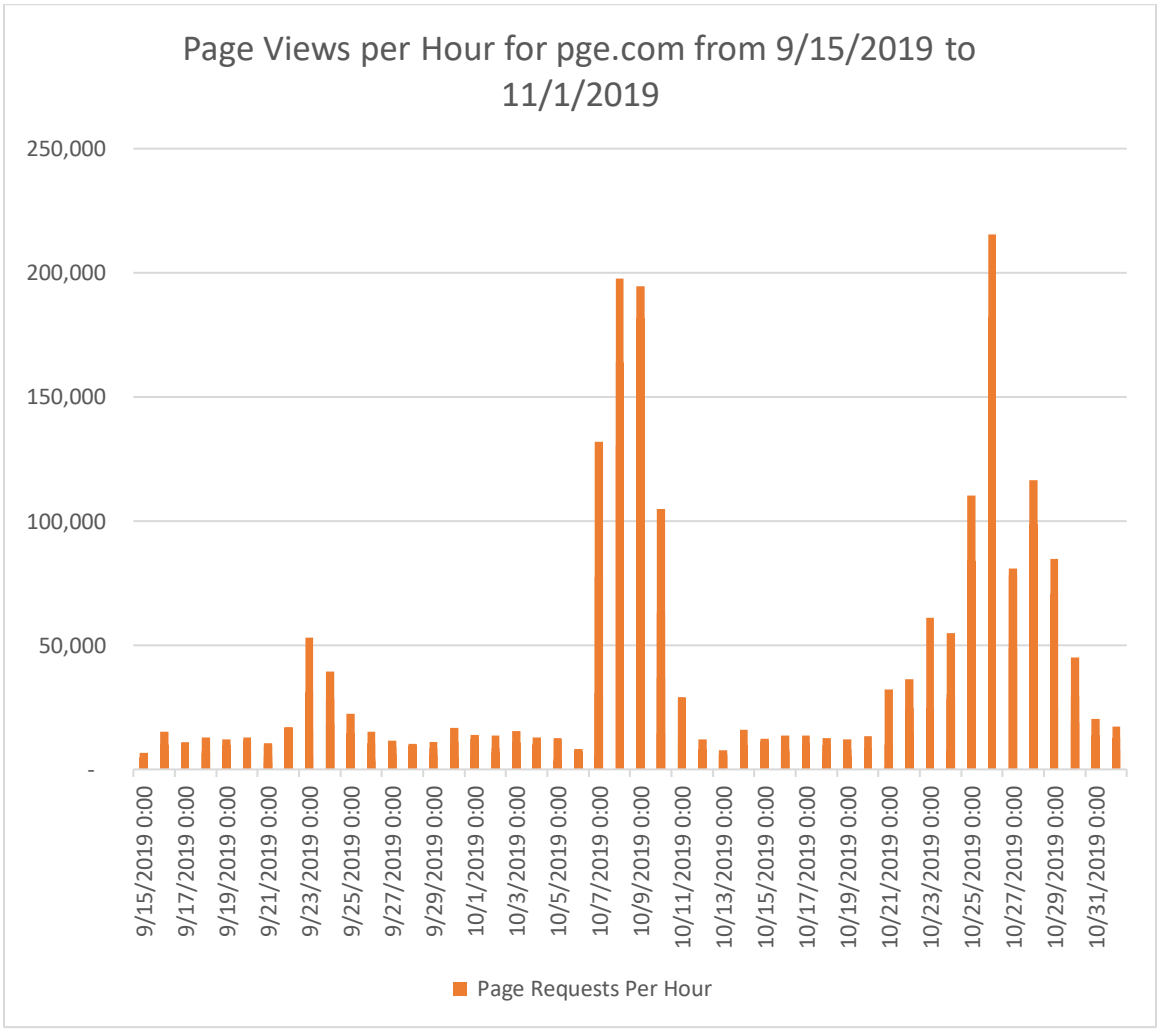

Figure 1 - PG&E Website Page Views Per Hour[54]

The September 23/25th PSPS events were smaller in scale, but still resulted in a significant spike in web traffic. The table below contains summaries for the major PG&E

[54] Data is from Appendix B; PG&E Response to MGRA Data Request MGRA_002-Q20 and corresponding Attachment 1.

PSPS events in Autumn 2019, both in the number of affected customers and the maximum number of page requests per hour received by the PG&E website.

Date	Customers	Pages/Hour	Reference
9/23	26,000		PG&E Public Safety Power Shutoff (PSPS) Report to the CPUC, October 10, 2019; p. 1.
9/25	49,000	50,000	PG&E Public Safety Power Shutoff (PSPS) Report to the CPUC, October 10, 2019; p. 1.
10/5	11,300	12,600	PG&E Public Safety Power Shutoff (PSPS) Report to the CPUC October 5-6, 2019 De-Energization Event; p. 1
10/9-10/12	729,000	200,000	PG&E Public Safety Power Shutoff (PSPS) Report to the CPUC October 9-12, 2019 De-Energization Event; p. 10
10/26-11/1	941,000	220,000	PG&E Public Safety Power Shutoff (PSPS) Report to the CPUC October 26 & 29, 2019 De-Energization Event; p. 1

Table 1 - Number of Affected Customers and Web Traffic

As can be seen in Table 1, the September 25th event resulted in a spike of almost 50,000, which is approximately one visit per hour per affected customer. The October 5th PSPS event affected only 11,300 customers and did not result in a significant spike in web traffic. The October 9th to 12th event resulted in a maximum of 200,000 pages per hour. However, it should be expected that this is an underestimate, since this number represents only ***successful*** connections to the PG&E website. Failed connection attempts would not be included in the total.[55] During the October 26th to November 1st event, however, the ratio of maximum page requests per hour to customers is roughly equivalent to that seen during the October 9th to 12th event, even though the PG&E website was operating properly during the latter event.

[55] Appendix B; PG&E Response to MGRA Data Request MGRA_001-Q06, MGRA_001-Q07, and MGRA_002-Q22.

In spite of the lack of exact proportionality between the ratios of affected customers to peak web traffic from event to event, the September 23rd – 25th events caused a significant spike in web traffic, one that was noticeable and should have been noted by PG&E. Even if using it would have overpredicted the web traffic for a larger scale event, it was an alarm sounded loudly that should have been used by PG&E to prevent the outage.

PG&E, however, takes issue with this assertion. They state that "the website traffic experienced during a PSPS event does not directly correlate with the total number of customers that are de-energized over the course of a PSPS event."[56] The data in Table 1 contradict PG&E's statement. In fact, if a correlation analysis is performed on the data from the 9/25, 10/5, 10/9, and 10/26 outages a correlation coefficient of 0.988 is observed, indicating a strong direct and statistically significant correlation between website traffic and number of affected customers during a PSPS event.[57] PG&E's statement that there is no direct correlation between website traffic and affected PSPS customers is false. Based on PG&E's September and October website traffic data, PSPS events having more affected customers generated greater website traffic.

Q. Had PG&E known of the web traffic it would experience, could the service outages of October 9th to 12th have been prevented?

[56] Appendix B; PG&E Response to MGRA Data Request MGRA_001-Q06, MGRA_001-Q07, and MGRA_002-Q23.

[57] The calculation was performed using the Excel CORREL function using the data in the "Customers" and "Pages/Hour" data in Table 1 for the four specified PSPS periods. CORREL calculates a Pearson product-moment correlation coefficient, which ranges from -1 (perfect negative correlation) to 1 (perfect positive correlation), with a value of 0 indicating no correlation. To check the statistical significance of the determined value of 0.988, we determine the critical value for a statistical significance threshold of $p < 0.05$ and two degrees of freedom (4 values minus 2 for a two-tailed test). The critical value for two degrees of freedom is 0.95, so a correlation coefficient of .988 exceeds this threshold and indicates a statistically significant positive correlation.
See: https://researchbasics.education.uconn.edu/statistical_significance/
https://researchbasics.education.uconn.edu/r_critical_value_table/#
Downloaded 2/23/2020.

A. Had PG&E anticipated that it would experience extreme web traffic during a major PSPS event, either through understanding customer usage patterns or by heeding the warning provided by the September 23rd to 25th event, and had it known that its infrastructure was at risk because it had done adequate performance testing at the anticipated levels, PG&E could have taken actions to prevent the October 8th to 12th service outages.

We know that PG&E could have rolled out changes to its website to handle web traffic equivalent to the October 9th to 12th PSPS event in short order because ***that is exactly what it did***, albeit after the event rather than before. By the time the October 26th PSPS event was initiated, PG&E had taken a number of steps, including:

- It had engaged its vendors and technology partners.
- It moved key services onto Amazon Web Services (AWS).
- It moved a large fraction of its content onto the Akamai Content Delivery Network.

For PG&E to conduct what is basically a re-architecture of its website in two weeks and fully test it was a remarkable achievement.

This raises the question, however: What if PG&E had anticipated web traffic from PSPS events and started the process of bolstering its website earlier? Even if it had started as late as the 25th of September, its rapid actions in mid-October show it could likely have substantially fortified its website by the time of the October 9th to 12th event and averted the website service outages that many users experienced. Had PG&E correctly estimated its peak load, even if it had not fully understood this load until September 25th, and done capacity testing at that load, it would have understood that its web infrastructure would be unable to handle the anticipated load and it would have taken measures to strengthen it

CONCLUSIONS

Q. What conclusions do you reach?

A. The following conclusions summarize this testimony:

- PG&E should have anticipated how its customers would use its website in the event of a widespread PSPS event.
- PG&E should have been doing performance testing of its website with loads realistically representing the number of anticipated users.
- PG&E should have heeded the warning provided by the spike in usage seen on September 23rd and 25th.
- PG&E demonstrated that it was able to rapidly fortify its website, fully re-architecting it to make it more resilient and scalable, within the two week period following the October 9th – 12th PSPS event.
- Had PG&E started its upgrade to its website earlier it would likely have prevented the outages observed during the October 9th to 12th PSPS event.

Q. Have you formed an opinion of PG&E's account of the incident as presented in its reports, filings, testimony and data request responses?

A. Yes. The PG&E weekly reports, testimony, and data request responses lack transparency and demonstrate an unwillingness to take full responsibility for the website incident of October 8th through 12th. This incident arose primarily due to a lack of adequate capacity planning, testing, and knowledge of its customer base. Rather than admit this is the case, PG&E makes a factual misstatement that website traffic is not directly correlated with the number of customers affected by PSPS.[58] PG&E instead blames exogenous circumstances, some of which should have been anticipated, and the

[58] Appendix B; PG&E Data Request Response MGRA_002-Q09 and MGRA_002-Q10.

rest of which provided without any showing that they constituted the bulk of the load on PG&E's website at the time of its failure.

In my 23 years in the IT and software realms, I've seen many mistakes, errors, and failures, and made some myself. Technology is hard, time and costs exert pressures, and people are fallible. An organization with integrity as a core value will not create a culture of blame, but it will insist on a full, honest, and detailed accounting of what went wrong so that measures can be taken so that it never happens again. If such exercises took place at PG&E they are not reflected in the information provided thus far to the Commission or MGRA.

This lack of transparency is a shame. PG&E has a compelling story to tell regarding a remarkable recovery in a short time frame. However, it squanders its advantage by failing to take full responsibility for the original website failure. It leaves us with doubt. If we can't believe its recounting of its failure, how can we trust its story of success?

Q. What open questions remain regarding PG&E's website outage?

A. PG&E's description of events provided in its testimony was not complete, in that the information provided regarding the factors leading to the October 8th-12th website issues do not fully justify PG&E's claims regarding cause. Furthermore, not all of PG&E's data request answers were fully responsive. The following questions remain to be addressed in PG&E's rebuttal testimony or in cross-examination:

- What CPU usage level was observed in the PG&E static content servers when performance issues were observed?
- Did PG&E know in advance of the October 9th-12th event that its static content servers would have degraded performance when experiencing 150,000 or more page requests per hour?

- What fraction of PG&E website traffic during the October 9th – 12th event was due to third-party redirections and "bot" traffic?[59]
- What is the exact timeline during which users were experiencing problems accessing the PG&E website during the October 8th – 12th outages?[60]
- What access rate was the Address Lookup Tool tested with prior to October 9th, and how did this access rate compare to measured tool usage during the October 9th and October 23rd PSPS events?
- At what level of management were design requirements that did not use estimations of PSPS-related web traffic approved?[61]

Q. Do you have further testimony?

A. This concludes my testimony for MGRA.

[59] Appendix B; PG&E Data Request Response MGRA_002-Q16.
[60] Appendix B; PG&E Data Request Response MGRA_002-Q13.
[61] Appendix B; PG&E Data Request Response MGRA_001-Q11.

APPENDICES

APPENDIX A – Joseph W. Mitchell, Ph.D. Vitae

JOSEPH W. MITCHELL, PH.D.

19412 Kimball Valley Rd.
Ramona, CA 92065
jwmitchell@mbartek.com
858 228 0089

About

Joseph Mitchell has been an expert witness at the CPUC on issues regarding wildfire and powerlines since 2006 and has authored academic papers on wildfires caused by utility infrastructure. He was the first to recognize and warn of the potential for catastrophic power line firestorms. He proposed and successfully advocated at the CPUC for the first utility fire protection plans aimed at preventing catastrophic fire ignitions. He also proposed the process that led to the statewide utility fire hazard maps created by the CPUC and CAL FIRE, and regulations requiring utilities to provide fire ignition data to the CPUC. As expert witness for and board member of the Mussey Grade Road Alliance (MGRA or Alliance), a grass-roots organization on the wildland urban interface in the San Diego backcountry that seeks to improve fire safety in California, he has helped them oppose utility applications that would compromise public safety, offering both testimony and comment.

With a background in experimental particle physics, Dr. Mitchell spent ten years in Europe during which he worked for academic institutions and industry. He arrived in California in 1999, and at the request of his wife designed a novel wildfire protection system (WEEDS) that saved their home in the 2003 Cedar fire. He published the innovations that it introduced in the world's leading fire engineering journal, and founded M-bar Technologies and Consulting, LLC to publicize the importance of protecting homes from embers during wildfires. In 2009 he was selected to serve on the California State Fire Marshal Task Force which established a framework for testing ignition-resistant construction proposed for the 2010 update to the California Building Code. With this background, Dr. Mitchell was able to establish himself as an expert in wildfire at the California Public Utilities Commission.

Dr. Mitchell simultaneously had a 23 year career in the software industry, joining with Sony in Brussels and later moving to Intuit, Inc. in San Diego. He worked as both an engineer and manager, supporting the creation of embedded software for consumer products and financial software products such as QuickBooks and TurboTax.

Physics and Fire Science Vitae

2018-2019 – Supported the Mussey Grade Road Alliance in the aftermath of the Northern California 2017 and 2018 power line firestorms in their opposition to legislation that would compromise fire safety. Authored expert comment in California Public Utility Commission (CPUC) proceedings following from passage of Senate Bill 901, including utility wildfire mitigation plans, proactive power shutoff, utility liability, and the safety culture and potential re-organization of PG&E. Made substantive contributions to the development Wildfire Mitigation Plans and guidelines for utility proactive power shutoff.
2017-2018 – Authored a chapter on radiant heat in the Encyclopedia of Wildfires and Wildland Urban Interface (WUI) Fires.

2009-2017 – Provided key fire safety testimony used in San Diego Gas and Electric Company's (SGE&E) WEBA and WEMA CPUC applications, which were utility proposals to pass on wildfire liability costs to ratepayers. Applications and appeals were denied.
2008-2017 – Participation in ongoing California Public Utility Commission (CPUC) safety proceedings on behalf of MGRA. Jointly sponsored proposed rules with the Consumer Protection and Safety Division (CPSD/SED) and facilitated participation of CAL FIRE. Four rule changes that were proposed on behalf of MGRA (or jointly proposed with the CPSD) were fully or partially accepted by a decision of the California Public Utilities Commission. Continuing to participate on issues of fire data collection and high-resolution fire threat maps for utilities. Made key contributions to the Safety Model Assessment Proceeding (S-MAP). Also analyzed utility fire safety data as a component of SDG&E's 2016 rate case.
2012-2013 – Presented on the power line fire threat at the International Conference on Engineering Failure Analysis conference in the Hague, Netherlands. Published in Engineering Failure Analysis in 2013.
2011 – Presented on the power line fire threat and California's regulatory response at the annual Wildland Fire Litigation Conference.
2009 – Presented paper and presentation at *Fire and Materials 2009* on catastrophic power line fires, which was the first paper to demonstrate the relationship between wind, fire suppression efficiency, and power line failure rates. Served on a California State Fire Marshal Task Force, which established a framework for testing ignition-resistant construction proposed for the 2010 update to the California Building Code. WEEDS water spray system was featured in a news segment by San Diego television station KGTV.
2008-2009 – Successfully opposed an application by San Diego Gas & Electric Company to shut off power under regularly occurring wind conditions, arguing instead for a cost/benefit analysis – a recommendation that was adopted by the CPUC.
2007-2008 – Submission of expert witness testimony on behalf of MGRA in the CPUC hearings for the proposed SDG&E "*Sunrise Powerlink*" transmission line on the subject of power lines and wildland fire, which included cross-examination and contribution to briefs. Demonstrated potential fire risks from transmission lines, and also found a significantly larger number of power line fires in San Diego County.
2007 – Presented work with Oren Patashnik at *Fire & Materials 2007* conference in San Francisco, whose Scripps Ranch data demonstrated potential ember vulnerability of curved-tile roofing (confirmed in 2009 by NIST research). Provided comment on and criticism of San Diego County's 'shelter-in-place' guidelines. Wrote an op-ed piece published in the San Diego Union Tribune and provided commentary for News 8 KFMB piece on shelter-in-place. Submitted expert testimony for CPUC on *Sunrise Powerlink* project.
2006 – Publication of peer-reviewed paper on the WEEDS water-spray wildland fire protection system in the *Fire Safety Journal*. Presentation of results at the *Third International Fire Ecology and Management Congress*, San Diego, CA.
2001-2005 – Developed the WEEDS method for structure defense during wildland fires. Completed in time for the October 26, 2003 Cedar fire, when it was validated under wildfire conditions. Founded M-Bar Technologies and Consulting to promulgate knowledge regarding WEEDS and the importance of designing for firebrand protection under high-wind conditions. Poster session at *Wildfire 2004* conference, Reno, NV. Articles published in *San Diego Reader* magazine and in *Home&fire* and *Wildfire* trade magazines. Computer modeling validates WEEDS principles.
1999 – Returned to the United States from Europe, settling in San Diego, CA.
1996-2019 – Work in software engineering and management for major multinational corporations.
1989-1998 – Lived and worked in Europe first as a postdoctoral physicist and then in software engineering for a multinational corporation. Resided in Switzerland, Germany, France, and Belgium.

1993-1996 – Postdoctoral work for University of California at Davis in heavy ion physics, performed at CERN. Continuing with work in lasers, optical systems and computer modeling.
1989-1993 – Postdoctoral work for McGill University in high energy physics at CERN (Center for European Nuclear Research, Geneva, Switzerland) and DESY (Deutsches Electron-Synchrotron, Hamburg, Germany). Developed expertise in energy measurement, computer modeling, lasers and optical systems.
1989 – Ph. D. in Physics received from Ohio State University, Columbus, Ohio
1981-1989 – Graduate research in elementary particle (neutrino) physics, Columbus and Los Alamos National Laboratory, NM. Trained in electronics, mechanical engineering, computing, energy measurement and statistics.
1981-1983 – Graduate teaching assistant, OSU physics department.
1981 – Bachelor of Science in Physics received from Ohio State University, Columbus, Ohio

Expert Testimony and Technical Commentary

California Public Utilities Commission (CPUC); Application Proceeding A.06-08-010; Mussey Grade Road Alliance (MGRA); MG-1; MGRA Phase 1 and Phase 2 Direct Testimony; Sunrise Powerlink Transmission Line Project; Application No. 06-08-010; March 12, 2008

DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE - WEBA IMPACTS ON FIRE RISK AND COSTS; Application No. 09-08-020; September, 11, 2011.

DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE, SDG&E 2016 RATE CASE; May 15, 2015.

DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE SDG&E WILDFIRE EXPENSE MANAGEMENT ACCOUNT; October 17, 2016

Provided all technical input on wildland fire for the following CPUC Proceedings for the Mussey Grade Road (MGRA):

P.07-11-007 – SDG&E fire safety petition.
R.08-11-005 – Fire safety rulemaking.
A.08-12-021 – SDG&E application for pro-active power shutoff.
(includes J. W. Mitchell report "*When to Turn Off the Power? Cost/Benefit Outline for Proactive De-energization*", March 27, 2009)
A.09-08-021 – SDG&E application to recover costs of 2007 wildfires.
A.13-11-006 - Rulemaking to Develop a Risk-Based Decision-Making for Energy Utilities.
A.14-11-003 – SDG&E 2016 rate case.
A.15-05-002-5 –Review of SDG&E Safety Model Assessment
R.15-05-006 – Rulemaking to Develop and Adopt Fire-Threat Maps and Fire-Safety Regulations.
A.15-09-010 – SDG&E application to recover costs of 2007 wildfires.
R.18-10-007 – Order Instituting Rulemaking to Implement Electric Utility Wildfire Mitigation Plans Pursuant to Senate Bill 901.
R.18-12-005 – Order Instituting Rulemaking to Examine Electric Utility De-Energization of Power Lines in Dangerous Conditions
I.15-08-019; PG&E safety culture investigation.

R.19-01-006 – Order Instituting Rulemaking to Implement Public Utilities Code Section 451.2 Regarding Criteria and Methodology for Wildfire Cost Recovery Pursuant to Senate Bill 901 (2018).
I.19-11-010-11 – SDG&E RAMP Proceeding (suspended)
I.19-11-013 – Order Instituting Investigation on the Commission's Own Motion on the Late 2019 Public Safety Power Shutoff Events

Publications

Fire Publications & Presentations - Academic

Mitchell, J.W., 2018. Radiant Heat, in: Manzello, S.L. (Ed.), Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires. Springer International Publishing, Cham, pp. 1–6. https://doi.org/10.1007/978-3-319-51727-8_65-1 (in press)

Mitchell, Joseph W.; Power line failures and catastrophic wildfires under extreme weather conditions; Engineering Failure Analysis; Volume 35, 15 December 2013, Pages 726–735 (ICEFA V, The Hague, The Netherlands, July 3, 2012)
http://www.sciencedirect.com/science/article/pii/S1350630713002343

Mitchell, Joseph W.; "Power Lines and Catastrophic Wildland Fire in Southern California"; Presentation to the Fire & Materials 2009 Conference, San Francisco CA, Jan 26, 2009.
http://www.mbartek.com/images/FM09_JWM_PLFires_1.0fc.pdf

Mitchell, Joseph W. and Oren Patashnik**;** Firebrand Protection as the Key Design Element for Structure Survival during Catastrophic Wildland Fires; Fire and Materials 2007, San Francisco, CA; Jan 29-31, 2007.
http://www.mbartek.com/images/FM07_FirebrandsWildfires_1.1F.pdf

Mitchell, Joseph W.; REDUCING URBAN INTERFACE ECOLOGICAL IMPACTS AND FIRE LOSSES THROUGH STRUCTURAL FIREBRAND PROTECTION; Third International Fire Ecology and Management Conference; San Diego, CA; Nov. 13-17, 2006.

Mitchell, Joseph W.; Wind-enabled ember dousing; Fire Safety Journal; v. 41 (2006); pp 444-458.
https://www.sciencedirect.com/science/article/abs/pii/S0379711206000567

WEEDS poster session; Wildfire 2004 conference, Reno, NV; Mar. 2004.

Presentations to Public Officials

Senate Energy, Utilities and Communications Subcommittee on Gas, Electric and Transportation Safety Hearing of 05-03-2016
https://ca.digitaldemocracy.org/hearing/1083?startTime=698&vid=1OQ4lwsNiZY Starting 23:37

Fire Publications & Presentations – Trade and General Public

Mitchell, Joseph W.; Goaded into Action: California's Regulatory Response to the Power Line Fire Threat
Presented at the 5th Annual Wildland Fire Litigation Conference, April 16, 2011

Conklin, Diane and Joseph W. Mitchell; The PUC should deny this plan outright; The San Diego Union Tribune; May 10, 2009.
http://www3.signonsandiego.com/stories/2009/may/10/puc-should-deny-plan-outright/?uniontrib

Mitchell, Joseph W; Wind-Enabled Ember Dousing - A comparison of wildland fire protection strategies; Prepared for the Ramona Fire Recovery Center, 8/12/2008.
http://www.mbartek.com/images/Mbar_WEEDS_Comparison_web.pdf

Mitchell, Joseph W.; Playing with fire: The county's 'Shelter in Place' gamble; The San Diego Union-Tribune; May 2, 2007, p. B7.
http://www.signonsandiego.com/uniontrib/20070502/news_lz1e2mitchell.html

Mitchell, Joseph W.; Brand Dilution (Cover article); Wildfire Magazine; Mar. 2005
http://wildfiremag.com/wui/brand_dilution/

Mitchell, Joseph W.; WEEDS: Wind Enabled Ember Dousing System; Home&fire Magazine; Spring,2005; p. 32

Mitchell, Joseph; Engineering a Miracle; San Diego Weekly Reader Magazine; April 29, 2004

Physics: List of neutrino, high-energy, and heavy ion physics publications is available upon request.

Software Industry Experience

Intuit, San Diego – Staff Engineer
2005 - 2019

Led and contributed to transitions through multiple generations of build and deployment pipelines, emphasizing automation and seamless end-user experience.
Built enterprise-wide Jenkins build system based on AWS, Chef, and CloudFormation and transitioned major projects such as TurboTax onto the corporate infrastructure.
Built tools and engaged with business unit teams to migrate builds from both internal and AWS-based build infrastructure to Kubernetes-based AWS build infrastructure.
Worked across organizational boundaries to develop, acquire and proselytize DevOps best practices.
Designed and built three generations of build systems using best current technology for Intuit's Central Technology Organization.
Designed, drove and implemented user engagement models that enabled a small team with one rotating support engineer to support 60% of builds for the entire enterprise.
Led migration of Central Technology Organization through two generations of source control systems (first to Perforce, then to Git).

Sony, Brussels and San Diego — Software Developer, SCM Engineer, SCM Manager
1996 - 2005
Managed a four person SCM team developing embedded software for Sony cable and satellite television products.
Developed virtualized build system following standard patterns and transitioned development team onto best of breed source control.

Contact info:

Joseph W. Mitchell, Ph. D
M-bar Technologies and Consulting, LLC
19412 Kimball Valley Rd.
Ramona, CA 92065
Phone: 868 228 0089
Email: jwmitchell@mbartek.com
Website: www.mbartek.com

Appendix B – PG&E Responses to MGRA Data Requests

Appendix B

PG&E Data Request Responses

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q01		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q01		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 01

What was the design of the original website designed to provide customers information regarding power shutoff information specific to their geographic area prior to the October 9 outage? Provide any high-level design documents and an architectural diagram.

ANSWER 01

PG&E objects to this request as unduly vague in that it fails to identify the relevant time period (other than "prior to the October 9 outage") and its undefined use of the words "design" and "original website." Subject to and without waiving these objections, PG&E provides the following response.

Please refer to PG&E's testimony at p. 4-2, line 9 to p. 4-5, line 4, which describes the content of PG&E's website in the months leading up to the 2019 wildfire season, including (1) the static and interactive content on the website; (2) the PSPS events landing page; (3) PG&E's dedicated weather webpage; (4) the Address Look-up Tool; and (5) website maps. Please also refer to PG&E's testimony at p. 6-3, line 14 to p. 6-5, line 2, which describes the website maps in greater detail.

To the extent this question seeks the technical design specifications underlying PG&E's website prior to the October 9 outage, PG&E will provide this information upon completion of a non-disclosure agreement.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q02		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q02		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 02

What specific hardware, software applications and tools were used for the application tier?

ANSWER 02

In response to both Question 2 and 3, PG&E has provided the following table:

	Presentation Layer	**Application Layer**
PGE.COM (Static Content Servers)	Operating System: Redhat Enterprise Linux Server: Apache Webserver Technology Code: JS/Bootstrap	Operating System: Redhat Enterprise Linux Server: Oracle Weblogic Technology Code: OpenText Livesite
YourAccount (Address Lookup)	Operating System: Redhat Enterprise Linux Server: Apache Webserver Technology Code: JS/Marionette	Operating System: Redhat Enterprise Linux Server: Oracle Weblogic Technology Code: JEE/Spring MVC

See PG&E's response to DRU-2195.02.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q03		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q03		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 03

What specific hardware, software technologies and tools were used for the presentation tier?

ANSWER 03

See PG&E's response to DRU-2195.02.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q04		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q04		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 04

What were the memory and CPU characteristics of the pge.com systems responsible for providing PSPS information in the PG&E data center before and after the October 9th shutoff event?

ANSWER 04

Please refer to PG&E's bi-weekly report (submitted 2/10/20 in R.18-12-005), p. 3.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q05		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q05		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 05

Provide a narrative description of the website failures that began October 9th.

ANSWER 05

Please refer to PG&E's testimony at pp. 4-8 to 4-13.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q06		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q06		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 06

Describe the various failure modes that users experienced during the outage, including the http error codes were returned.

ANSWER 06

PG&E objects to this request as unduly vague in that the phrases "failure modes" and "outage" are not defined. PG&E also objects to this question as the requested information is in the possession, custody, and control of third parties, not PG&E. Subject to and without waiving these objections, PG&E provides the following response.

As discussed in PG&E's testimony at p. 4-11, lines 16-18, some customers experienced longer-than-usual wait times or received the message "site not found." PG&E does not maintain information as to the types of "failure modes" that users experience.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q07		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q07		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 07

Of the total number of requests posted to the website, how many succeeded and how many returned an error code?

ANSWER 07

PG&E objects to this question as unduly burdensome. PG&E does not maintain some of this information in the ordinary course of business. Subject to and without waiving these objections, PG&E provides the following response.

Please refer to PG&E's testimony at p. 4-8, lines 8-10 and Figure 4-3. PG&E does not have information on the number of requests posted to the website that returned an error code.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q08		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q08		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 08

What capacity limitation(s) led to the failure of the PG&E website to provide correct responses to user requests?

ANSWER 08

Please refer to PG&E's response to Question MGRA-5.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q09		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q09		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 09

What traffic was the PG&E website designed to handle?

ANSWER 09

PG&E objects to this request as unduly vague in so far as it fails to identify the relevant time period for which it seeks information and because the phrase "designed to handle" is unclear. Subject to and without waiving these objections, PG&E provides the following response.

Although PG&E does not have specific records documenting the original design limits for website traffic, PG&E regularly monitored its system performance, and prior to the October 9-12 PSPS event, PG&E's front-line static content servers were generally operating at 5 percent or less of their total capacity. Please refer to PG&E's Opening Testimony at 4-7 at lines 10-23.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q10		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q10		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 10

What peak capacity, in number of user requests per second, was the PG&E IT team directed to design the website for?

ANSWER 10

PG&E objects to this request as unduly vague in so far as it fails to identify the relevant time period for which it seeks information and because the phrases "peak capacity" and "number of user requests" are unclear. Subject to and without waiving these objections, PG&E provides the following response.

Although PG&E does not have specific records documenting "peak capacity" requirements for the PG&E website, PG&E regularly monitored its system performance, and prior to the October 9-12 PSPS event, PG&E's front-line static content servers were generally operating at 5 percent or less of their total capacity. Please refer to PG&E's Opening Testimony at 4-7 at lines 10-23.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q11		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q11		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 11

At what level of management was the design requirements for peak capacity made?

ANSWER 11

PG&E objects to this request as unduly vague in so far as it fails to identify the relevant time period for which it seeks information and because the phrases "level of management" and "design requirements for peak capacity" are unclear. Subject to and without waiving these objections, PG&E provides the following response.

Peak capacity design requirements were presented for review to various levels of PG&E IT management. The management positions that approved the designs to go forward spanned infrastructure services, customer facing systems and emergency management departments within IT.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_001-Q12		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q12		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 12

What considerations led to the decision to choose the hardware, software, and tool capacity that was in place during the October 9th outage failures, and not a larger capacity?

ANSWER 12

PG&E used a combination of system performance analysis and best practices to determine the appropriate hardware, software and tool capacity for the website. As demonstrated in PG&E's Opening Testimony, PG&E experienced very strong "Overall Annual Availability" metrics for the website on a historical basis (over 99% for both 2017 and 2018) and PG&E's front-line static content servers were generally operating at 5 percent or less of their total capacity. PG&E also developed and implemented back-up systems and utilized a second data center for redundancy purposes. Please refer to PG&E's Opening Testimony at 4-6 at lines 5-24, and 4-7 at lines 10-23.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q13		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q13		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 13

What features will no longer be available on the PG&E website if it fails over to the CDN backup site?

ANSWER 13

PG&E objects to this data request in so far as it is based on a faulty assumption. The CDN, which was not implemented until after the October 21, 2019 PSPS event, has as its primary purpose to serve as a network to deliver content. It does not function as a "backup server site." The technical improvements that PG&E is currently implementing prior to the 2020 wildfire season will move all features to a hosted provider.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_001-Q14		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q14		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 14

If CPU spikes again beyond 80%, what actions will PG&E take to ensure that the site remains available?

ANSWER 14

Please refer to PG&E's bi-weekly report (submitted 2/10/20 in R.18-12-005), p. 5, noting that PG&E will now be alerted when CPU usage reaches 60 percent. Answering further, PG&E states that there could be a variety of reasons for a spike in CPU usage – either during or outside of a PSPS event – and the specific actions that PG&E will take will depend on the facts and circumstances surrounding that particular spike.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q15		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q15		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 15

Did PG&E conduct performance and stress testing on its website prior to the October 9 event? If so, what capacity was it tested at, and how were the parameters for testing chosen?

ANSWER 15

PG&E objects to this request as unduly vague in so far as it fails to identify the relevant time period (other than "before the October 9 event") for which it seeks information and because the phrase "performance and stress testing" is not clear. Subject to and without waiving these objections, PG&E provides the following response.

PG&E routinely conducts performance and stress testing of PG&E's systems. On the morning of the October 8th, PG&E tested YourAccount from approximately 1AM to 3AM. PG&E can provide these test scripts and results upon request.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q16		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q16		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 16

How did PG&E determine the current capacity testing level of 2.5 million transactions per hour?

ANSWER 16

This figure was developed after evaluating the peak transaction counts for the October 9, 2019 PSPS event and adding the counts from YourAccount and PGE.COM together. The logic for combining the counts was that all traffic from both sites will be redirected to a single outage search portal. This value was then used as used as a basis for performance testing.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q17		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q17		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 17

Which website features are being moved onto cloud-based solutions, and which will remain within the PG&E data center?

ANSWER 17

As part of PG&E's corrective action plan, PG&E is in the process of moving all of the PSPS functions to cloud-based environments. These functions will include Address Lookup, Partner File Download, Events Page and the Customer Landing Page.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q18		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q18		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 18

Provide high-level design documents and diagrams showing the PG&E architecture that has currently (January 2020) been put in place to handle customer requests for outage information.

ANSWER 18

This figure was developed after evaluating the peak transaction counts for the October 9, 2019 PSPS event and adding the counts from YourAccount and PGE.COM together. The logic for combining the counts was that all traffic from both sites will be redirected to a single outage search portal. This value was then used as used as a basis for performance testing.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q19		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q19		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 19

Why are functions remaining in the PG&E data center, and what is the motivation for keeping them onsite rather than moving them to a cloud-based solution?

ANSWER 19

PG&E objects to this data request in so far as it is based on a faulty assumption. Functions that appear to remain in the data center are actually being served from CDN, which is a third-party cloud-based provider. As a part of the 2020 plan, PG&E will fully migrate all remaining PSPS functions out of the data center before the start of the 2020 wildfire season.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q20		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q20		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 18, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 20

What Amazon Web Services (AWS) are currently (January 2020) being utilized by the PG&E website?

ANSWER 20

PG&E objects to this data request as unduly vague in so far as the phrase "[w]hat Amazon Web Services (AWS) are currently (January 2020) being utilized" is unclear. Subject to and without waiting this objections, PG&E provides the following response.

PG&E is currently leveraging AWS hosting services for the website.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q21		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q21		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 21

What fraction of PG&E's web traffic during an outage comes from mobile devices? Is PG&E's website outage information optimized to handle mobile traffic?

ANSWER 21

PG&E estimates that approximately 65% of traffic from October 9-12 came from mobile devices.

Oct 9 2019 - Oct 12 2019

Total mobile traffic = 65%

Mobile phone = 60%

Tablet = 5%

The pge.com web site including the outage map is mobile responsive – meaning the design re-sizes itself based on the screen size being used.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q22		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q22		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 22

To what extent do PSPS events disrupt internet traffic in PG&E's service area due to loss of mobile connectivity or cable service, in terms of number or fraction of users affected?

***Issues were also reported in regard to the accuracy of the data provided by the* PG&E website as far as which locations, residences, and critical facilities would be affected by PSPS events.[1]**

ANSWER 22

PG&E objects to this data request in so far as it requests information to which PG&E does not have access. To respond to this question, PG&E would need detailed information about internet providers' facilities—including the number of facilities with backup generators—and customers, which PG&E does not possess.[2]

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1 For example, CITY OF SAN JOSÉ'S RESPONSE TO ORDER INSTITUTING INVESTIGATION (OII) AND RESPONSE TO PACIFIC GAS & ELECTRIC COMPANY'S RESPONSE TO OII; January 10, 2020, p. 9 states that: "San José also heard from residents that PG&E's address lookup tool was not always accurate, either. Residents reported outages when their address lookup said they would not be affected, and vice versa."

2 *See* comments by AT&T, Verizon, and California Cable & Communications Associations submitted in R.18-12-005.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q23		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q23		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

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For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 23

Has PG&E conducted a post-mortem analysis of the accuracy of its address lookup tool to compare it with the actual customer addresses affected by the shutoff initiated on October 9th? If so, provide the fraction of false positives and false negatives returned by the PG&E website.

ANSWER 23

No, PG&E has not conducted such an analysis.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q24		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q24		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

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For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 24

Please provide a description of the methodology that PG&E uses currently and is planning to collect metrics on false positive and false negative addresses for customer addresses and critical facilities that are shown as potentially or actually affected by PSPS events.

ANSWER 24

PG&E objects to this data request in so far as it is based on a faulty assumption: namely, that PG&E collects metrics on false positive and false negative addresses based on PG&E's Address Look-up Tool. Subject to and without waiting this objection, PG&E provides the following response.

Please refer to PG&E's bi-weekly report (submitted 2/10/20 in R.18-12-005), p. 35.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q25		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q25		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 25

When the PG&E operation center changes its plans to energize or de-energize circuits, is this information reflected immediately on the PG&E customer-facing website? If not, what is the process for transferring the data from the operation center to the customer-facing website, and what is the typical delay between the time changes are made at the PG&E operations center and the time they are reflected on the customer website?

ANSWER 25

As described in PG&E's testimony (at p. 4-4 to p. 4-5), PG&E's website includes two tools to assist customers to determine whether they will be affected by a PSPS event: the Address Look-up Tool, and website maps. During the 2019 PSPS events, there were slight delays between the time PG&E modified the anticipated scope of the PSPS event and the time that updated information was uploaded to PG&E's customer facing website. This small delay was primarily the result of PG&E utilizing a manual process to upload the files to the external website.

To understand what PG&E is doing in advance of the 2020 wildfire season, please refer to PG&E's bi-weekly report (submitted 2/10/20 in R.18-12-005), p. 35.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_001-Q26		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_001-Q26		
Request Date:	January 30, 2020	Requester DR No.:	001
Date Sent:	February 14, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ DianeConklin

MGRA intends to provide testimony and comment on failure and malfunctions of the PG&E website during the October 9th shutoff event. The following questions are intended to illuminate for the Commission PG&E's level of preparedness, planning, and technical adequacy that was in place prior to the initial large-scale PSPS events and the adequacy of the recovery efforts afterwards.

For the purposes of the following data request, the "October 9th" outage refers to the entire PSPS event initiated on October 9th and extending until full restoration of service to all users.

QUESTION 26

If there are delays between the time that PG&E circuits are scheduled for de-energization or re-energization and the transmission of this information to the PG&E customer-facing website, what measures is PG&E currently taking to reduce this delay?

ANSWER 26

Please refer to PG&E's response to Question MGRA-25.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q01		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q01		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 01

Page 4-5 of PG&E's testimony states that "Prior to and during the 2019 PSPS events, PG&E's Digital Strategy team was constantly making updates to the website-both the static content and the interactive services-based on customer feedback and customer experience best practices."

What were the update schedules for the site prior to and including the October events? Were they continuous, nightly, scheduled?

ANSWER 01

With respect to the quoted testimony, PG&E's Digital Strategy team was making continuous changes to the static content and interactive services both prior to and during the October events.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q02		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q02		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 02

How were the changes included in the updates tested prior to release to the main website?

ANSWER 02

PG&E routinely tests website content with customers prior to use. In preparation for the 2019 PSPS season, PG&E had prepared test website content for customer research. That research was put on hold in coordination with other in-market testing being done by the California Office of Emergency Services. PG&E did not complete consumer testing before the June 8th PSPS event, and subsequently used real event customer feedback from the June 8th event to inform the content used in later events. Learnings from each subsequent event were quickly captured and then applied to events that followed in an effort to continuously improve the customer experience.

PG&E has numerous feedback mechanisms in place to be able to quickly react to consumer feedback. In addition to receiving near real time feedback from the call centers, the Digital Strategy team reviews click patterns, how far down the page people scroll, and customer comments left on the website.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q03		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q03		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 03

Page 4-6 of the PG&E Testimony describes simulation programs that "allow PG&E to evaluate the speed of the website under various conditions and to trouble-shoot and make improvements if the website is slow or not operating in an optimal manner."

What transactions did PG&E expect to occur during a PSPS event?

ANSWER 03

The website transactions that PG&E expected to occur during a PSPS event included checking PG&E's dedicated weather webpage, the Address Look-up Tool, the Outage Map and PSPS maps, as well as accessing PSPS related information. (PG&E testimony, pp. 4-2 to 4-4.)

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Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q04		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q04		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 04

What simulation programs were run that were specifically dedicated to the kind of transaction that would occur during a PSPS event?

ANSWER 04

PG&E conducted performance test scripts on the Address Lookup Tool using the Load Runner tool. PG&E can provide test scripts and results upon request. These scripts simulated the behavior of real-world users to generate the anticipated load on PG&E's servers. However, the Static Content Servers were not included in this test based on previous performance feedback.

PACIFIC GAS AND ELECTRIC COMPANY
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Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q05		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q05		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 05

Page 4-6 of the PG&E Testimony states that the "back-up website was designed to handle up to 100 times the normal traffic of PGE.com."

What is the design tolerance for the main website PGE.com compared to its "normal" traffic? In other words, how many times "normal" traffic was the pge.com website itself designed to handle?

ANSWER 05

Please see response to MGRA-1, Questions 9 and 10.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q06		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q06		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 06

What was the capacity of the backup website compared to the main website?

ANSWER 06

In 2014, per PG&E testimony, p. 4-6, lines 11-14, the backup website was originally designed to manage 100 times the capacity of the main site. However, at the time of the design, the interactive PSPS functions (address lookup tool and Google maps rendering of shape files) were not considered.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q07		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q07		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 07

On Page 4-7 of the PG&E Testimony it is stated that "PG&E maintains a number of static content servers across its two data centers, ten of which act as the front line defense for the others. If the ten servers were to be overwhelmed, the website would go down."

How many static content servers were in the cluster overall?

ANSWER 07

PG&E understands this question to be related to production servers that are active. During the event, all ten servers were active in the cluster.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q08		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q08		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 08

On p. 4-7 of the PG&E testimony, it states that: "When PG&E analyzed its server capacity in the months leading up to the October 2019 events, PG&E observed that its servers were generally operating at 5 percent or less of their total capacity. Based on this analysis, PG&E was confident that it had more than sufficient excess capacity to handle even a large-scale PSPS event."

Was PG&E's capacity analysis correct?

ANSWER 08

PG&E objects to this data request on the grounds that it is unduly vague. If the question is asking whether PG&E's capacity analysis (i.e., its servers were generally operating at 5 percent or less of their total capacity) was correct, the answer is yes, that analysis remains accurate. If the question is asking whether PG&E's assessment of that capacity (i.e., PG&E had more than sufficient excess capacity to handle even a large-scale PSPS event) was correct, that answer is no, at peak times, the capacity was not sufficient.

As described in PG&E's testimony (at pp. 4-8 to 4-11), while the website had sufficient capacity to handle a substantial increase in traffic from PG&E customers, PG&E learned, through the October 9-12 PSPS event, that during a large-scale PSPS outage, the size and nature of the traffic is dramatically different. Specifically, many of the transaction requests were from users who were not PG&E customers; traffic to PG&E's website was multiplied through third-party website traffic and "bots"; users were performing multiple transactions on the website; and content such as PSPS maps that PG&E made available to be transparent put additional strain on the system. All of these factors resulted in PG&E's website experiencing intermittent outages and accessibility issues.

PACIFIC GAS AND ELECTRIC COMPANY
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Data Response

PG&E Data Request No.:	MGRA_002-Q09		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q09		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 09

What did PG&E anticipate would be the number of customers affected by a potential "large scale" PSPS event?

ANSWER 09

PG&E's IT group did not utilize a specific estimation prior to October 2019, as to the number of customers that it anticipated would be affected by future PSPS outages. Each PSPS event is unique and the scope is dependent upon constantly changing weather conditions and other factors, all of which influence the number of customers that will be affected during a PSPS outage. Further, the website traffic experienced during a PSPS event does not directly correlate with the total number of customers that are de-energized over the course of a PSPS event. The scope and number of transactions that the website will experience will depend on a number of factors, including the number of customers de-energized at a given time, the extent to which third-party web traffic is directed to the PG&E website, etc. Please also refer to PG&E testimony, p. 1-3, lines 4-13.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q10		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q10		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 10

What server capacity was PG&E anticipating would result from a "large-scale" PSPS event, both in number of accesses anticipated and predicted CPU response?

ANSWER 10

PG&E did not utilize a specific estimation prior to October 2019, as to the "server capacity . . . [that] would result from a 'large-scale' PSPS event." Each PSPS event is unique and the scope is dependent upon constantly changing weather conditions and other factors, all of which influence the number of customers that will be affected during a PSPS outage. Further, the website traffic experienced during a PSPS event does not directly correlate with the total number of customers that are de-energized over the course of a PSPS event. The scope and number of transactions that the website will experience will depend on a number of factors, including the number of customers de-energized at a given time, the extent to which third-party web traffic is directed to the PG&E website, etc. Please also refer to PG&E's prepared Testimony Chapter 4 at 4-8, line 17 to 4-9, line 25.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q11		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q11		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 11

What is an acceptable server CPU usage in percentage?

ANSWER 11

As described in the Bi-Weekly Report of Pacific Gas and Electric Company (U39E) in Compliance with January 30, 2020 Assigned Commissioner's Ruling (filed 2/10/20) (p. 5), PG&E's internal protocols call for its Enterprise Network Operation Center (ENOC) to be alerted any time CPU utilization reaches 60%, which is a lower threshold than the 80% that PG&E previously applied. Once alerted, ENOC will engage the required resource to triage and address the problem.

PACIFIC GAS AND ELECTRIC COMPANY
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Data Response

PG&E Data Request No.:	MGRA_002-Q12		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q12		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 12

What is the maximum server CPU usage that could be tolerated before performance problems would be expected?

ANSWER 12

The maximum server CPU usage that could be tolerated before performance problems may occur is 80%.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q13		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q13		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 13

On p. 4-8 of the PG&E Testimony, it states that "the extent of the website outage was narrower than described in the Scoping Memo."

Provide a timeline showing the times when the website available and unavailable.

ANSWER 13

PG&E objects to this data request on the grounds that it assumes facts not in evidence. Specifically, the primary website and the back up website(s) were never complelely down from a technical perspective, although from a customer experience perspective, the primary site and the back up(s) were largely unavailable for portions of time. For a narrative timeline of PG&E's website issues, please see PG&E's testimony, p. 4-11 to p. 4-13.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q14		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q14		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 14

How did PG&E determine whether its website is available or not?

ANSWER 14

PG&E relies on alerts and synthetic transaction monitoring (automated script) that can validate whether the website is up and running.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q15		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q15		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 15

What was the failure mode during the period of "unavailability"? Did all requests fail or just some fraction of requests?

ANSWER 15

Please see PG&E's response to MGRA-1, Question 6.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q16		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q16		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 16

On p. 4-9 of its testimony, PG&E states that "PGE.com experienced almost a million page requests from users located outside of California."

Did PG&E have any way of identifying how much of their traffic was as a result of redirects from 3rd party websites?

ANSWER 16

Adobe tracks referral traffic for those that were successfully served content but not for those that got a page not found. Therefore, PG&E does not have a way to comprehensively respond to this question.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q17		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q17		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 17

Did PG&E have any mechanism for identifying bot traffic?

ANSWER 17

During the event, PG&E did not have a way to identify “bots” because it was not a part of the programming at that time.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q18		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q18		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 18

On p. 4-9 of its testimony, PG&E states that "PG&E estimates that more than 50 percent of the transactions on October 9 and more than 60 percent of the transactions on October 10, 11 and 12 were performed by repeat users."

What fraction of repeat users was PG&E anticipating, and how was this estimate made?

ANSWER 18

PG&E did not make a specific estimation as to the "fraction of repeat users" that it anticipated during any particular PSPS event.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q19		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q19		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 19

Did PG&E analyze its data from earlier, smaller-scale PSPS events (specifically the September 23/25 event) to determine how many times users access the site during a PSPS event?

ANSWER 19

Yes, as described in PG&E's testimony (at p. 4-7), PG&E analyzed its server capacity in the months leading up to the October 2019 events, and based on that analysis, felt confident that it had more than sufficient excess capacity to handle a large-scale PSPS event.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q20		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q20		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 20

Regarding Figure 4-4 in the PG&E Testimony "PAGE REQUESTS PER HOUR FOR JANUARY THROUGH OCTOBER 20, 2019":

Please provide the same graph but with the date scale from September 15, 2019 to November 1, 2019, in order to more clearly show the page request usage pattern during the October events.

ANSWER 20

Please see De-EnergizePowerLines_DR_MGRA_002-Q20Atch01.xlsx. PG&E has provided an excel workbook with a specific tab addressing the requested date scale. All raw data for each view is in columns A, B and C of each tab.

PACIFIC GAS AND ELECTRIC COMPANY
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Data Response

PG&E Data Request No.:	MGRA_002-Q21		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q21		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 21

Please provide the raw data for Figure 4-4 in Excel spreadsheet or csv format.

ANSWER 21

Please see the response to MGRA_002-Q21

PACIFIC GAS AND ELECTRIC COMPANY
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Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q22		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q22		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 22

Does Figure 4-4 include page requests that failed to reach the PG&E website?

ANSWER 22

No.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q23		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q23		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 23

PG&E's Sept 23/25 shutoff event affected 49,000 customers. The October 5-9 event affected 735,000 customers. According to Figure 4-4, the September 23/25 event caused a peak of approximately 50,000 page requests an hour. Assuming that the peak number of page requests will approximately scale with the number of affected customers, what peak number of page requests per hour would be expected for 735,000 customers, extrapolating from the data observed during the September 23/25 event?

ANSWER 23

PG&E's IT group did not utilize a specific estimation prior to October 2019, as to the number of customers that it anticipated would be affected by future PSPS outages or the anticipated volume of website traffic associated with a PSPS event affecting 735,000 customers. Each PSPS event is unique and the scope is dependent upon constantly changing weather conditions and other factors, all of which influence the number of customers that will be affected during a PSPS outage. Further, the website traffic experienced during a PSPS event does not directly correlate with the total number of customers that are de-energized over the course of a PSPS event. The scope and number of transactions that the website will experience will depend on a number of factors, including the number of customers de-energized at a given time, the extent to which third-party web traffic is directed to the PG&E website, etc. Please refer to PG&E testimony, p. 1-3, lines 4-13 and p. 4-8, line 17 to p. 4-9, line 25.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q24		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q24		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 21, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 24

At what page request rate did functional problems start to appear on the pge.com website?

ANSWER 24

PG&E observed functional problems with the pge.com website at 150,000 page requests per hour.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q25		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q25		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 25

Based on prior (to October 9th) testing of the PG&E website, at what page request rate were functional problems expected to occur on the PG&E website?

ANSWER 25

PG&E testing prior to October 9 did not identify a specific "page request rate" at which "functional problems [were] expected to occur.

PACIFIC GAS AND ELECTRIC COMPANY
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Data Response

PG&E Data Request No.:	MGRA_002-Q26		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q26		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 26

On p. 4-11 of its testimony, PG&E states: "While the inclusion of the downloadable maps provided additional transparency to the public, they also put substantial strain on PG&E's servers - over and above the other sources of strain described above."

How many download requests occurred?

ANSWER 26

PG&E does not track download requests as a part of routine technical maintenance.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
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Data Response

PG&E Data Request No.:	MGRA_002-Q27		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q27		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 27

Were multiple simultaneous downloads occurring during the peak period?

ANSWER 27

See PG&E's response to Question 26.

PACIFIC GAS AND ELECTRIC COMPANY
De-Energize Power Lines OIR
Rulemaking 18-12-005
Data Response

PG&E Data Request No.:	MGRA_002-Q28		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q28		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 28

What is the typical transfer rate in bits per second that users experienced when downloading the data files?

ANSWER 28

PG&E does not track the transfer rate that users experience when downloading data files, which would typically depend on the user's computer bandwidth.

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Data Response

PG&E Data Request No.:	MGRA_002-Q29		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q29		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 29

What were the file sizes of the data files?

ANSWER 29

PG&E objects to this data response as overly vague, as it fails to specify a time period and PG&E had numerous maps of varying file sizes over the course of the October 9-12 PSPS event. Subject to and without waiving this objection, PG&E provides the following response.

The last map updates to the pge.com website had the following file sizes.

Kmz – one zip file = 52,610 KB

Shapefile – one zip file = 53,859 KB

PDF – 37 files totaling 62 MB (maps provided by county and ranged from 665 KB – 3852 KB)

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Data Response

PG&E Data Request No.:	MGRA_002-Q30		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q30		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 30

Describe the network infrastructure of the PG&E website as of October 5. Provide a diagram.

ANSWER 30

Please see response to MGRA-1, Question 1.

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Data Response

PG&E Data Request No.:	MGRA_002-Q31		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q31		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 31

What kind of "strain" did the file downloads put on the server? In other words how did the file downloads interfere with other server requests?

ANSWER 31

PG&E does not track the effects of file downloads on server performance.

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Data Response

PG&E Data Request No.:	MGRA_002-Q32		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q32		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 32

On p. 4-11 of its testimony, PG&E states that its "cybersecurity team analyzed the traffic and identified the Internet Protocol (IP) addresses for the sources that were imposing the highest demand on PG&E's website and temporarily blocked some of those IP addresses from accessing the website."

What was the nature on high-demand IP addresses that were blocked? Were these bots? News organizations?

ANSWER 32

Both of the cited high-demand IP addresses were not bots or news organizations. One belonged to an investment company and the other belonged to a telecommunications service provider.

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Data Response

PG&E Data Request No.:	MGRA_002-Q33		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q33		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 33

On page 4-12 of its testimony, PG&E states that: "PG&E partnered with Second Watch, the vendor that services PGEalerts.com and its Critical Web Outage Map tool in Amazon Web Services (AWS), to analyze performance bottlenecks and implement solutions to boost functionality.[5] Further, the Company deployed a new webpage hosted in AWS for its Public Safety Partners and moved their designated PSPS file download to a cloud-based infrastructure to further boost performance."

At what date/time was Second Watch engaged?

ANSWER 33

Second Watch was engaged to analyze performance bottlenecks and increase IOPS and EBS volumes for Critical Web Outage Maps on October 8, 2019 at or around 12:11pm.

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Data Response

PG&E Data Request No.:	MGRA_002-Q34		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q34		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 34

At what date/time was the PSPS file download moved into AWS?

ANSWER 34

The PSPS file download was moved into AWS on October 9, 2019 at or around 8:20 am.

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Data Response

PG&E Data Request No.:	MGRA_002-Q35		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q35		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 35

On page 4-12 of its testimony, PG&E states that "the Address Look-up Tool was unavailable".

Provide a timeline stating the periods of availability and unavailability of the Address Look-up Tool.

ANSWER 35

PG&E assumes that this question is in reference to Address Lookup Tool version 1. On October 8th at 8:34AM this version of the tool became unavailable and was subsequently archived. During the event, an alternative was launched on October 9th at 15:00 hours. This alternative was called Area Map Lookup. It was not built with like for like functionality compared to Address Lookup Tool version 1; it was a general area map and did not have the circuit level of detail. Post event, version 2 of Address lookup Tool was launched in AWS. This version has like for like functionality compared to version 1 and is currently being supported.

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PG&E Data Request No.:	MGRA_002-Q36		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q36		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 36

On p. 4-12, PG&E states that by the evening of October 9th, "PG&E had largely stabilized the ESRI website and users were able to consistently access its content."

How many visitors accessed PG&E's ESRI web page during the October 9-12th outage?

ANSWER 36

PG&E does not maintain records showing how many visitors accessed PG&E's ESRI web page during the October 9-12 outage.

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Data Response

PG&E Data Request No.:	MGRA_002-Q37		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q37		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 37

On pp. 4-13 to 4-14 of its testimony, PG&E states that: "PG&E now has a policy of stress-testing its website as part of any pre-event preparation. As part of this process, the website is subjected to high load volumes to monitor its performance so that any kinks can be resolved before the event."

Prior to the October 9th outages, did PG&E stress-test its website to simulate a large scale PSPS event? If so, how many customers were anticipated to be affected and how many page requests per hour were anticipated to result from that level of usage?

ANSWER 37

Please see response to Question 4.

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Data Response

PG&E Data Request No.:	MGRA_002-Q38		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q38		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 38

On p. 4-14 of its testimony, PG&E states that "Within days of the October 9-12 PSPS event, PGE.com experienced 215,340 page requests per hour, which was the highest number of page requests the website had experienced all year- roughly 20,000 more page requests per hour than the October 8 peak. Despite this jump, the website scaled to meet the traffic and continued to make information available to customers and Public Safety Partners.

On what date or dates were the PG&E website's technology and process upgrades in place that allowed it to successfully manage subsequent large-scale PSPS events?

ANSWER 38

PG&E had several technology and process upgrades implemented to support subsequent large-scale PSPS events. On October 9th, File Download was migrated to AWS and Outage Map's AWS servers were ramped up to support increased volume. On October 21st, a partnership with Akamai, a large content distribution network, was implemented and Address Lookup Tool was migrated to AWS. See PG&E testimony, pp. 4-13, lines 22 through 30 for a description of Akamai services. See also PG&E's Bi-Weekly Report (dated 2/10/20), pp. 3-4 for a listing of other improvements.

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Data Response

PG&E Data Request No.:	MGRA_002-Q39		
PG&E File Name:	De-EnergizePowerLines_DR_MGRA_002-Q39		
Request Date:	February 10, 2020	Requester DR No.:	002
Date Sent:	February 24, 2020	Requesting Party:	Mussey Grade Road Alliance
PG&E Witness:		Requester:	Joseph Mitchell/ Diane Conklin

QUESTION 39

If, based on data from the September 23/25 PSPS events and subsequent load testing based on those results, PG&E had engaged its Second Watch, AWS, ESRI and Akamai partners, is it likely that the website outage associated with the October 9-12 PSPS event would have been avoided?

ANSWER 39

PG&E objects to this request to the extent that it assumes facts not in evidence, including facts related to the dates when Second Watch, AWS, ESRI and Akamai were engaged. PG&E also objects to this request as vague and ambiguous, including because the phrases "data from the September 23/25 PSPS events," "subsequent load testing based on those results," and "engaged" are not clear. PG&E furthermore objects to this question for asking PG&E to speculate.