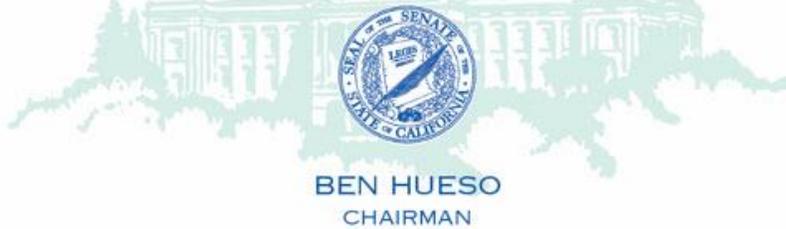


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## OVERSIGHT HEARING

### Keeping the Power On: A Focus on Electricity Reliability

#### BACKGROUND

State Capitol, Senate Chamber  
Wednesday, August 25, 2021  
1:30pm

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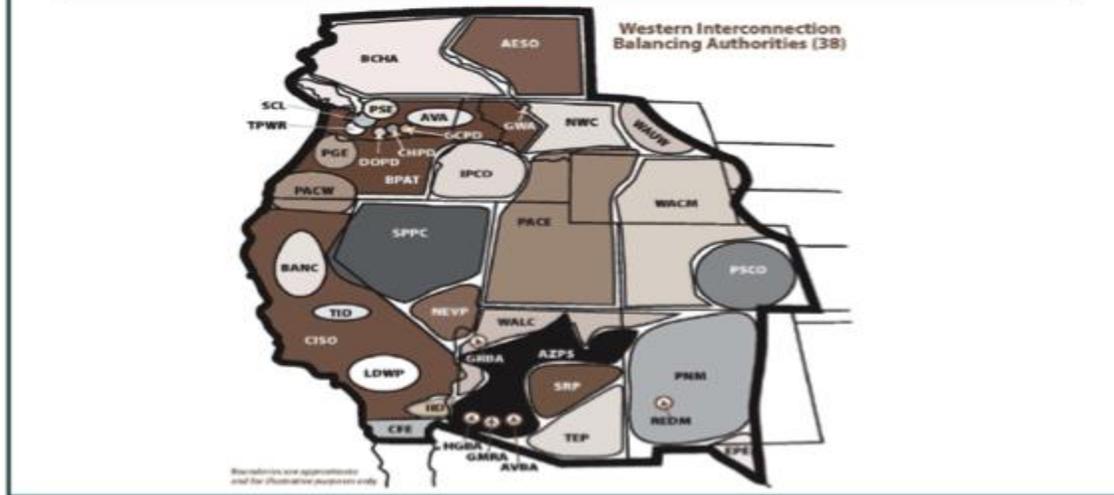
For the first time in twenty years, California experienced rotating electricity outages when the electric grid operator, the California Independent System Operation (CAISO), forced electricity outages in order to balance electricity supply and demand on Friday, August 14 and Saturday, August 15, 2020. The outages occurred in the midst of an extreme heat wave affecting much of the western United States. The August 14<sup>th</sup> rotating outages caught many by surprise and resulted in the loss of power during the evening hours to nearly 500,000 customers within the CAISO footprint for a duration of 15 minutes to nearly two and a half hours, depending on the utility service territory. The August 15<sup>th</sup> rotating outages affected fewer customers for a shorter duration, specifically 321,000 customers experienced rotating outages ranging between eight minutes to one and a half hours, depending on the utility service territory. These events occurred at a time when temperatures were soaring and Californians were relying on electricity to both operate air conditioning in order to keep cool and to maintain connectivity, as many were working or staying home in order to reduce the risk of infections from the COVID-19 pandemic. The purpose of today's hearing is to learn what actions are being taken in order to mitigate against the potential for future widespread rotating outages and to better prepare the electric grid for extreme heat events.

## **BACKGROUND**

*Western United States Heatwave.* From August 14 through August 19, 2020, the western United States suffered an intense and prolonged heatwave affecting many areas across the Western Interconnection (the electrical grid in the western portion of the country, roughly from the Rockies and Great Plains to the western shore). During this time, Death Valley set a record for the hottest temperature ever recorded on Earth – 130 degrees Fahrenheit on August 16! The heatwave resulted in temperatures 10-20 degrees higher than normal, including higher than normal overnight temperatures. Electric generation and transmission capacity was strained to keep up with the increased electricity demand – setting a peak demand record in the Western Interconnection of just over 162,000 megawatts (MW) on August 18, 2020. Many balancing authorities (BAs) were forced to declare energy emergencies as they were unable to meet their load obligations, including the CAISO and five BAs outside California.

*Balancing Authorities (BA).* A “balancing authority” is an entity responsible for managing the transmission of high-voltage electricity across long-distance transmission lines. Maintaining the electric grid necessitates the need to balance supply and demand in real-time, otherwise the entire system is at risk of shutting down. A BA has several ways to maintain the balance of supply and demand, from turning on or off generators, to encouraging conservation, to importing or exporting excess electricity to or from their neighbors. The CAISO oversees the largest BA in California, overseeing management of the electric grid for 80 percent of the state. (In addition to its BA responsibilities, the CAISO also oversees the wholesale electricity market.) Other BAs in California, include: Los Angeles Department of Water and Power, Balancing Authority of Northern California (which includes Sacramento Municipal Utility District), Turlock Irrigation District, and Imperial Irrigation District. Unlike the CAISO, most of these BAs are vertically integrated publicly owned electric utilities who operate their own electric grids, balancing supply and demand for their own electric load. There are 38 separate BAs operating across the interconnected western United States (known as the Western Interconnect), as shown below:

## WECC Balancing Authorities



*Rotating outages.* On August 14, 2020, the CAISO found itself lacking enough resources to meet the system demand. As a result, and in adherence to reliability protocols, the CAISO issued emergency alerts which were escalated to a need to shed energy load in order to prevent catastrophic uncontrolled outages and, potentially affect neighboring BAs in the Western Interconnect. Actual system loads on August 14 reached about 46,750 MW, about 1,000 more than the day-ahead forecast. Peak load on Saturday August 15 reached about 45,000 MW, similar to the day-ahead forecast.

Below are two tables noting the specific minutes and utility service territory that experienced the August 2020 rotating outages within the CAISO footprint, as detailed in the *Final Root Cause Analysis* report:

Friday, August 14 - CPUC –Jurisdictional Customers Affected by Rotating Outages						
Service Territory	Customers	CAISO-Initiated rotating outage (MW)	IOU Actual response (MW)	Duration (in minutes)	Start Time	End Time
SCE	132,000	400	400	63	6:56 PM	7:59 PM
PG&E	300,600	460	588	~150*	6:38 PM	~9:08 PM
SDG&E	59,000	71.6	84	~15-60		
<b>TOTAL</b>	<b>491,600</b>	<b>931.6 MW</b>	<b>1,072 MW</b>	<b>15 to 150 minutes</b>		

Saturday, August 15 - CPUC –Jurisdictional Customers Affected by Rotating Outages						
Service Territory	Customers	CAISO-Initiated rotating outage (MW)	IOU Actual response (MW)	Duration (in minutes)	Start Time	End Time
SCE	70,000	200	200	8	6:43 PM	6:51 PM
PG&E	234,000	230	459	~90*	6:25 PM	~7:55 PM
SDG&E	17,000	35.8	39	~15-60		
<b>TOTAL</b>	<b>321,000</b>	<b>465.8 MW</b>	<b>698 MW</b>	<b>15 to 90 minutes</b>		

*\*The duration of the rotating outages experienced by PG&E customers significantly exceeds the load shed duration called by the CAISO. PG&E utilized a protocol that required manual switching using field personnel, resulting in longer-duration outages. PG&E has since updated its procedures to allow for more expedient restoration of power flow.*

*Root causes identified.* Governor Newsom, working with the California Public Utilities Commission (CPUC), California Energy Commission (CEC), and CAISO took emergency actions in order to prevent additional rotating outages that week, as the Western United States heatwave continued to challenge electricity grid operations. However, the threat of the loss of power and the need for all-hands on-deck emergency actions raised concerns about the State’s ability to prepare the electric grid for future extreme heat events. In the aftermath, Governor Newsom requested the CAISO, CPUC, and CEC, report on the root causes of the events leading to the August outages. The CAISO, CPUC, and CEC released a *Preliminary Root Cause Analysis* report on October 6, 2020, and continued their analysis to confirm and supplement findings, releasing a *Final Root Cause Analysis: Mid-August 2020 Extreme Heat Wave* report on January 13, 2021.

The report identified three major causal factors contributing to the August outages:

- 1. The climate-change-induced extreme heat wave across the western United States resulted in demand for electricity exceeding existing electricity resource adequacy (RA) and planning targets.**

Taking into account 35 years of weather data, the extreme heat wave experienced in August was a 1-in-30 year weather event in California. In addition, this climate change induced extreme heat wave extended across the western United States. The resulting demand for electricity exceeded the existing electricity resource planning targets and resources in neighboring areas were also strained.

- 2. In transitioning to a reliable, clean, and affordable resource mix, resource planning targets have not kept pace to ensure sufficient resources that can be relied upon to meet demand in the early evening**

**hours. This made balancing demand and supply more challenging during the extreme heat wave.**

The rotating outages both occurred after the period of gross peak demand, during the “net demand peak,” which is the peak of demand net of solar and wind generation resources. With today’s new resource mix, behind-the-meter and front-of-meter (utility-scale) solar generation declines in the late afternoon at a faster rate than demand decreases. This is because air conditioning and other load previously being served by solar comes back on the bulk electric system. These changes in the resource mix and the timing of the net peak have increased the challenge of maintaining system reliability, and this challenge is amplified during an extreme heat wave.

**3. Some practices in the day-ahead energy market, operated by the CAISO, exacerbated the supply challenges under highly stressed conditions.**

A subset of energy market practices contributed to the inability to obtain or prioritize energy to serve CAISO load in the day-ahead market that could have otherwise relieved the strained conditions on the CAISO grid on August 14 and 15. The practices which obscured the tight physical supply conditions included under-scheduling of demand in the day-ahead market by load serving entities or their scheduling coordinators, and convergence bidding, a form of financial energy trading used to converge day-ahead and real-time pricing. In addition, the CAISO implemented a market enhancement in prior years. In combination with real-time scheduling priority rules, this enhancement inadvertently caused the CAISO’s day-ahead Residual Unit Commitment process to fail to detect and respond to the obscuring effects of underscheduling and convergence bidding during August’s stressed operating conditions. Although the CAISO is now actively developing solutions to these market design issues, most of the day-ahead supply challenges encountered were addressed in the real-time market as a result of additional cleared market imports, energy imbalance market transfers and other emergency purchases.

*Actions identified to mitigate against widespread outages.* In response to the findings of the causes of the rotating outages, the CAISO, CPUC, and CEC have been implementing several actions identified in the Report to better prepare the electric grid for Summer 2021 and beyond, including, among others:

- CPUC directing the electric investor-owned utilities to seek additional supply-side capacity and additional demand-side resources, especially during the net peak period (i.e. the hours past the gross peak when solar production is very low or zero).
- CAISO performing analysis supporting an increase to the CPUC’s Resource Adequacy program procurement targets which at the time of the outages had required 15 percent in reserves for all load-serving entities (the targets have since been increased).
- CAISO making market rule and practice changes by June 2021 that will ensure the CAISO’s market mechanisms accurately reflect the actual balance of supply and demand during stressed operating conditions.
- CPUC tracking progress on generation and battery storage projects that are currently under construction in California to ensure there are no CPUC-related regulatory barriers that would prevent them from being completed.
- CEC conducting probabilistic studies that evaluate the loss of load expectation on the California system to determine the amount of capacity needed to meet the desired service reliability targets.

For a full list of identified actions, the CPUC, CEC, and CAISO have provided an updated table listing all the identified recommended actions and their status, the document is attached and titled “Combined Energy Resource Planning and Procurement Actions, August 2021.”

*Context about the impacts of the August Rotating Outages.* Californians rely on electricity to power not only lights, but also air conditioning, refrigeration for food, medicine, and vaccines, clean water supply, devices to maintain connectivity, traffic signals, and in some cases medical equipment to sustain life, and many other operations. In short, electricity has become an essential service to support modern life. Therefore, any unexpected (and even expected) loss of power can pose inconveniences, challenges, and potential harm. The August 2020 rotating electricity outages were unexpected, particularly as many Californians were sheltering at home to protect against COVID-19 infections and to keep cool from the heatwave. However, it is important to note that the rotating outages that occurred in August, while unexpected, were in most cases shorter in duration than many of the proactive power shutoffs (coined as Public Safety Power Shutoffs – PSPS) that some utilities have employed to reduce the risk of their infrastructure igniting a fire. This is especially true in comparison to the widespread PSPS events in the fall of 2019, given that several of those PSPS events lasted for several days and affected over a million customers. On the other hand, the August 2020 rotating

outages were much shorter in duration (at most 2.5 hours, and in some cases only 8 minutes). In general, rotating outages are rotated from geographic areas by the load-serving entities, when directed by the CAISO to curtail load, in order to avoid affecting one area for an extended duration. Yet, customers are likely to confuse rotating outages with distribution-level outages resulting from the impacts of the heatwave on electric utility distribution infrastructure. This was noticeable during the subsequent heatwave over the Labor Day weekend when there was widespread media attention about the potential for additional rotating outages which were successfully avoided due to the numerous emergency actions. However, distribution-level outages seemed to be rampant based on utility outage maps at the time, with many lasting several hours and in some cases days. Anecdotally, some of the customers who experienced distribution-level equipment related outages assumed they were experiencing rotating outages. However, such confusion illustrates that from a customer perspective the source of the outage is likely less of a concern as compared to the duration and frequency of outages, whether rotating, PSPS, equipment failures, or maintenance.

Nonetheless, the rotating outages experienced in August, along with subsequent potential threats of rotating outages since then, raises questions about the ability of the electric grid operator and state agencies to better prepare for future extreme heat events, which may become more frequent and intense due to climate change. The August 2020 events could be a harbinger of future more widespread and longer duration rotating outages, if improvements in planning and preparedness are not implemented. Moreover, the net-peak load, when electricity demand is still high and variable solar and wind generation (including rooftop solar) may be no longer producing, presents a challenge for the electric grid operator to ensure other resources are available to match the demand. While this is a challenge, it is one that the three entities have been working to address. However, the August 2020 rotating outages underscore the need to ensure all aspects of procurement planning and forecasting are accounting for the changing climate reality and the changes in procurement resources, even as California continues to push towards reducing its climate emissions and transition to clean energy.

Today's hearing will provide members of this committee the opportunity to hear directly from the CPUC, CEC, and CAISO about their progress in keeping the power on for Summer 2021 and beyond. Additionally, the hearing will help members of the committee ensure the state is making progress to appropriately prepare the electric grid for future extreme heat events. Members of the committee may wish to consider:

- Which of the identified actions have the CAISO, CPUC, and CEC implemented to address the near-term electricity supply and demand expected during extreme heat events, especially during the net-peak load?
- Which actions have not been accomplished as planned? What are the hurdles?
- Which, if any, identified actions have been adjusted?
- How are the three entities (CAISO, CPUC, CEC) ensuring that energy procurement planning and forecasting is better accounting for changes in electricity demand and supply across the western United States and the related impacts on available imports?
- How has forecasting and procurement planning since summer 2020 improved accounting for de-rating of generation and transmission facilities during extreme heat events?
- How are the entities improving demand forecasting since summer 2020? What additional tools are needed to continue to refine forecasting?
- What have we learned about the performance of programs to address demand, including demand response, Flex Alert, etc.?
- How have findings by other entities regarding the August 2020 events informed the need for additional actions for better planning and preparedness, including those identified by the Western Electricity Coordinating Council (WECC) and the CAISO Department of Market Monitoring?
- How are transmission constraints better addressed in planning for future extreme heat events?
- How is affordability informing the decisions regarding reliability?