

California's Outages Blamed On Warming Climate

Extreme heat played a role but it was the "Duck Curve" that ultimately got CAISO

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Following a request by the California Governor **Gavin Newsom** to find the root cause of the outages in mid Aug 2020, the 3 agencies responsible for keeping the lights on released a report on 6 Oct. titled **Preliminary root cause analysis: Mid Aug 2020 heat storm**.

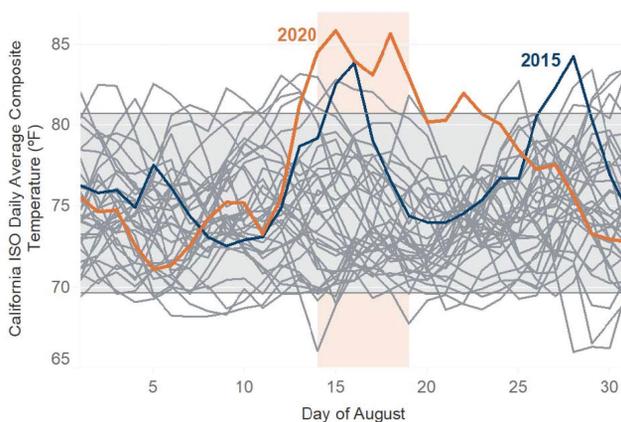
Apologetically, the **California Independent System Operator** (CAISO), the **California Public Utilities Commission** (CPUC), and the California Energy Commission (CEC) said that they recognize their "... shared responsibility for the power outages many Californians unnecessarily endured." Good way to start, with an apology and a pledge not to let it happen again.

They said several factors, in combination, led to the need for the CAISO to order the rotating outages including:

- The **climate change-induced extreme heat** across the western US, which resulted in the demand for electricity to exceed the planning targets and available resources;
- Admission that the actual resources have not kept pace with the demand, particularly in the early evening hours – the neck of the **California "Duck Curve,"** and
- Some deficiencies in the **day-ahead energy market**, which exacerbated the supply shortages under highly stressed conditions.

The joint report said, "... it is our responsibility and intent to plan for such events, which are becoming increasingly common in a world rapidly being impacted by climate change."

6 hot days from hell, much worse and persistent than in 2015



Source: Preliminary root cause analysis: Mid Aug 2020 heat storm, 6 Oct 2020

With the recent devastating wildfires, still burning, the impact of climate change is not disputed in the West.

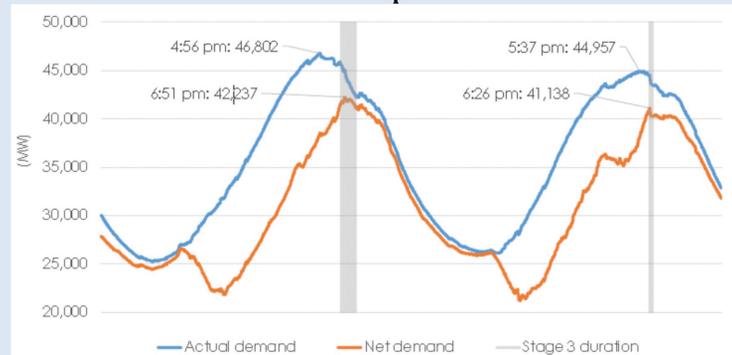
- "From August 14 through 19, 2020, the Western US as a whole experienced an extreme heat storm, with temperatures 10-20 degrees above normal. During this period, California experienced 4 out of the 5 hottest August days since 1985; August 15 was the hottest and August 14 was the third hottest. This heat event was the equivalent of the hottest year of 35."

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See footnotes at end of text.

Peak net load is the one to watch not peak demand



Source: Preliminary root cause analysis: Mid Aug 2020 heat storm, 6 Oct

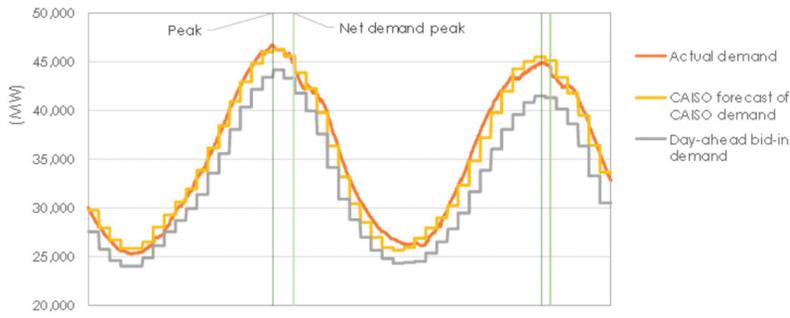
What happened on 14-15 Aug is not in dispute either. CAISO has to maintain minimum reserves at all times, approximately equal to 6% of the load. At 6:38 pm on 14 Aug it was forced to initiate rotating outages for about an hour affecting roughly 492,000 customers for 15 to 150 minutes (Table).

As often happens, CAISO's **net demand**, that is demand minus solar and wind generation, peaked at 6:51 pm after the sun had already set.

On the following day, Saturday 15 Aug, a Stage 3 Emergency requiring rotating outages was declared at 6:28 pm for 20 minutes, 2 minutes prior to the net demand peak at 6:26 pm, affecting 321,000 customers for 8 to 90 minutes.

To be sure, mid Aug was unusually hot and not just in California. Between August 14 through 19, California experienced state-wide extreme heat with temperatures ranging 10-20 degrees F above normal exposing 32 million residents to extreme heat. Across the West, some 80 million people fell within an excess heat watch or warning (map below).

Fix the day-ahead bidding in CAISO market



Source: Preliminary root cause analysis: Mid Aug 2020 heat storm, 6 Oct 2020

dreaded “duck curve” fell victim to it at last.

The report notes that it is not the **traditional peak demand**, which occurs in midafternoon, that breaks the system but **net load peak**, which happens in the early evening hours after the sun has gone down – while the demand remains high. It said, “The net demand peak is becoming the most challenging time period in which to meet demand.” This, however, should not have come as a surprise to anyone at CAISO.

On Aug. 14, the *net demand peak* of 42,237 MW at 6:51 pm was 4,565 MW less than the *peak demand* 2 hours earlier

while solar (and to a less extent, wind) generation had decreased by 5,431 MW, according to the report.

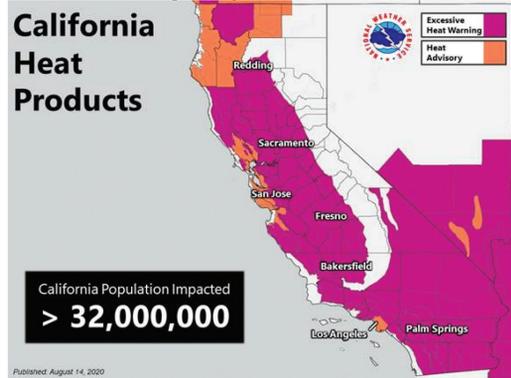
Other major deficiencies of the current market is the lack of adequate **demand response (DR)** – many reasons why this is the case. While the details are still being investigated, DR programs reduced load by an estimated 1,200 MW on Aug. 14 and about 1,000 MW on the following day, a fraction of the technical potential. Why so little? Perhaps the retail prices are not right. It is a long story.

Other factors contributed. During the 2 critical days, a transmission line sending power from the Pacific Northwest went offline because of the heat, reducing the flow by 330 MW while other lines were threatened by raging forest fires. Wind was more-or-less non-existent when it was needed, and solar output was adversely affected by smoke from the fires and the clouds. Making matters worse, some practices in the CAISO’s day-ahead energy market exacerbated the challenges – it is complicated (Box).

What needs to be done? The agencies said they would work together to:

- Update current resource adequacy (RA) and reliability planning targets to better account for future heat storms;
- Expedite on-time construction of generation and storage projects including additional procurement by non-CPUC jurisdictional entities;

80 million people exposed to extreme heat in the West in mid-Aug, not just in California



Source: Preliminary root cause analysis: Mid Aug 2020 heat storm, 6 Oct 2020

The report is a must read for the technical types, perhaps a tad too technical for others. Its main message is that

- CAISO – who is ultimately responsible for keeping supply and demand in balance – underestimated the resources it needs;
- Forecasts by CAISO, and everyone else, were off especially given the extreme heat;
- Resources that are normally available to meet the peak demand, both natural gas and renewables, fell short;
- Imports from out of state, which typically fill the gap, were constrained because the entire Western US was experiencing unusually high demand; and
- CAISO, having talked incessantly since 2012 about the challenges of meeting the neck of the

Glitches in market rules and software allowed exports out of California

During California’s last **electricity crisis in 2000-01**, manipulating power traders including **Enron**, were able to take advantage of loopholes in the market rules that allowed them to fictitiously ship power out of state at low costs and buy it back at much higher prices, making obscene profits in the midst of the power shortages.

As it happens, unintended market rules in the CAISO day-ahead market bidding plus glitches in the software allowed scarce resources to be shipped out of California while the reverse should have happened. Buried amidst technical details, CAISO said that its **Residual Unit Commitment (RUC)** model erroneously led dispatchers to believe that approx. 4,000 MW of power *exports*, could be supported during the crisis days in mid-Aug. We now know that should not have happened.

Starting on Sunday 16 Aug, CAISO began to cut the erroneous exports and suspended the so-called **convergence bidding**. It apparently took 3 weeks for CAISO programmers to detect the technical flaws and fix the glitch. It says the software has been fixed, fingers crossed. ■

- Expedite procurement of additional DR and flexible resources by summer of 2021; and
- Amend CAISO market rules in the day-ahead market to better reflect the actual balance of supply and demand during stressed operating conditions.

None are easy to do. All will be needed if California is to avert future outages in the years ahead. **Elliot Mainzer**, the new CEO of the CAISO said, "We are committed to working with the Governor's office, state agencies, and the broad set of stakeholders in California and across the Western US to accelerate our efforts to reliably decarbonize the electricity grid." Just what you expect the CAISO's CEO to say after an embarrassing outage.

Not everyone was pleased with the assessment. According to a 13 Oct article in the *CA Current*, **Jim Patterson**, the vice-chair of the **California Assembly**

Utilities & Energy Committee publicly castigated the state's 3 energy agencies, claiming their report was essentially finger pointing and excuses. The agencies blamed the extreme heat – a 1 in 35-year event – as the main culprit. Patterson insisted that the outages were because of reductions in fossil fuel capacity and the rise in renewables. The former is true, the latter not – renewables were not to blame.

CAISO's outgoing CEO **Steve Berberich** begged to differ, noting that renewables have served up to 80% of the system load. Other experts also testified on remedies to prevent future outages, including additional flexible resources specifically available after sundown, more DR, more and longer duration storage, and so on.

CPUC President **Marybel Batjer** said 2,400 MW of additional resources are expected to be online by next summer with plans to increase RA levels by 2022. ■

<http://www.aiso.com/Documents/Preliminary-Root-Cause-Analysis-Rotating-Outages-August-2020.pdf>

Footnotes

¹ The original appeared in the Nov 2020 issue of EEnergy Informer newsletter available at <http://www.eenergyinformer.com>

Numbers of customers affected by mid-Aug outages in California

	Customers	MWs	Time (in mins)	Start	Finish
SCE	132,000	400	63	6:56 PM	7:59 PM
PG&E	300,600	588	~150	6:38 PM	~9:08 PM
SDGE	59,000	84	~15-60		
Total	491,600	1,072	15 to 150 mins		

Source: Preliminary root cause analysis: Mid Aug 2020 heat storm, 6 Oct 2020