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Blaming the innocent; Praising the Uninvolved

It is difficult to read the October 6, 2020 report "Preliminary Root Cause Analysis: Mid-August 2020 Heat Storm" from the California ISO, CPUC, and CEC without a sense of humor. The report blames the innocent (global warming) and rewards the uninvolved (Governor Newsom). However, it does shed light on why the best funded balancing authority on the West Coast was the only organization that required rolling blackouts during hot weather on August 14th and 15th.[1]

A good place to start is with the facts. What went wrong?

The August rolling blackouts were a policy, rather than an operational, decision. A combination of poor reliability planning, high loads, high resource outages, and computer programming issues led the ISO to initiate rolling blackouts.

Overall, the California ISO reports a reserve margin of 15%, within a state with a 20.9% reserve margin, and a region with a 22.7% reserve margin.[2,3,4] This is, by historical operating standards, an excellent reserve margin for facing a hot summer day. The North American Electric Reliability Corporation's (NERC) required reserve margin for California was only 13.7%.[5]

Planned and forced outages at the California ISO were a serious challenge. The loss from outages for the 14th was 5,424 MW and for the 15th was 6,490 MW.[6,7] The ISO predicted that their August capacity was 46,903 MW.[8] This would correspond to an outage rate of 11.6% on the 14th, increasing to 13.8% the next day. These are very high loss rates. NERC maintains a database of outage rates (GADS). Here is the summary of values from 2015 through 2019:

[1] The California ISO's 2019 FERC Form 1, page 114 puts the ISO's income at over $200 million.
[2] Preliminary Root Cause Analysis, Mid-August 2020 Heat Storm, CAISO/CPUC/CEC, October 6, 2020, page 18.
[3] 2020 Summer Reliability Assessment, NERC, June 2020, page 32.
[4] Ibid.
[5] Ibid.
[6] http://content.caiso.com/unitstatus/data/unitstatus202008150830.html
[7] http://content.caiso.com/unitstatus/data/unitstatus202008160830.html
[8] 2020 Summer Loads and Resources Assessment, CAISO, May 15, 2020, page 15.

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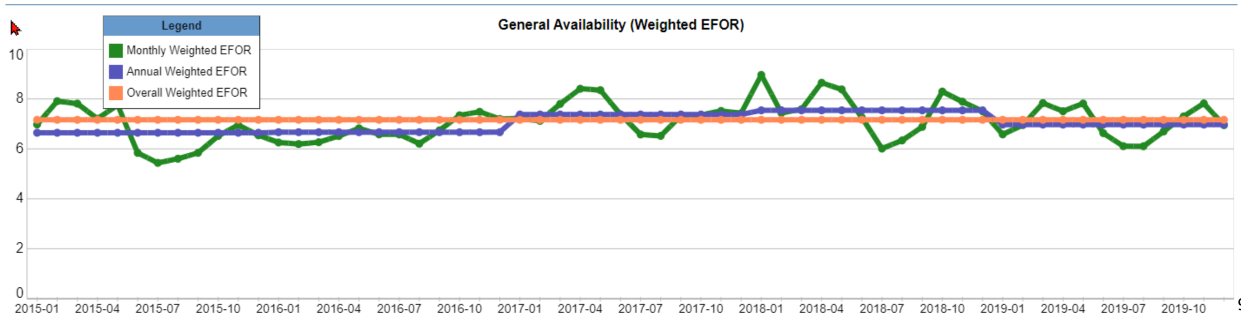

[9]

The August 15th outage levels are unusually high for a large diversified system.

On the other hand, the ISO's forecasted peak loads on the rolling blackout days were relatively close to actuals.

Table 5.1: Day-Ahead Peak Forecast vs. Actual Peak During Heat Event

	Day-Ahead Peak forecast (MW)	Actual Peak (MW)	Difference (MW)
8/14/2020	46,257	46,797	540
8/15/2020	45,514	44,947	(567)
8/16/2020	44,395	43,815	(580)
8/17/2020	49,825	45,152	(4,673)
8/18/2020	50,485	47,118	(3,367)
8/19/2020	47,382	46,023	(1,359)

[10]

The forecasts for the days with rolling blackouts were good. However, their forecasted peak load was 45,907.[11] This is based on an unusual "1 in 2" peak forecasting methodology. This, as is addressed in the preliminary report, is not so good.

A traditional utility planner would not view this as acceptable. The California ISO adds in expected imports in order to fix the problem – the utility term for this is "leaning on the neighbors." There are a number of reasons why assuming that imports will be available during hot weather isn't a common practice in utility reliability planning:

1. The assumption that warm conditions would not affect neighboring systems is incorrect.

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[9] https://www.nerc.com/pa/RAPA/Pages/GeneralAvailabilityReview.aspx
[10] Preliminary Root Cause Analysis, Mid-August 2020 Heat Storm, CAISO/CPUC/CEC, October 6, 2020, page 60.
[11] 2020 Summer Loads and Resources Assessment, CAISO, May 15, 2020, page 19.

2. Transmission outages – especially those interties that pass through mountainous and forested terrain – are subject to significant outages. The massive intertie north to the Pacific Northwest is specifically a concern given increasing wildfire risks.
3. The economics of reliability planning that are not based on firm contracts is doubtful at best.
4. Although the ISO performs a massive modelling effort with thousands of runs, the accuracy of the model is only as good as its assumptions. The assumptions concerning Pacific Northwest hydro operations are inadequate.[12]

Simply put, CAISO's existing reliability planning methodology would not be acceptable anywhere outside of California.

The Preliminary Root Cause Analysis admits as much on page 43:

> "● The climate change-induced extreme heat storm across the western United States resulted in the demand for electricity exceeding the existing electricity resource planning targets. The existing resource planning processes are not designed to fully address an extreme heat storm like the one experienced in mid-August."[13]

Translated into normal English, this paragraph effectively says that leaning on the neighbors does not work if the weather is bad. A better paragraph might have said "leaning on neighboring systems without firm capacity and transmission contracts is expensive and undependable."

Page 43 goes on to address two other "root causes":

> "● In transitioning to a reliable, clean, and affordable resource mix, resource planning targets have not kept pace to lead to sufficient resources that can be relied upon to meet demand in the early evening hours."[14]

True. Every utility in North America is addressing the challenge of integrating low cost intermittent renewable resources into their systems. On August 14th and 15th only one system failed to do so. Any number of studies have indicated that the California ISO needs more energy storage and/or quick start gas turbines. This paragraph might well have been rewritten as "global warming snuck up on us." So, indeed, it did.

The most interesting paragraph on page 43 states:

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[12] "The Northwest River Forecast Center projected the April to August reservoir storage at The Dalles Dam on the Columbia River to be 95 percent of average. Since the 2019 – 2020 snow water content and reservoir levels are similar to 2017 – 2018 levels, the 2018 hydro generation profile was selected for the 2020 modeling process." This assumption misses the entire operating nature of the Columbia and Peace Rivers. It is highly imprudent to assume that current hydro operations will mirror a specific historical year.

[13] Preliminary Root Cause Analysis, Mid-August 2020 Heat Storm, CAISO/CPUC/CEC, October 6, 2020, page 43.

[14] Ibid.

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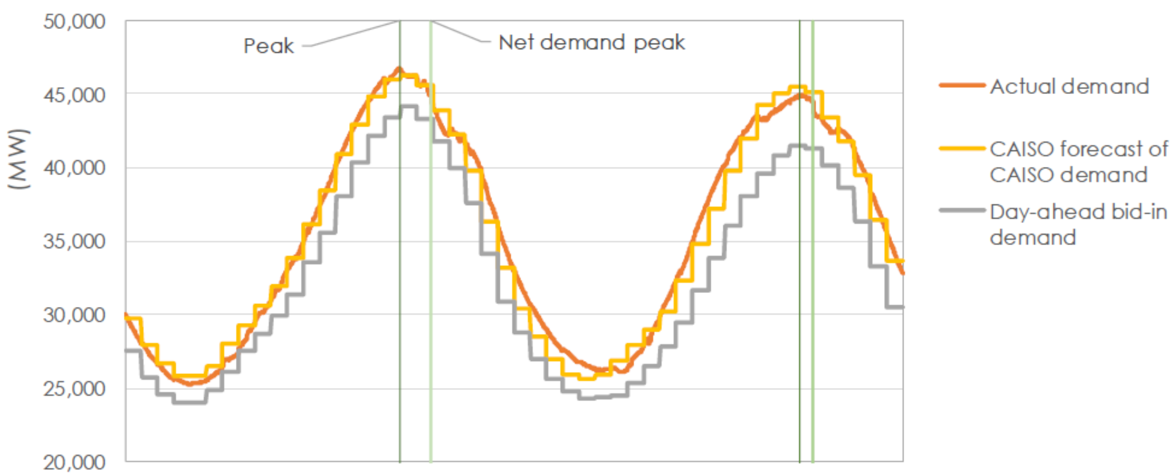
> "• Some practices in the day-ahead energy market exacerbated the supply challenges under highly stressed conditions."[15]

A recommended rewrite of this paragraph might well be "we have some very embarrassing problems to report."

The report indicates two specific problems and may be referencing, depending on a careful reading of the torturous text, an even more significant problem of market manipulation.

First, a central problem in the summer of 2000 was a practice by the three investor owned utilities to underbid their loads. By submitting bids less than actual loads, this created an apparent surplus in the day ahead market and produced lower day ahead prices. The shortfall would then need to be addressed in the real time market. Surprisingly, this practice appears to still be present in the ISO's California marketplace.

Figure 4.8: Comparison of Actual, CAISO Forecast, and Bid-in Demand



Day-ahead bid-in demand below actual:

	8/14	8/15
At peak:	3,386	3,434
Time of net demand peak:	1,792	3,219

[16]

It is very difficult to adjust generation schedules – especially for large shortfalls – unless a fleet of quick start turbines are available or substantial unloaded hydroelectric capacity is available. The right answer

[15] Ibid.
[16] Ibid., page 57.

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does not require new resources, however. The right answer is to identify the underbidding behavior and solve it prospectively.

Second, it appears that a computer programming error at the ISO treated financial transactions as being physical transactions.

Physical transactions involve a commitment to deliver an actual commodity at a specific time and place. Ordering a pair of shoes over the internet is a physical transaction. The buyer can depend on actually wearing the shoes when they are delivered. Alternatively, a financial transaction would allow you to gamble on the price of shoes falling or rising in the near future. If successful, the counterparty would send you a payment for the difference in the price offered today and the price that was actually charged later. You cannot wear these shoes. If you are planning on wearing financial shoes, you may well be barefoot later.

The market in question is called the convergence market. It allows "fixed for floating" transactions where the price in the day ahead market is compared with the price in the real-time market on the following day. The result is either a windfall or a bill. No actual energy is involved in such a transaction. Like the financial shoes above, the financial transaction will not drive air conditioners or illuminate homes.

A very opaque portion of the preliminary report can be found on pages 101 through 107. The reader can judge for themselves whether this passage communicates the problem adequately:

> The CAISO had previously applied the PIME to the RUC as a matter of applying PIME to all its markets. The PIME in the other markets is necessary because it is necessary to have consistency between energy schedules and prices. The lack of energy schedules in RUC obviates the need for PIME in the RUC process. As a result, starting from the day-ahead market for September 5, 2020, the CAISO stopped applying the PIME functionality to RUC process, which enabled it to use the scheduling run results for RUC schedules and awards instead of the pricing run results.[17]

This translates to "we applied an energy fix to the capacity calculations which overstated available capacity in the real time operations." It appears that the ISO created a computer programming adjustment so arcane that only when it contributed to rolling blackouts was the error corrected.

The solution appears to have worked. Although the peak loads on the 14th and 15th were high, even higher loads on August 18th and September 6th did not lead to rolling blackouts.

The computer problem might also have contributed to market manipulation:

> Similar to under-scheduled load, during conditions in which physical supply is scarce, cleared virtual supply can mask physical supply shortages and allow more demand

[17] Ibid., pages 105 and 106.

including low-priority exports to clear than what can be physically supported (refer to Figure B.28 illustration).[18]

Market participants can profit – enormously – from artificial shortages. This was the raison d'etre for a number of the trading schemes that crashed the California markets in 2000 and 2001. Convergence bidding – especially with the aforementioned computer problem – would provide an incentive to place unrealistic bids. If the bids helped create a shortage, the day ahead offer would be paid at high real time prices and the trader would receive a windfall. Best of all, no real energy is involved, so the only constraint on such a market scheme would be the appetite for risk of the trader involved.

Even worse, if the convergence bid was submitted by a generator whose unit could contribute to such a shortage if it went off line, this would be a powerful incentive to report unnecessary outages. Given the very high outage rates experienced by the ISO, this seems like a serious concern.

In a horse race, when you bet against your own horse and it loses the race, the authorities step in and test the horse for drugs. This seems like a good reason for FERC to carefully review convergence trades over this period. The decision by the ISO to close the convergence market after August 15th indicates that similar concerns might have occurred to them as well.

[18] Ibid, page 104.