

California's Rolling Blackouts and Near Blackouts in August and September 2020

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What Happened in August and September in California?

- Heat wave in California and nearby states in the West mid-August to early September
 - Heat waves not atypical for this time of year but this one was extreme
- As a result of the heat wave electricity demand increased significantly in California and across the West in mid-August and early September (and again October 1-3)
 - Up to 47,000 MW peak demand on August 14 -19 and September 5,6,7
 - Previous peak 50,000 MW in 2006 and 2017 without blackouts
 - But VRE, especially solar, generation has increased a lot as 10,000MW of gas capacity retired in the last few years
 - Attributes of “net demand” (customer demand seen by ISO minus wind + solar) are more and more relevant in high and growing VRE systems as in CAISO --- further complicated by BTM PV
 - Responding effectively to variations in net demand are more challenging with very high VRE penetration
 - CAISO has significant reliance on imports from outside but heat wave across the West reduced availability of import supplies
 - CAISO import/export rules are complicated
 - Western Balancing Market
 - California has a complicated “resource adequacy” process driven by the CPUC rather than the ISO

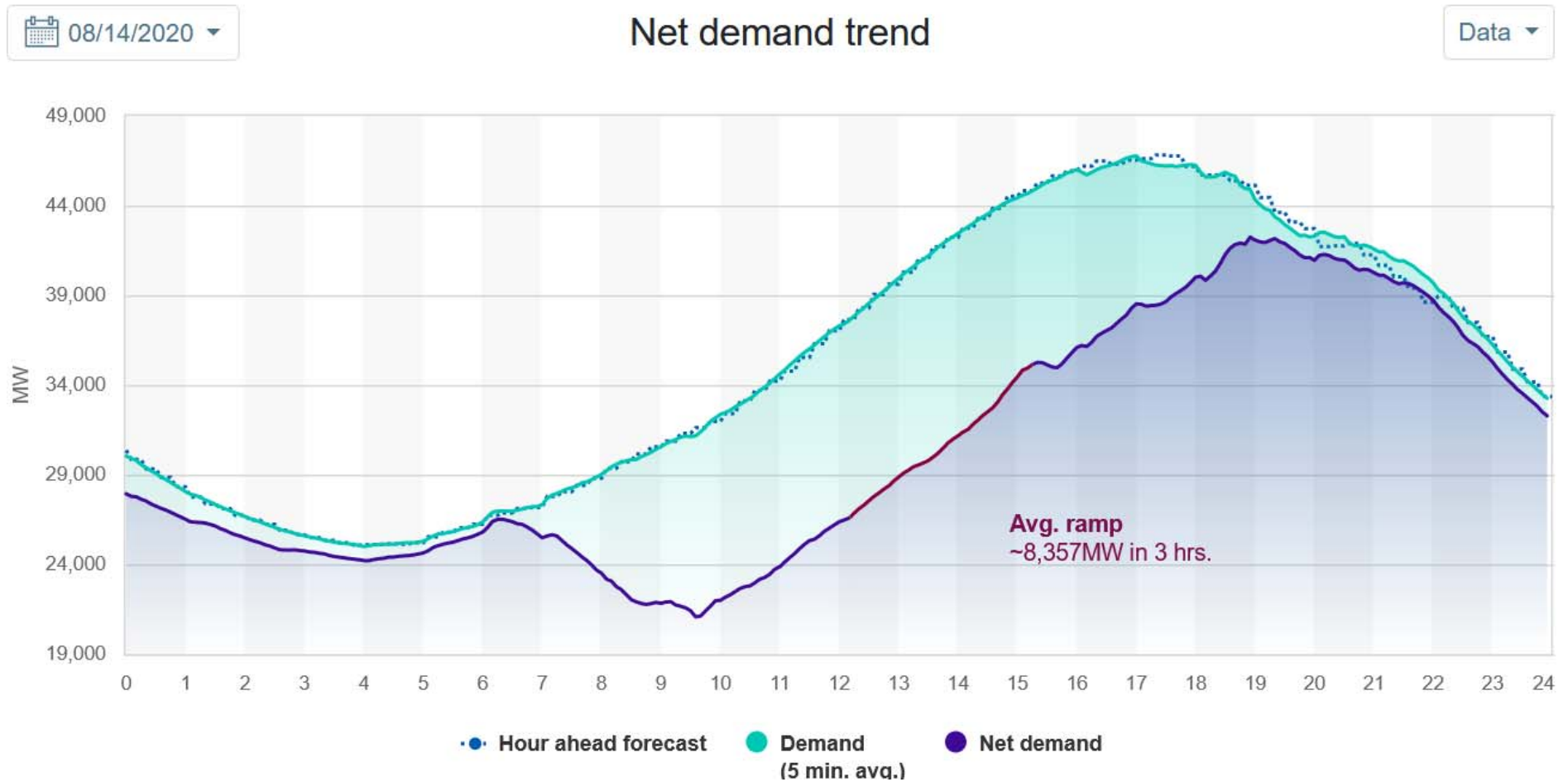
Actual and Near Rolling Blackouts

- Actual rolling blackouts only on August 14 and 15 and threatened rolling blackouts on August 17-19 and September 5-7, 2020
 - First rolling blackouts in California since 2001
 - August 14 OK solar generation day for the season (10 GW peak vs. 12 GW on good days in June/July), but a bit ragged, and relatively poor wind day
 - August 14 rolling blackouts 1000 MW for 2-3 hours ~ 6:30 to 8:30 PM
 - August 15 poor very ragged solar day and better wind day
 - But August 15 had sudden dip and then fast recovery in wind generation (~ 1200 MW), derating of NW transmission, loss of 470 MW fossil plant during evening net peak demand period
 - August 15 rolling blackouts for only about 20 minutes starting at 6:30 PM
 - August 18 OK but very ragged solar day and better wind day for season. Formal and informal demand response. No blackouts.
 - September 6 (4,000 MW generation deficiency forecast) Good solar and wind day for season. Formal and informal demand response. No blackouts

What Happened in August and September in California?

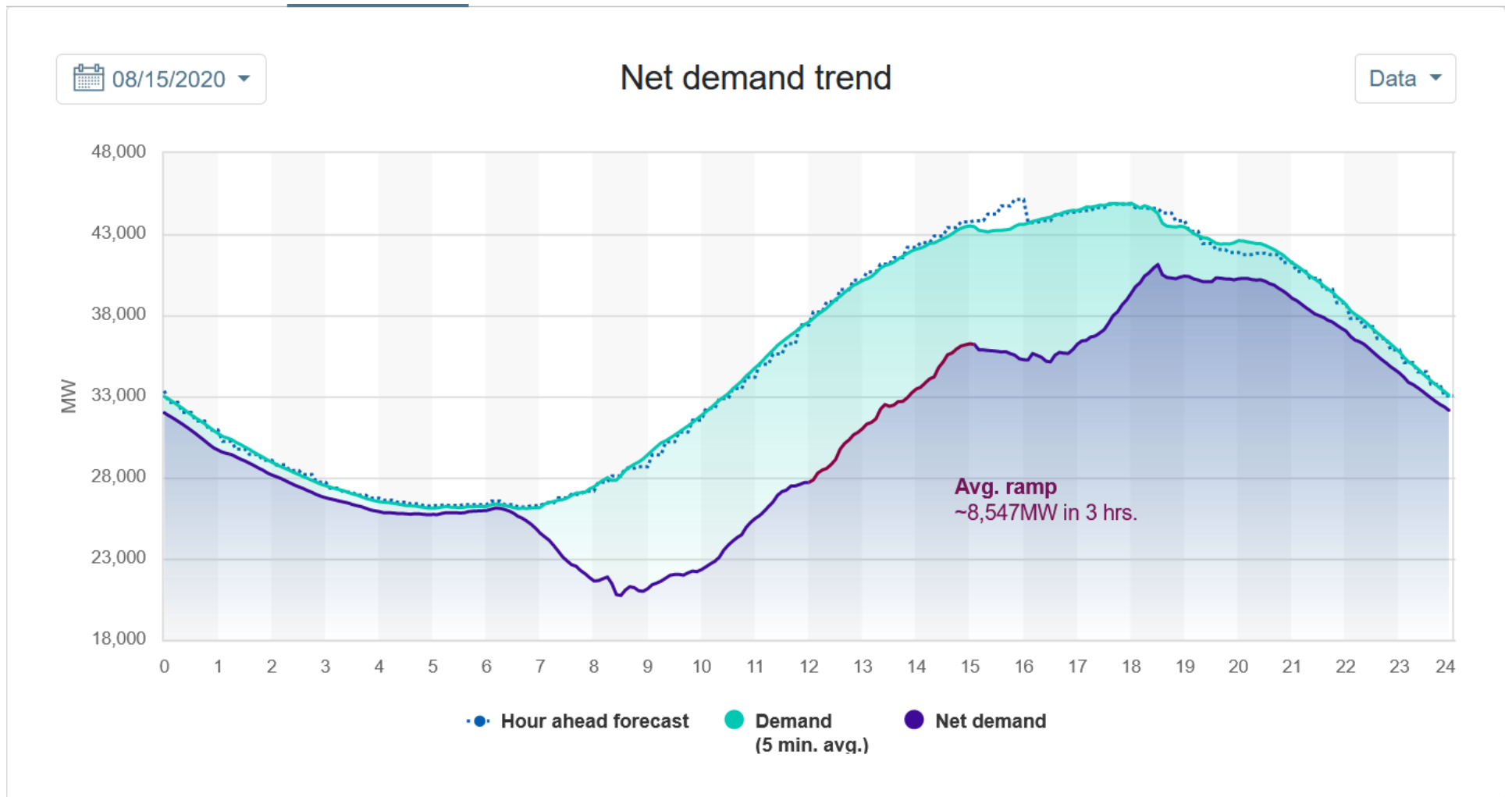
- The system was or was expected to be very stressed late afternoon/early evening on several days in August and September
- Formal demand response programs, voluntary conservation, and emergency actions by the ISO appear to have played important rolls in keeping rolling blackouts from being implemented on some of the Stage 2/3 Emergency days in mid-August and early September
- Market Monitoring Committee found that contribution of formal demand response programs appears to have been less than anticipated
- Market Monitoring Committee (MMC) has concluded that market manipulation (withholding) was not a contributing factor
- MMC has also concluded that wind and solar underperformed their RA values as gas capacity was derated by 3% due to heat
- MMC concluded that virtual demand bidding led to underestimation of demand
- Combination of exports and imports (at the same time) with different RA credits complicated operations and created some confusion about imports available
- The fires led to de-rating of one line from the NW at least on August 15 and a reduction in solar radiation a bit later.

Net Demand August 14, 2020

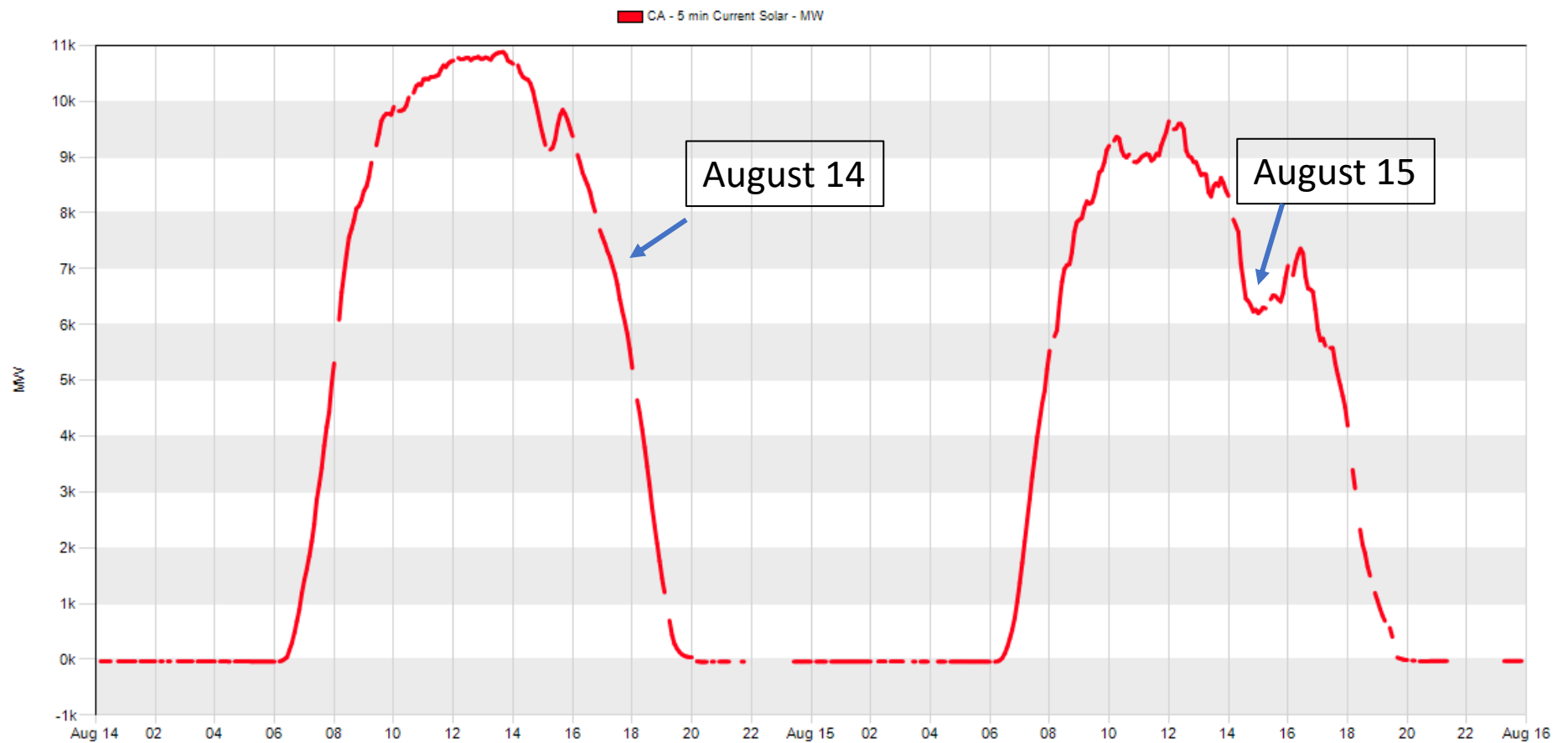


CAISO

Net Demand August 15, 2020

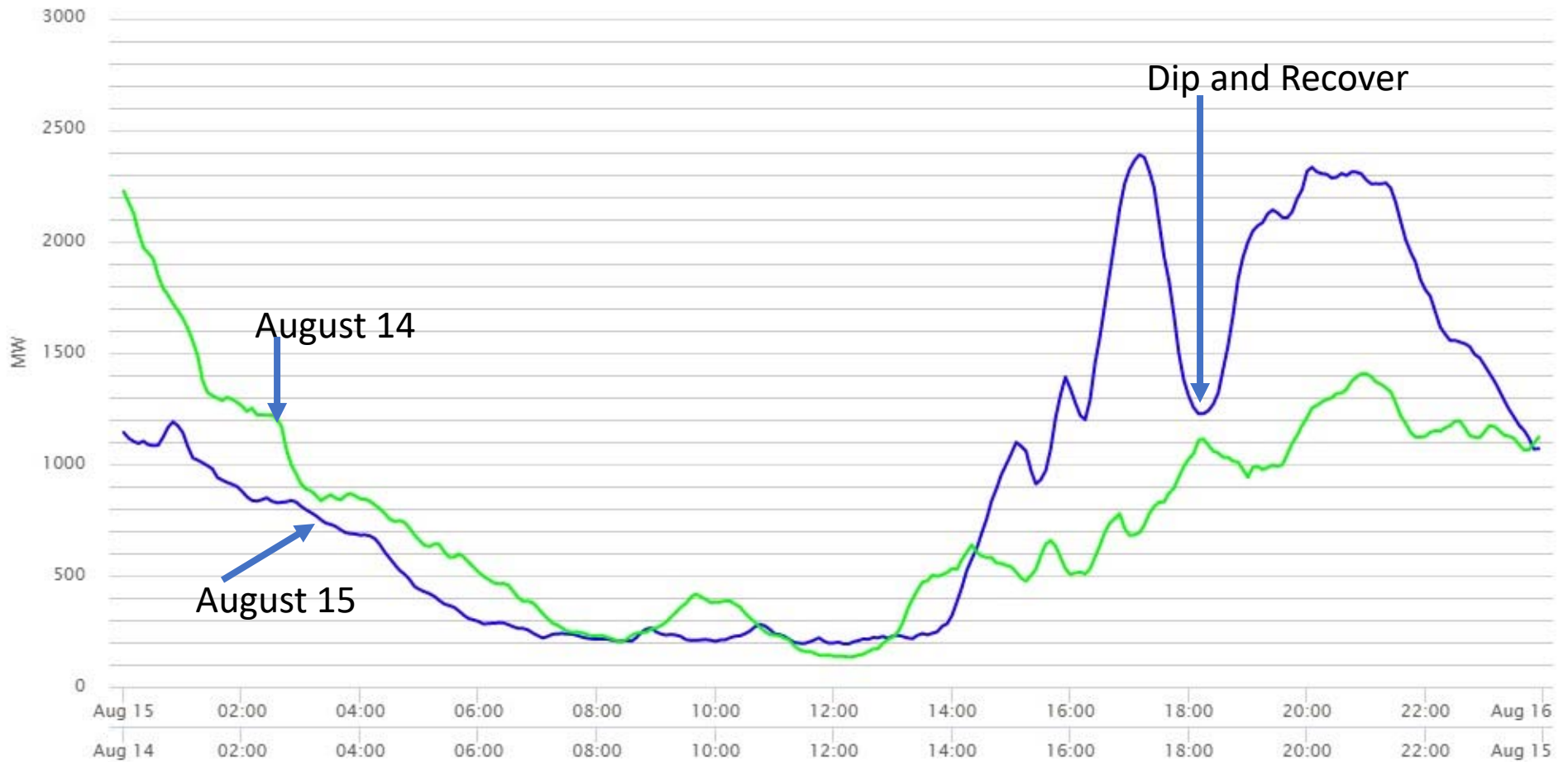


CAISO Solar Generation on August 14 and August 15, 2020

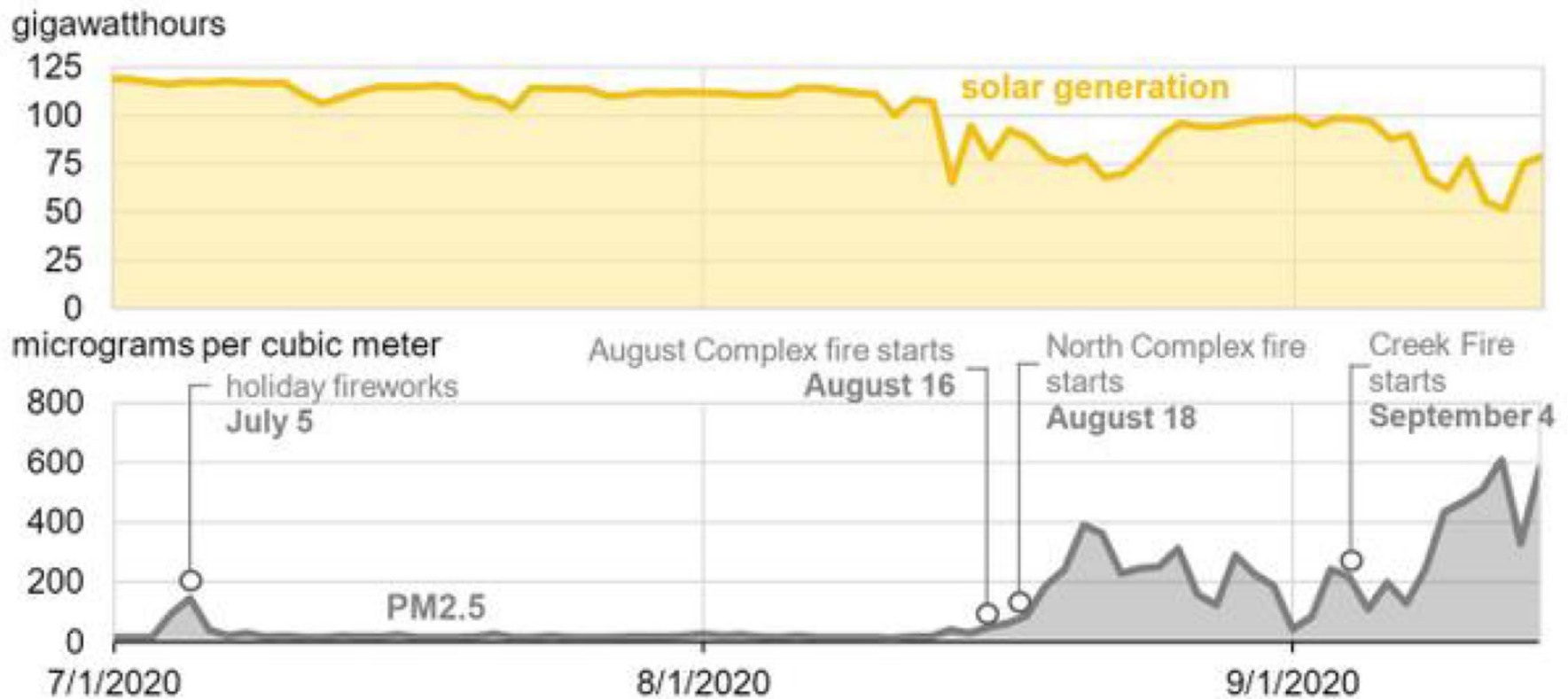


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CAISO WIND GENERATION ON AUGUST 14 and 15, 2020

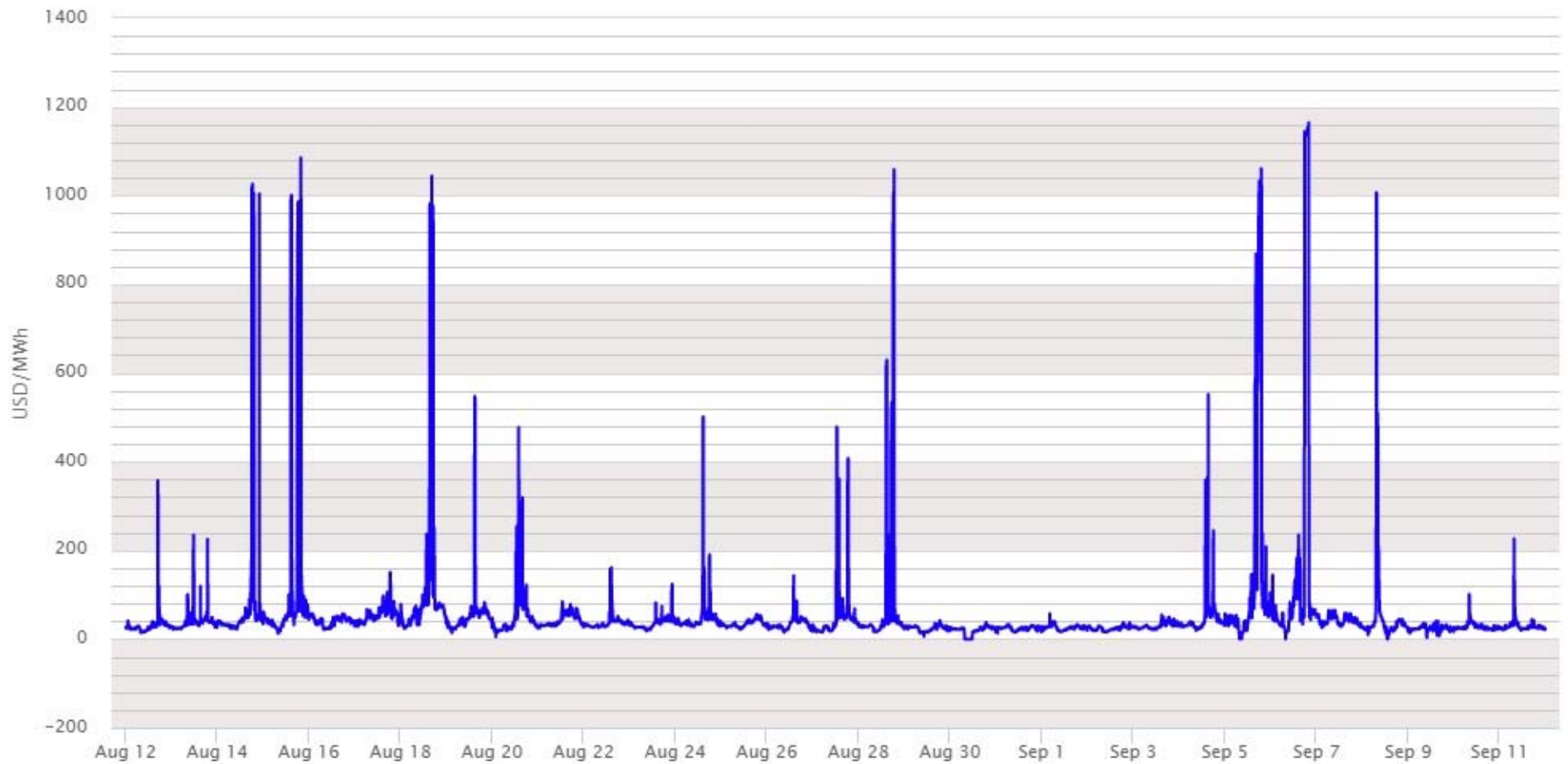


Smoke Effects on Solar Generation



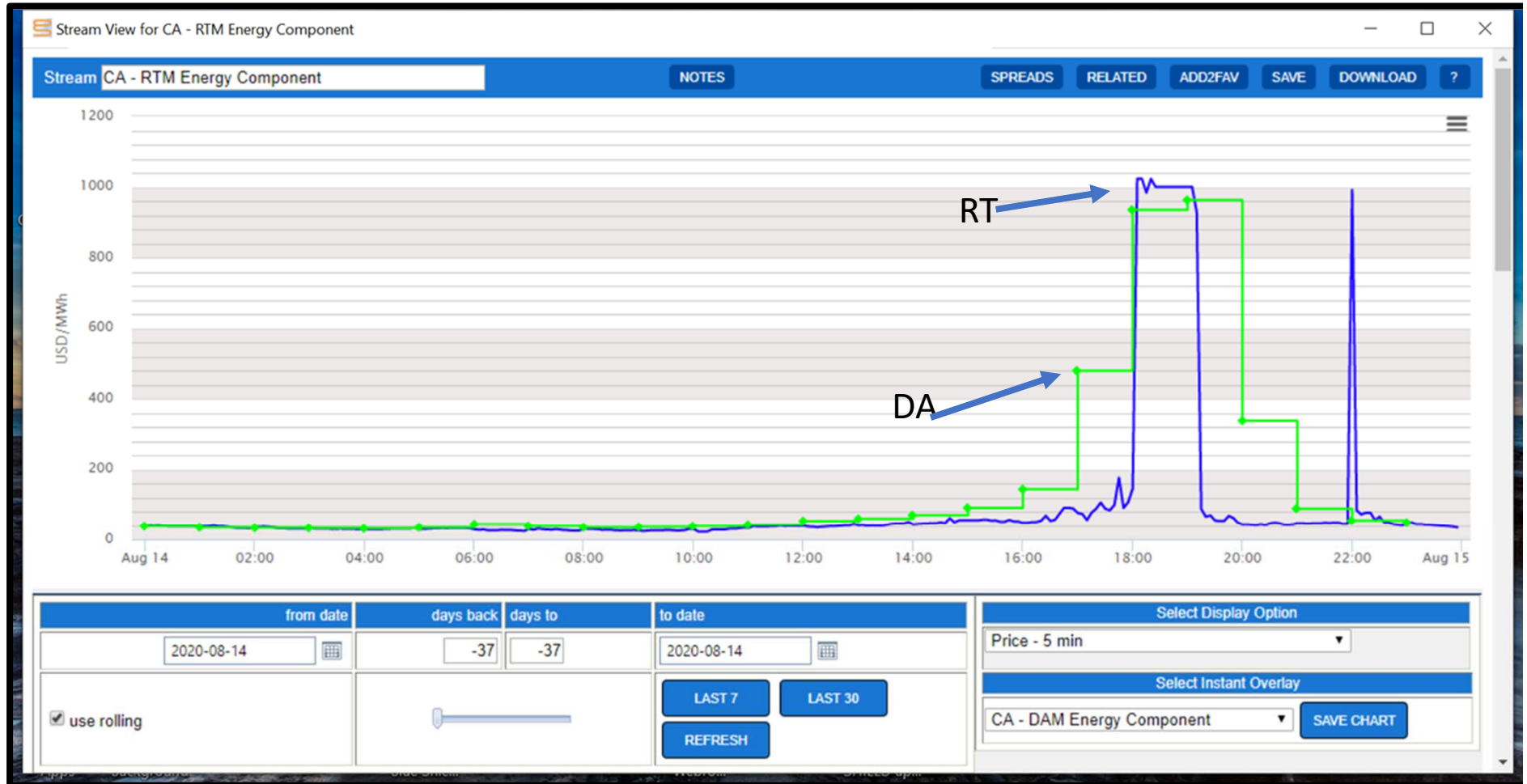
American Energy Association, *Energy Matters*, October 12, 2020

Real Time Prices SP15



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Day-ahead and Real Time Prices August 14, 2020



Generated with NRGStream Trader 8

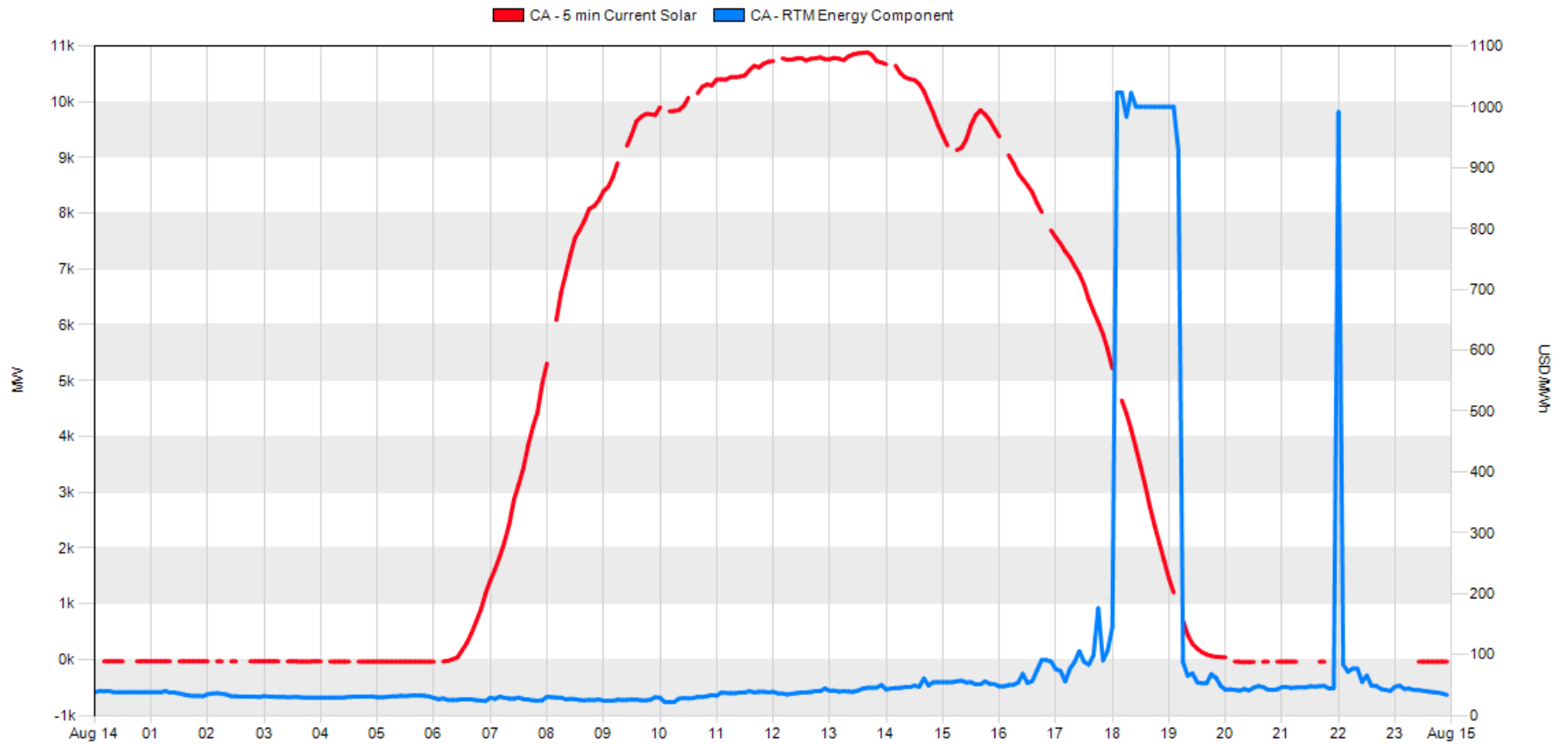
Conclusions and Responses

- Despite all of the attention and hand wringing, actual blackouts during the heat wave were relatively small (1000 MW) and of short duration
 - Extreme heat wave situation but capacity planning was based on 1 in 2 year peak demand and 15% administrative reserve margin
 - Not like 2001 when there were 38 days of rolling blackouts
 - Not like the pre-emptive “Public Safety Power Shutoff” and wild-fire-related events in 2017, 2018 and especially 2019 when millions of customers had their power cut often for several days to reduce the risk of fires
 - Not like outages after severe hurricanes in the East which can last days
 - But perhaps it’s a warning about the challenges for market-based systems which are heavily reliant on intermittent generation
- The ISO generally responded reasonably well to the situation
 - Perhaps responded too slowly on August 14
 - ISO should have been able to handle the sudden dip in wind generation on August 15 with operating reserves but recovered quickly
 - Derating of gas plants due to heat should have been expected
 - Actual capacity value for VRE is more uncertain than for dispatchable generation
 - Import/Export interactions during tight supply situations need to be sorted out

Conclusions and Responses

- Responses to calls for voluntary conservation and activation of formal demand response program appear to have averted more blackouts though formal demand response underperformed
 - Demand response will become more and more important in high-VRE/EV systems but there are limits to the effects of calls for voluntary conservation
 - Advanced metering technology is not being used effectively --- opportunities to integrate BTM PV, storage and EV in demand response programs and wholesale markets
 - Need to better link wholesale market prices with retail prices, though TOU tariff changes are a step in the right direction
- High VRE system require new approaches to “resource adequacy” which reflect variability of supplies from intermittent generation
 - The utilities in California face a complicated regulatory environment
 - CPUC, CEC, ISO, FERC
 - California has neither a centralized capacity requirement/capacity market system nor an ORDC system as in ERCOT
 - Costs of LDC contracts to meet resource adequacy criteria are not reflected in wholesale market prices
 - Need more fast flexible resources (generation and/or storage) to meet late day ramp and variations in wind and solar
 - Too much flexible gas capacity exited before storage and flexible replacement capacity entered

August 14, 2020



Region	BTM PV	Fixed PV	Tracking PV	Tracking PV Hybrid	Wind	Wind Hybrid
PGE	4.3%	5.4%	6.9%	99.6%	21.8%	54.0%
SCE/SDGE	3.6%	4.6%	5.4%	99.9%	18.0%	47.0%
AZ APS		4.6%	5.4%	99.0%	38.8%	78.3%
NM EPE		4.6%	5.4%	99.0%	38.8%	78.3%
BPA					32.7%	57.2%
CAISO	4.0%	5.0%	6.2%	99.8%	19.9%	50.5%
Average	4.0%	4.8%	5.8%	99.4%	30.0%	62.0%

Table ES2. Recommended ELCC Values for 2026

Region	BTM PV	Fixed PV	Tracking PV	Tracking PV Hybrid	Wind	Wind Hybrid
PGE	1.3%	2.1%	3.4%	98.8%	17.9%	43.5%
SCE/SDGE	0.6%	1.2%	1.9%	96.4%	17.8%	35.3%
AZ APS		~0.0%	1.9%	96.0%	30.8%	79.2%
NM EPE		~0.0%	1.9%	96.0%	30.8%	79.2%
BPA					32.8%	52.8%
CAISO	1.0%	1.7%	2.7%	97.6%	17.9%	39.4%
Average	1.0%	0.8%	2.3%	96.8%	26.0%	58.0%

CPUC Advice Letters 4243-E, 3560-E, 5868-E, July 21, 2020; See also CPUC Decision 19-09-043, September 26, 2019

Conclusions and Responses

- The \$1000/MWh price cap in CAISO is too low and rises too slowly as generation deficiency approaches
 - FERC Order 831 allows for higher “offer” caps but is based on nothing an economist would recognize
 - Scarcity pricing mechanism integrated with demand response programs and retail rates should be designed and implemented
- Too many ISO emergency actions are “out of market” and are not properly reflected in wholesale market prices
 - Reduces investment incentives and increases generation retirements for plants that rely entirely on the wholesale market for revenues