

California's Blackouts, Near Blackouts, and Fires

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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 attributes of “net demand” (customer demand seen by ISO minus wind + solar) are more and more relevant in high and growing VRE systems --- further complicated by BTM PV
 - CAISO has handled at or close to these “gross” peak loads without problems in recent years but VRE generation has increased and late afternoon and early evening “net demand” is more challenging
- CAISO has significant reliance on imports from outside but heat wave across the West reduced availability of import supplies
- About 10,000 MW of gas-fueled capacity has retired in the last few years reducing dispatchable generation as wind and solar capacity has increased significantly

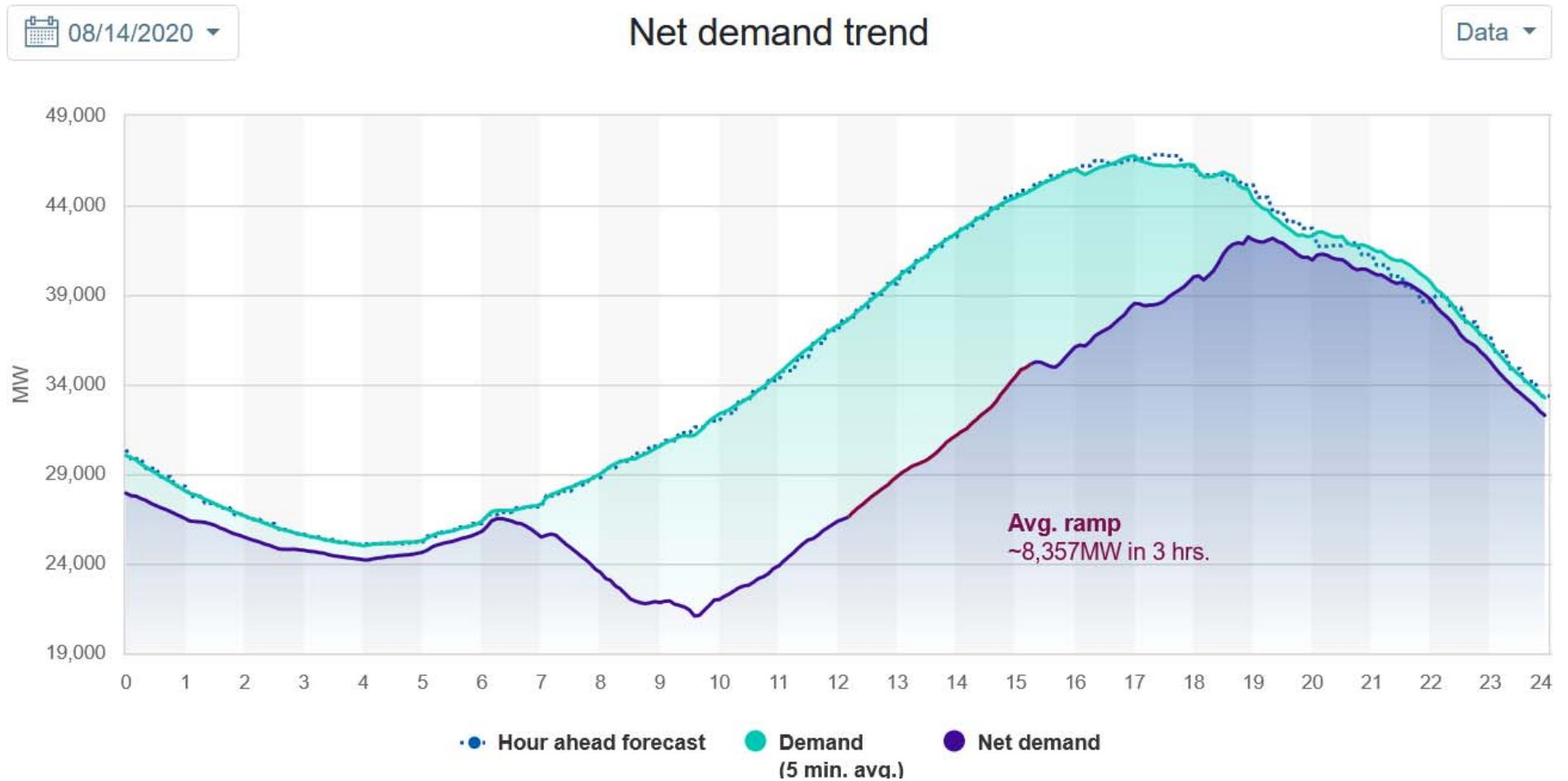
Actual and Near Rolling Blackouts

- 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) and 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. No blackouts.
 - September 6 (4,000 MW generation deficiency forecast) Good solar and wind day for season. No blackouts

What Happened in August and September in California?

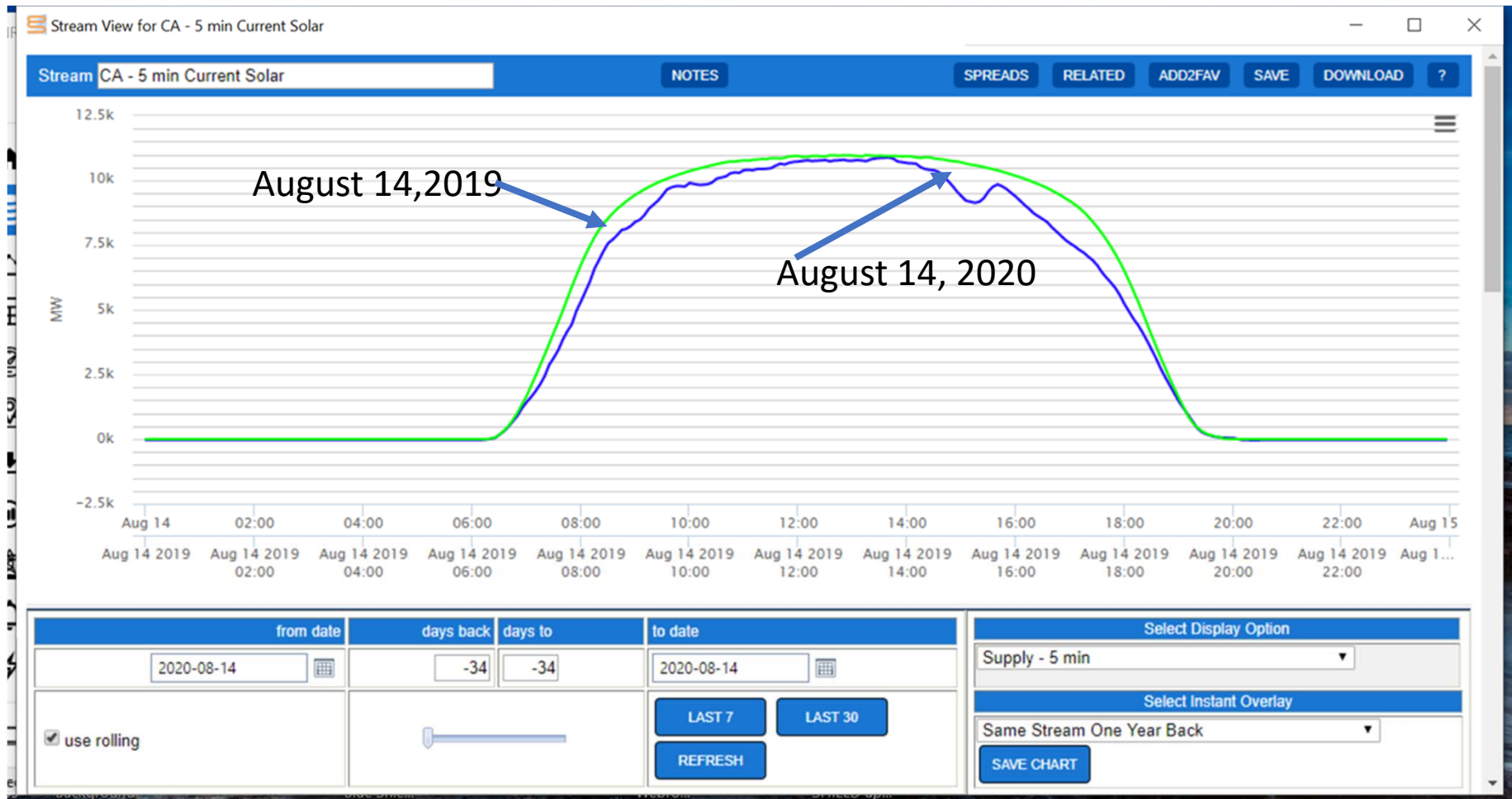
- Formal demand response programs, voluntary conservation, and emergency actions by the ISO played a roll in keeping rolling blackouts from being implemented on some of the Stage 2/3 Emergency days in mid-August and early September

Net Demand August 14, 2020



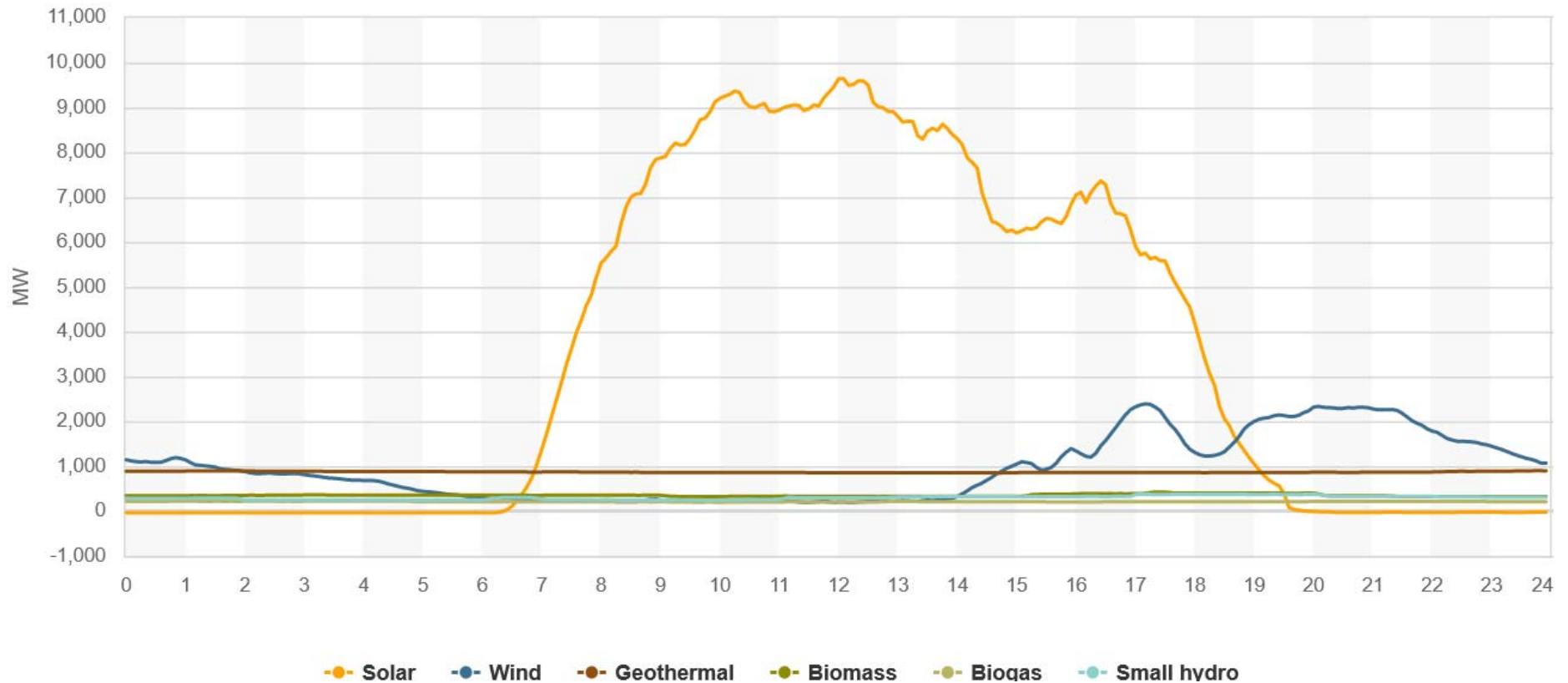
CAISO

CAISO Grid-based Solar Generation August 14, 2020 and August 14, 2019



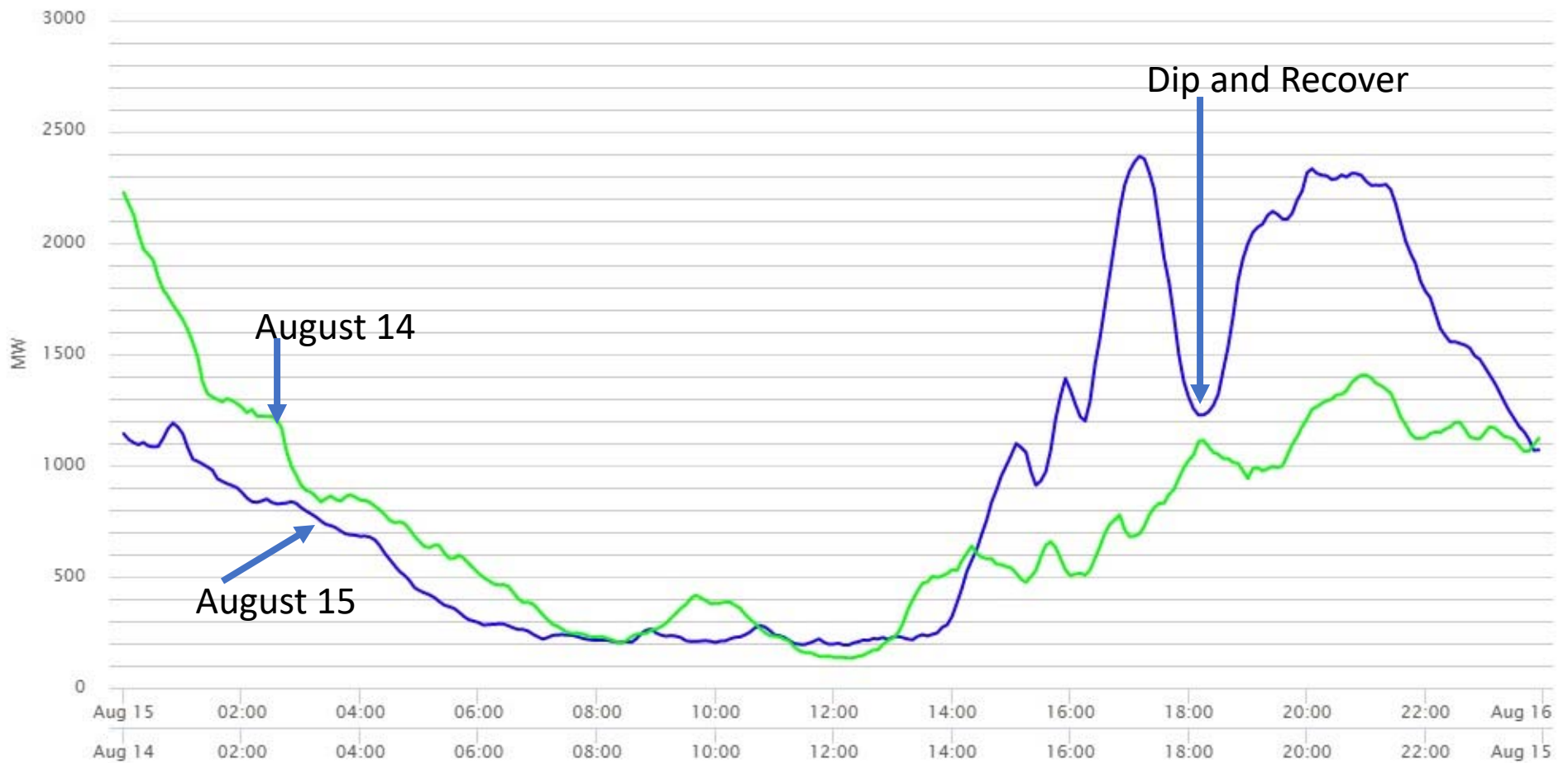
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CAISO Renewables August 15, 2020

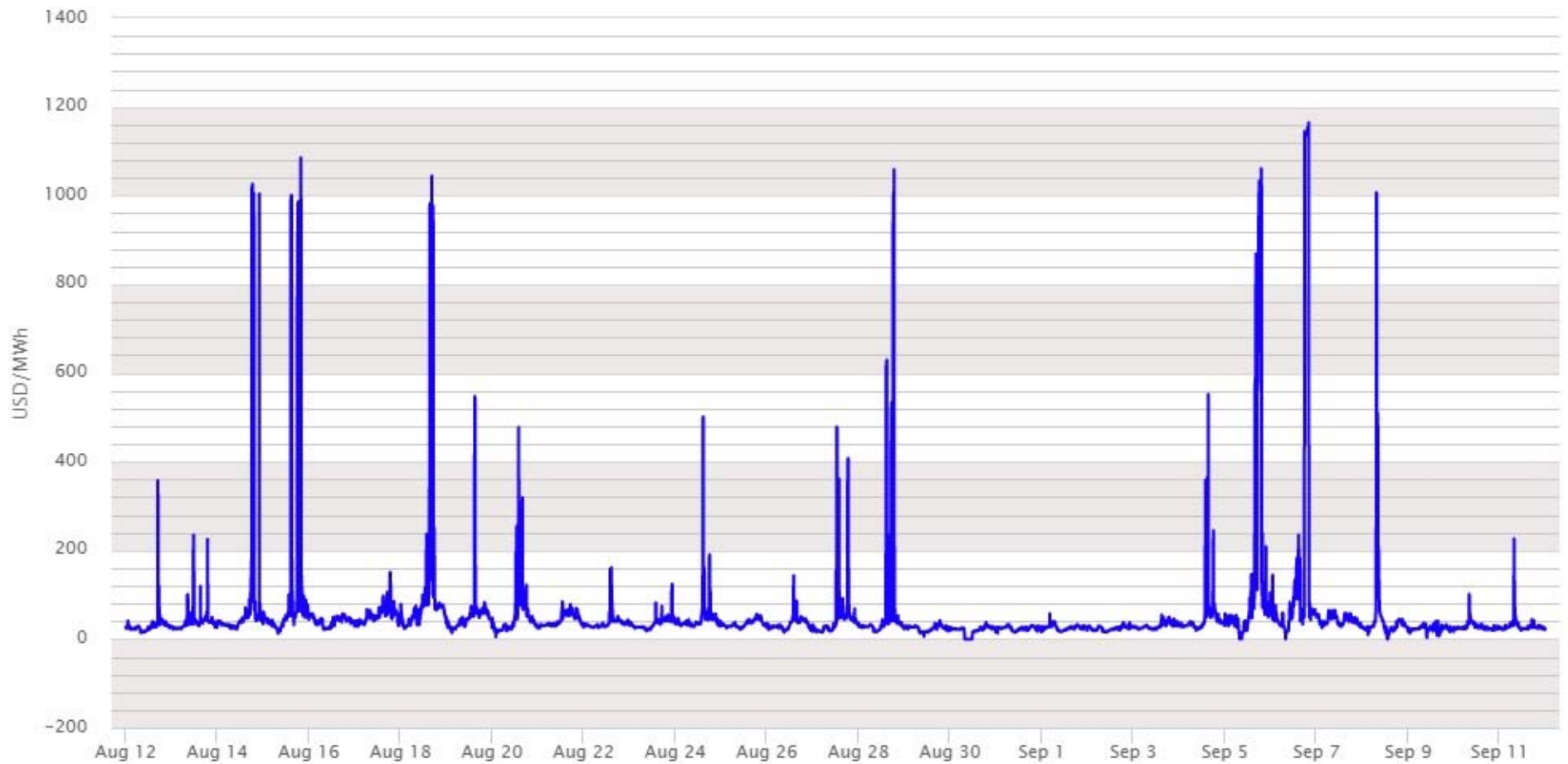


CAISO

CAISO WIND GENERATION ON AUGUST 14 and 15, 2020

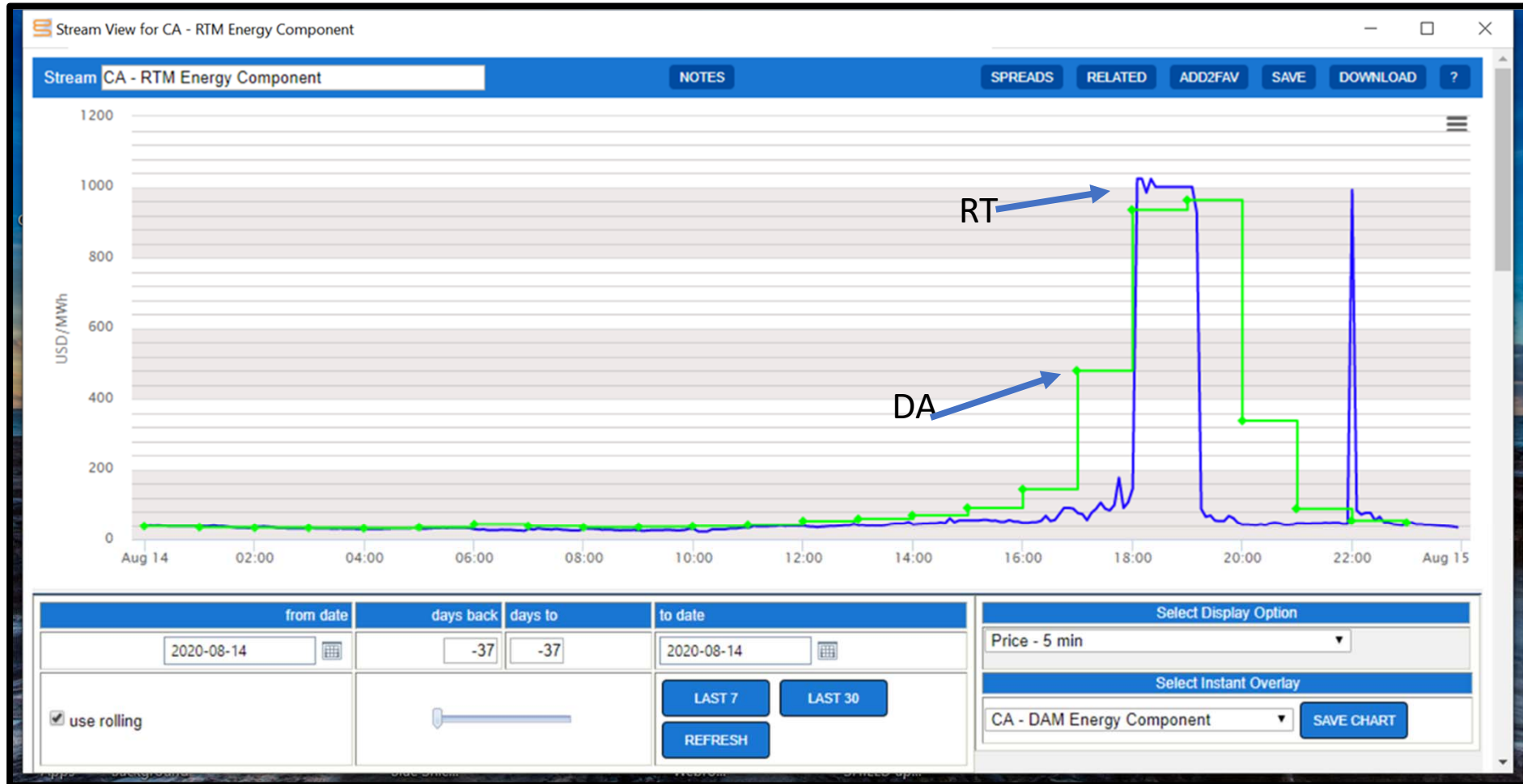


Real Time Prices SP15



Generated with NRGStream Trader 8

Day-ahead and Real Time Prices August 14, 2020



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Conclusions and Responses

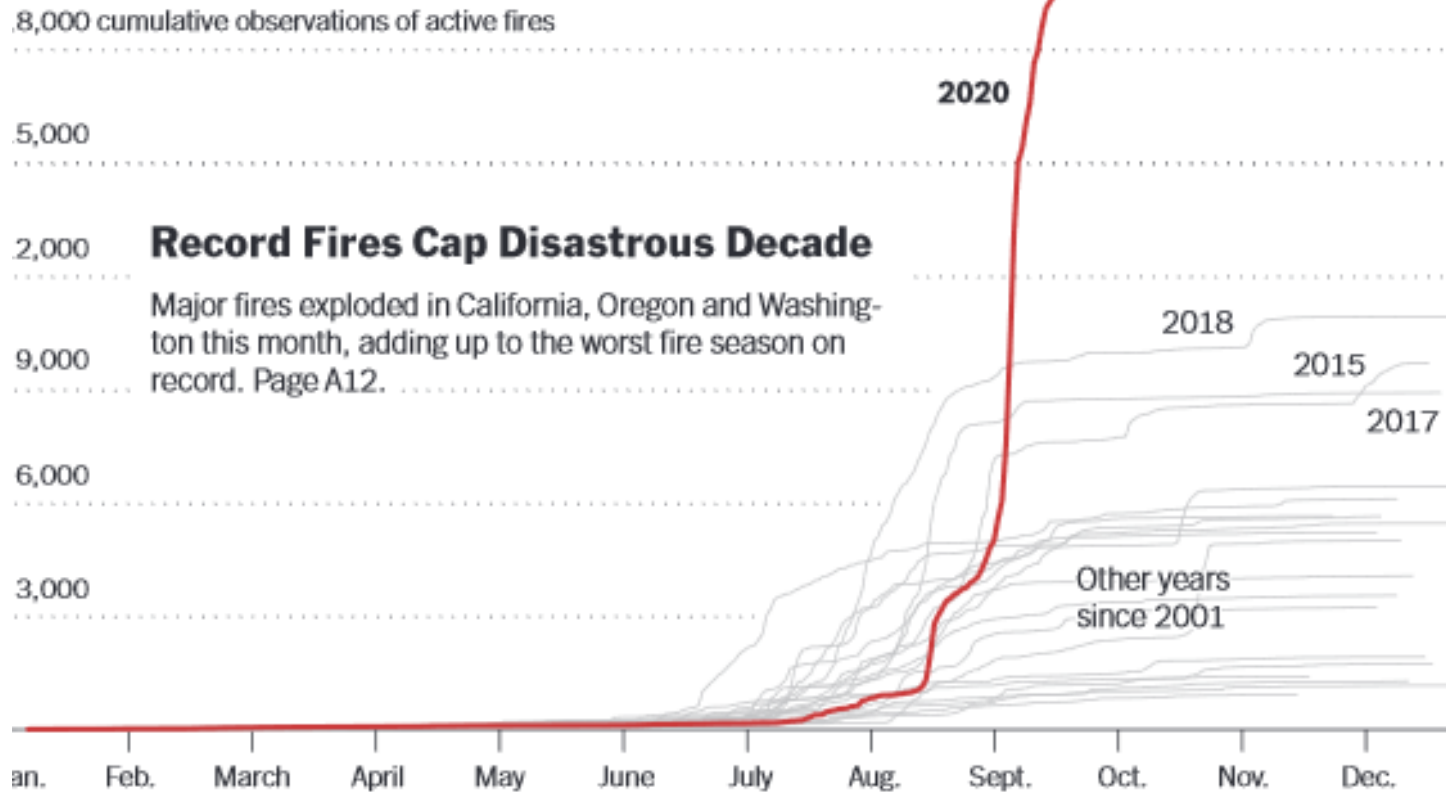
- Despite all of the attention and hand wringing, actual blackouts during the heat wave were relatively small (1000 MW) and of short duration
 - Not like 2001 when there were 38 days of rolling blackouts
 - Not like the pre-emptive “Public Safety Power Shutoff” and wild-fire-related events in 2017, 2018 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
 - Questions have been raised about operating reserve policies and reliance on imports
- Responses to calls for voluntary conservation and activation of formal demand response program averted blackouts
 - 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

Conclusions and Responses

- 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
- 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
 - Scarcity pricing mechanism integrated with 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

Pre-emptive Power Shutoffs to Avoid Wild-fires

- Public Safety Power Shutoffs (PSPS) have been standard practice in California for many years
 - De-energize transmission lines when fire risk is high to avoid fires caused by faults and fires due to network damage, conductor slap, etc.
 - Incentives created by strict liability rules
 - Historically these events were fairly rare and affected rural areas with small populations
 - Population and development have increased at the edges of forest areas increasing consequences of wild-fires
 - Wild-fires and threats of wild-fires driven by high winds (Diablo and Santa Anna winds), lightening, heat, very dry grasses and trees, effects of invasive species, have increased significantly --- climate change has likely contributed to increasing the wild-fire risk but it is not the only factor
 - Economic costs of shutoffs are high but so too are uncontrolled fires
 - 2017 – Tubbs Fire
 - 2018 -- Camp Fire
 - 2019 – 30 million people affected by long duration PSPS outages
 - 2020 – Here we go again with fires and power outages – 23 major fires burning on 10/3/2020
 - Damage to bulk power and distribution systems

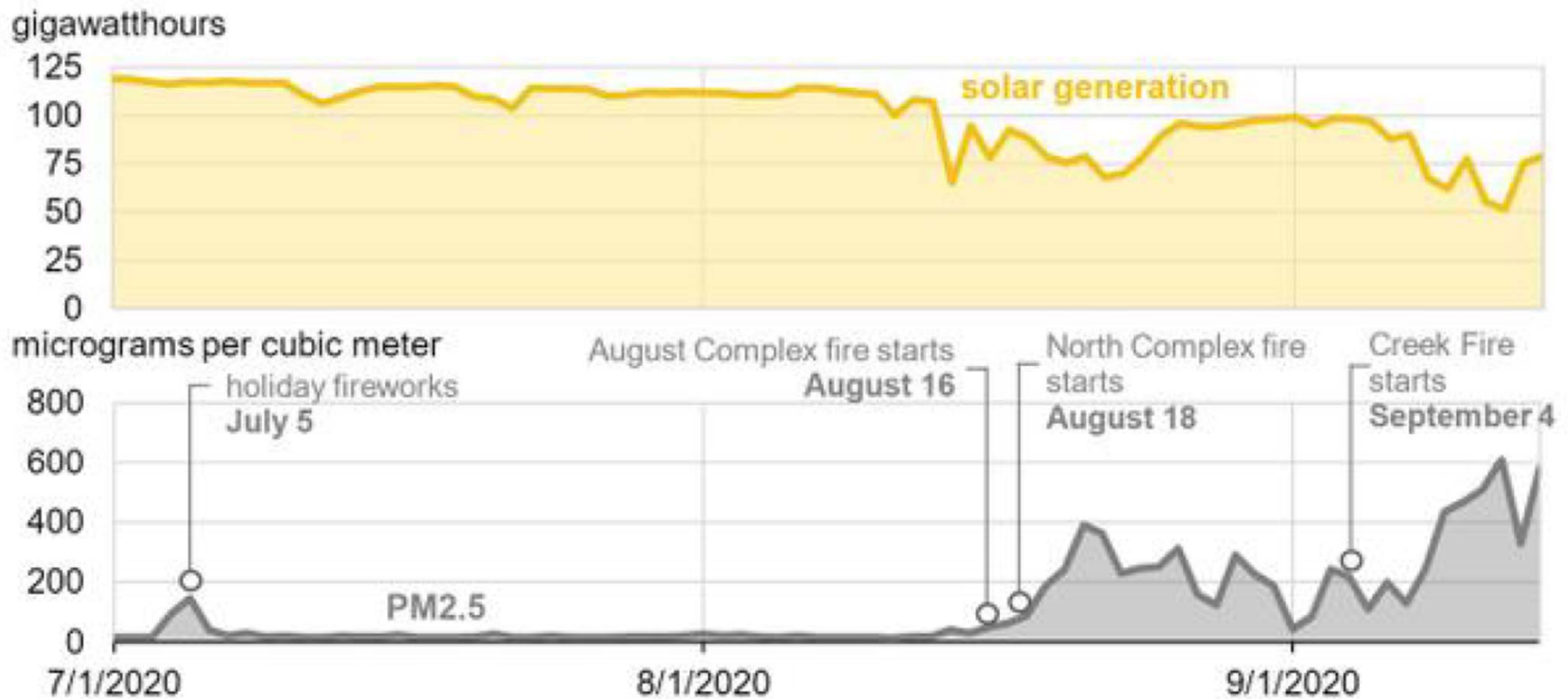


Note: Active fires may be counted multiple times in the same location. Data is as of Sept. 21.

Source: NASA satellite data, based on daily observations with greater than 95 percent confidence levels.

BLACKI MIGLIOZZI/THE NEW YORK TIMES

Smoke Effects on Solar Generation



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

Policy Responses

- Underground transmission and distribution lines
 - Very expensive
- Better forest and foliage management in and near transmission corridors including controlled burns
- More remote sensors and cameras to better predict fire risk
- Reconfigure transmission systems to reduce fault risks and allow for “islanding” to reduce area de-energized
- Backup generators in micro-grids or at businesses and homes
 - The long potential duration of these outages is a special problem
- Improve regulatory oversight and create targeted performance-based incentives