Operating an Electric System in Transition – A view from CA

ESIG – 2021 Spring Technical Workshop

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April 8, 2021

What is Resource Adequacy (RA)?

- While many definitions exist, the industry generally defines RA as:
  - Having enough resources (generation, efficiency measures, and demand-side resources) and delivery capability to serve load
  - Considered across a wide range of conditions with a sufficient allowance for uncertainty
  - Timeframes – typically assessed on a monthly or annual basis over 1-3 or more years; *RA is not real-time*
- The relationship of RA to the broader concept of reliability
  - *Resource adequacy is a fundamental aspect of reliability by* providing a structured framework to assess the procurement adequacy

What are drivers for the regional conversation on RA?

- The region's bulk electricity system is in transition to lower GHG emitting resources
- Increased need for flexibility while decline in responsive, dispatchable resources
  - Retirement of some thermal generators, difficulty in adding new thermal resources
  - Increase in Variable Energy Resources
  - Increasing use of Demand as a resource
- The region may begin to experience capacity shortages in the near future
  - The shut down of resources can cause short-run shortages due to the "lumpiness" of generating capacity

Elements of an Effective RA Program

- Forward planning study to determine a planning reserve margin based on an expected level of risk
- Periodic “showing” to assess whether sufficient capacity has been committed to be delivered across the expected transmission system to the forecast demand when needed
- Mechanism to encourage or enforce full coverage to avoid shortages or leaning on one participating entity by another
- Process to make all RA capacity available to the system operator(s) to meet demand needs under real time conditions

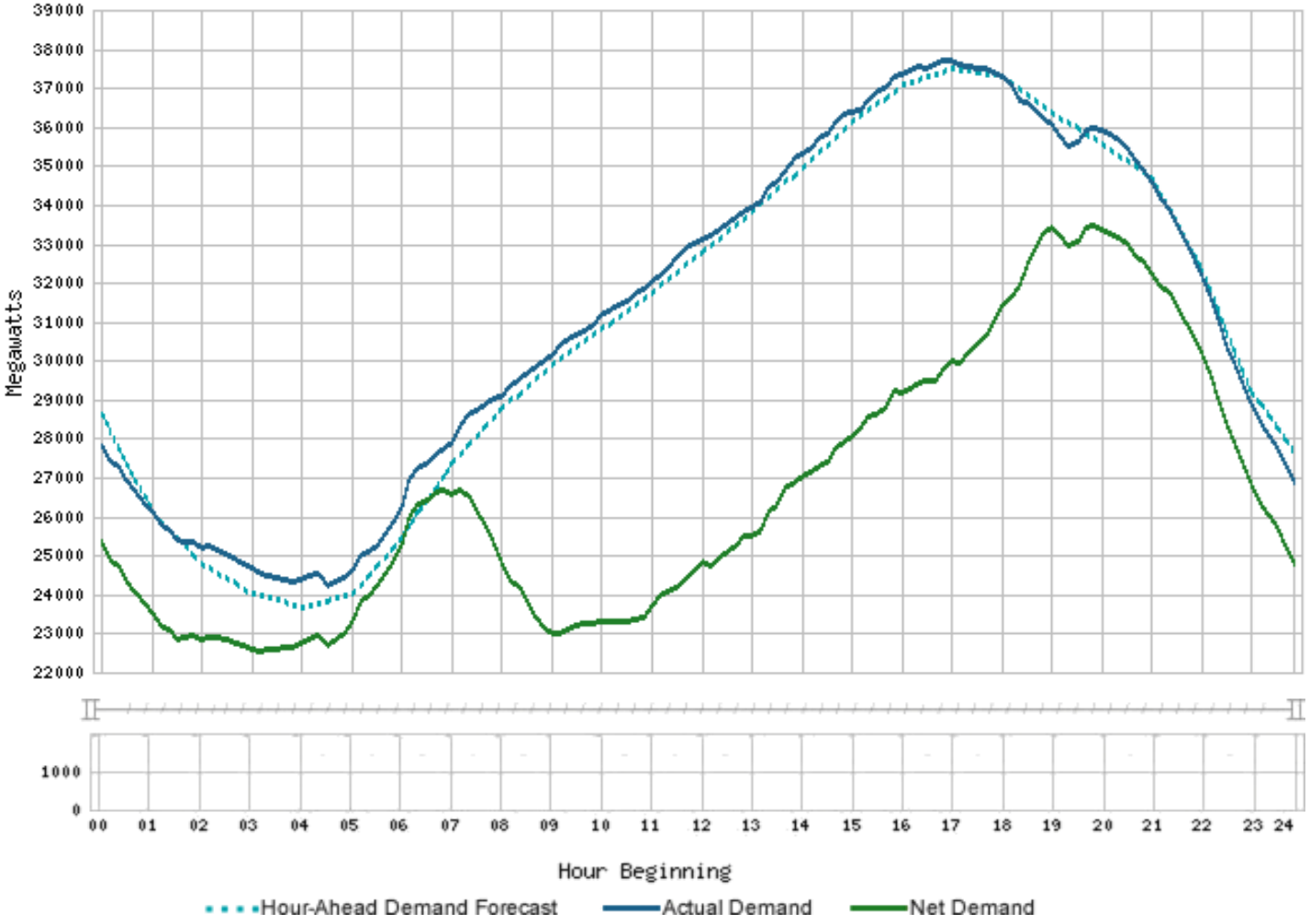
Recap: ESIG April 9, 2020

- **Challenge 1: Capacity shortfall in 2020 and meeting summer evening peak load**
- Challenge 2: Increased ramping needs
- Challenge 3: Low renewable energy production from multi-day weather events

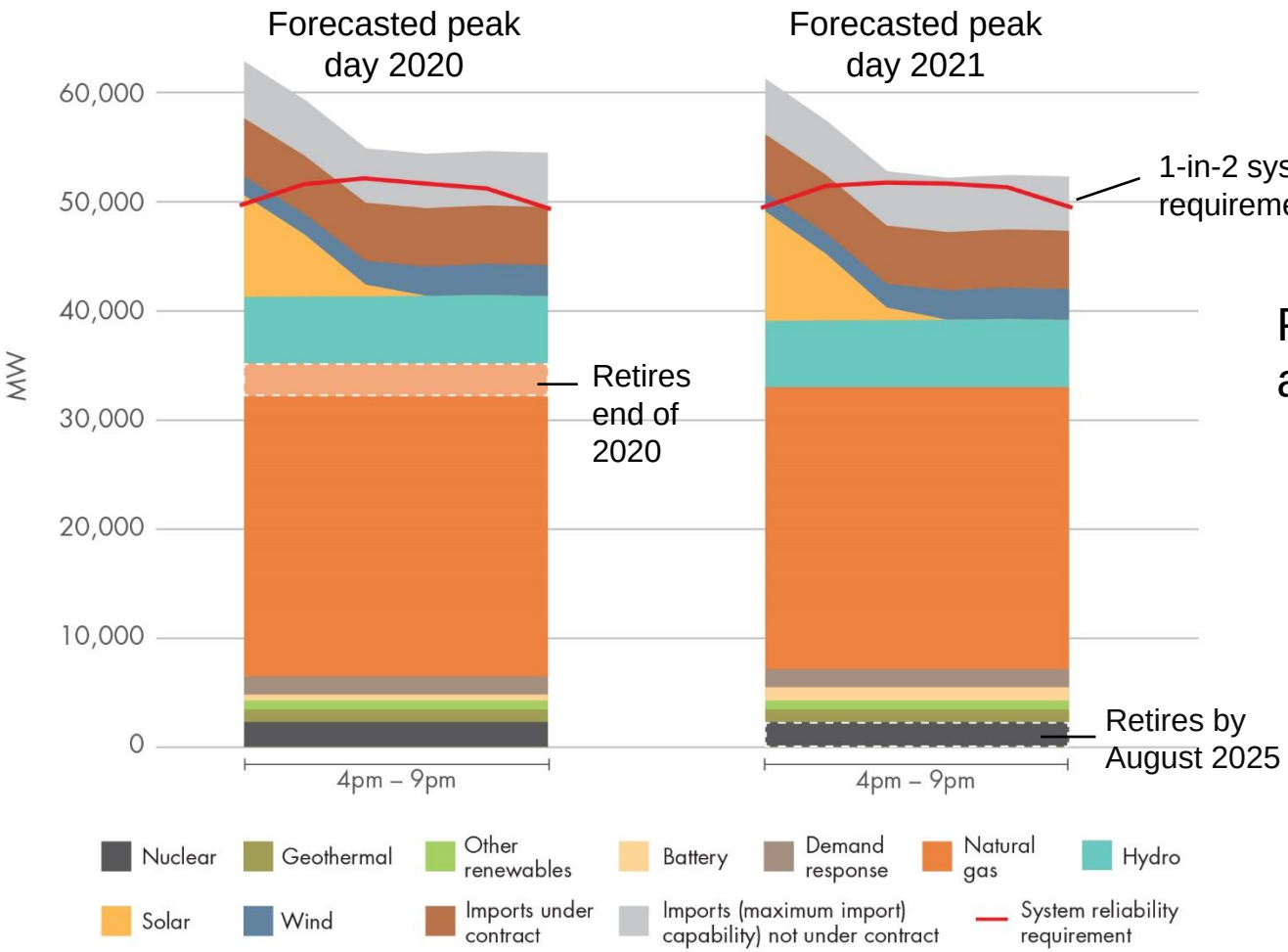
Capacity shortfall in 2020 and meeting summer evening peak load

- The peak demand the ISO serves is shifting from the afternoon to the early evening
- Solar production is significantly reduced or not available during these new, later peak demand hours
- Instead, we now rely on energy from natural gas resources and imports
- However, energy capacity is decreasing due to:
  - Net retirement of 4,000 MW of once-through cooling steam generation
  - Reduced imports due to increasing load, thermal resource retirement, and increasing renewable integration needs outside of California
  - Potential changes in hydro conditions and availability in CA and west

Solar & wind production drive a shift in use pattern for conventional resources on peak demand days



Potential resource shortage[1] starting in 2020



Projected shortfalls at 7 p.m.:

2020 = **2,300 MW**

2021 = **4,400 MW**

2022 = **4,700 MW**

[1] *Assumes no transmission outages or other significant events affecting availability of generation*

Public Safety Power Shutoff (PSPS) programs to protect public safety- Investor Owned Utilities (IOUs)

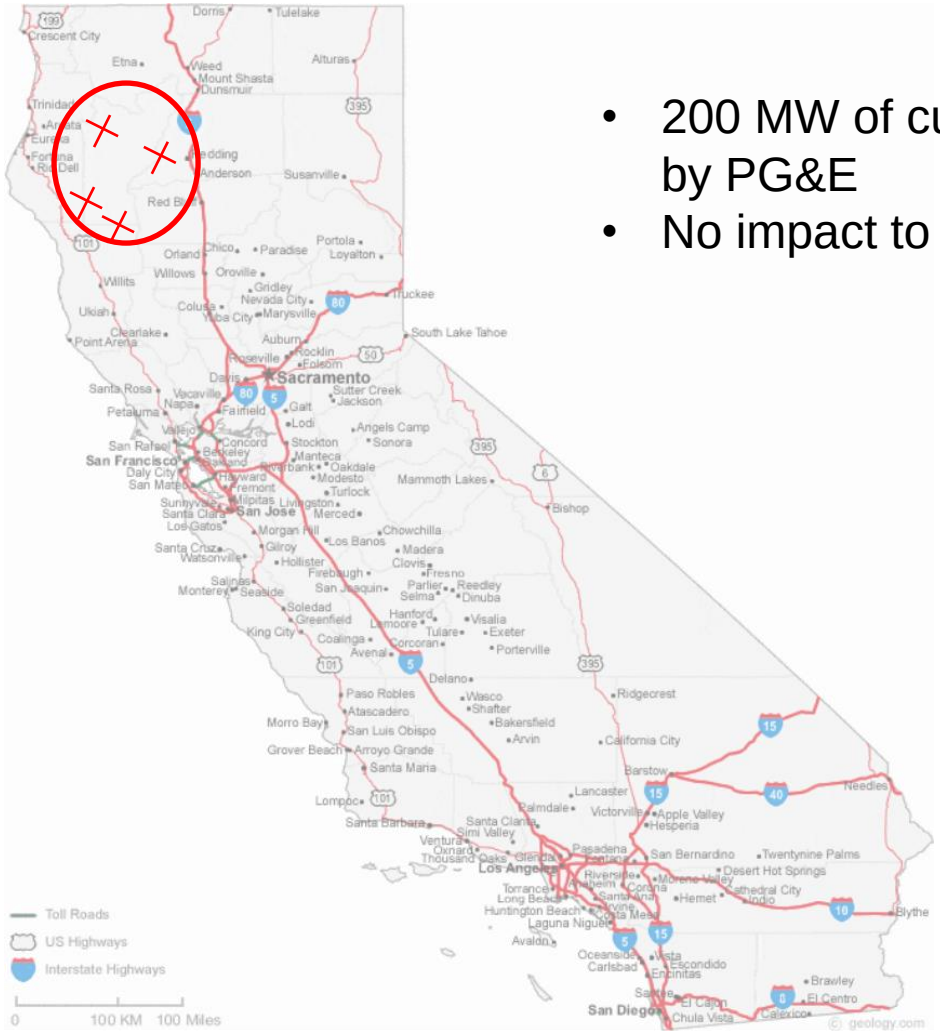
- The CPUC has reviewed & approved the IOUs plans
- The IOU's PSPS plans include all voltage levels (distribution to 500kV)
- PSPS triggers are based on meteorological data, vegetation, terrain, etc.
- IOUs evaluate conditions and determine which circuits will be de-energized
- IOUs direct the circuit de-energization at PSPS triggers
- IOUs are responsible for direct load management on circuit de-energization
  - Direct load management happens when the circuit feeding the load is de-energized

Note: These actions are independent of the CAISO responsibilities

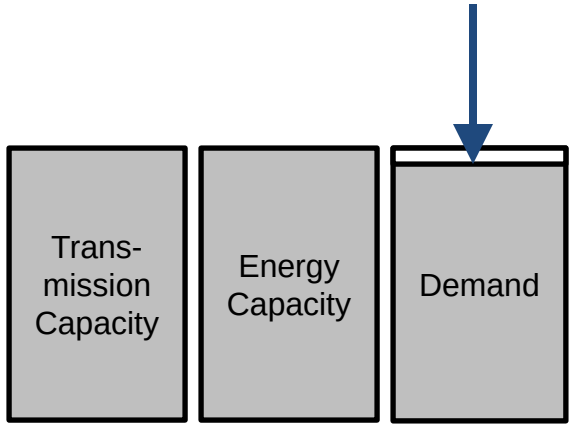
California's Public Safety Power Shutoff program - CAISO Operating Principles

- Facilitate PSPS outages
- Analyze, identify & communicate PSPS impacts
  - ❖ Provide any required mitigation to the IOU
- Maintain reliability of the bulk electric system
- Implement additional load management as required
- Confine PSPS impacts to the initiating IOU
- Confine PSPS impacts to CAISO BA

PSPS Scenario 1 – 60kV & distribution level
Minimal impact on the BES

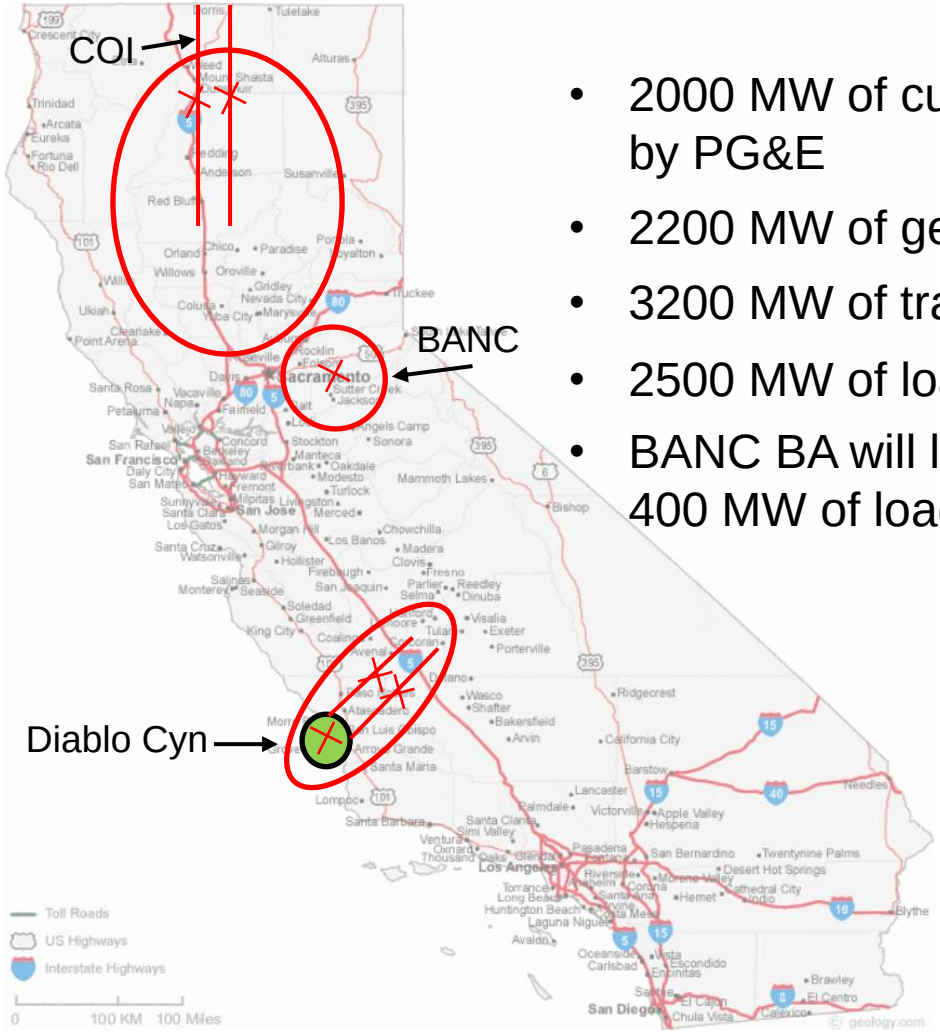


- 200 MW of customer demand will be de-energized by PG&E
- No impact to CAISO generation or transmission

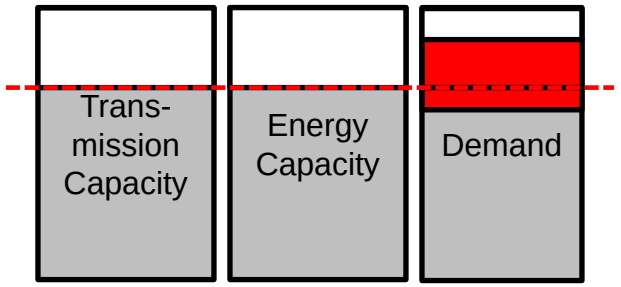


ISO energy & transmission capacity available to meet demand

PSPS Scenario 2 – Transmission Interruption Significant impact on the BES



- 2000 MW of customer demand will be de-energized by PG&E
- 2200 MW of generation will be forced off (Diablo Cyn)
- 3200 MW of transmission capacity will be lost (COI)
- 2500 MW of load will be ordered off by ISO
- BANC BA will lose 900 of imports, and may shed 400 MW of load to re-balance their system



California ISO

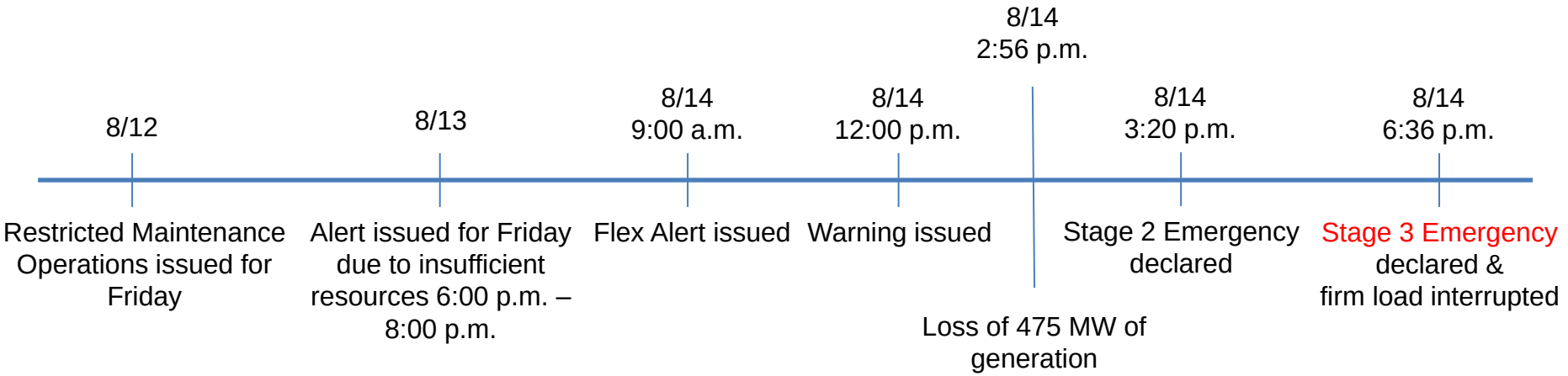
Review of System Outages on August 14 & 15, 2020

CAISO Alerts Warnings & Emergencies (AWE)

The AWE process predates the NERC standards and is embedded in CPUC and Utility procedures

- Flex Alert
- RMO (Restricted Maintenance Operations)
- Alert (Day Ahead)
- Warning – triggering of demand response
- Emergency Stage 1 - Contingency Reserve shortfalls
- Emergency Stage 2 – ISO market intervention
- Emergency Stage 3 – Load interruption is eminent

Timeline of events for Friday August 14, 2020



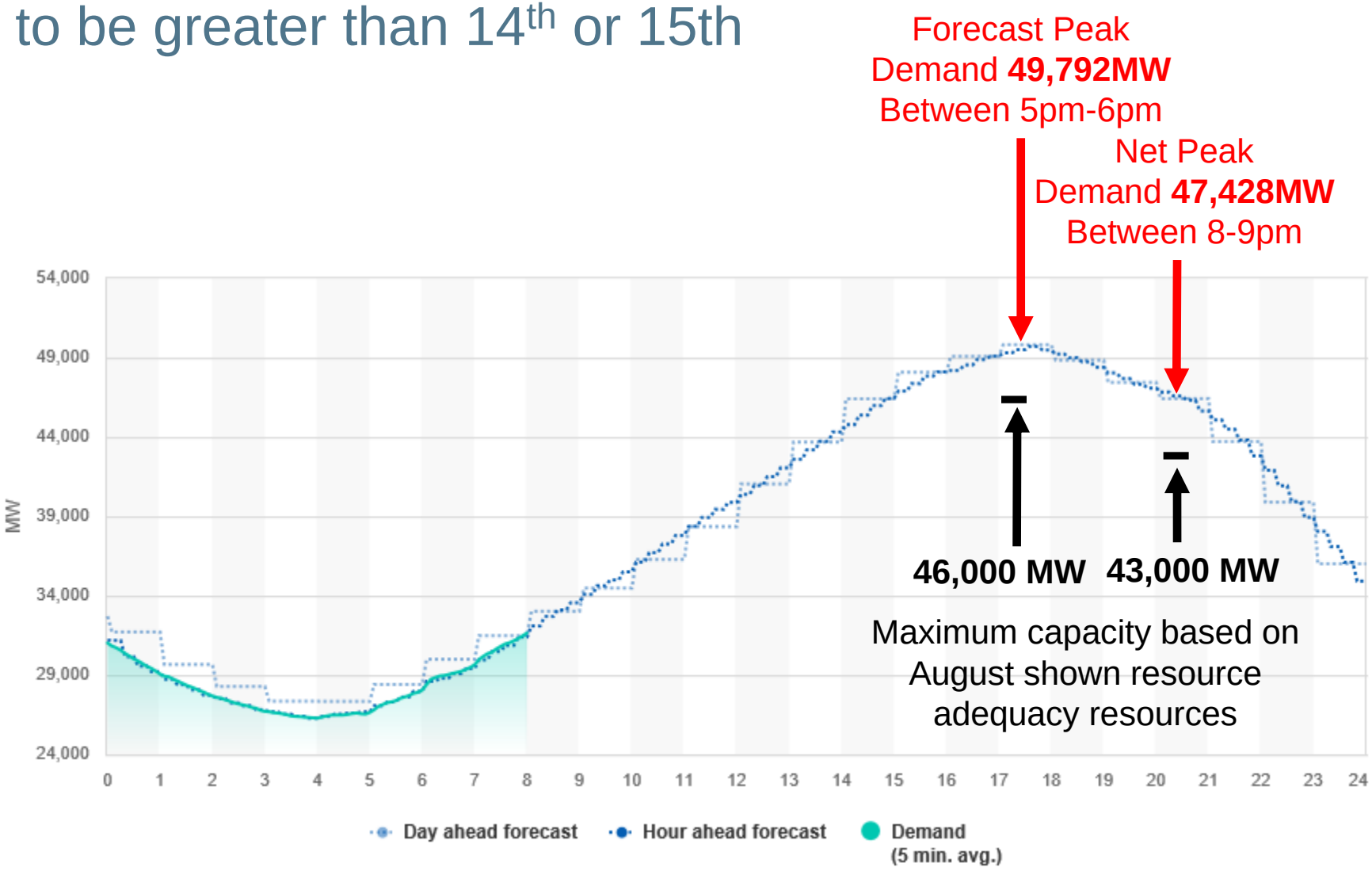
Sequence of events Friday August 14

12:00 p.m.	Unable to secure additional energy, a Warning was issued effective 12:00 p.m. through midnight
2:56 p.m.	Loss of generation – 475 MW
2:58 p.m.	Dispatched contingency reserves to recover
3:20 p.m.	Forecasting a shortage of energy for next few hours - Declared CAISO Stage 2 Emergency, began procuring Emergency Assistance from external entities
5:15 p.m.	Dispatched approximately 800 MW of demand response to maintain load and resource balance
6:36 p.m.	Unable to maintain load and contingency reserve obligation – ordered 500 MW of load shed pro-rata to CAISO Utility Distribution Companies (UDC's) – Stage 3 Emergency declared
6:46 p.m.	Ordered an additional 500 MW of load shed pro-rata to CAISO UDC's
7:56 p.m.	Load has decreased and resources are adequate to meet our load and contingency reserve obligations. Ordered all load to be restored.

Sequence of events Saturday August 15

4:10 p.m. to 5:10 p.m.	Total wind output increased quickly requiring other generation to ramp down quickly
5:10 p.m. to 6:05 p.m.	Total wind decreased quickly requiring other generation to ramp up quickly. CAISO ACE was -1421 MW.
6:13 p.m.	While recovering our ACE, a generator ramped down quickly from 400 MW.
6:25 p.m.	Ordered 470 MW of load shed pro-rat from UDC's
6:47 p.m.	Received Emergency Assistance, wind ramped back up, load began to trend down, additional resources available. Ordered all load be restored.

Forecast demand for August 17, 2020 was projected to be greater than 14th or 15th



Measures taken to effectively mitigate the potential August 17th shortfall

- Actively collaborating with numerous entities such as utilities within the balancing area, the California Energy Commission, and neighboring Balancing Authorities.
- Issued flex alerts and warnings
- Procuring available emergency energy
- Called on demand response programs and other demand relief
- Suspended convergence bidding
- Put demand on notice of potential curtailment