August 2020 – California Rolling Outages: A retrospective look.

INTERNAL WRA STAFF PRESENTATION

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Presentation Outline

- **Stage-setting: Actors**
- **What was the real problem?**
- **How was it managed?**
- **Lessons learned or yet to be learned?**

August 2020 Outages: A Perfect Storm

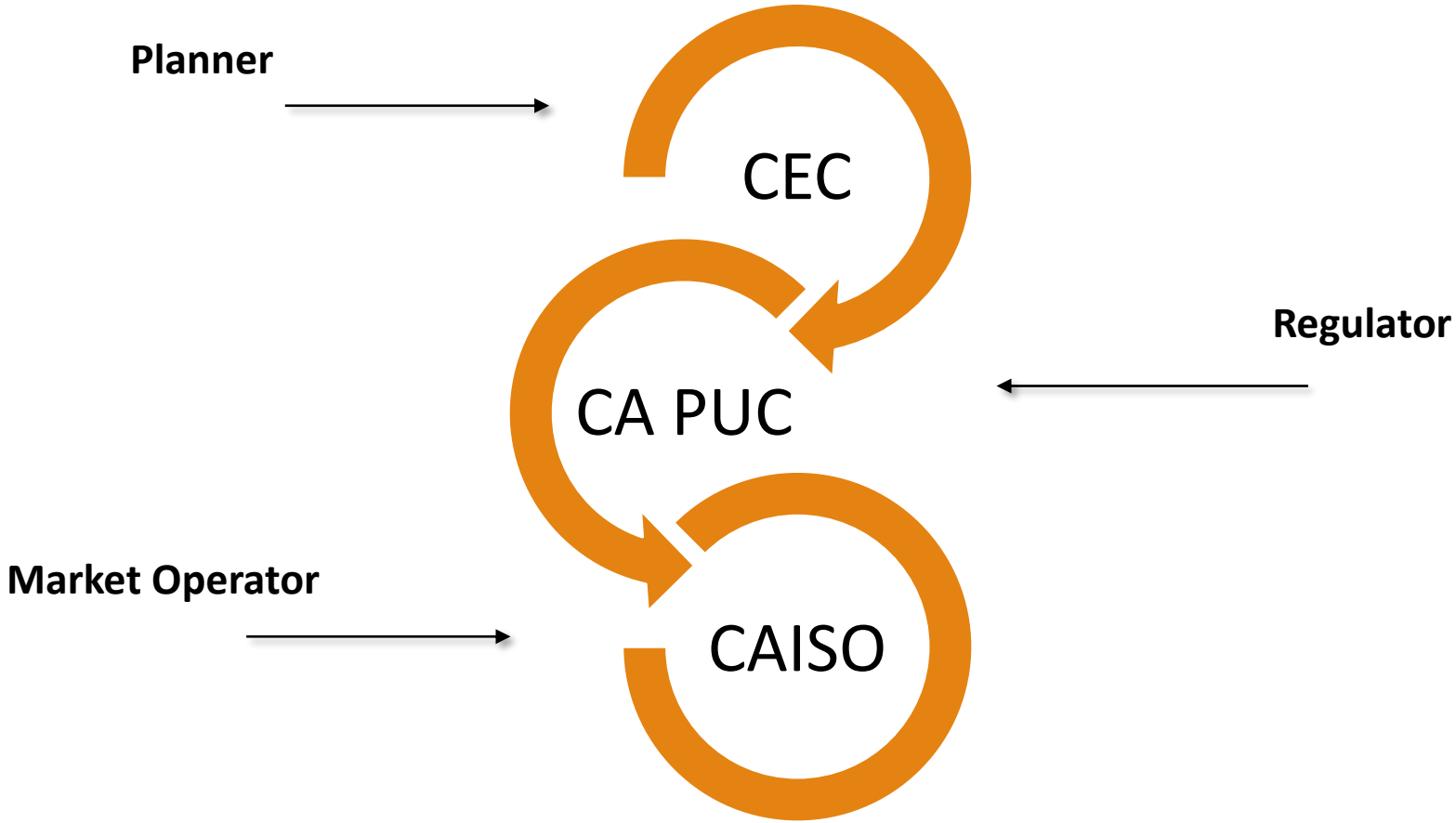
- Underestimation of potential “seasonal” load forecasts
- Underestimation or awareness of the severity of the summer heat-waves
- Market rules for CAISO performed as expected – unintended impacts to the larger system
- Poor timing with forced outages of gas generation
- Restrictions on importation of out-of-state RE resources

https://www.youtube.com/watch?v=W9Tdw5nG4dQ

Conclusions!

- There are NO “bad” guys!
- No one actor is singularly at fault!
- Lots more (and better) information is needed
- Decision-making authority deserves clarity

Multi-Actor Determination: Resource Adequacy in California



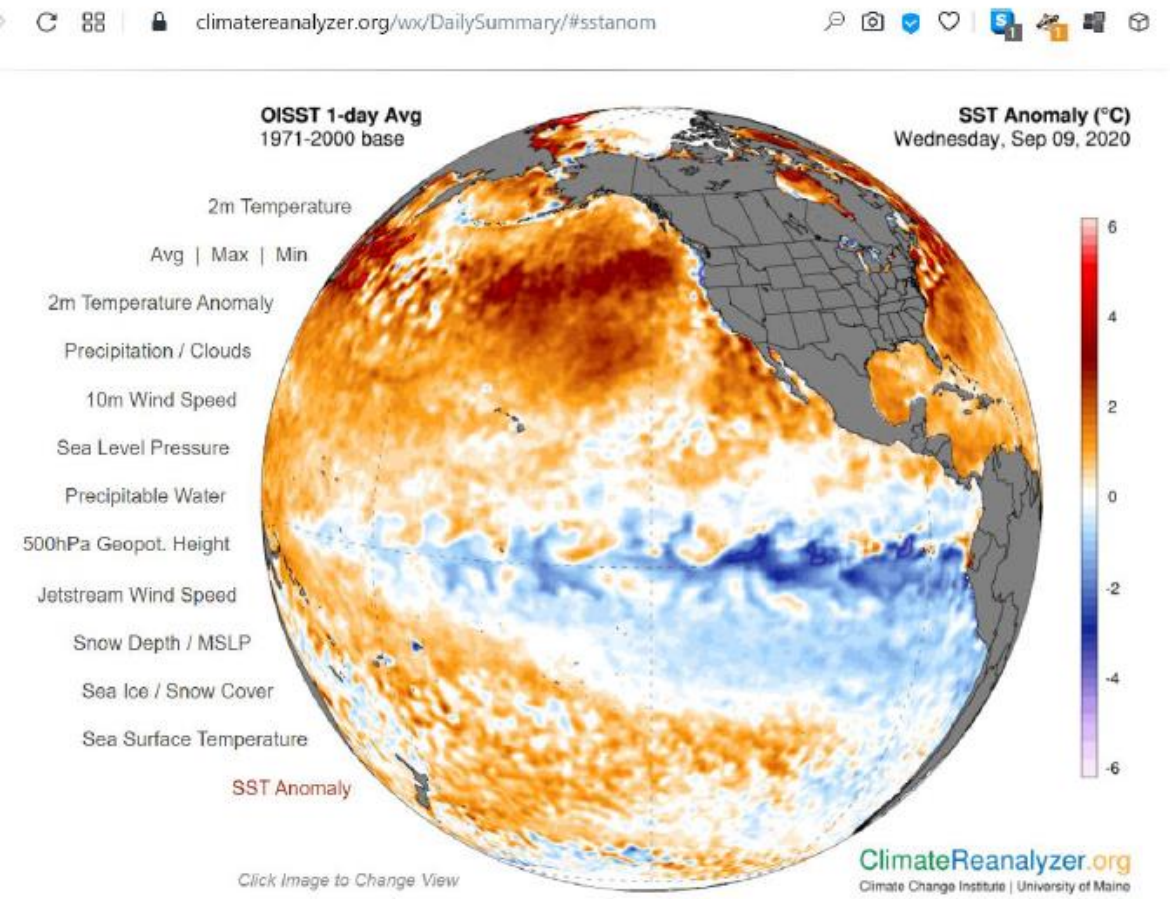
Actors: Who all had “lead” roles ?

- **California Energy Commission (Planner)**
  - Helps set the “load forecasts” and related “planning reserve margins”
- **California PUC (Regulator)**
  - Sets “load forecast” to be based in a 1-in-2 peak forecast, i.e. an average year forecast.
  - Developed in partnership with CEC (using methodology developed with CAISO and CEC)
  - 15% planning reserve margin is front-loaded into the forecast to address:
    - Variability of imported power,
    - Forecasting errors,
    - Other reserve needs.
- **California ISO (Market Operator)**
  - Uses the “agreed” load forecasts (“LF”) to ensure resources are adequately meeting load
  - Use forecasts to assign resources (through generation and non-generation options) into market to serve load.
  - Creates “market price” signals to optimize (adjust) demand with supply → Solve for all load to be satisfied.

Why load forecasts? And what is PRM?

- **Resource Adequacy:** A good load forecast (short term and long term) helps satisfy demand for power.
- Planning Reserve Margin: *Percentage by which the total capacity of system resources exceeds the median peak load.*
- **CA RA rules require:** Take into account the fact that the grid needs sufficient – quantity and quality – of resources to meet demand.
- **Resource shortages in CA** exacerbated for the week due to CA's heavy reliance on import resources to meet *"late afternoon"* energy needs and evening hours in the summer.
- **Imported resources in "immediate/short-term" are not long-term contracts:** Influenced by real-time market prices. *Expanding existing electricity market could really help!*

When Climate Change Becomes Weather Change



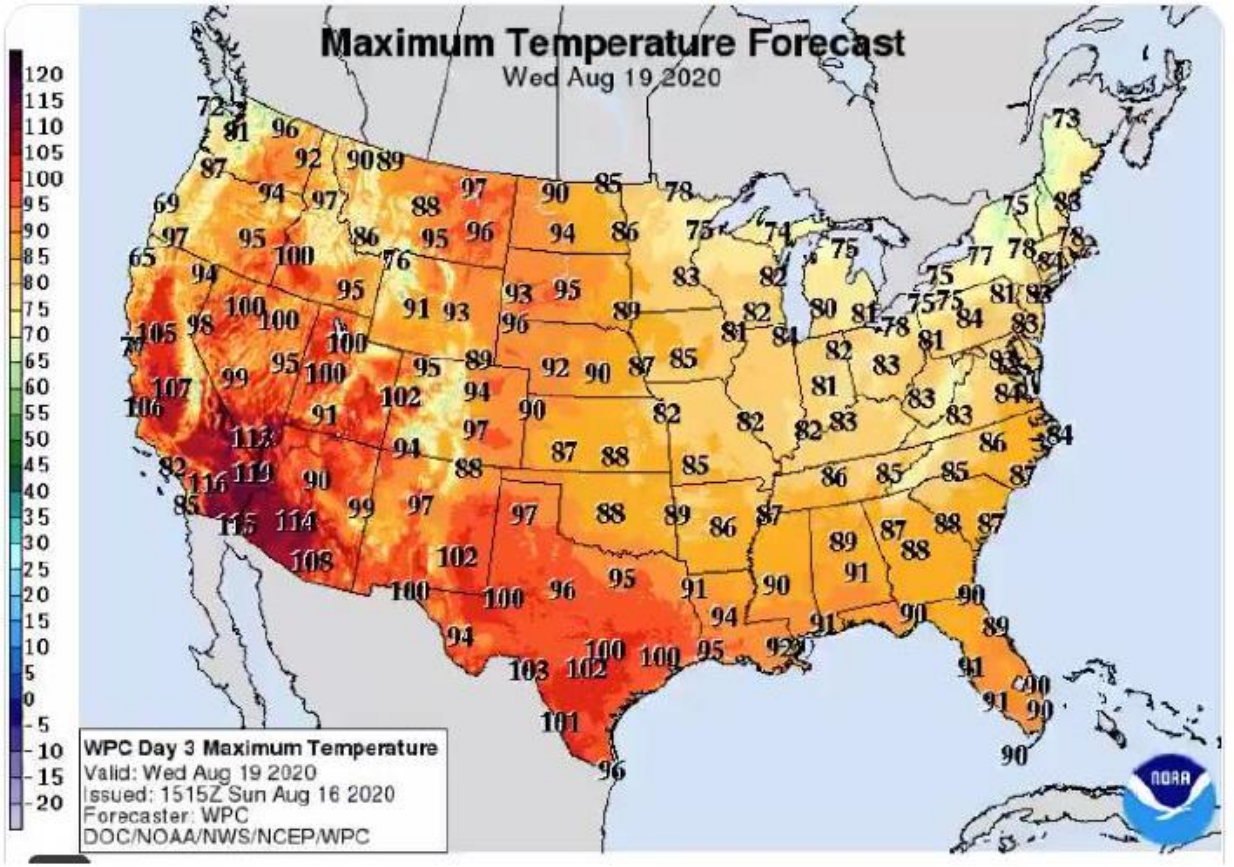
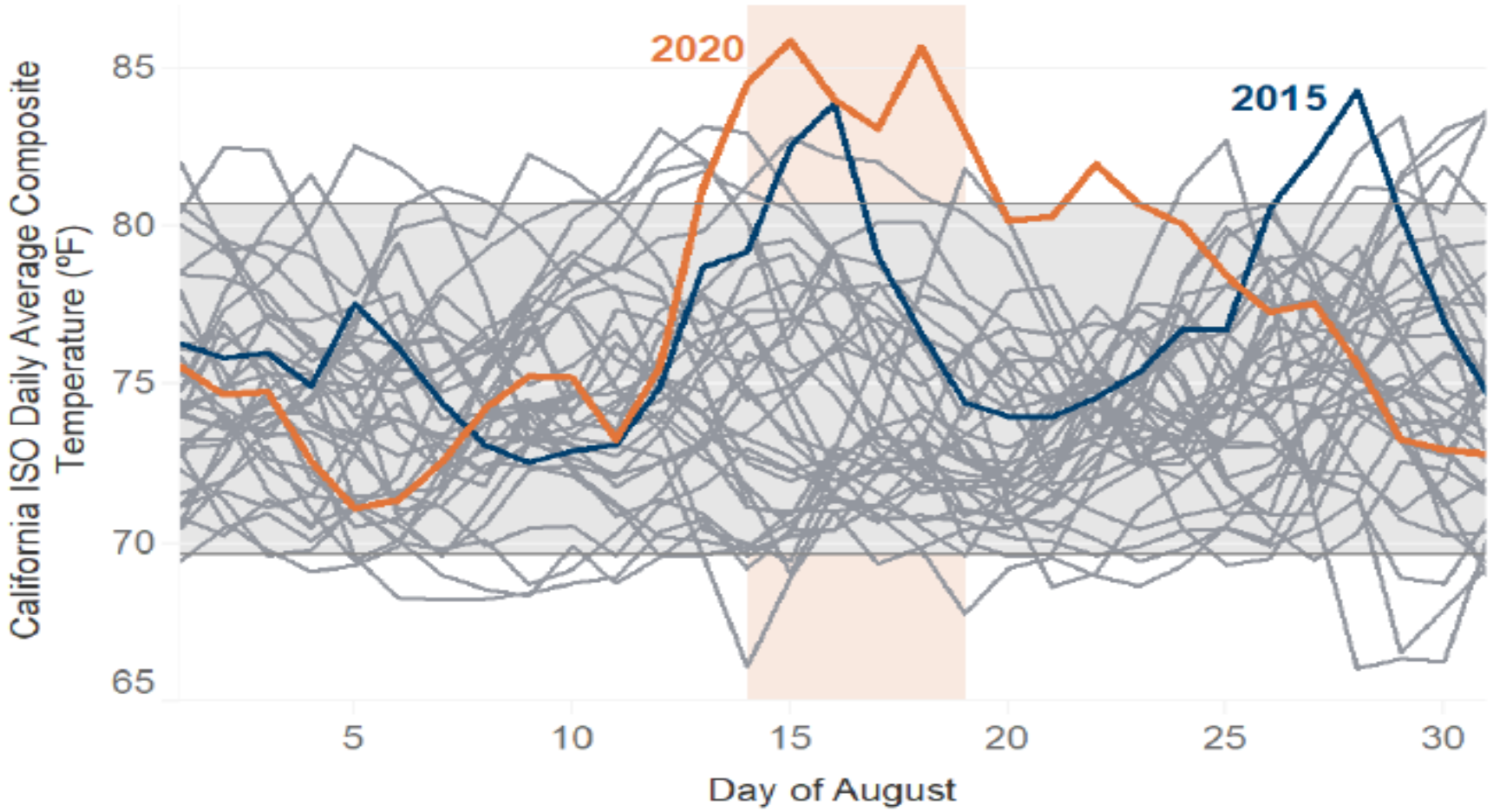
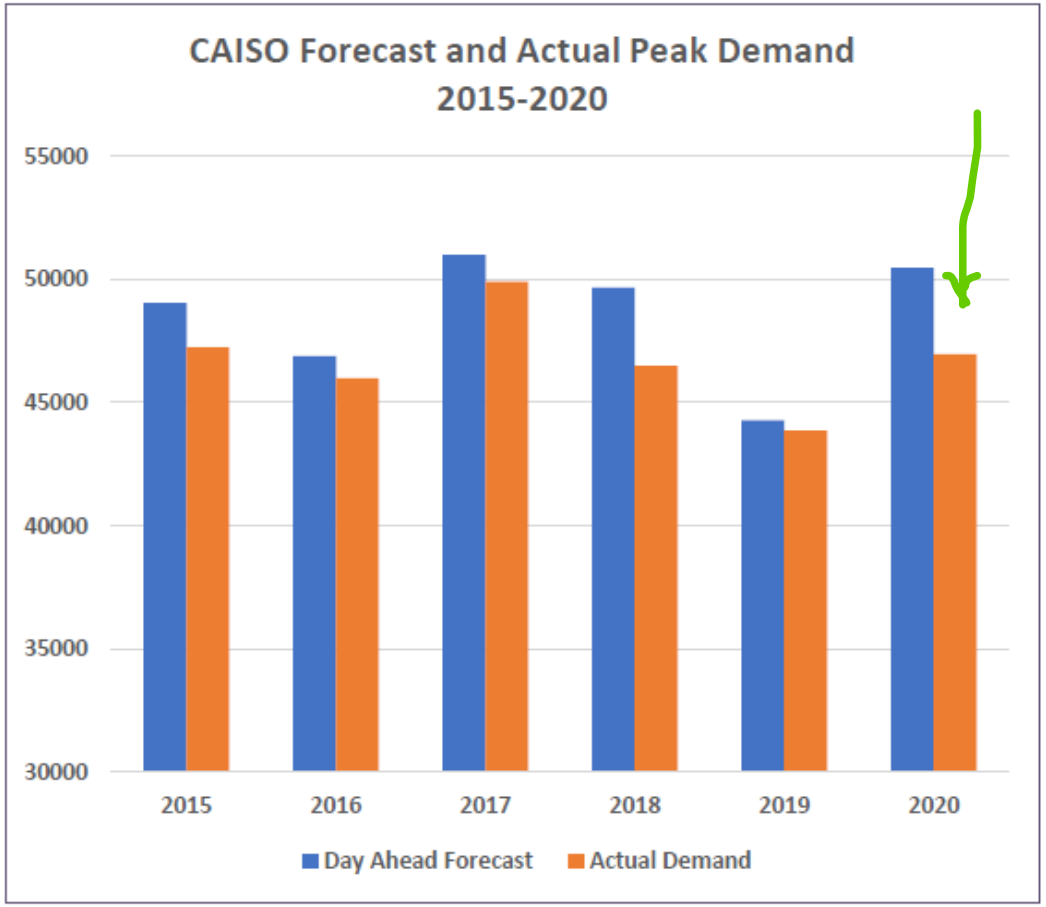


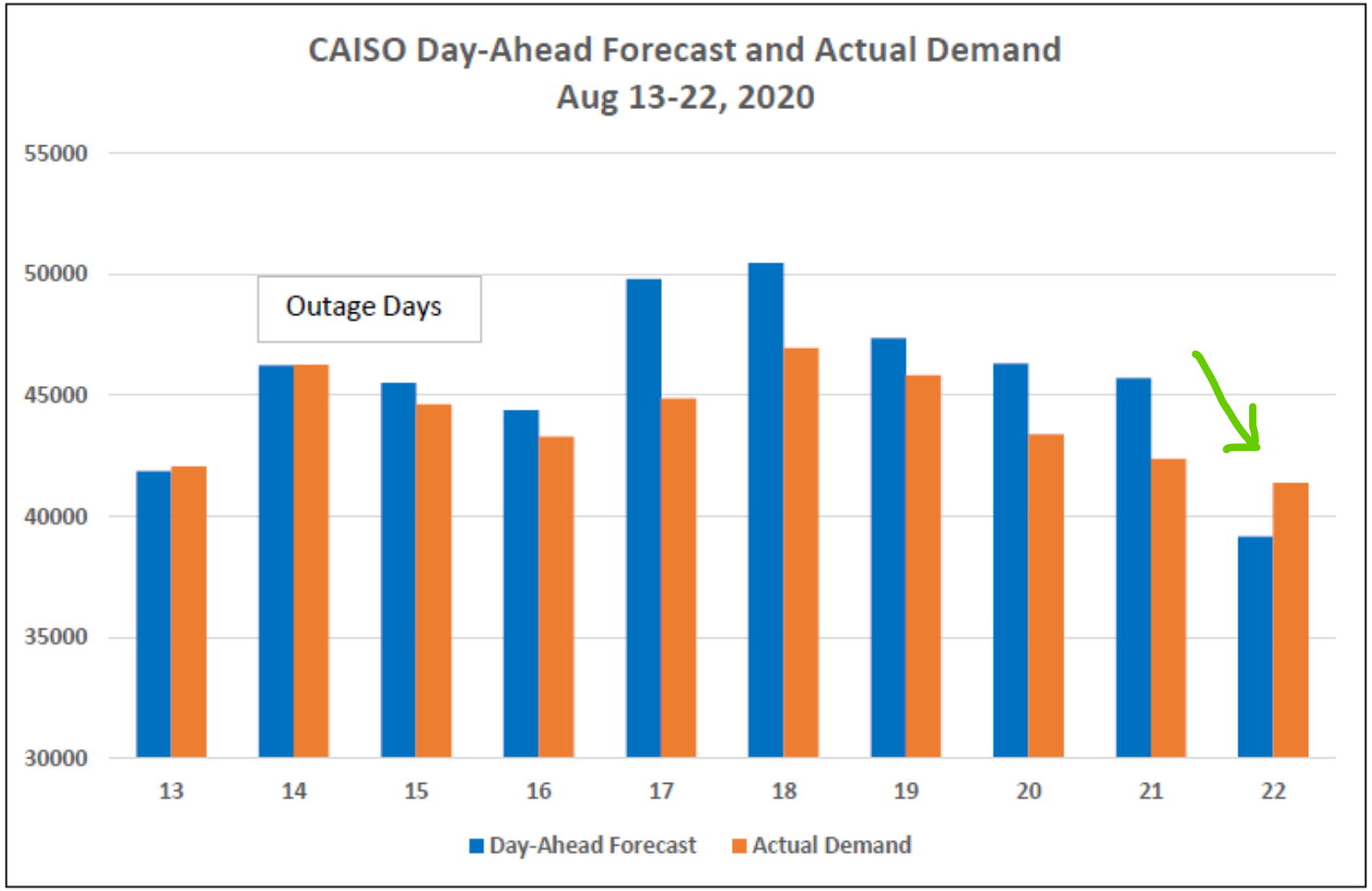
Figure ES.1: August Temperatures 1985 - 2020



(Source: CEC Weather Data/CEC Analysis)

Demand trends





Sequence of Events: August 15th, 2020

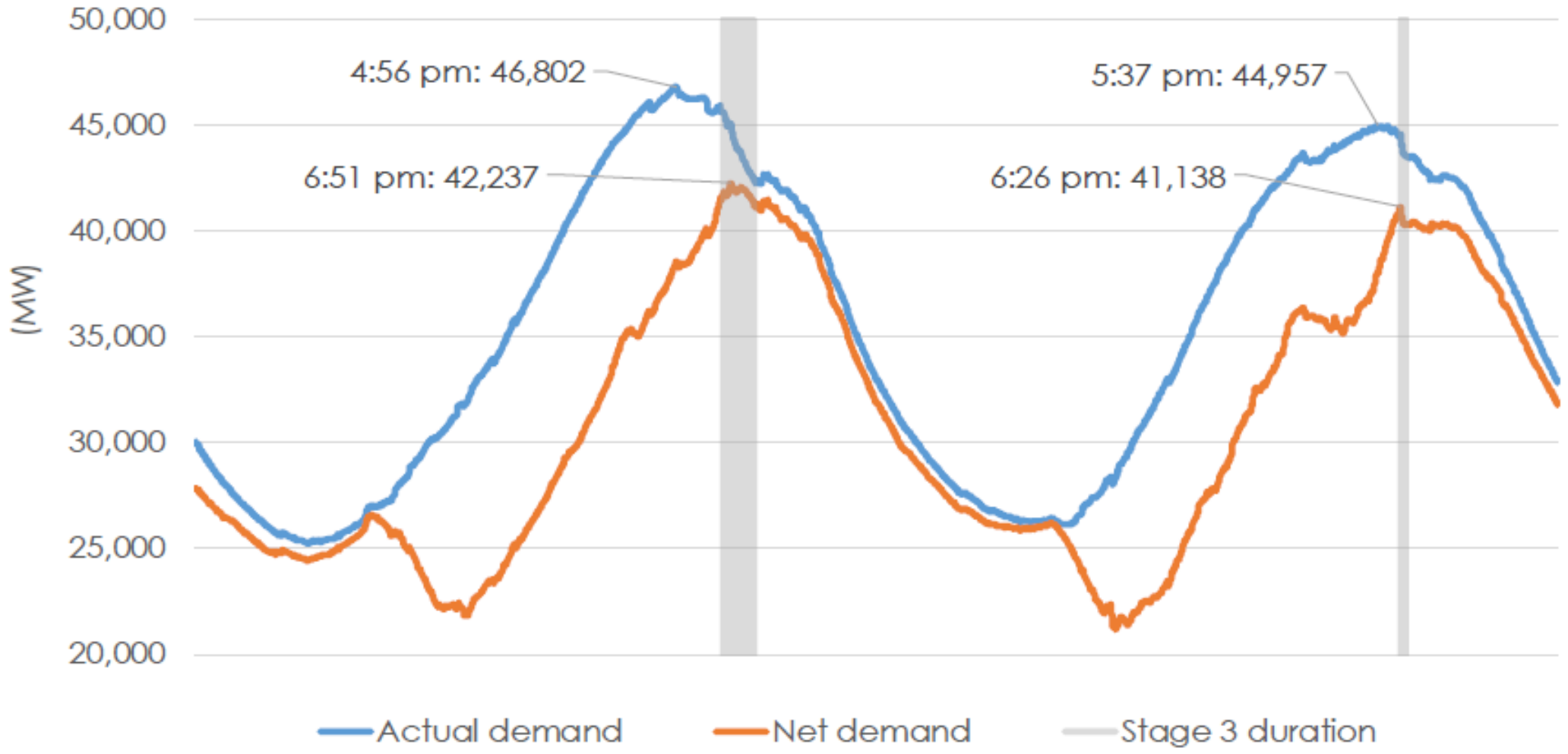
Sequence of events Saturday August 15

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.

So, what was the real problem? Real drivers?

- **Grid peak demands on Aug 14th and 15th: 47,000 MW and 45,000 MW respectively.**
- **Only other period of the highest temperatures prior to this: July 21-25, 2006.**
- **Resource constraints:**
  - Thermal plant retirements
  - Declining imports of power and heat wave coming in from AZ
  - Transmission constraints (COI)
  - Northwest AC Intertie – 1000 MW of derating for maintenance
  - So Cal Gas delivery restrictions: Aliso Canyon issues.
- ***Good news:***
  - NW hydro delivered over 3050 MW in the heavy hours.
  - Voluntary conservation: over 4,000 MW by 6 pm. Reduced "Forecasted demand" by more than 6,000 MW
  - 50 % of total peak demand between 6-8 pm was met with "economic" demand response

Figure ES.2: Demand and Net Demand for August 14 and 15



Realizations: How bad is it?

- **August 14, 2020:** Reductions of peak demand by 4,000 MW and an additional 950 MW in peak demand.
- **August 15, 2020**: Increasing wind production with swings: needs " ramping support" energy to "steady" the wind energy into system. Further, wind energy rapidly dropped after 4 pm. Load was spiking.

- **CAISO realization:** 4,700 MW need through 2022. Gap "started" in 2020. Only 3,300 MW was authorized until 2021.
- Existing resource planning targets NOT designed for heat storm conditions.
- Some day-ahead market practices (import transfer restrictions) exacerbated. Not enough power to meet the 5-7 pm peak demand needs.
- Needed advance warning of tight supply conditions. Stage 3 rolling outages called by 6.38 pm on August 14th and 6.26 pm, August 15th.
- Heat storm spanned most of the American West – impacted CAISO reliance on "imported power."
- *Total import bids in DAM were around 40% more than August projected RA requirements.*

How was the “system stressed” condition managed?

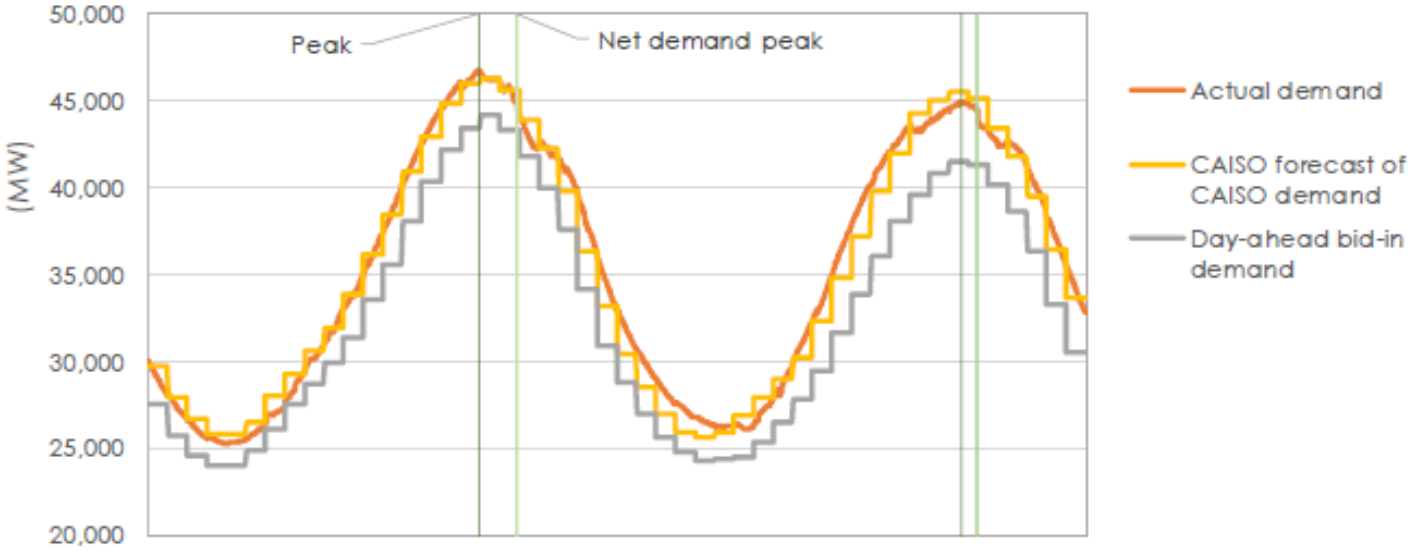
- Natural gas generation: 1,400 MW to 2,000 MW of forced outages (i.e., derating or resource capacity reduced)
- Total Import bids: 40-50% higher than the August 2020 RA projections
- Solar generation: Solar fleet collectively bid at 13% more (370 MW more) on August 14th and 5% less on August 15th in comparison to the RA projections for August at “net” demand peak.
- Total wind fleet: 20% lesser than the RA projections for August 14th and over 110 MW more (10% more) on August 15th.
- Demand Response on August 14th and 15th responded with over 80% and 50% by IOUs as part of economic price signal response, respectively. Huge game-changer response by DR.

CAISO Suite of Options

- **Restricted Maintenance Operations** request generators and transmission operators to postpone any planned outages for routine equipment maintenance and avoid actions which may jeopardize generator and/or transmission availability, thereby ensuring all grid assets are available for use.
- **Alert** is issued by 3 p.m. the day before anticipated contingency reserve deficiencies. The CAISO may require additional resources to avoid an emergency the following day.
- **Warning** indicates that grid operators anticipate using contingency reserves. Activates demand response programs (voluntary load reduction) to decrease overall demand.
- **Stage 1 Emergency** is declared by the CAISO when contingency reserve shortfalls exist or are forecast to occur. Strong need for conservation.
- **Stage 2 Emergency** is declared by the CAISO when all mitigating actions have been taken and the CAISO is no longer able to provide for its expected energy requirements. Requires CAISO intervention in the market, such as ordering power plants online.
- **Stage 3 Emergency** is declared by the CAISO when unable to meet minimum contingency reserve requirements, and load interruption is imminent or in progress. Notice issued to utilities of potential electricity interruptions through firm load shedding.

Day-Ahead Market (bids put in a day-before)

Figure ES.7: 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

Customers Affected by Rolling Outages

Table 3.1: Customers Affected by August 14 Rotating Outages

	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**		

Table 3.2: Customers Affected by August 16 Rotating Outages

	Customers	MWs	Time (in mins)	Start	Finish
SCE	70,000	200	8	6:43 PM	6:51 PM
PG&E	234,000	459	~90	6:25 PM	~7:55 PM
SDGE	17,000	39	~15-60		
Total	**321,000**	**698**	**8 to 90 mins**		

Lessons learned or yet to be learned? - Strategic

- **Improving Situational Awareness:**
  - CEC with CAISO and CPUC will develop a "statewide" summer assessment for 2021 RA proceedings
  - CEC to engage in WECC RA processes (NERC LTRA)
  - Contingency Plan – Lay out sequential emergency measures to include load flexibility, conservation, micro-grids and back-up generation.

- **Resource Planning and Development:**
  - Consider new resources
  - Dynamic rates for customers
  - Market Enhancements
  - Improve situational awareness and plan for contingencies

Lessons learned or yet to be learned? – Operational

- **Actions already taken:**
  - Construct new generation (2,100 MW of storage and hybrid storage resources)
  - Adjustments to energy market processes – Adjust CAISO ability to limit market exports and allow for physical capabilities over market contractual limits.
  - Increase RA requirements to LSEs to more accurately reflect climate change induced risks!

- **Actions yet to be taken but now accelerated:**
  - Bring additional resources online
  - Maximize Flex Alert options
  - Consistency between non-CPUC and CPUC jurisdictional entities for PRM forecast setting.
  - Market Enhancements
    - Address under-scheduled load in the CAISO “Day-Ahead” market

Lessons learned or yet to be learned? Political and Institutional

- **Decision-making clarity –** Role of CEC and CPUC in assisting CAISO with resource targets

- **Politics of expanding jurisdiction –** Non-jurisdictional CA utilities do not want more CA PUC oversight.

- **5 prior years of gas leaks, or storage concerns, or wildfire damages –** Concern about IOUs capabilities and infrastructural quality.

- **Concern about renewables capabilities –** Ramping needs – presents a challenge: More renewable resource exports to CA IS feasible. How to predict and manage better!

Ongoing Efforts

- Multiple agency assessment in CA led by 3 sister agencies
- WECC mandatory (NERC) Reliability Assessment of the Outages
- FERC review likely after reports from CAISO and WECC/NERC are completed.
- More to come!!!

Key takeaways!

- There are NO “bad” guys!
- No one actor is singularly at fault!
- Lots more (and better) information is needed
- Decision-making authority deserves clarity.

- **It’s a system-wide problem – Need all solutions on the table.**

Solutions… Diversity, Flexibility, Transparency

- **Facts:**

  # 1: Climate change is "here to stay" … Will continue to (often) impact western electric grid.

  #2: Decision-making in silos only creates more vacuum, delays in adapting to changing conditions

- **Solutions (WRA is a part of all of these ongoing efforts):**

  - Need to create a more flexible electric grid that brings in more diverse energy supplies
  - Support current efforts to expand current electricity market beyond California to other western states
  - Leverage combined effect of conservation and clean energy development to build diversity of options

Relevant Media Articles

https://www.utilitydive.com/news/were-in-a-bind-california-braces-for-rolling-outages-as-heatwave-contin/583679/

https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/calif-grid-operator-says-generation-shortfall-may-prompt-more-blackouts-59964845

https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/calif-grid-operator-says-generation-shortfall-may-prompt-more-blackouts-59964845

https://www.fresnobee.com/news/california/article245025785.html

https://energycentral.com/news/california-experiences-first-rotating-power-outages-19-years-what-went-wrong

Questions?

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