September Heatwave Analysis
Summer Readiness

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Introduction

Despite the sustained heat wave and unprecedented load levels, the California Independent System Operator (ISO) did not order rotating outages and maintained reliable system operations at all times during the September heatwave.

- This presentation discusses
  - the heatwave and its impacts,
  - performance of different market areas,
  - opportunities for improvements.

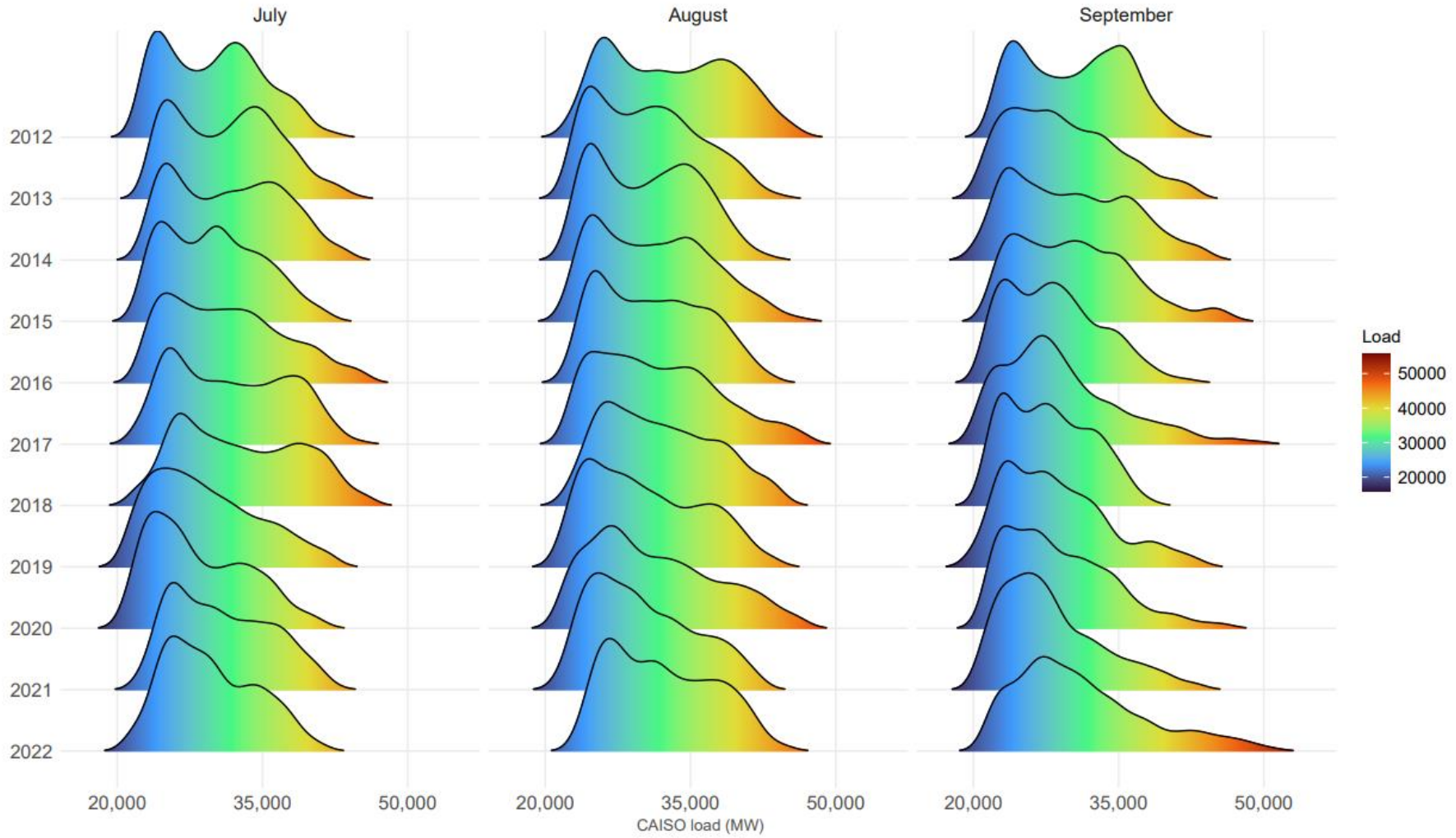
CAISO was able to keep the lights on due to action steps and multiple external factors

1. Increased capacity through resource adequacy procurement,
2. Enhanced coordination, awareness, and communications,
3. Market enhancements developed and implemented over the past two years,
4. The use of new state programs to provide non-market resources to address extreme events,
5. Deployment of demand response and calls for conservation efforts,
6. Geographic diversity of extreme heat across the West.

Areas for improvements

- Addressing miscalculation of the capacity used in the WEIM capacity test
- Enhancing the market logic to clear exports based on intended scheduling priorities and their consideration in the capacity test
- Fixing logic to properly schedule storage resources in the real-time market and properly account for their ancillary services awards in the capacity test

CAISO set a record load of 52,061 MW on Sept. 6



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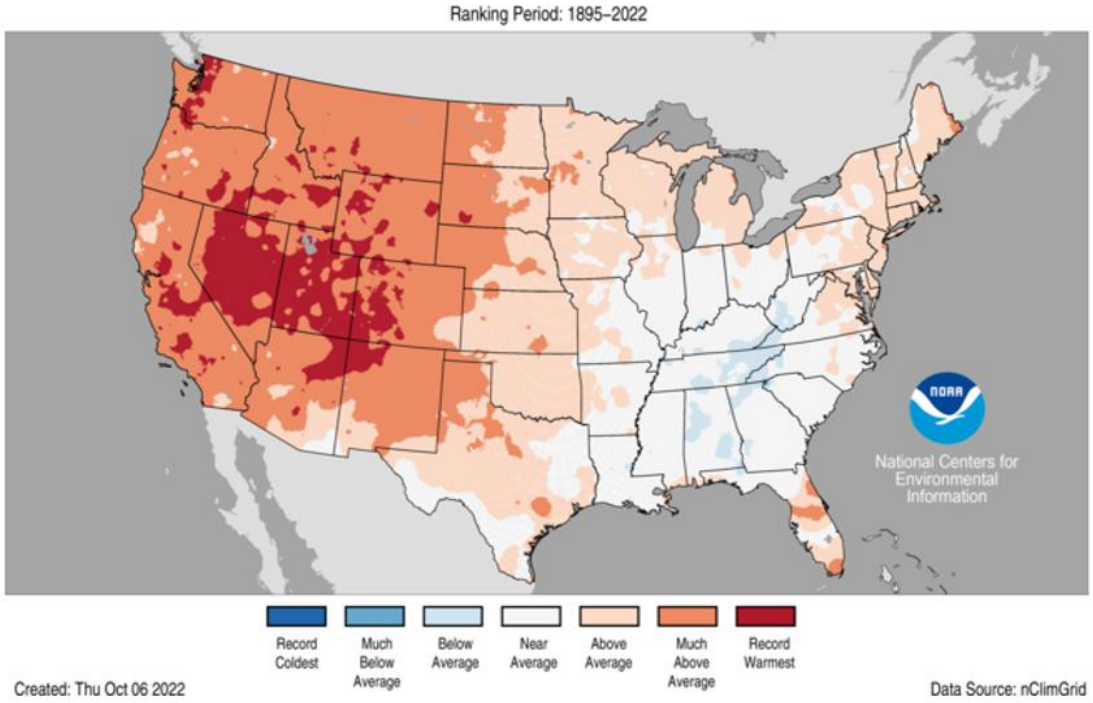
A 10-day shattering heatwave drove record demands



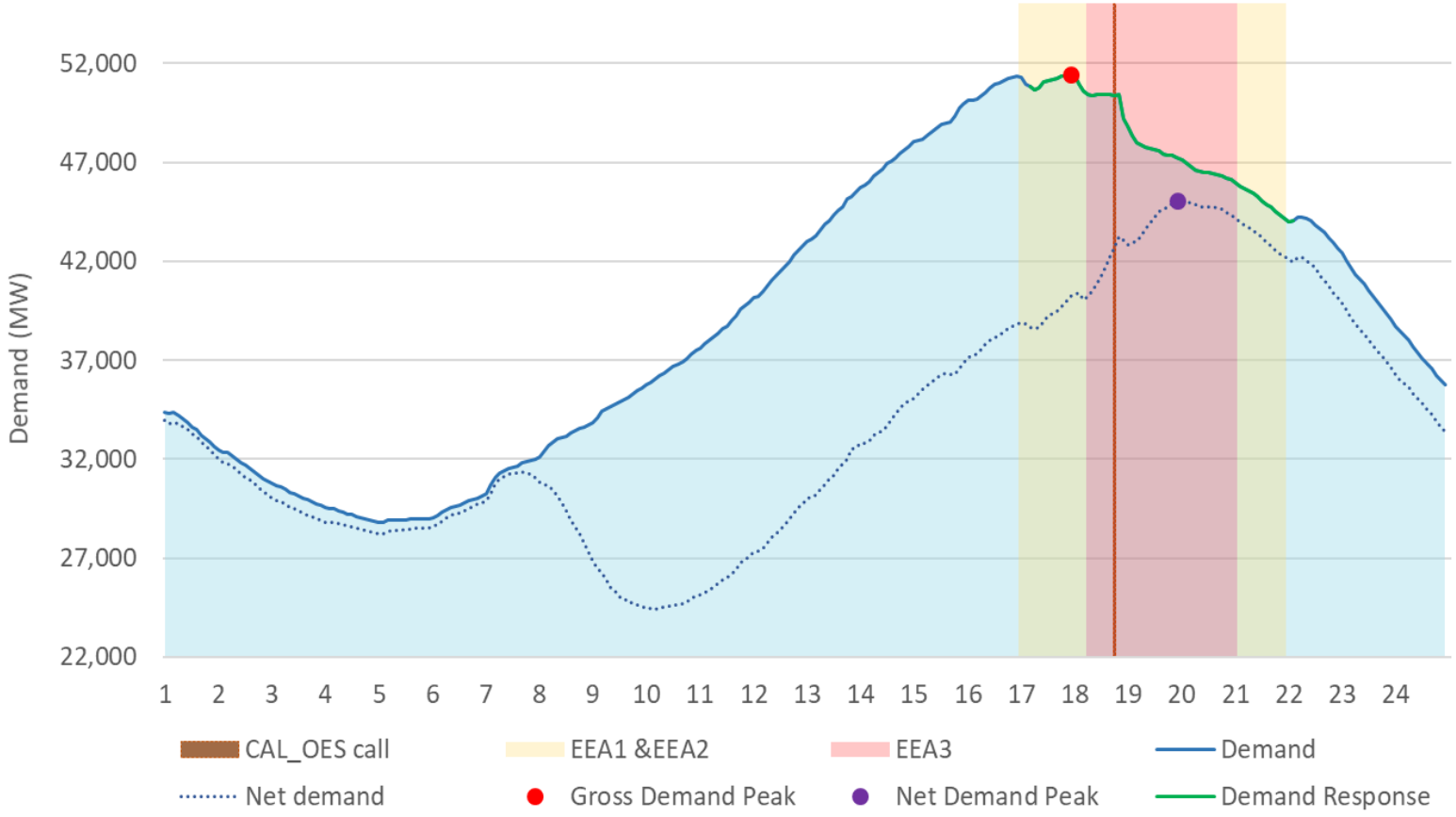
- Multiple cities in California broken 100-year old records for maximum and minimum temperatures

- Using 28 years' worth of weather data, the ISO weighted 3-day temperature through September 6 was a 1-25 year event

Enhancements in place for summer 2022

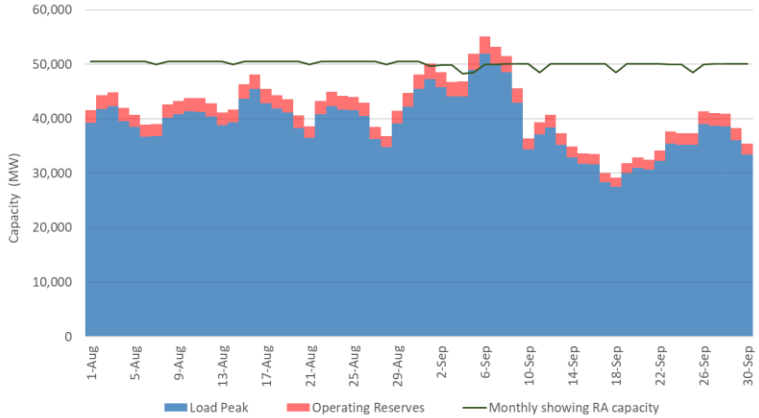
- WEIM resource sufficiency test
- Import market incentives during tight supply conditions
- Enhanced real-time pricing signals during tight supply conditions
- Management of storage resources during tight system conditions
- Reliability demand response dispatch and real-time price impacts
- Load, export and wheeling priorities
- Enhancements to supporting resources for exports and added visibility to scheduling coordinators
- Increased bid caps under FERC Order 831

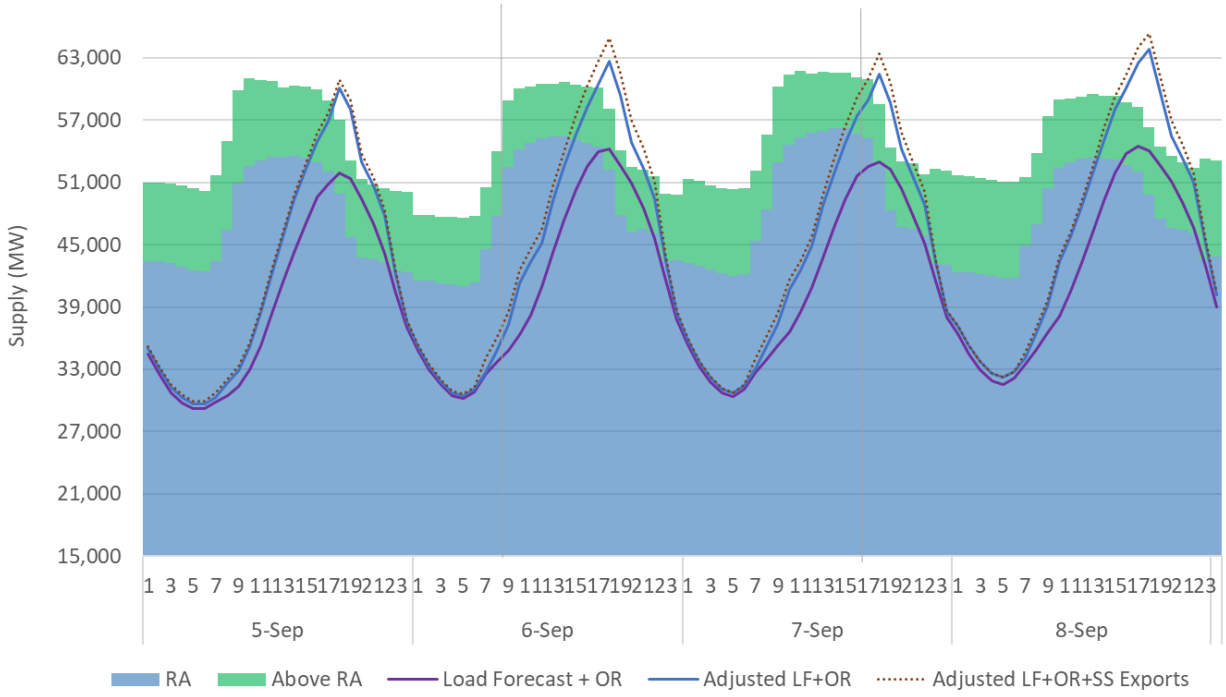
Many factors helped prevent the CAISO from ordering rotating outages



Demand Response and conservation efforts may have reduced demand by up to 1,500MW

The loads levels during the heatwave were above the show resource adequacy capacity





To meet the demand, CAISO also relied on:

-Above RA supply

-Non-RA supply

-Non-market capacity

-Conservation efforts

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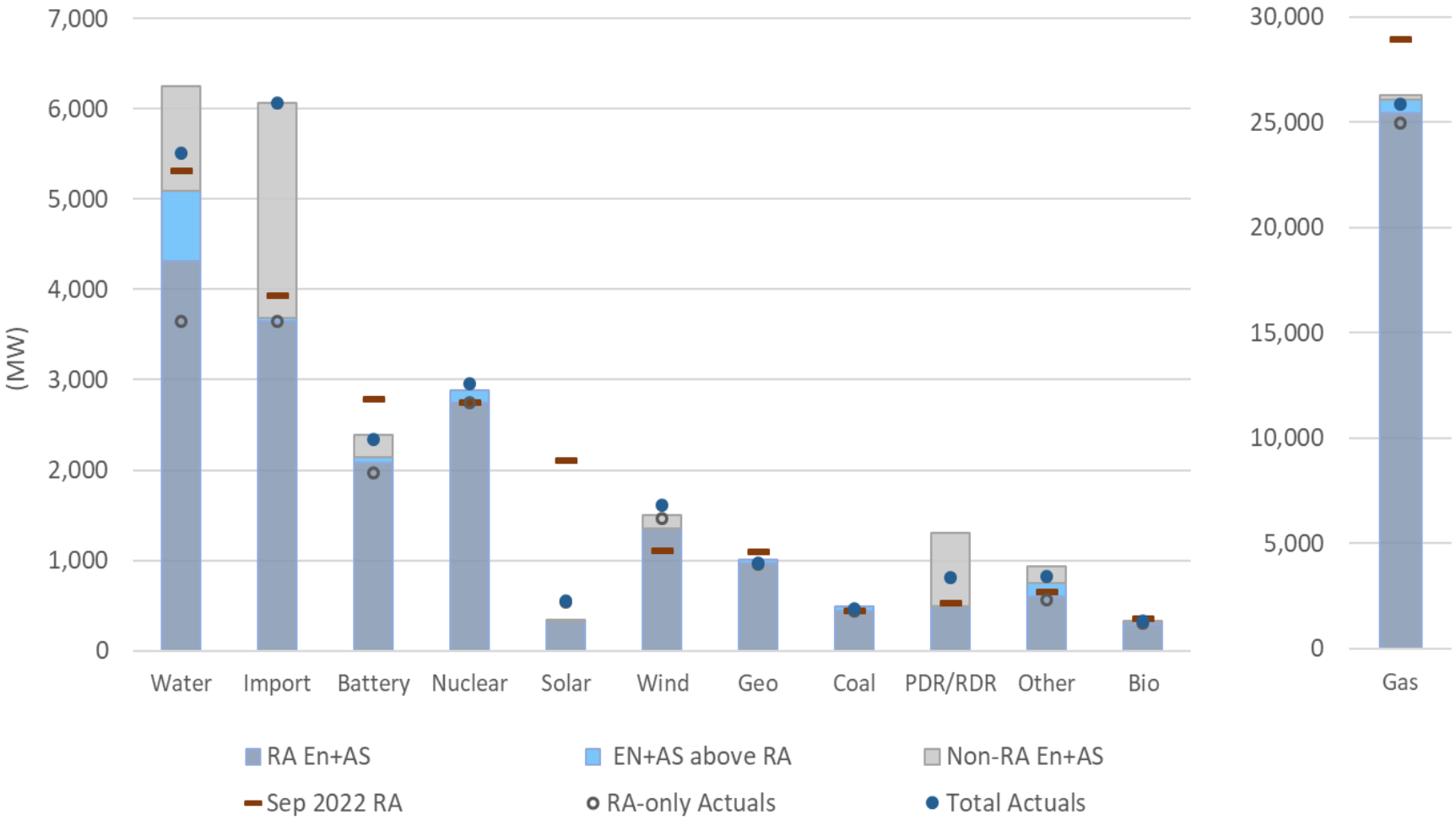
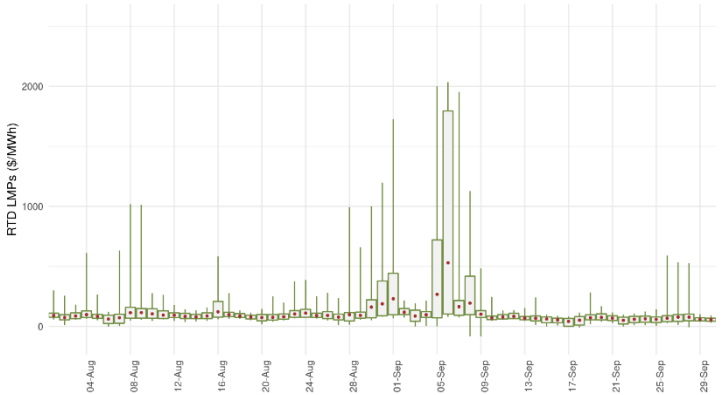
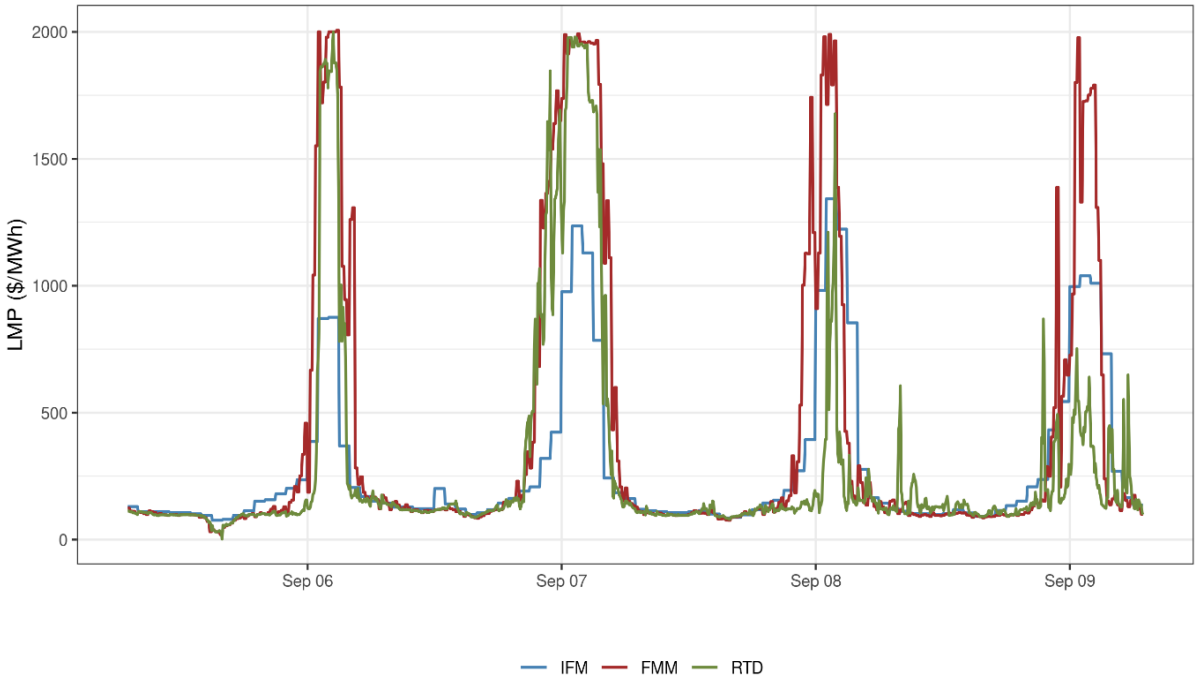
RA fleet performed at different rates depending on the time assessed and resource type



With the adjusted bid cap in place, market prices reached $2,000 MWh"





Higher FMM prices driven by load conformance

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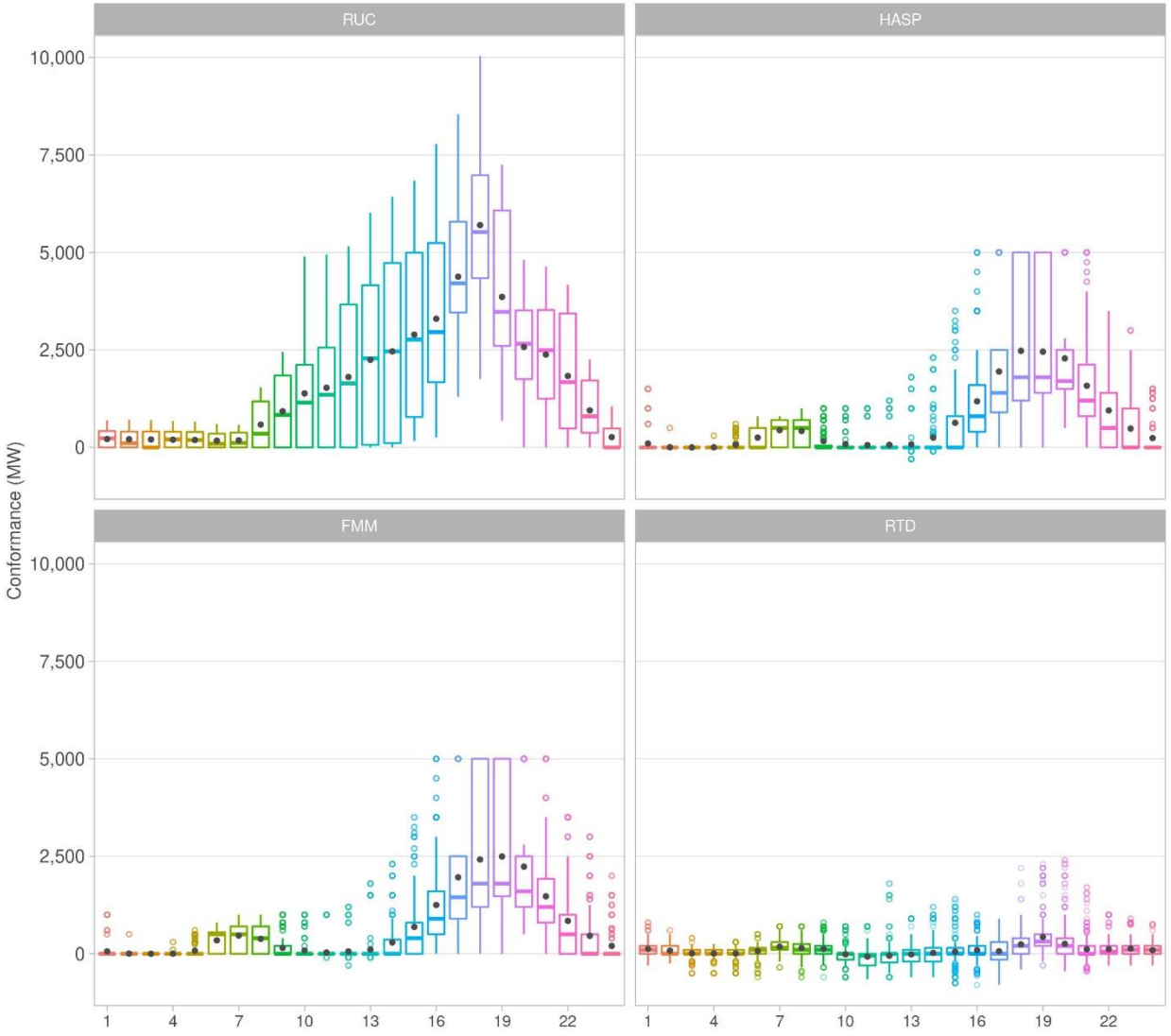
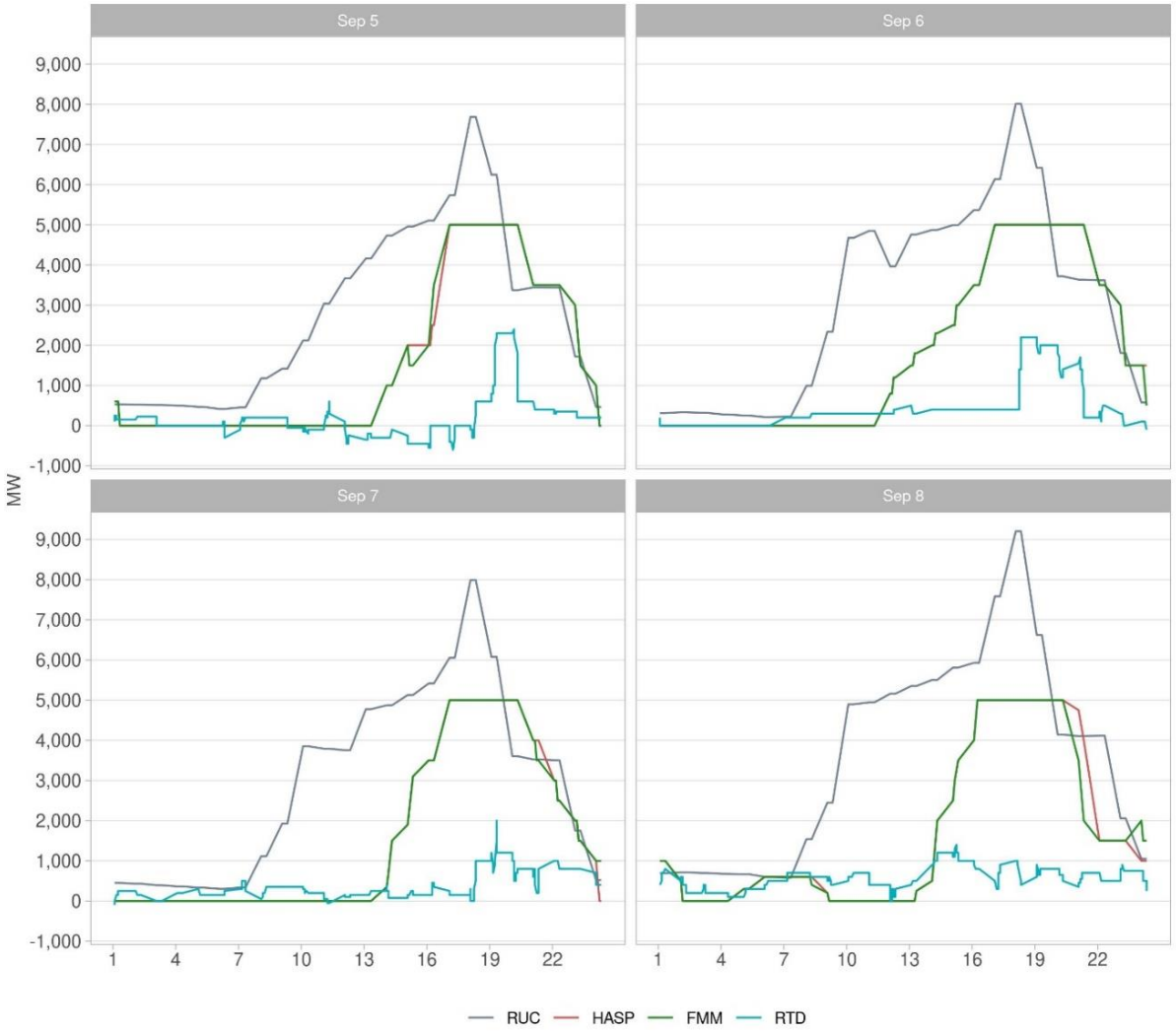
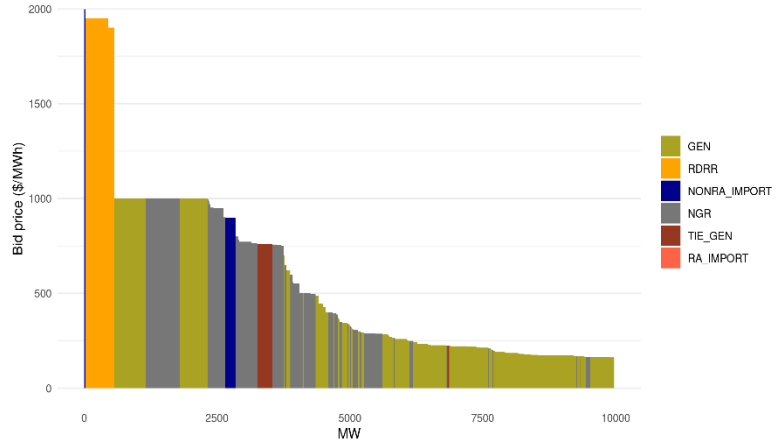
Load adjustments in the day-ahead and real-time markets drove higher prices, reduction of export schedules and infeasibilities

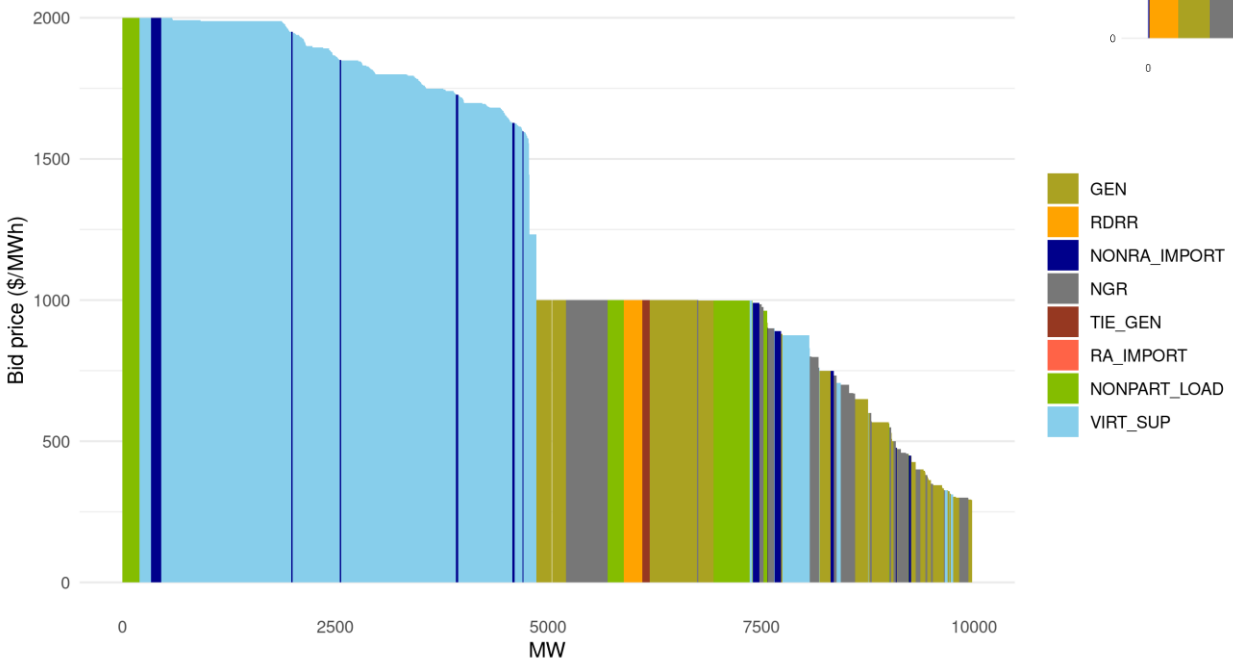


Load adjustments in day-ahead and real-time markets drove higher prices, reduction of export schedules, additional WEIM transfers



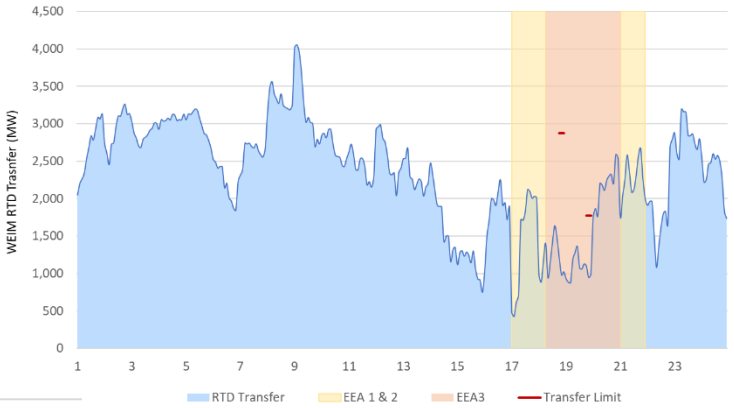
Based on bilateral prices, CAISO triggered FERC831 logic to increase the bid cap to $2,000

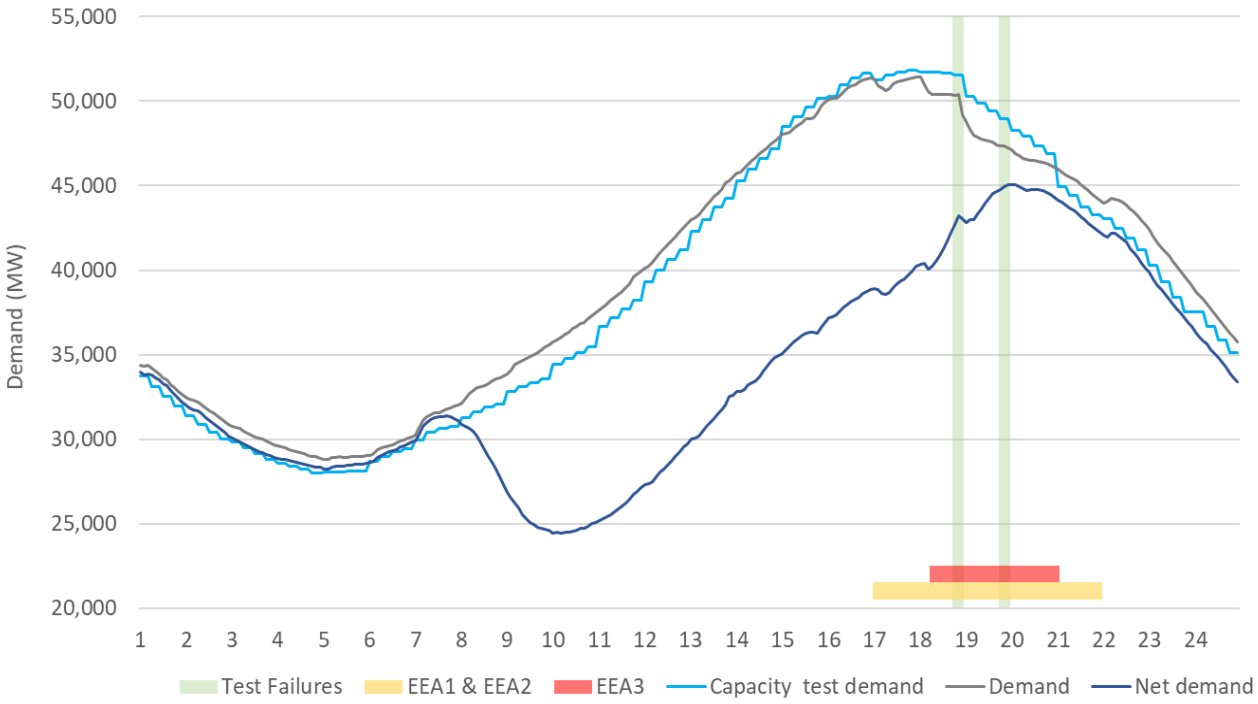




CAISO failed the capacity test in two 15-minute market intervals on Sept. 6

The consequence of the failures were *di minimus* given current levels of transfers





These occurred during the EEA timeframe

All energy conservation effort decreased the load obligation

Multiple issues impacted the accurate assessment of the capacity used in the test

Issues with MSG calculation

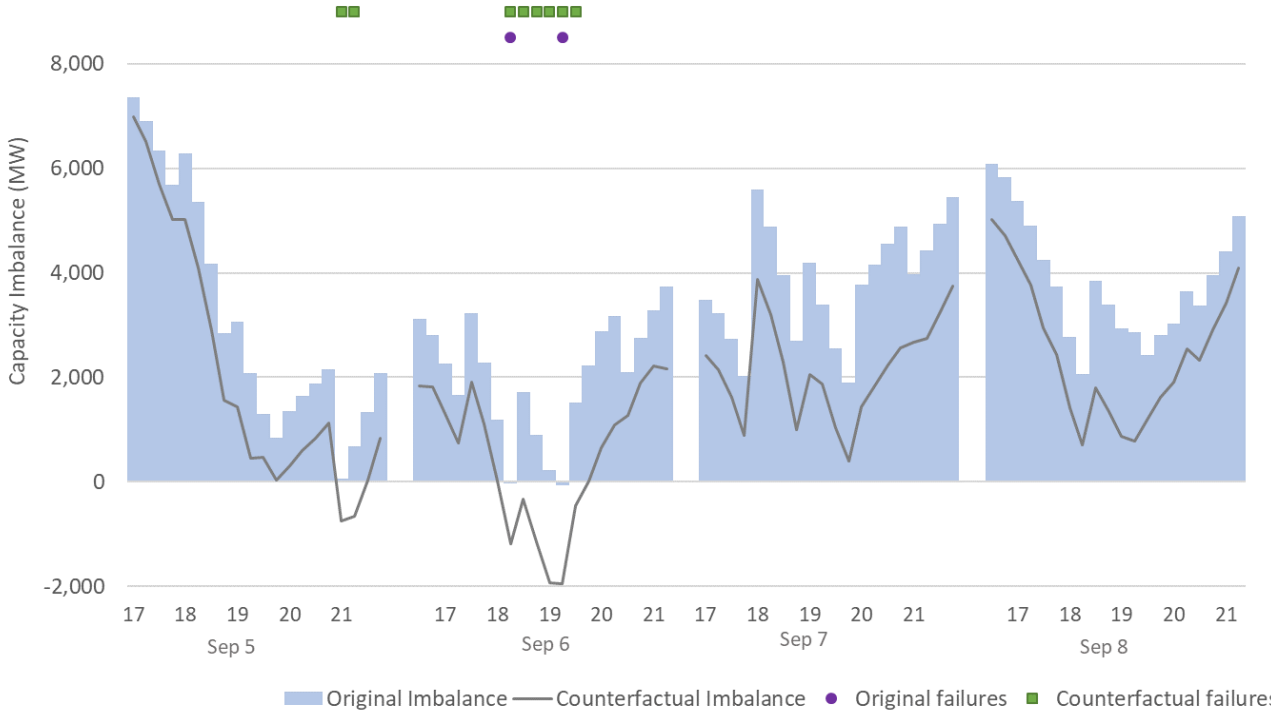
Consideration of AS capacity

Counting of imports/export reductions

Counting of DC losses

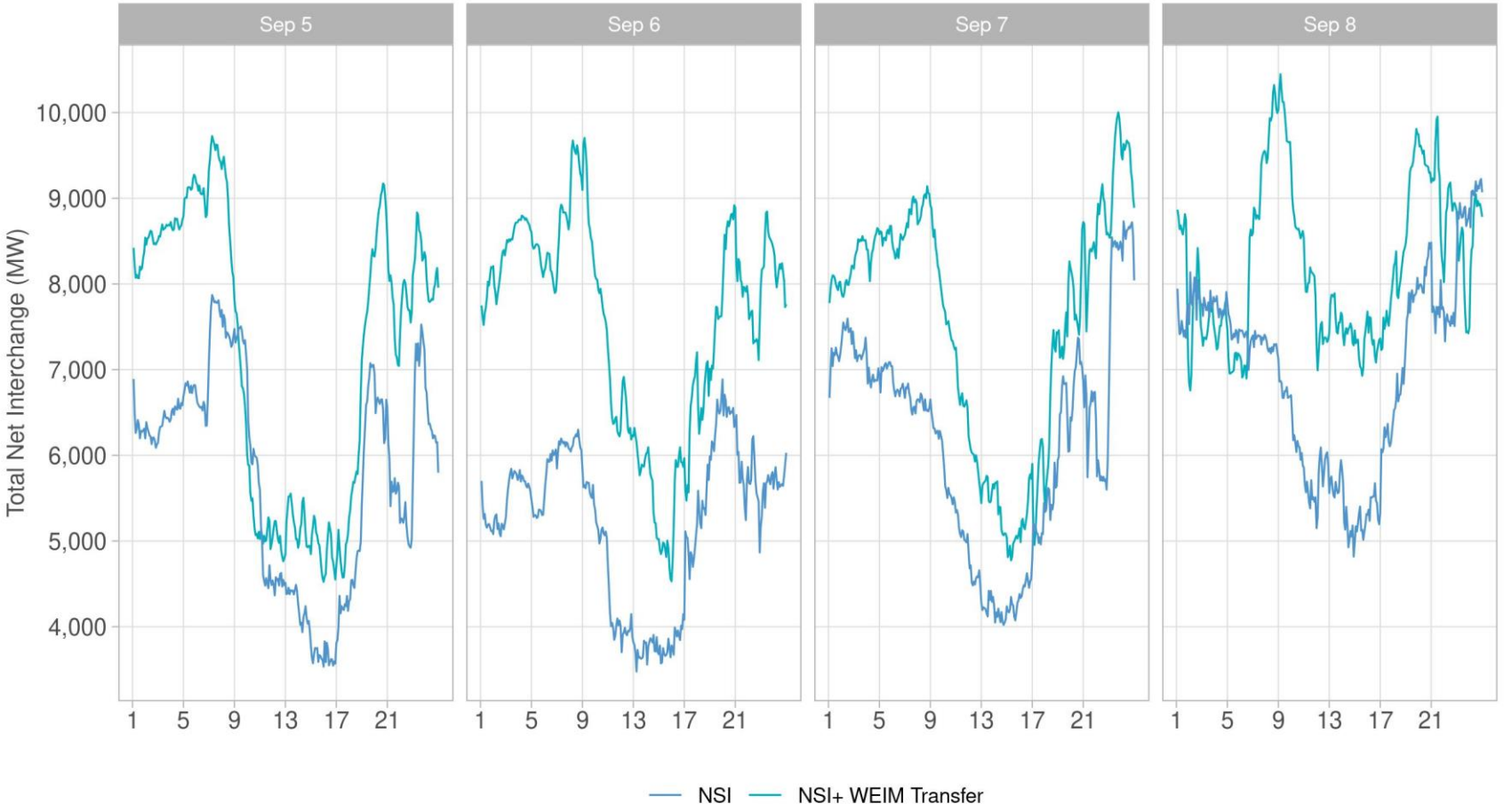
Counting of emergency energy

Not counting armed load

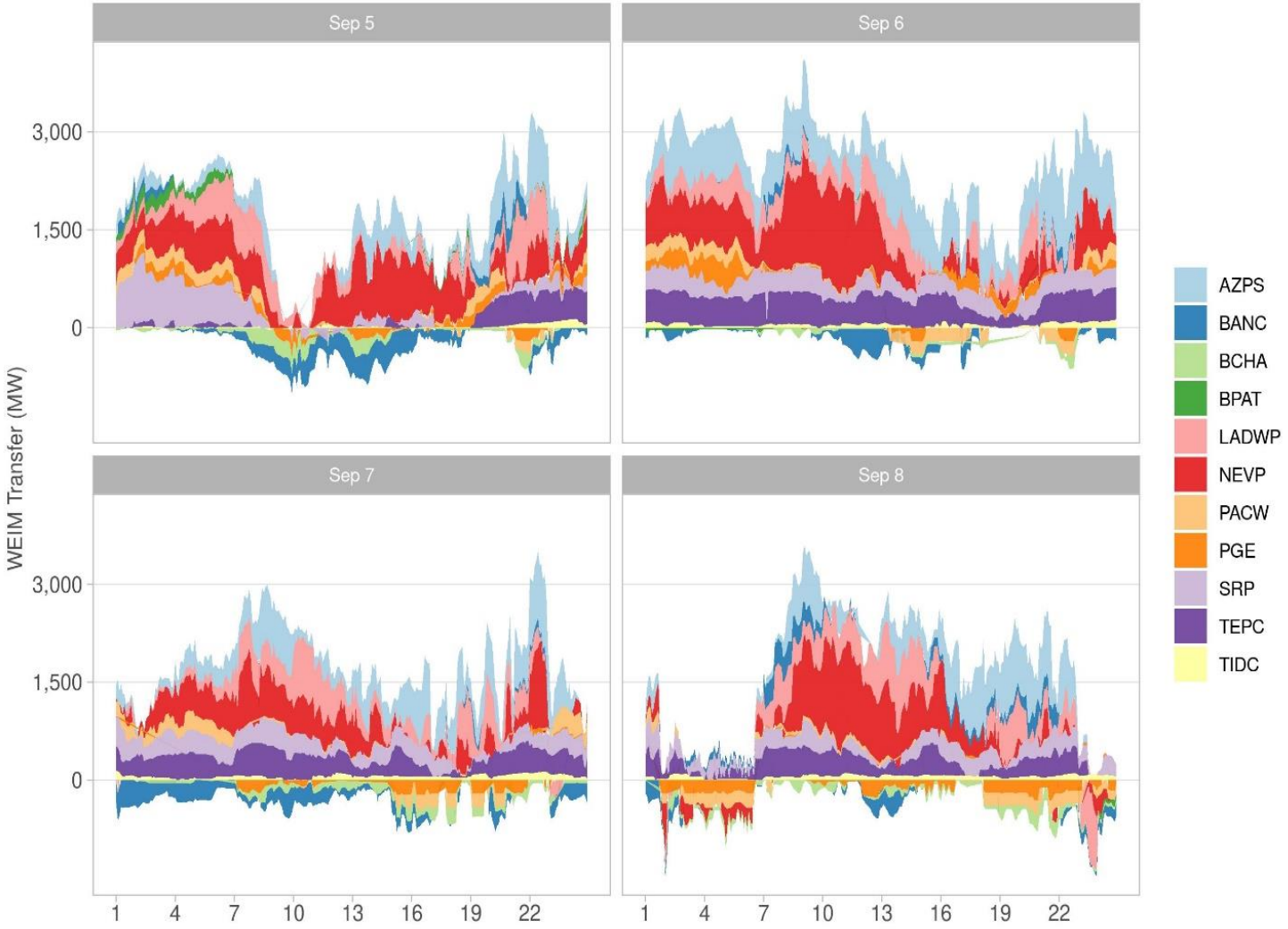


On September 6, CAISO would have failed four additional intervals if these issues were not present

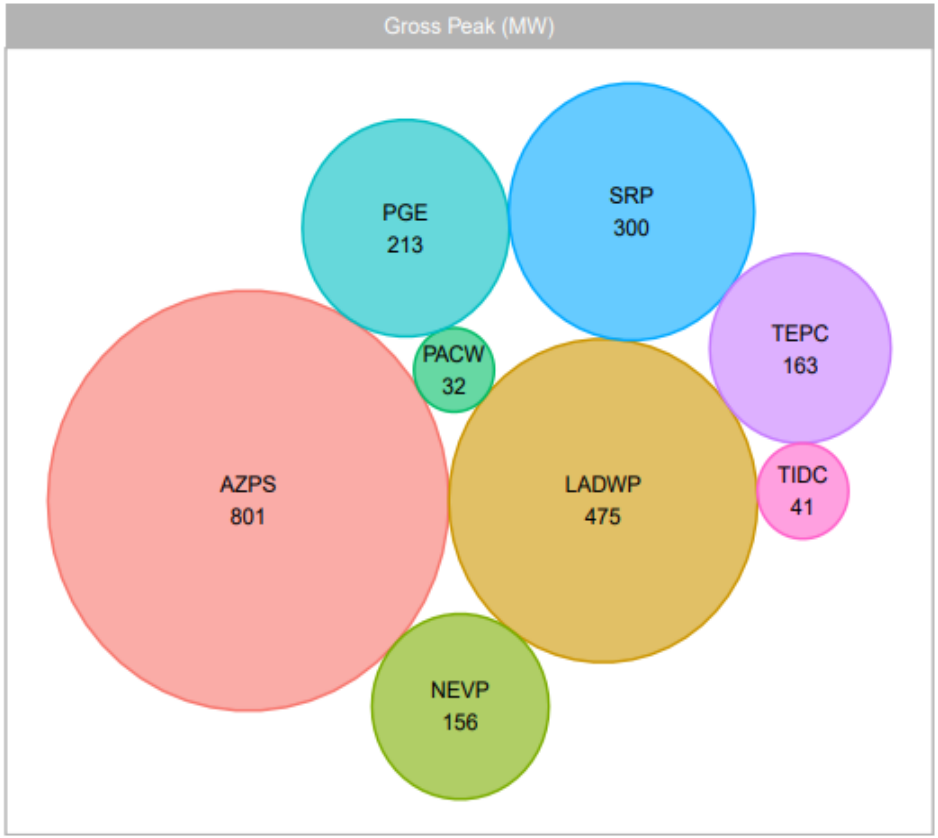
CAISO observed robust level of net interchange during the heatwave, with over 6,000MW during the most critical times

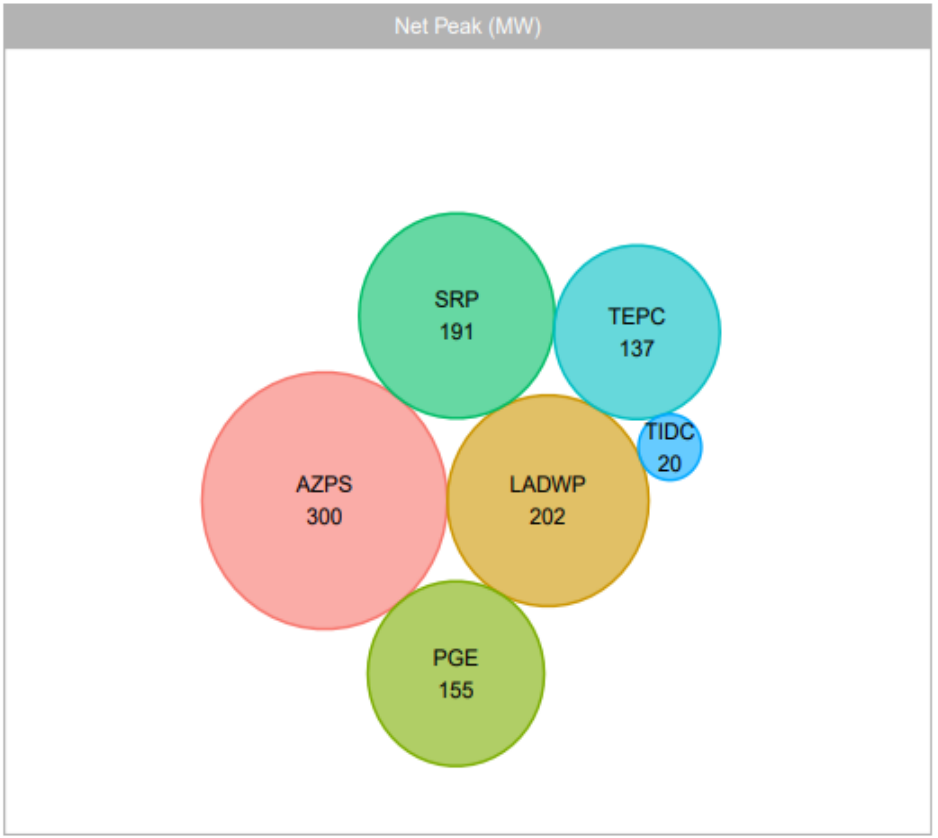


WEIM transfers helped CAISO with 1,000MW of imports during the most critical time

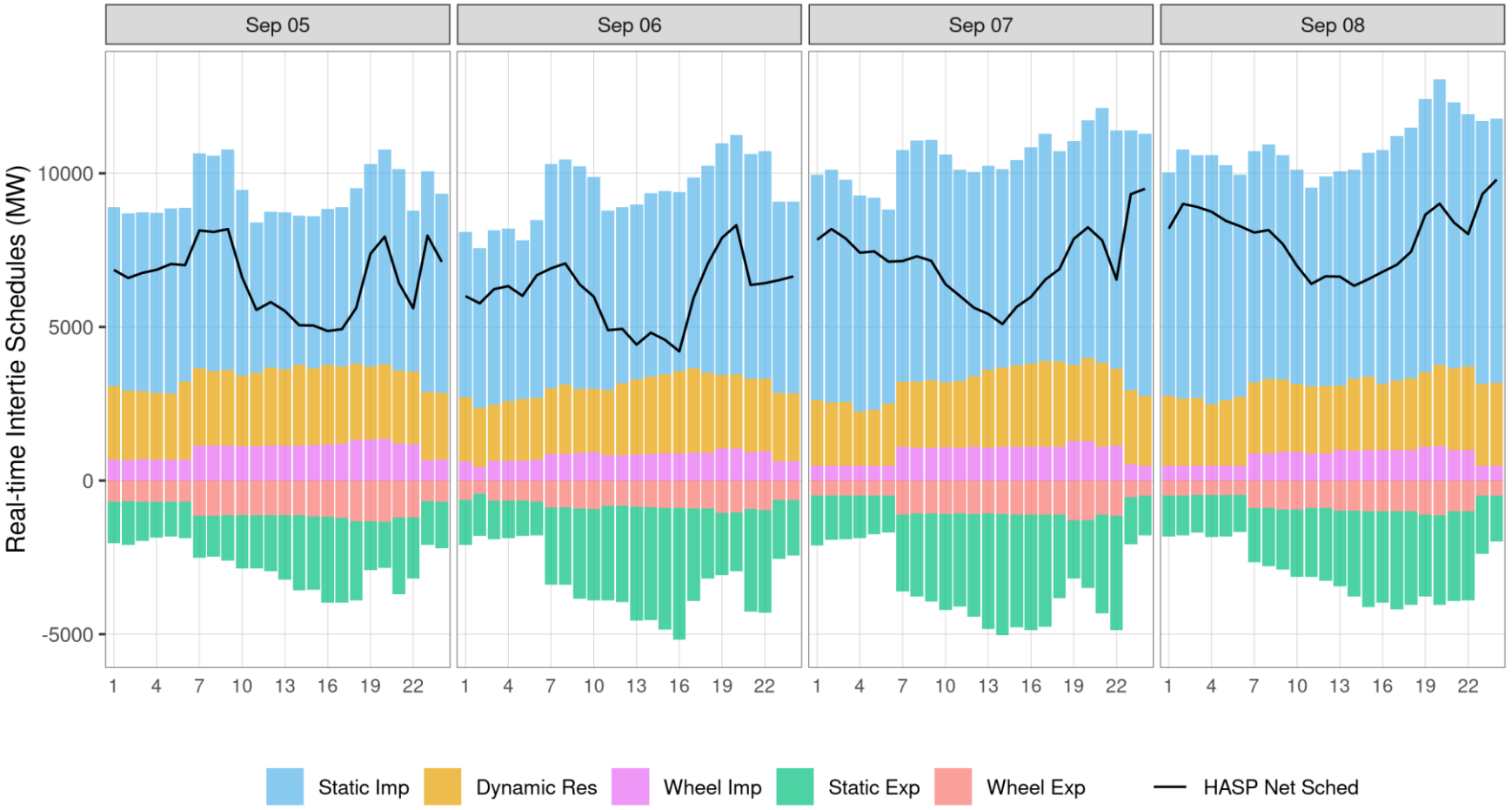


WEIM transfers came from many different balancing areas and were very dynamic

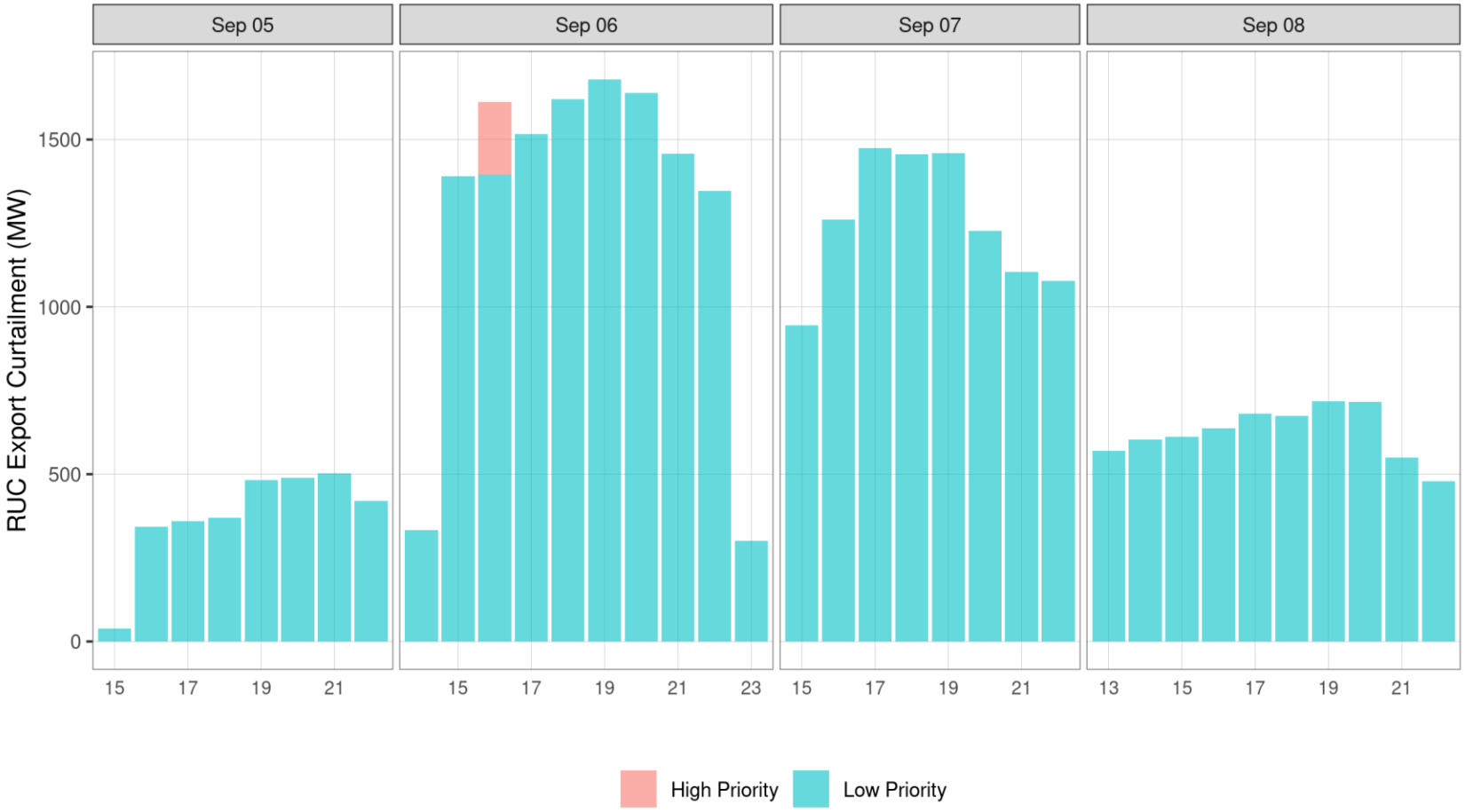




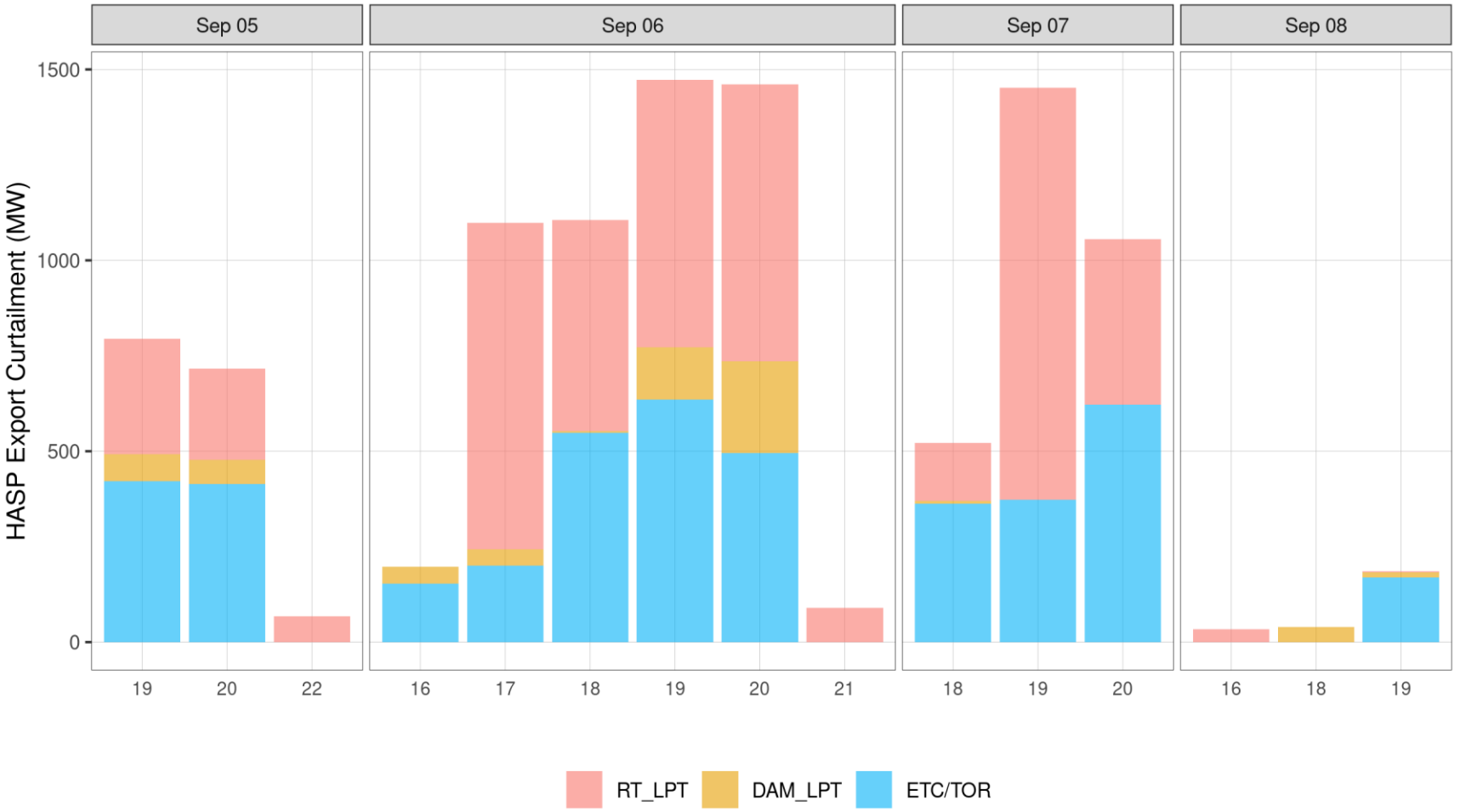
The net interchange volume depends on the level of both imports and imports



With insufficient supply to meet the load obligation, the day-ahead market reduced over 1,500MW of exports

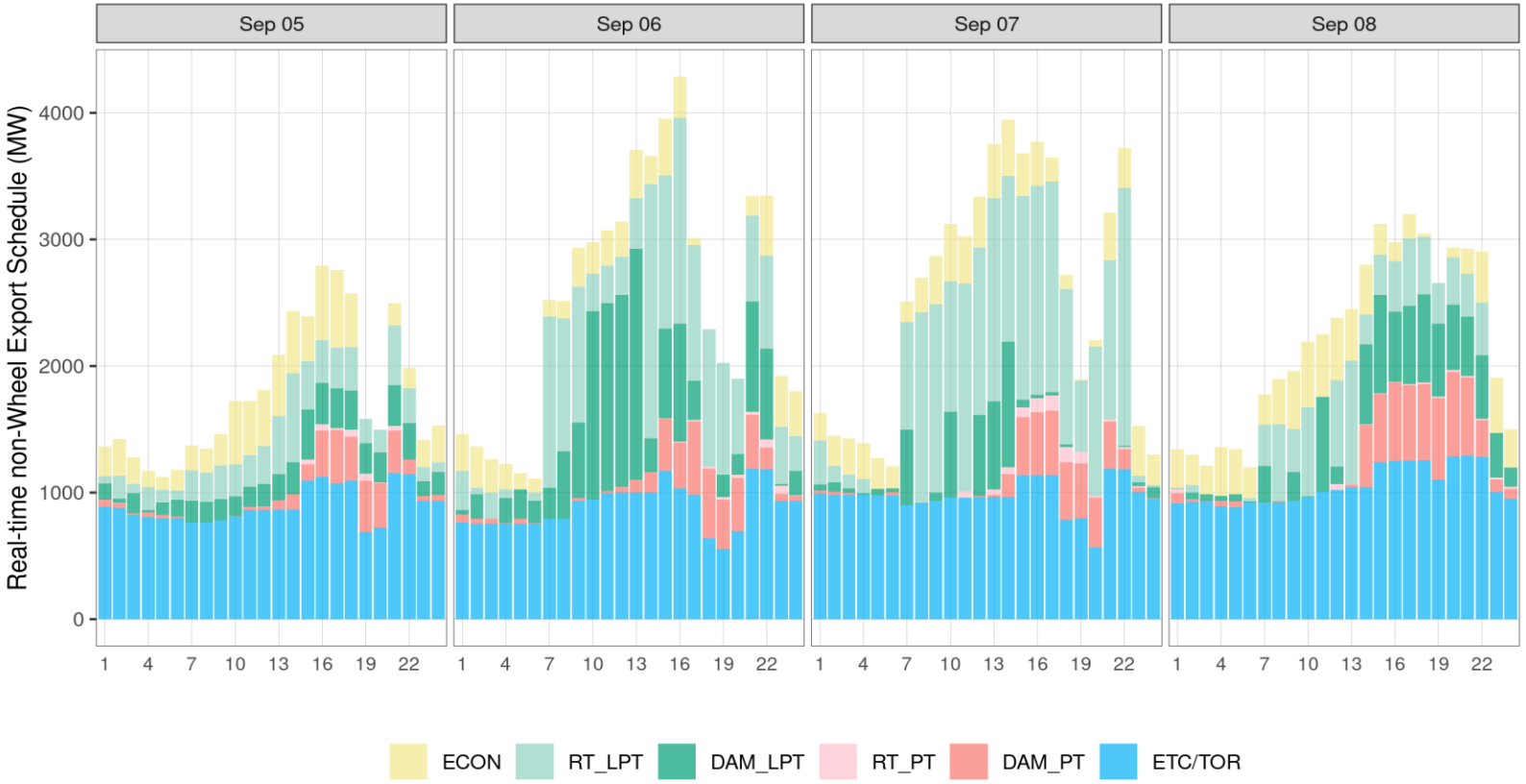


HASP process reduced exports to balance the load under tight supply conditions



HASP also projected to reduce high priority exports, but they are not depicted here because they were blocked before the solution went out

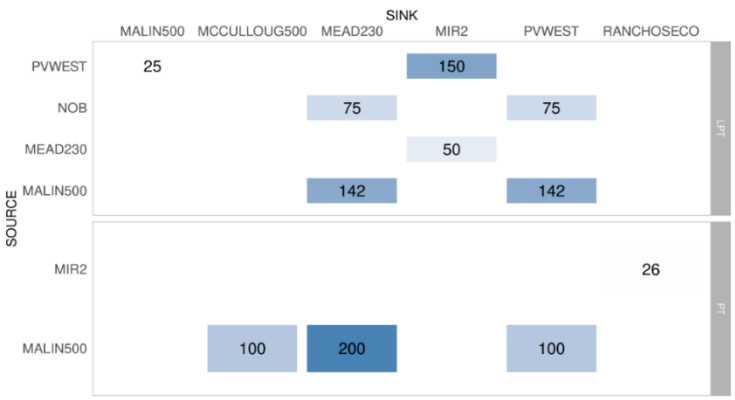
Export schedules in the market cleared at different volumes, maxing out prior to peak hours when there is sufficient supply



Low priority exports cleared during critical hours due to unintended interplay of market functionalities

All high-priority wheels bid in the market were honored

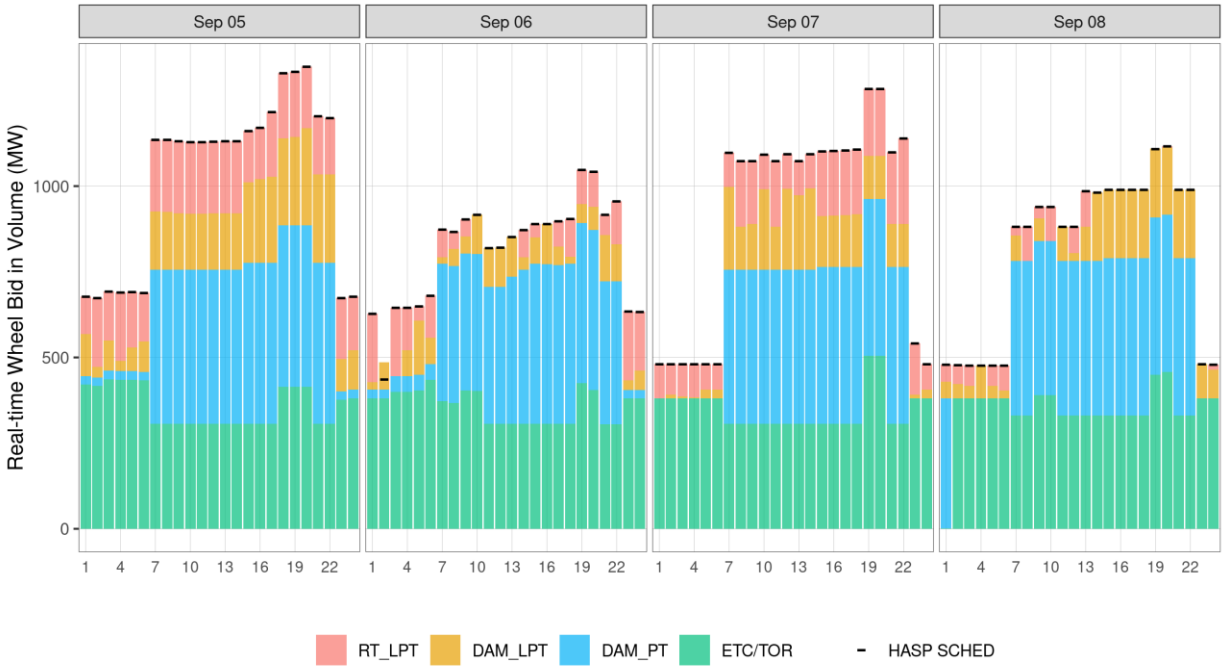
Maximum wheels scheduled by path



About 55% of all the high priority wheels registered in September were scheduled in the market

Registered wheels

Source	Sink	MW
CFEROA	MEAD230	50
CFETIJ	MEAD230	75
CTW230	LLL115	105
MALIN500	ELDORADO	12.5
MALIN500	MCCULLOUG500	100
MALIN500	MEAD230	200
MALIN500	PVWEST	162.5
MIR2	RANCHOSECO	30
NOB	MEAD230	51
NOB	PVWEST	62.5
NOB	ELDORADO	12.5
	Total	861



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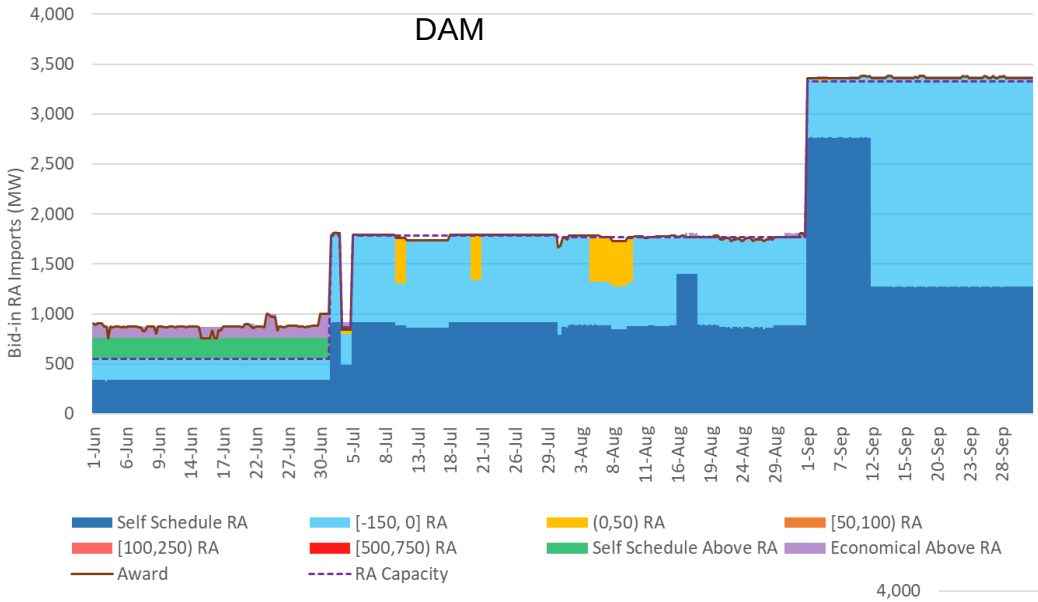
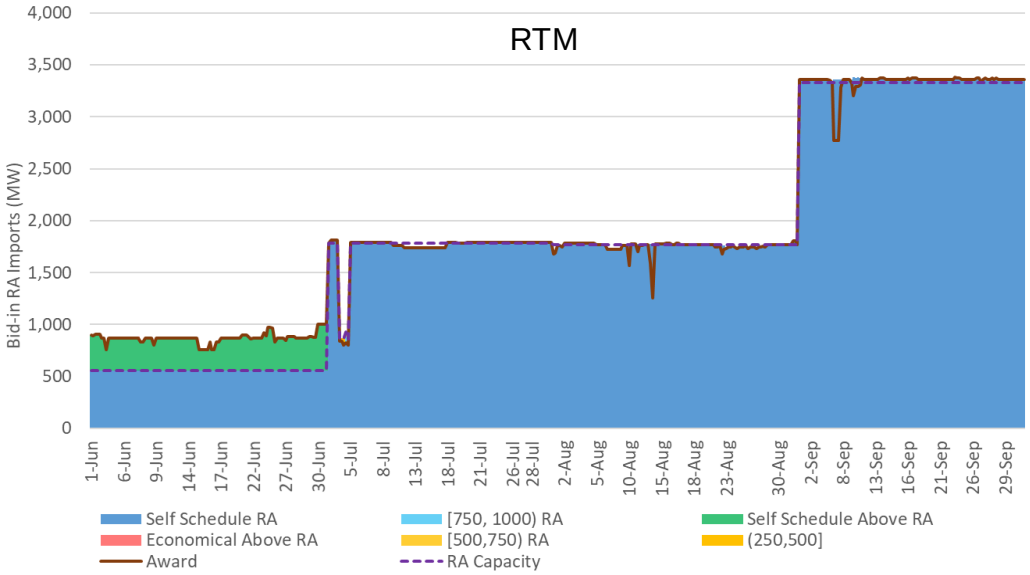
Over 99% of RA imports bid in at or below $0/MWh in September





Assessment is based on only

- CPUC-jurisdictional Imports
- Non-resource specific Imports
- Weekdays and peak hours

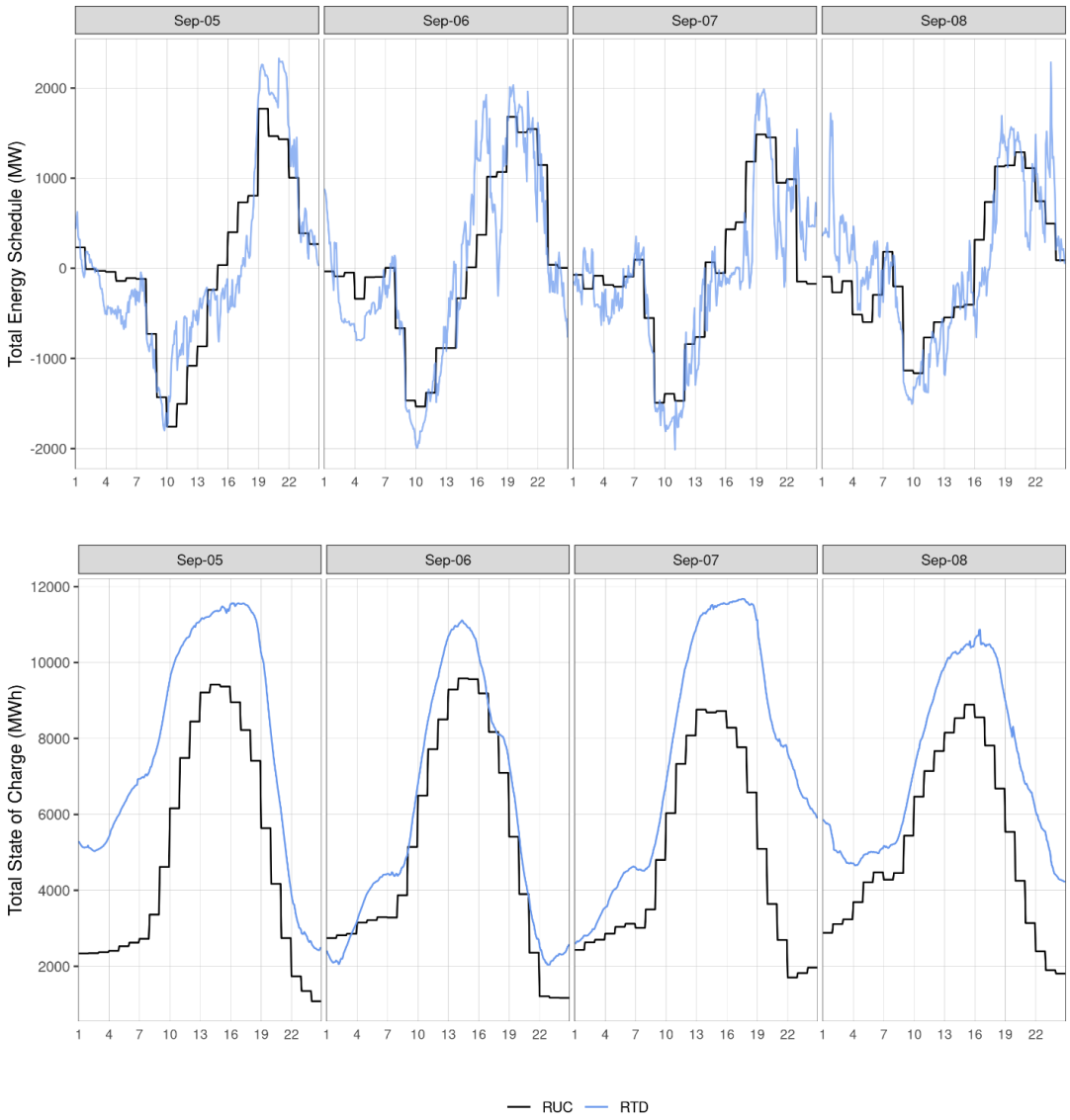
Storage resources provided critical supply during peak hours

On Sept. 6 they were depleted too early in the day based on higher clearing prices

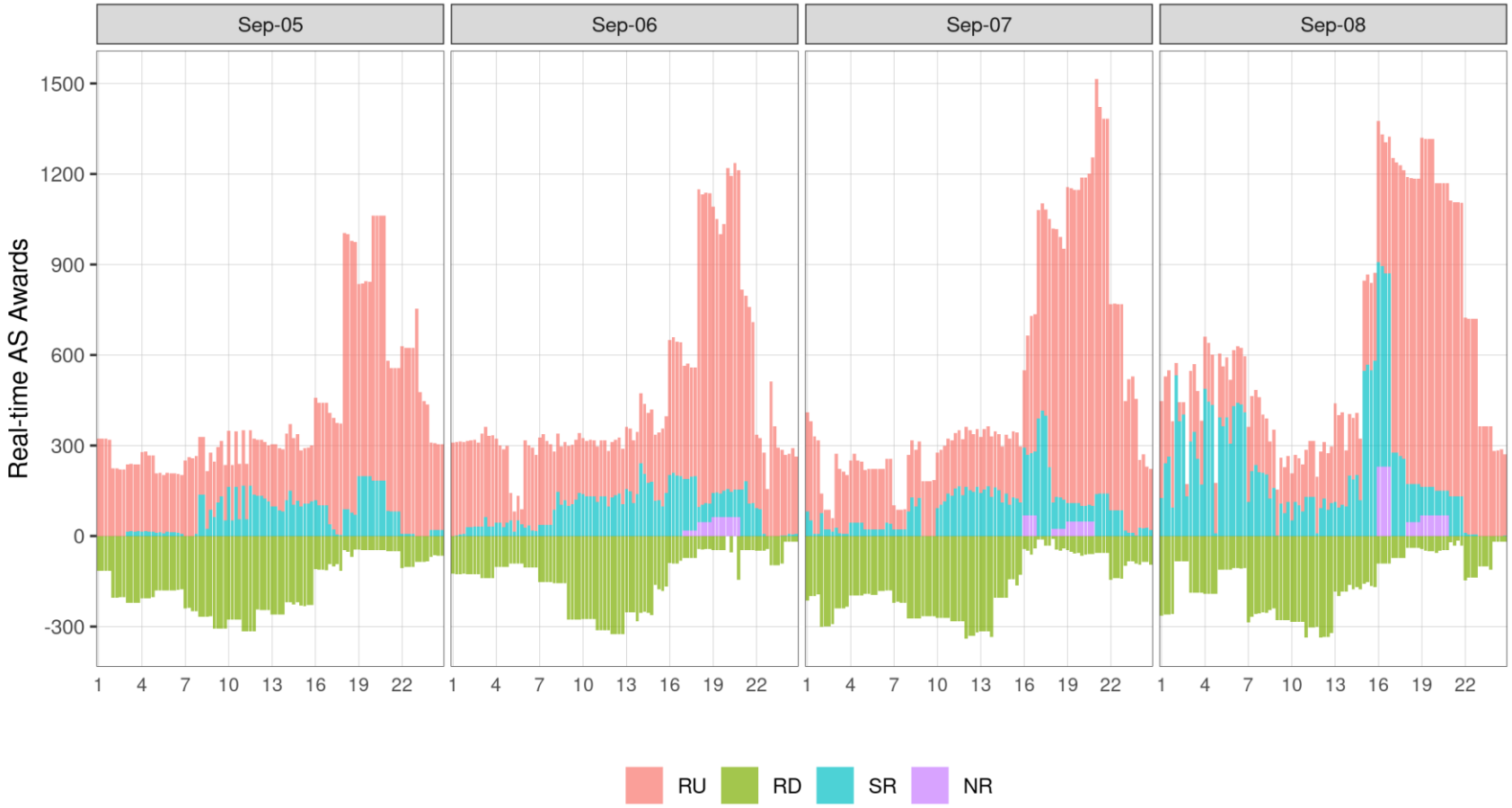
Minimum state of charge triggered to preserve storage level

Operators manually dispatched resources on Sept 6-8

A software issue prevented some resources to charge early in the day



Storage provided both energy and ancillary services capacity



Average daily wholesale cost in September was about $110 million, with the highest at $375 million on Sept. 6