



An Imbalance Reserve Product to Manage Uncertainty between the Day-ahead and Real-time Markets

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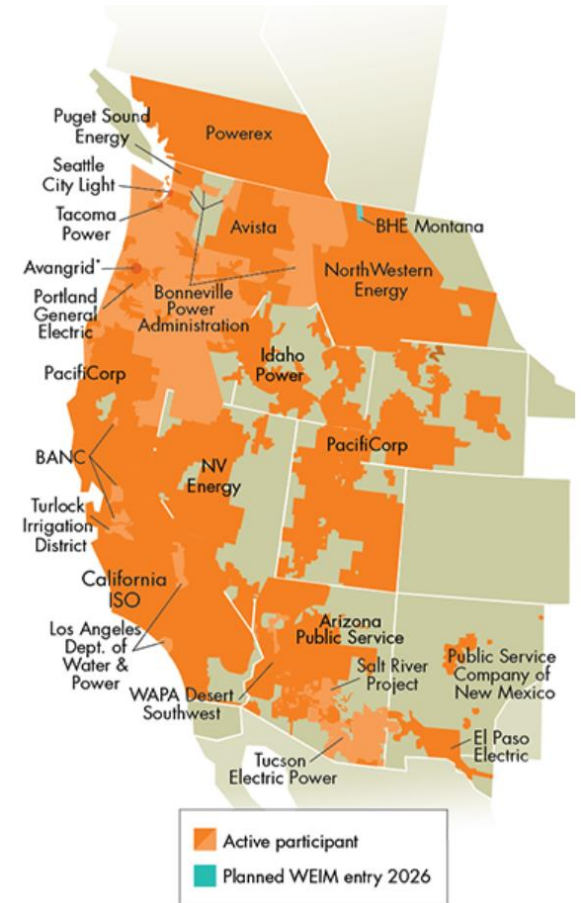
California ISO is a nonprofit, public benefit corporation

Our responsibilities are to...









Provide market transparency
Drive innovation

Maintain grid reliability
Facilitate infrastructure planning
Support state and federal policy goals
Coordinate the bulk electric power system

Provide situational awareness
Run the Market



Strategies to integrate renewables into power system

 <p>Storage – Increase the effective participation by energy storage resources.</p>	 <p>Western Energy Imbalance Market – expand the Western Energy Imbalance Market.</p>
 <p>Demand response – enhance DR initiatives to enable adjustments in consumer demand, both up and down, when warranted by grid conditions.</p>	 <p>Regional coordination – offers more diversified set of clean energy resources through a cost effective and reliable regional market.</p>
 <p>Time-of-use rates – implement time-of-use rates that match consumption with efficient use of clean energy supplies.</p>	 <p>Electric vehicles – incorporate electric vehicle charging systems that are responsive to changing grid conditions.</p>
 <p>Minimum generation – explore policies to reduce minimum operating levels for existing generators, thus making room for more renewable production.</p>	 <p>Flexible resources – invest in modern, fast-responding resources that can follow sudden increases and decreases in demand.</p>

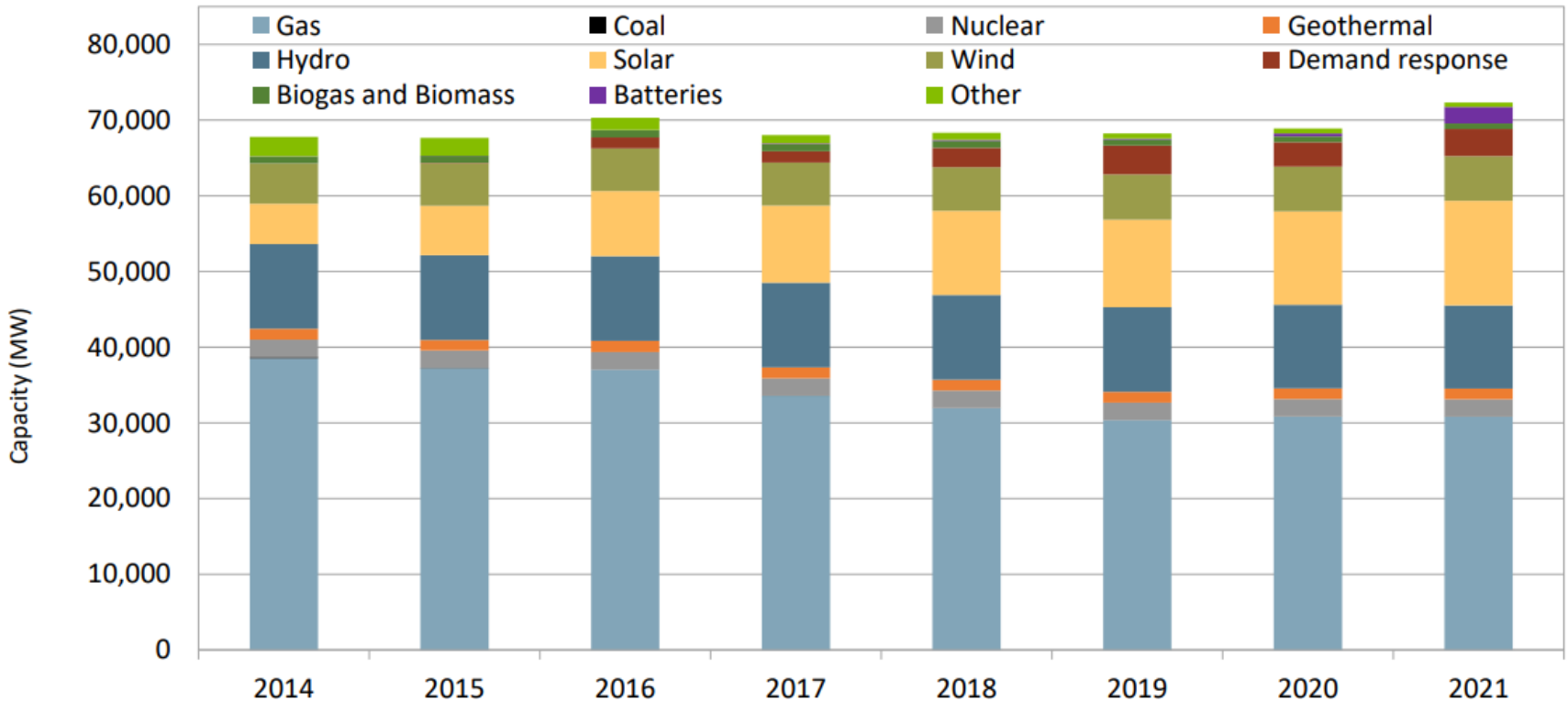
Helpful background information

- To understand this presentation, it is helpful to have a basic understanding of the **Day-Ahead Market (DAM)** and the **Real-Time Market (RTM)**.
- The DAM is a market where participants can submit bids and offers for energy and ancillary services for the **next day**.
- The RTM is a market where participants can submit bids and offers for energy and ancillary services in **real-time**.

Helpful background information

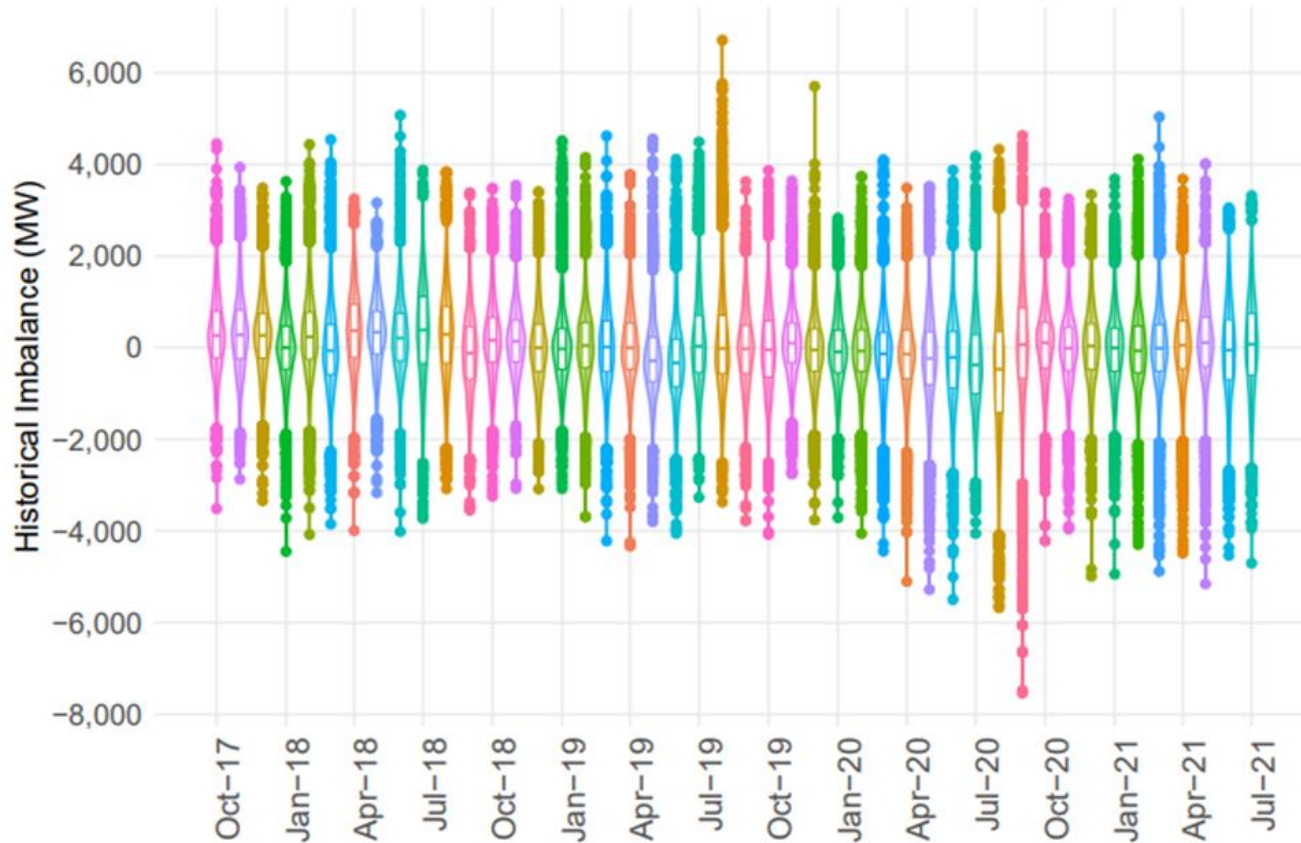
- CAISO's Day-Ahead Market includes two financially binding market passes, the Integrated Forward Market (IFM) and the Residual Unit Commitment (RUC) process:
 - **IFM:** The IFM clears energy and ancillary service schedules based on bid-in supply and demand
 - **RUC:** The RUC process follows the IFM. The purpose of the RUC process is to ensure that there is enough capacity online to meet the day-ahead demand forecast.

The CAISO resource mix is changing



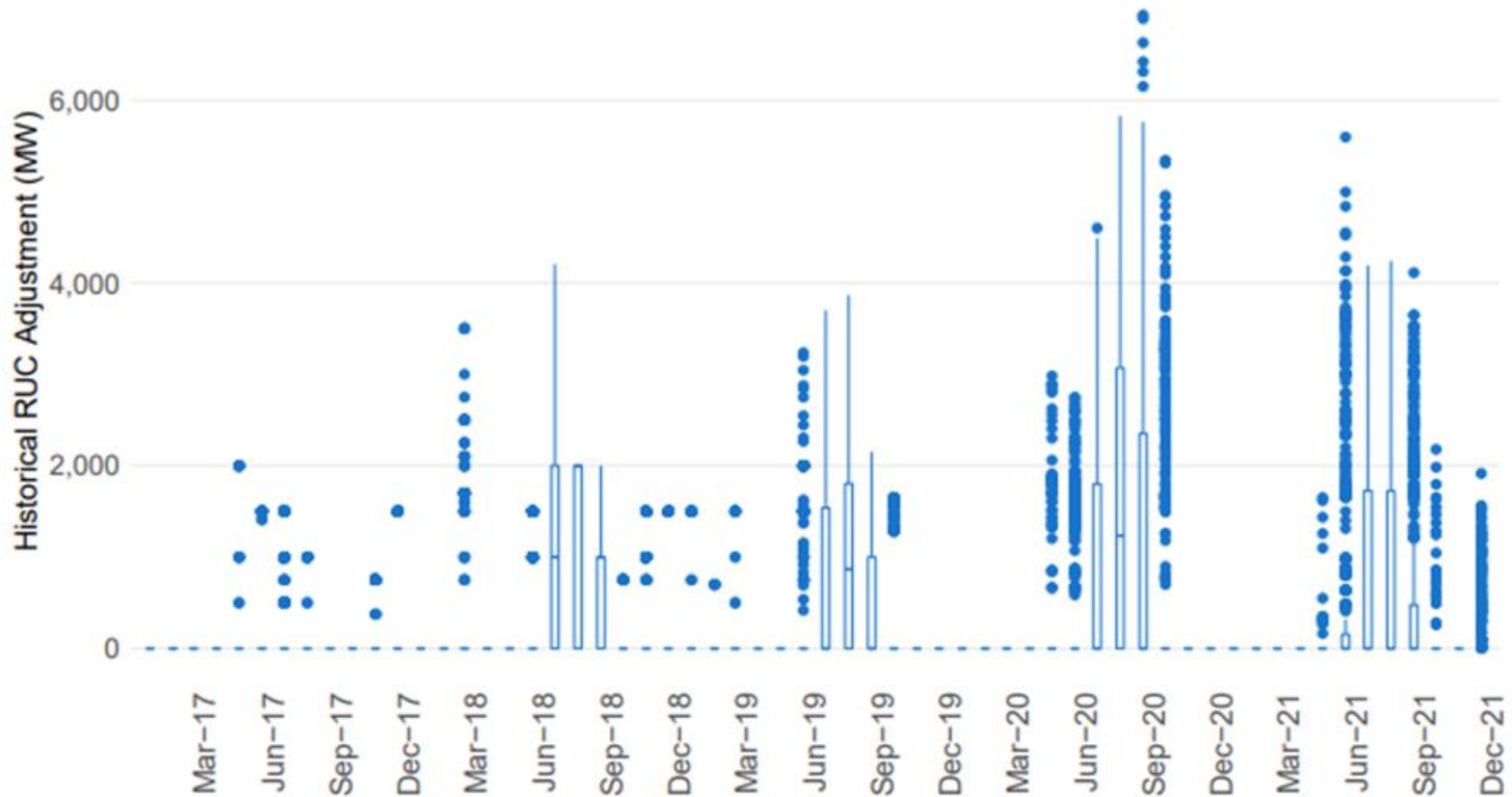
Fuel Type	2014 (MW)	2024 (MW)
Wind/Solar	~10,000	~24,500
Natural Gas	~38,000	~30,000
Batteries	0	~7,000

Variable loads and renewables create more imbalances between day-ahead and real-time forecasts



Imbalance = Real-time net load forecast – Day-ahead net load forecast

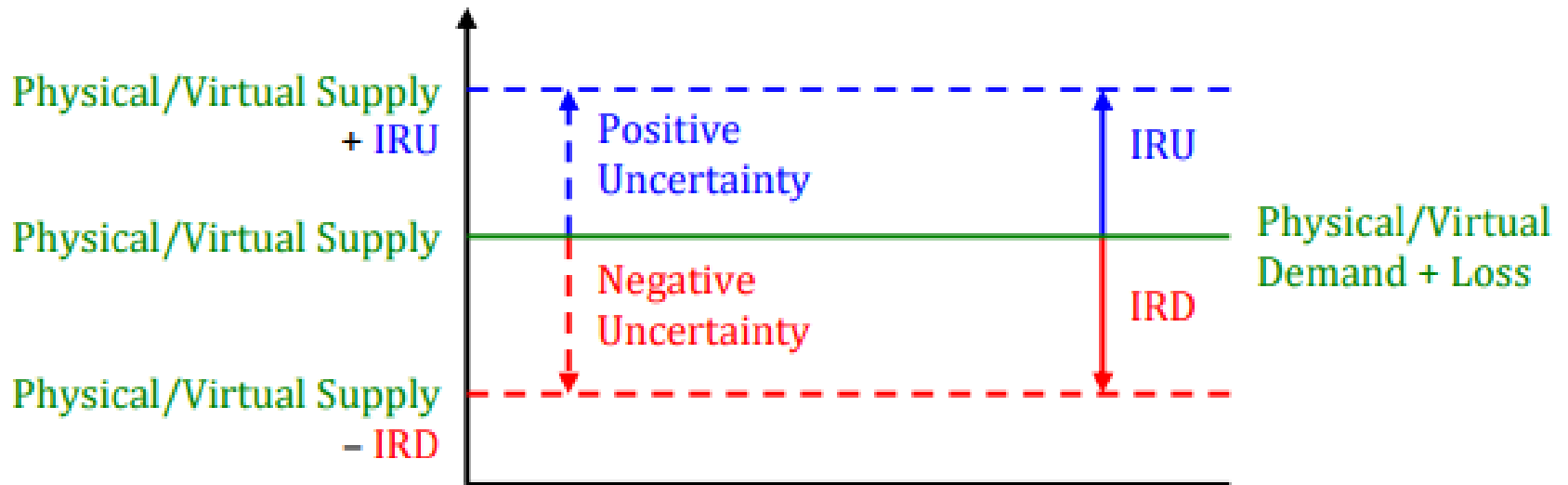
CAISO operators secure capacity for uncertainty and ramping by taking out-of-market actions



For reference: CAISO 2023 peak load was ~45,000MW

CAISO is introducing a new day-ahead market product: imbalance reserves

- This product reserves upward and downward ramp capacity in the day-ahead market to address uncertainty in the net load forecast (load minus wind and solar) that might emerge between the day-ahead and real-time.



CAISO is introducing a new day-ahead market product: imbalance reserves

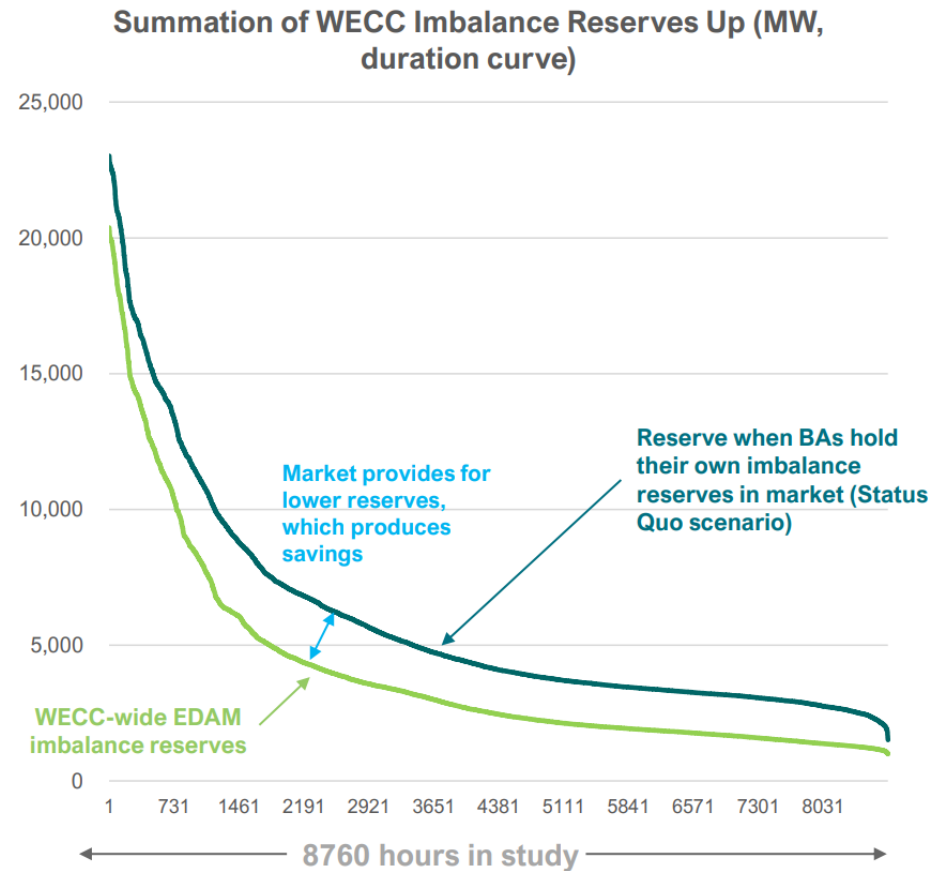
- Biddable product (imbalance reserve up and imbalance reserves down)
- CAISO will procure imbalance reserves in the integrated forward market and co-optimize them with energy and ancillary services
- CAISO caps awards at the resource's 30-min ramp capability, and eligible resources must be dispatchable in the 15-minute market
- Awards obligate the supplier to provide energy bids in the real-time market above or below their day-ahead energy schedule for the quantity of their up/down awards
 - Penalties for unavailability encourage adherence to these obligations

CAISO is introducing a new day-ahead market product: 'imbalance reserves'

- The integrated forward market will use a mechanism called 'deployment scenarios' to ensure the deliverability of imbalance reserves without violating transmission constraints
 - This approach leads to locational marginal prices for imbalance reserves
- CAISO will subject imbalance reserve procurement to a demand curve

Imbalance Reserves generate benefits within regional markets like the Extended Day-Ahead Market (EDAM)

- Regional markets allow market participants to net out forecasting errors over a larger geographic footprint
 - Reduces operational cost
 - Reduces renewable curtailment



Sources and additional information

- Final Proposal -
<https://www.caiso.com/InitiativeDocuments/RevisedFinalProposal-Day-AheadMarketEnhancements.pdf>
- EDAM Benefits Study -
<https://www.caiso.com/Documents/Presentation-CAISO-Extended-Day-Ahead-Market-Benefits-Study.pdf>
- CAISO Market Monitoring 2022 Annual Report -
<https://www.caiso.com/Documents/2022-Annual-Report-on-Market-Issues-and-Performance-Jul-11-2023.pdf>
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