



California ISO

Hedging Locational Price Risk under LMP: Experiences from North America and Application to Europe

Webinar

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Established in 1998, the ISO is a federally regulated nonprofit organization that manages the high-voltage electric grid in California and a portion of Nevada

52,061 MW record peak demand (Sept. 6, 2022)

287.2 million megawatt-hours of electricity delivered (2022)

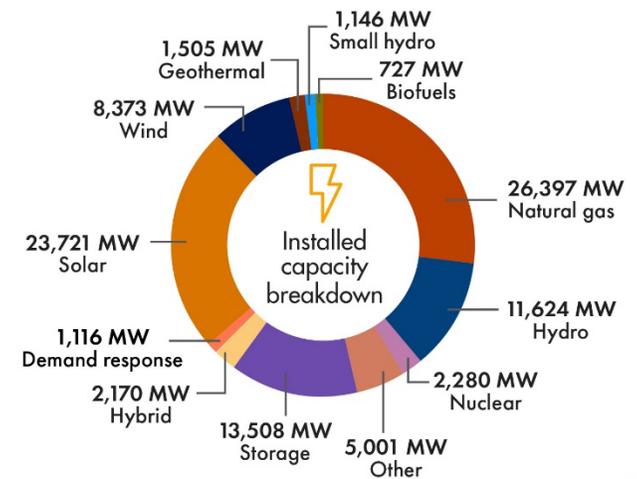
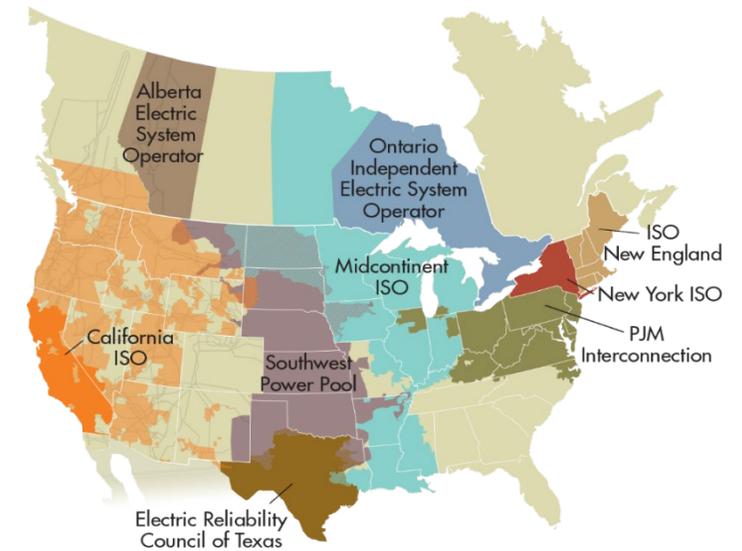
87,750 MW power plant capacity *Source: California Energy Commission*

Approximately 1,600 power plants *Source: California Energy Commission*

32 million people served

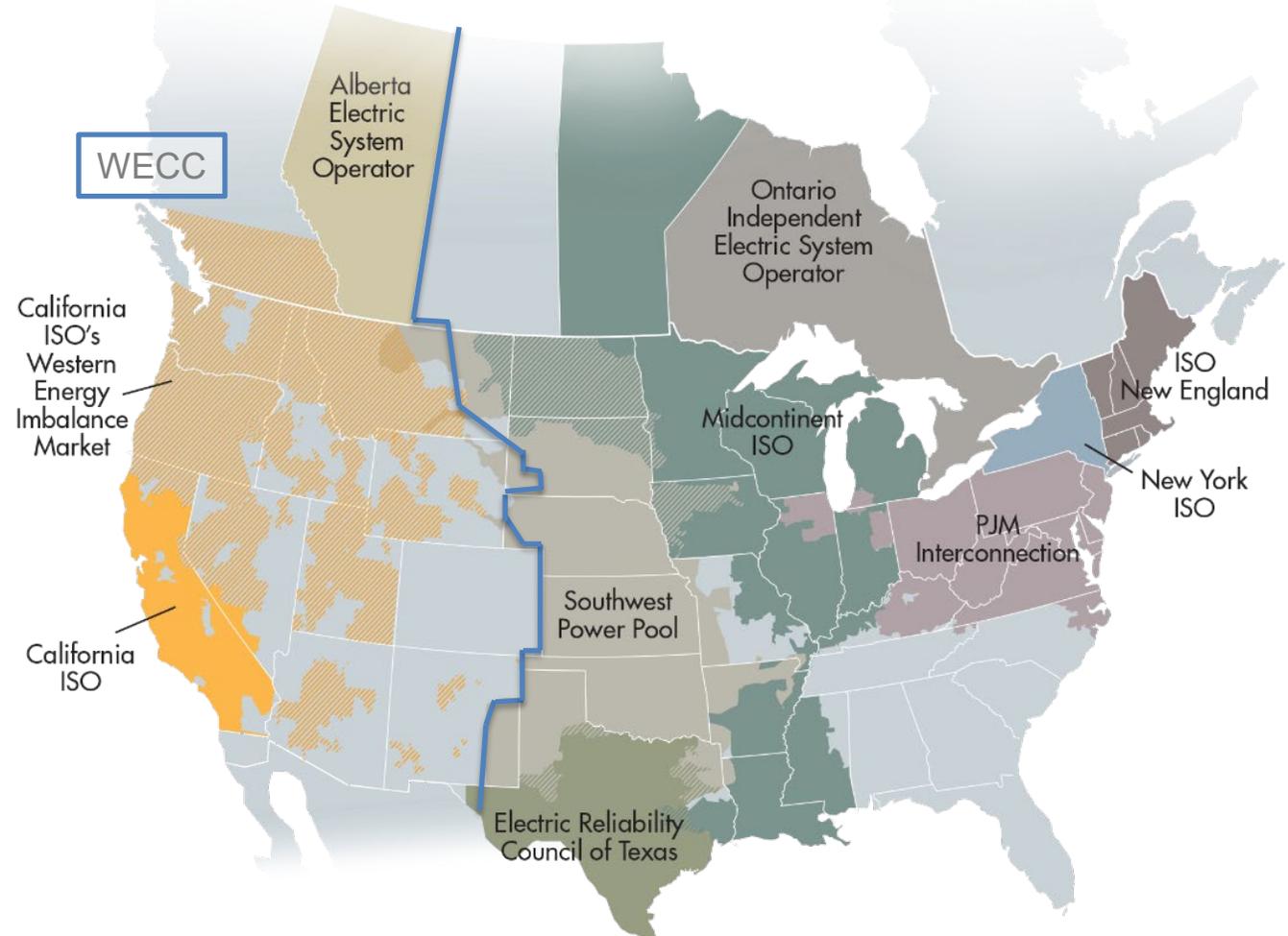
One of **9** ISO/RTOs in North America

Largest of **38** balancing areas in the Western Interconnection North America



CAISO core responsibilities and functions in California and across the West

- Performs **balancing area** functions and operates wholesale electric market within its area.
- Operates the **Western Energy Imbalance Market (WEIM)** – real time market across the West.
- Serves as **Reliability Coordinator (RC West)** across the Western interconnection.



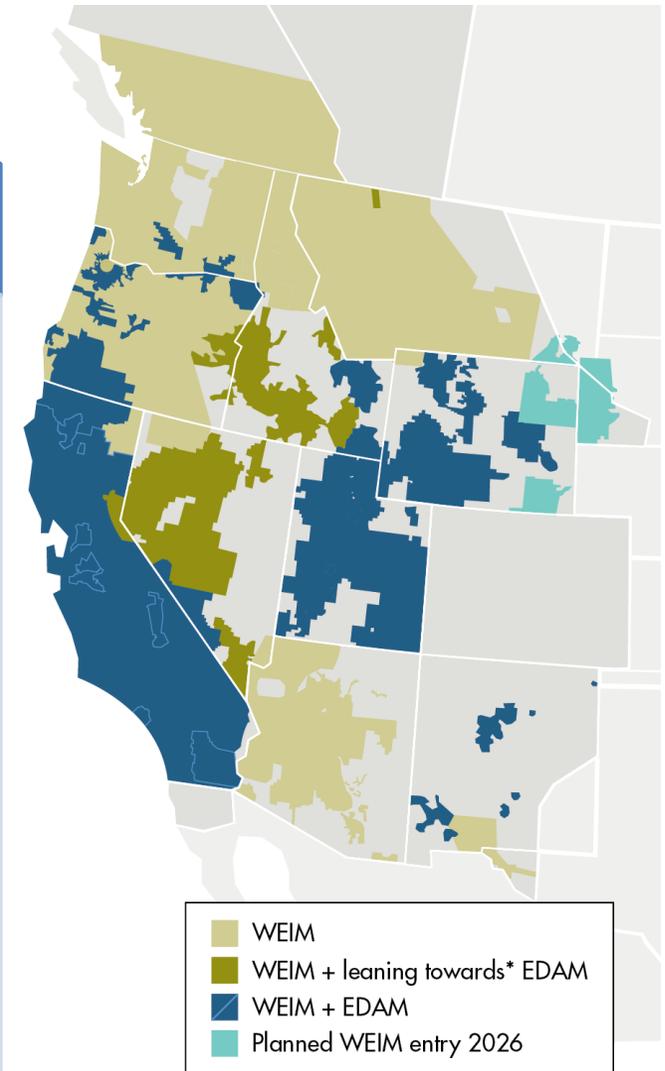
Western Energy Markets

Western Energy Imbalance Market

- Launched 2014
- Real-time market for 15 and 5 minute energy exchanges across the eleven Western states
- 22 participating entities
- Enhanced grid reliability
- Gross benefits \$7.4 billion
- Reduced over 1 million metric tons of CO₂ emissions

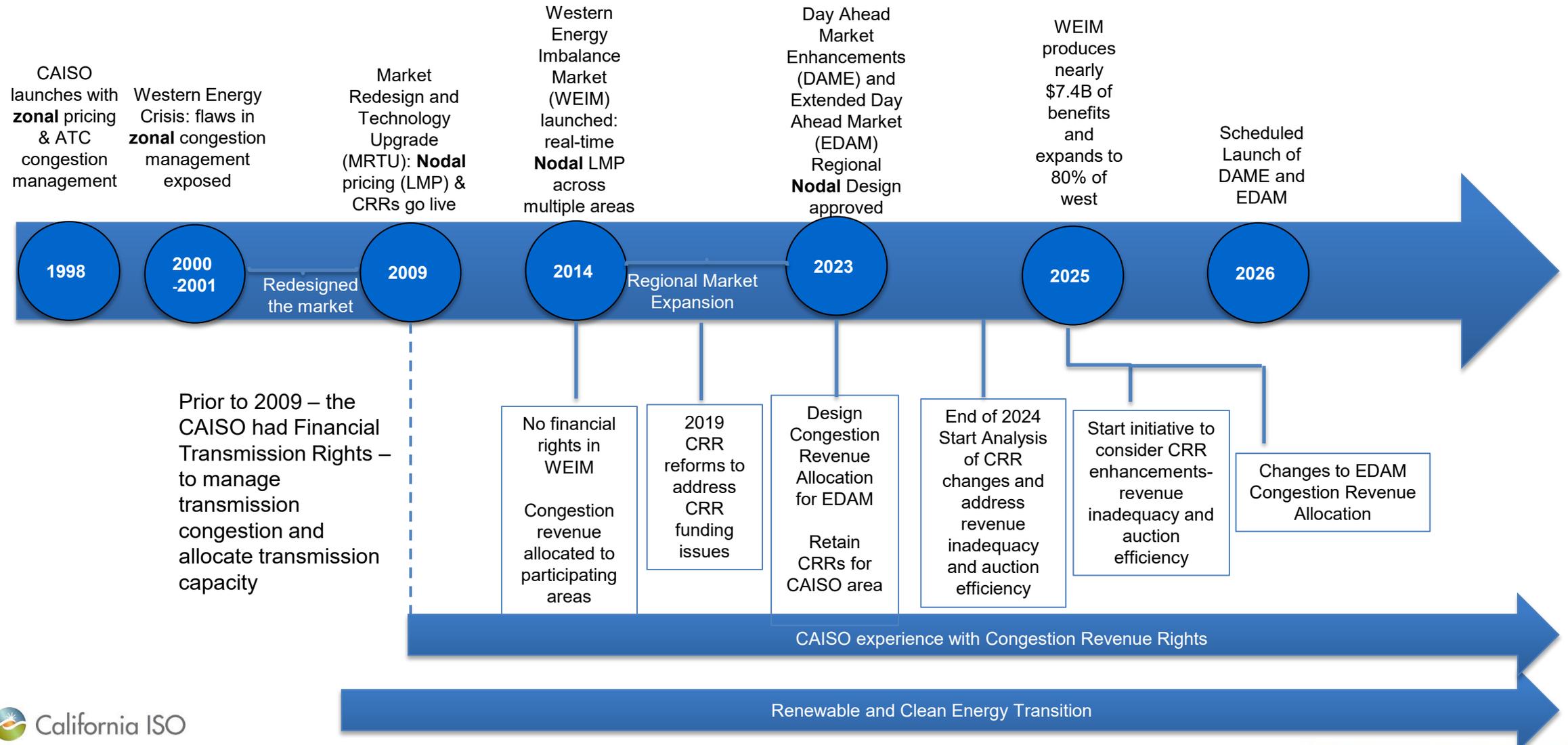
Extended Day-Ahead Market

- A voluntary day-ahead electricity market.
- Building on the success of the Western Energy Imbalance Market
- Increase regional coordination and optimization of regional diversity of resources and load
- Seven entities committed to join
- Three additional entities signal intent to join or prefer EDAM for their day-ahead market



**These entities have publicly indicated a leaning towards EDAM as their preferred day-ahead market.*

Evolution of Congestion Management in CAISO Markets

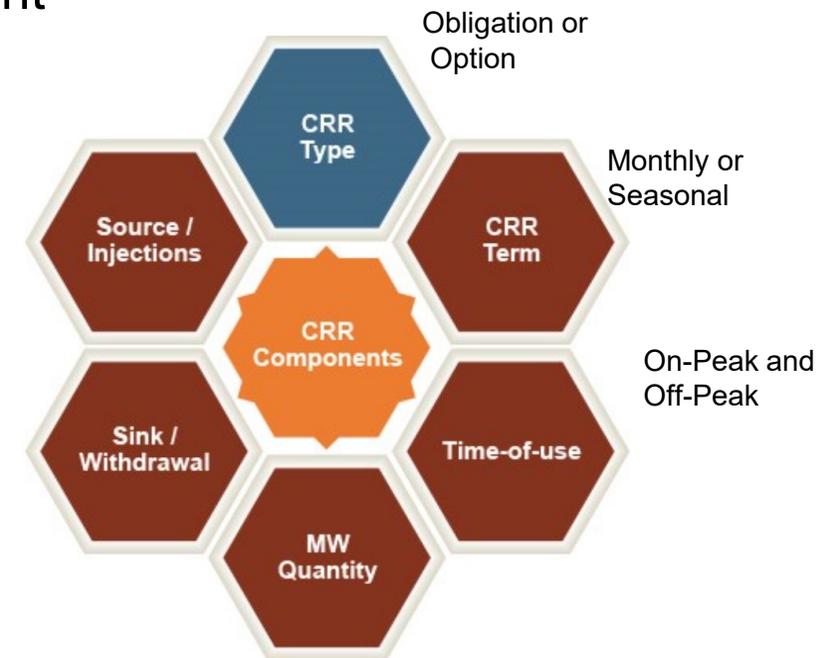


What are congestion revenue rights?

- Congestion revenue rights are financial instruments that enable holders of such rights to hedge congestion risks from the day-ahead market
- In other ISOs they are known as financial transmission rights
- Holders receive source/sink specific, MW quantity instrument

Obligation- the holder paid or pays the cost of congestion \$/MWh for the MW entitlements, depending on the direction of the congestion

Option - the holder is only paid if in the direction of congestion, not charged if in opposite direction



Congestion Revenue Rights Precedent at FERC and CAISO



Provide open access transmission

Allocate fairly transmission revenues to customers paying the imbedded costs of the transmission system

Allow hedging of congestion costs in the context of a day-ahead energy



California ISO

Distribute congestion rents created from congestion pricing in the LMP market

Support equitable allocation of costs and benefits of using transmission system

Facilitate long-term contracting by LSEs and generators

How can these rights be acquired in the CAISO markets?

- There are various types of processes to acquire congestion revenue rights
 - Annual and monthly allocations
 - Annual and monthly auctions
 - Load migration process
 - Bilateral (secondary) trades
- Certain entities can acquire rights in specific processes
 - Only load serving entities can participate in allocations
 - Any qualified entity can participate in auctions
 - Rights from load migration are directly allocated to load serving entities
 - Anybody holding a right can transact in secondary trades

How are congestion revenue rights allocated and awarded?

- Congestion revenue rights are released up to the level supported by the transmission capacity in the CAISO balancing area
- CAISO runs a power flow analysis, known as feasibility test, similar to the day-ahead market, to determine the optimal quantities and prices of congestion revenue rights
- The CAISO transmission system is modelled in the allocation and auction processes considering -
 - Configuration (topology) of the transmission system
 - Transmission parameters and limits
 - Outages and derates
- Rights from allocation are free of cost; rights from auctions are awarded based on bid-in and clearing prices

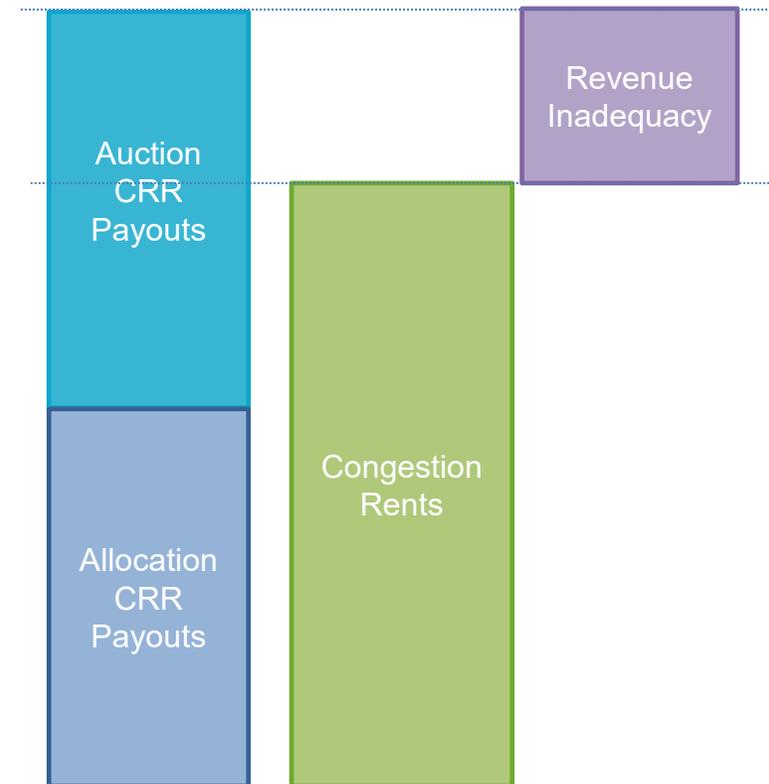
Monitoring performance of the CRR release process – revenue adequacy

Revenue Adequacy: There are sufficient congestion rents from day-ahead market to pay all congestion revenue rights

Quantities of allocated and auctioned CRRs limited by the physical capability of the grid

Differences between the congestion revenue rights model and the day-ahead market model can result in revenue inadequacy

- Differences in topology (outages)
- Differences in limits (derates)
- Differences in model (detailed in day-ahead, approximated in auctions)
- Differences in time granularity

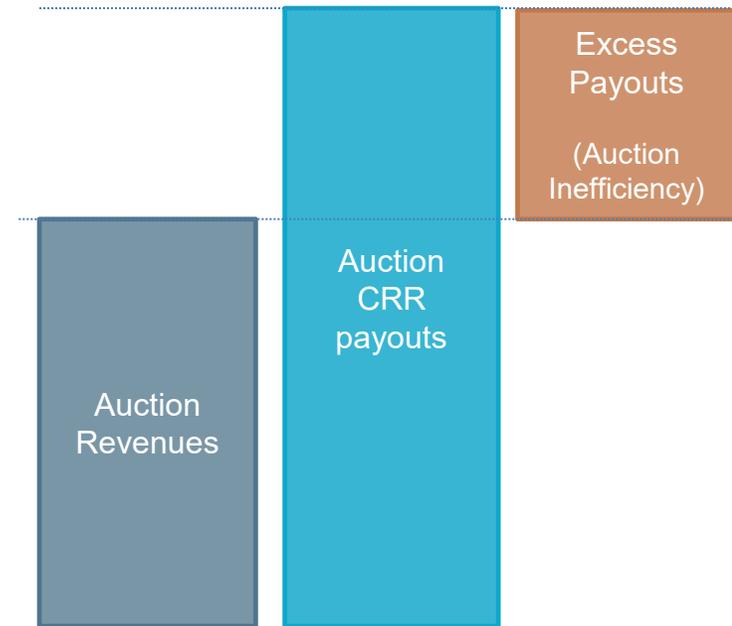


Revenue Adequacy is about how well CRR processes converge to the congestion measure and priced in the day-ahead market

Monitoring performance of the CRR release process – auction efficiency

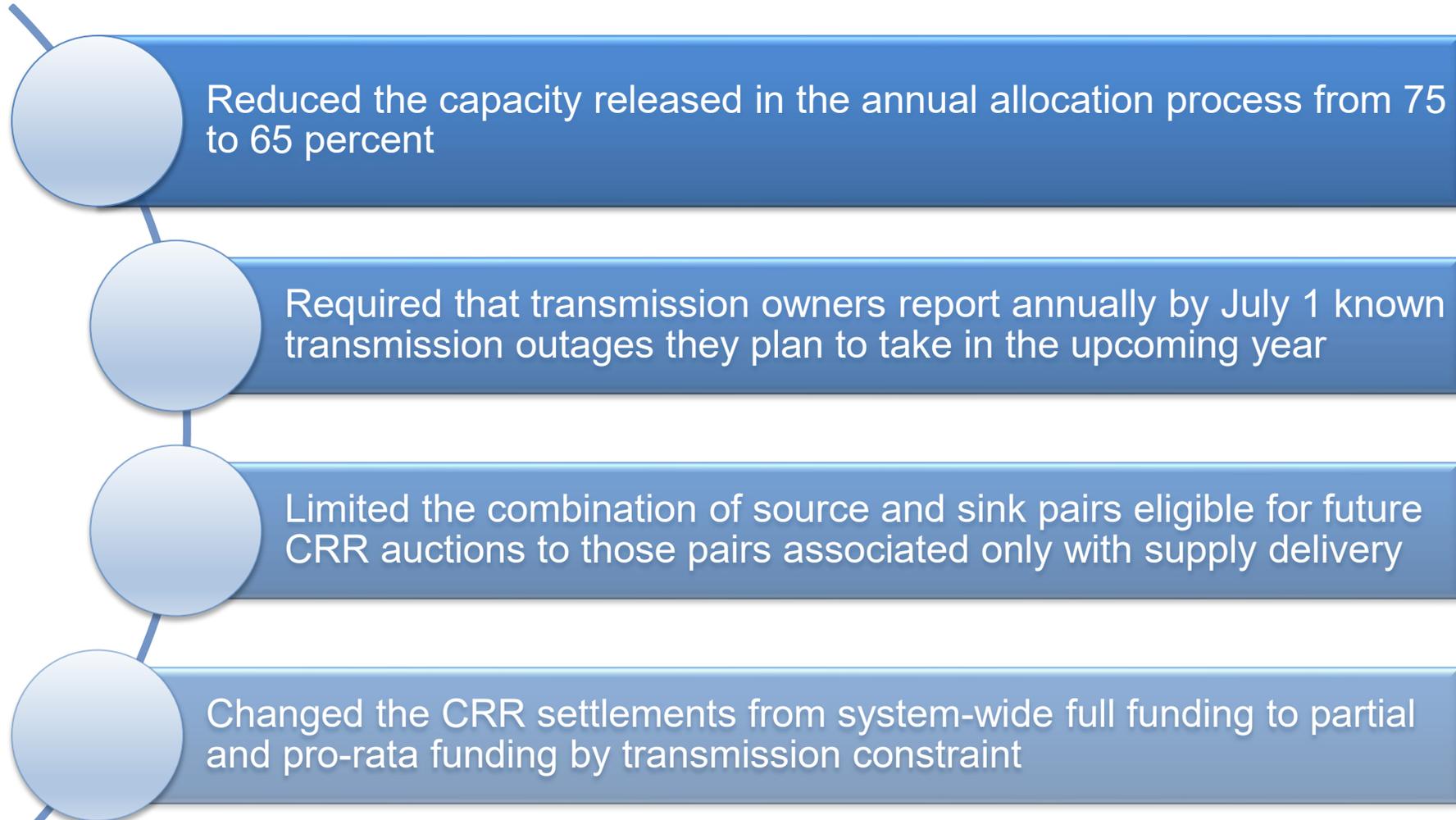
Auction Efficiency: The money paid to acquire a right converges to the value of the right in the day-ahead market

- CRR's held by entities that most value the hedge of congestion risk (or who can absorb the counterflow risk) and CRR prices reflect expected day-ahead market congestion
- Allow LSEs receiving allocated CRRs to reconfigure allocated rights to better match customer risk exposure
- CRR auctions designed such that auction prices expected to reflect expectations of congestion prices in the day-ahead

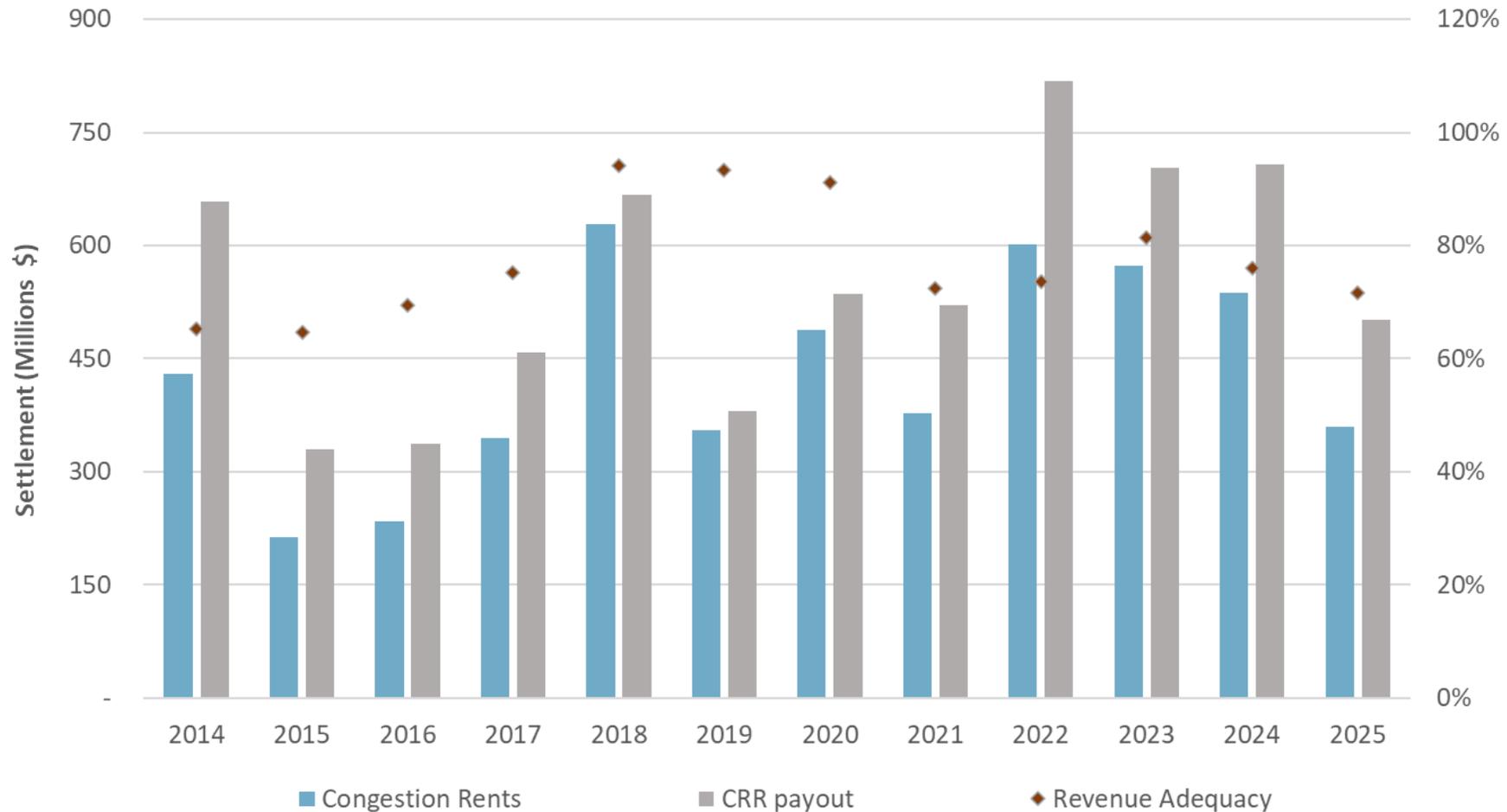


Auction efficiency is about how well CRR auction prices discover day-ahead congestion value

Reforms implemented in 2019 to address revenue adequacy and auction

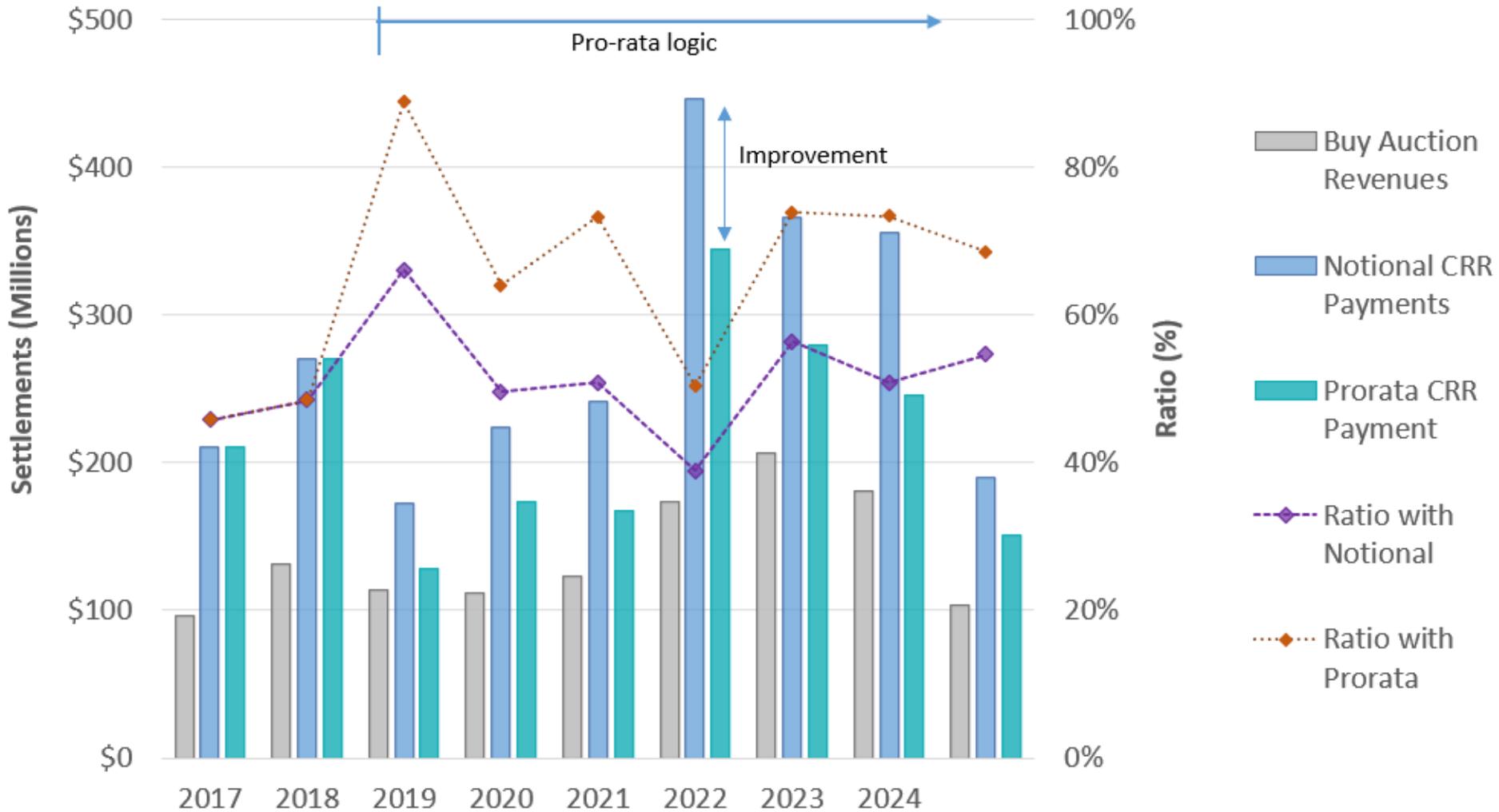


Revenue adequacy at the system level is at 80 percent

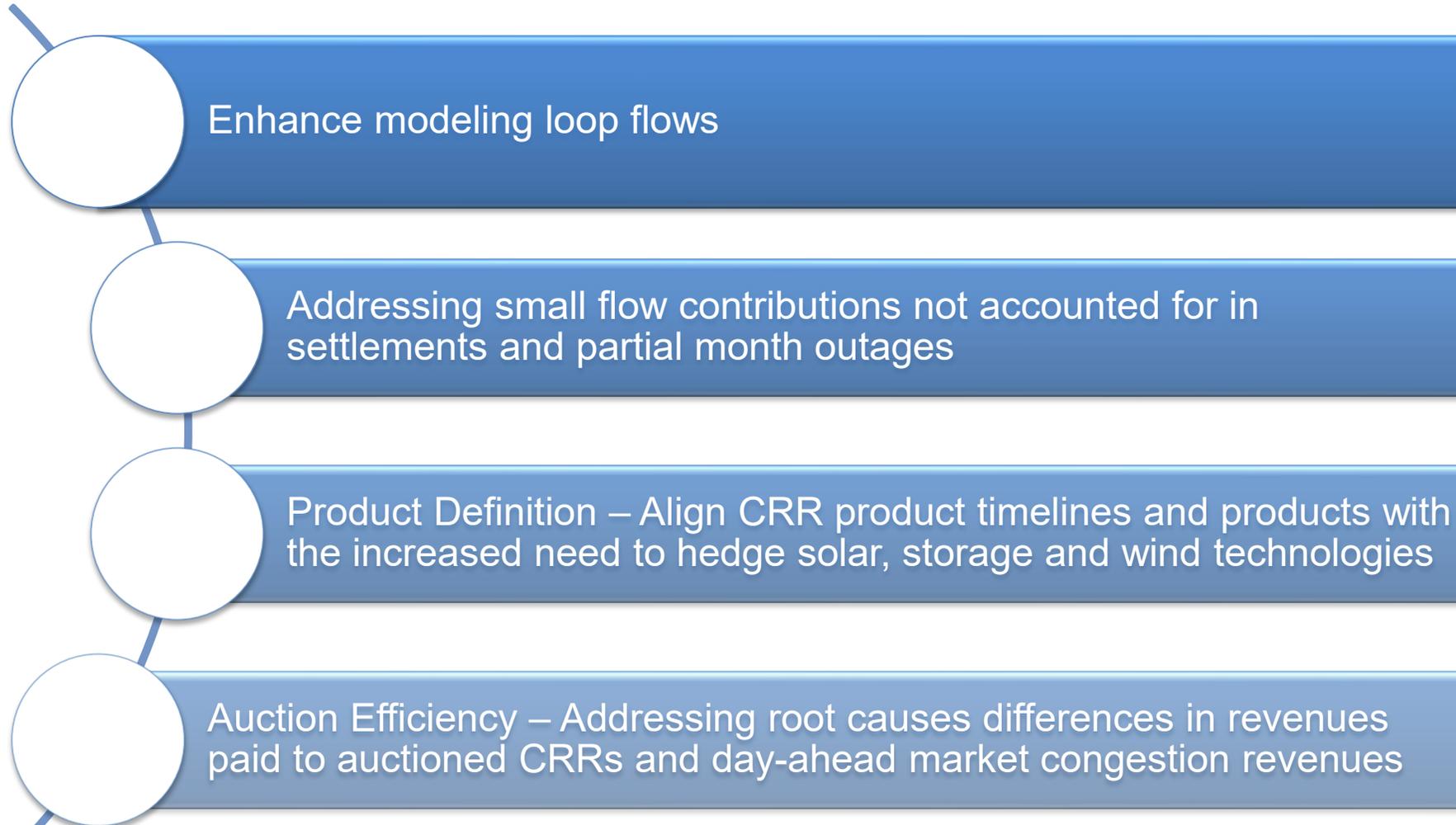


With the policy changes implemented in 2019, the revenue deficiency of about \$730 million is no longer allocated to measured demand but instead it is pro-rata allocated to all CRRs.

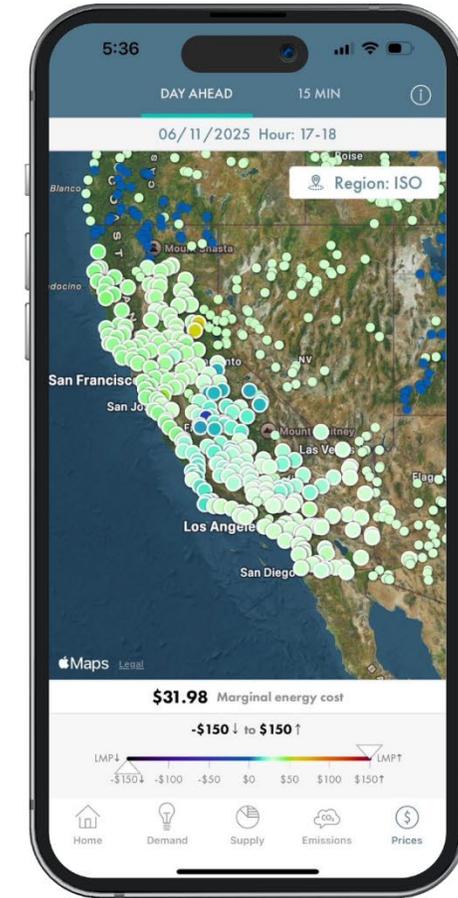
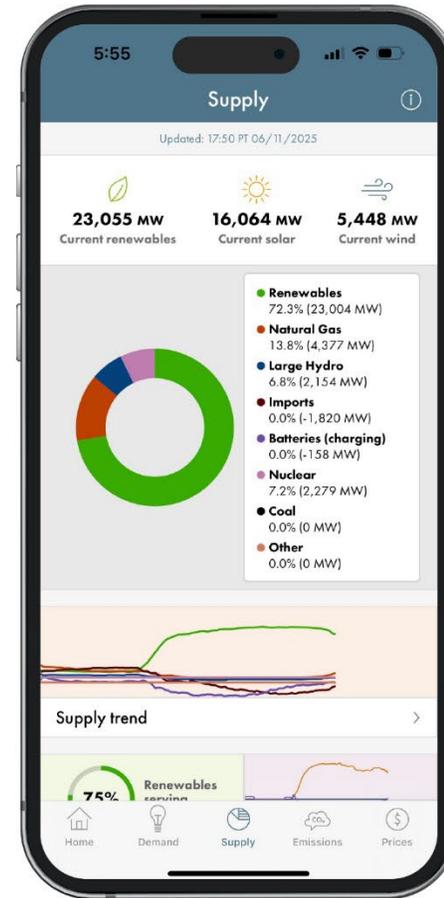
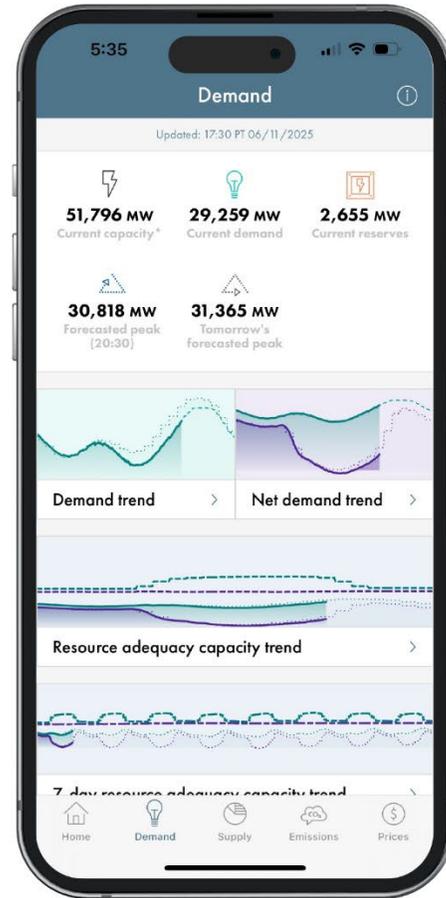
Pro-rata adjustments reduced CRR payouts to CRRs, raising the ratio of auction price to payouts from 51 percent to 68 percent



Reforms being considered in current stakeholder process



ISO Today APP provides public view into the status of the system



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