



Q3 Report on Market Issues and Performance

December 20, 2022

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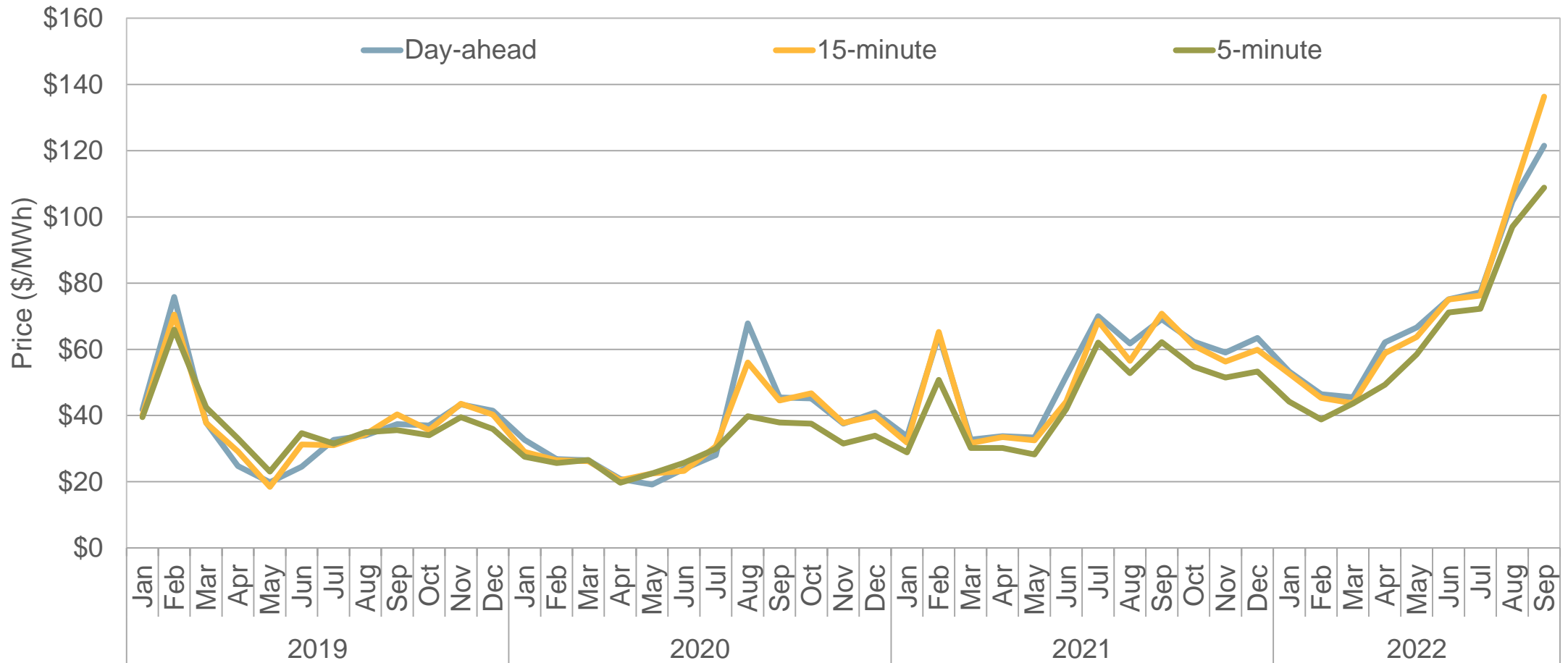
<http://www.caiso.com/Documents/2022-Third-Quarter-Report-Market-Issues-Performance-2022-12-14.pdf>
<http://www.caiso.com/market/Pages/MarketMonitoring/Default.aspx>

Highlights of Q3 2021 market performance

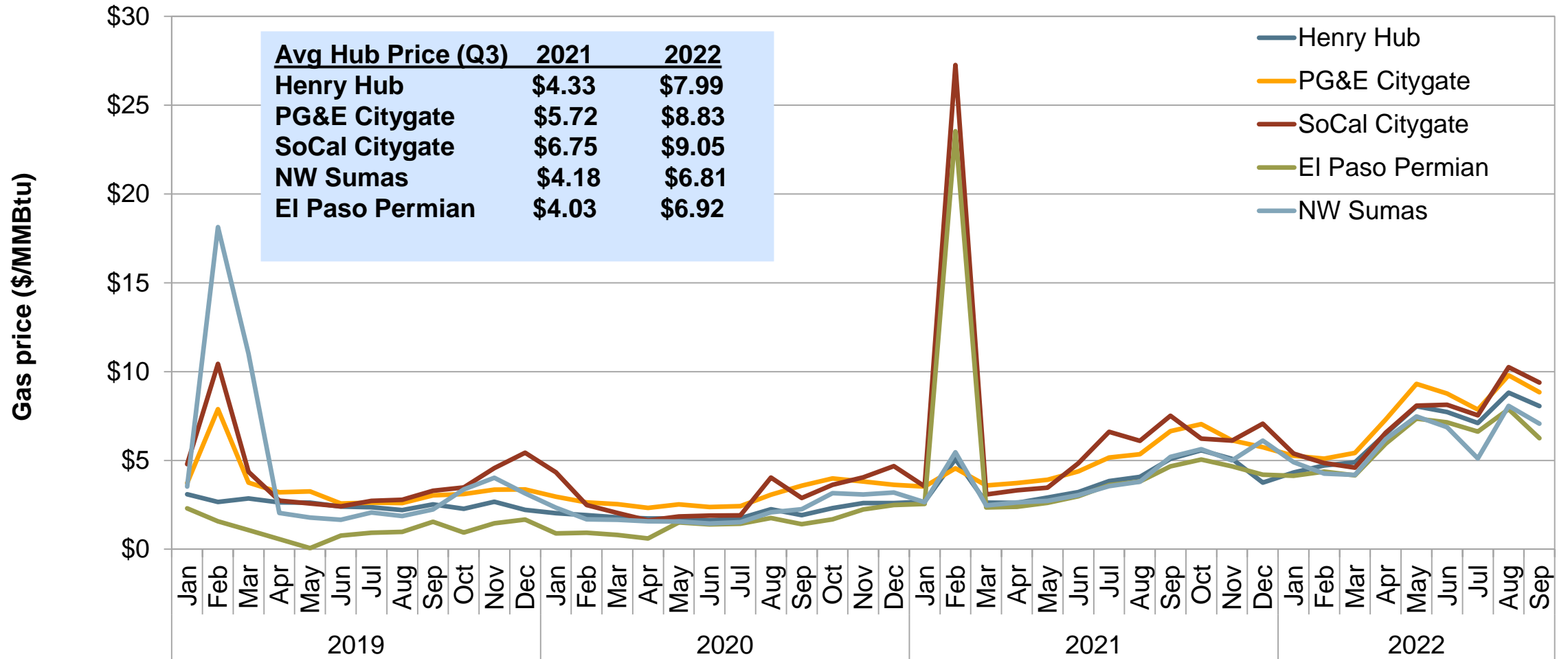
- **Record high load in CAISO and WEIM**
 - High costs and alert status, but no area curtailed load to maintain reliability
- **Higher prices in CAISO and WEIM compared to 2021**
 - Higher natural gas prices
 - Congestion increases
 - High real-time imbalance offset costs
 - High bid cost recovery

CAISO prices increase with gas prices and demand

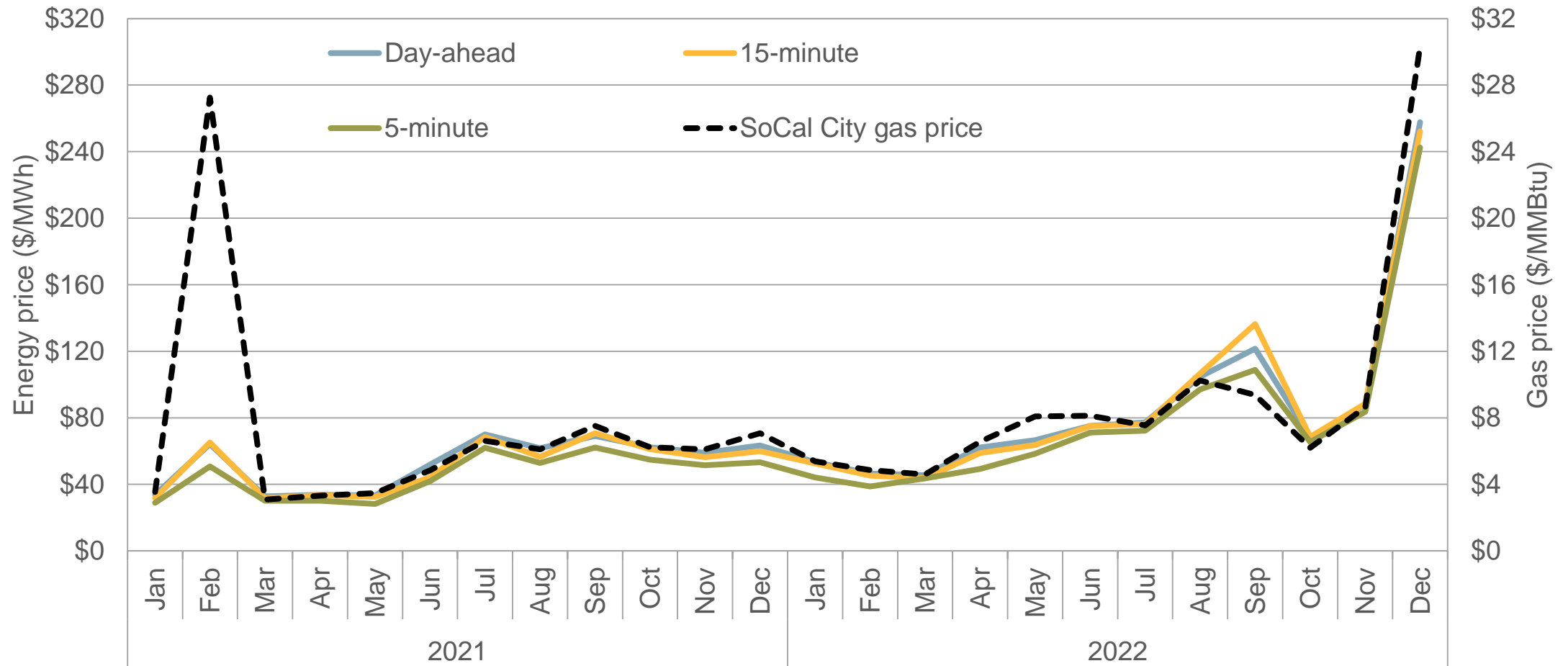
Q1 CAISO day-ahead \$101/MWh, 15-minute \$106/MWh, 5-minute \$92/MWh



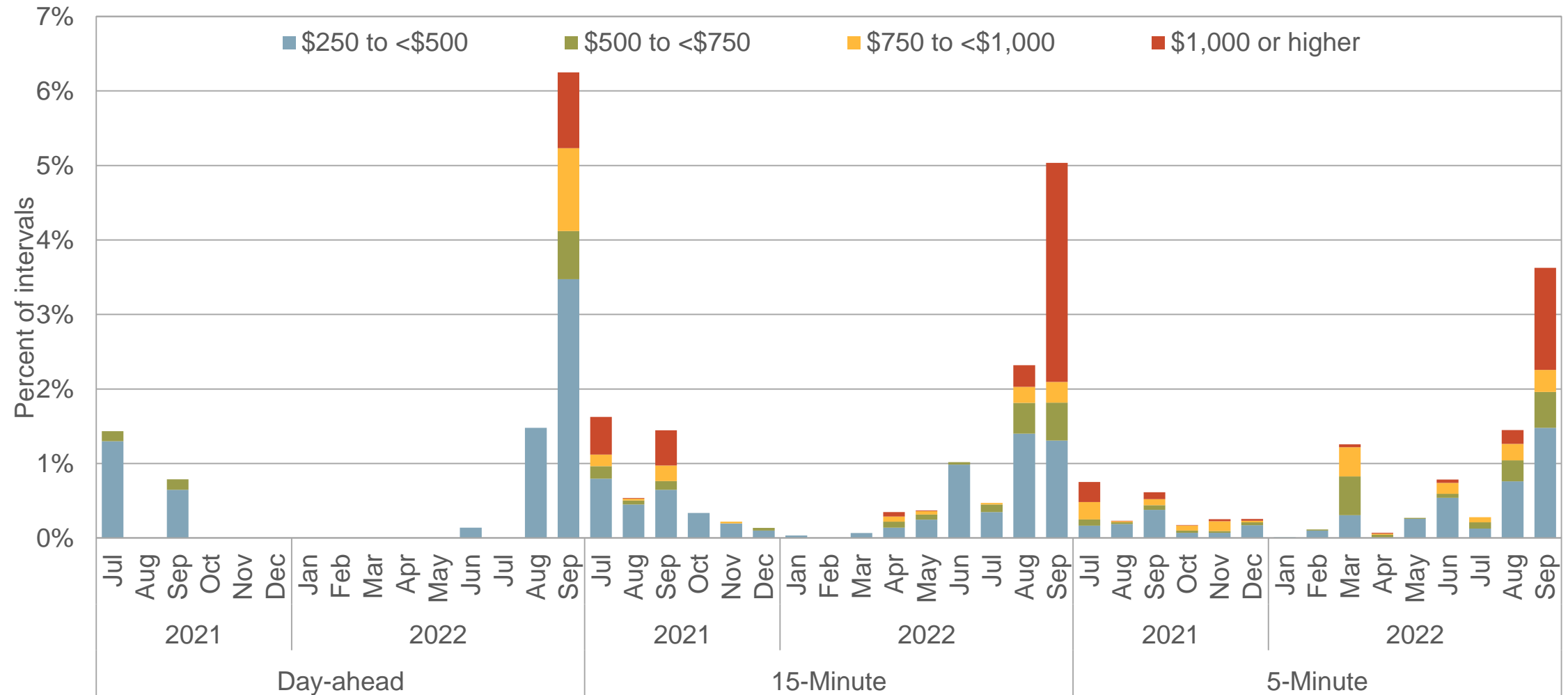
Higher natural gas prices support higher electricity prices



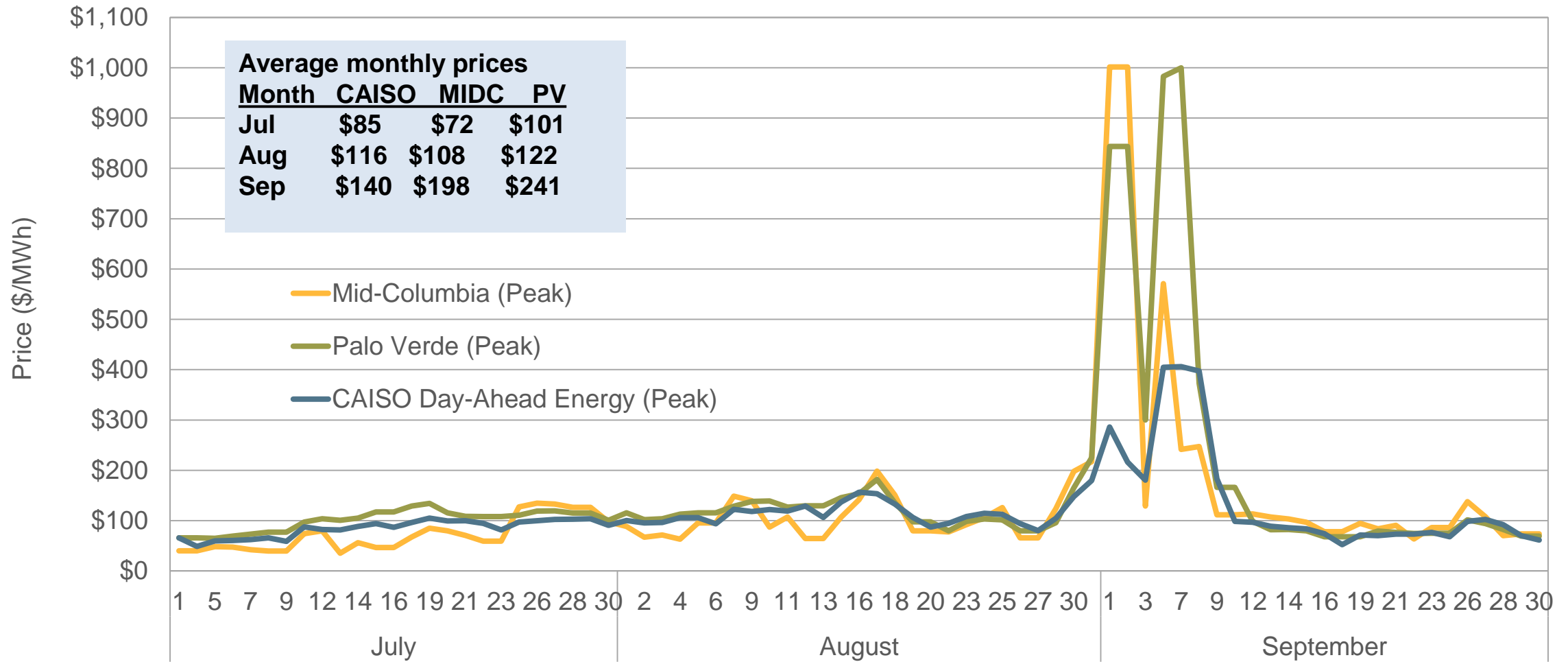
As gas prices have continued to rise in 2022, so have electricity prices



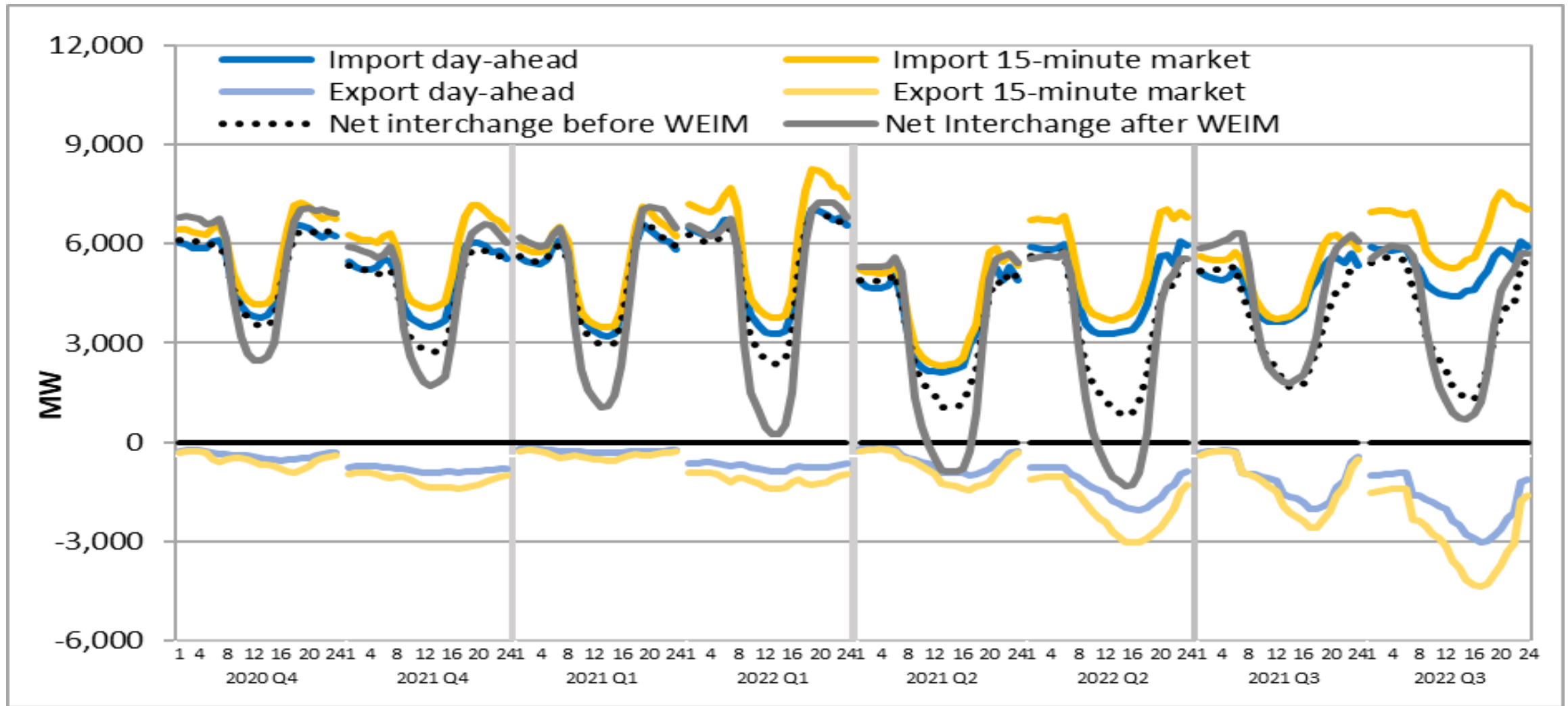
Frequency of high CAISO prices (\$/MWh) by month



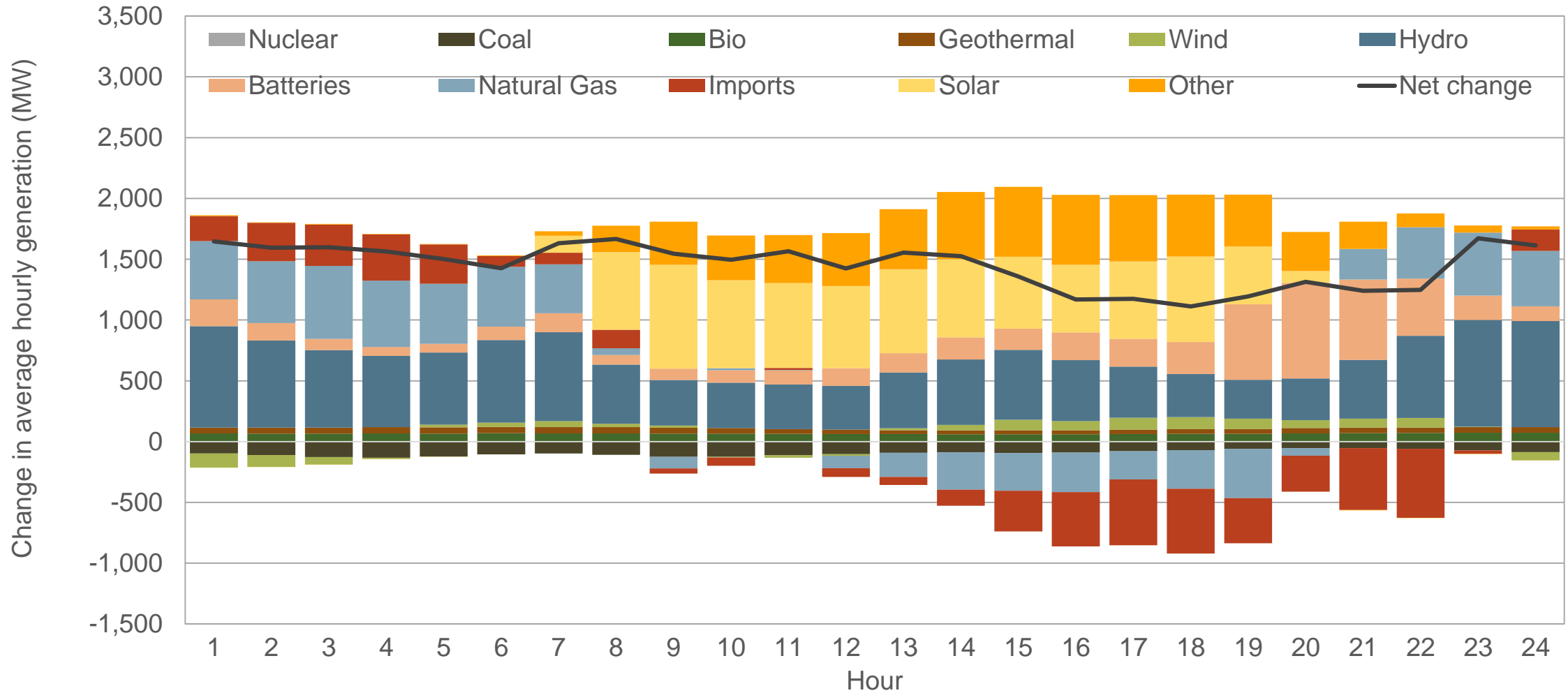
Day-ahead California ISO and bilateral market prices (July - September)



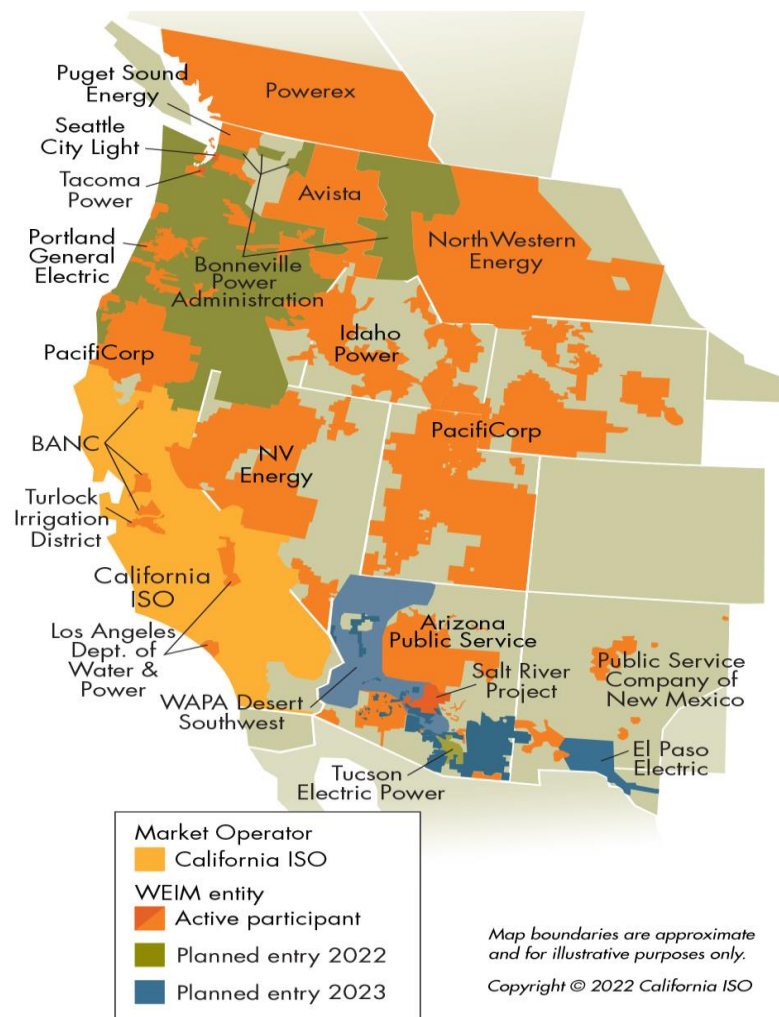
Average imports and exports both increase



Change in average hourly generation by fuel type (Q3 2021 to Q3 2022)

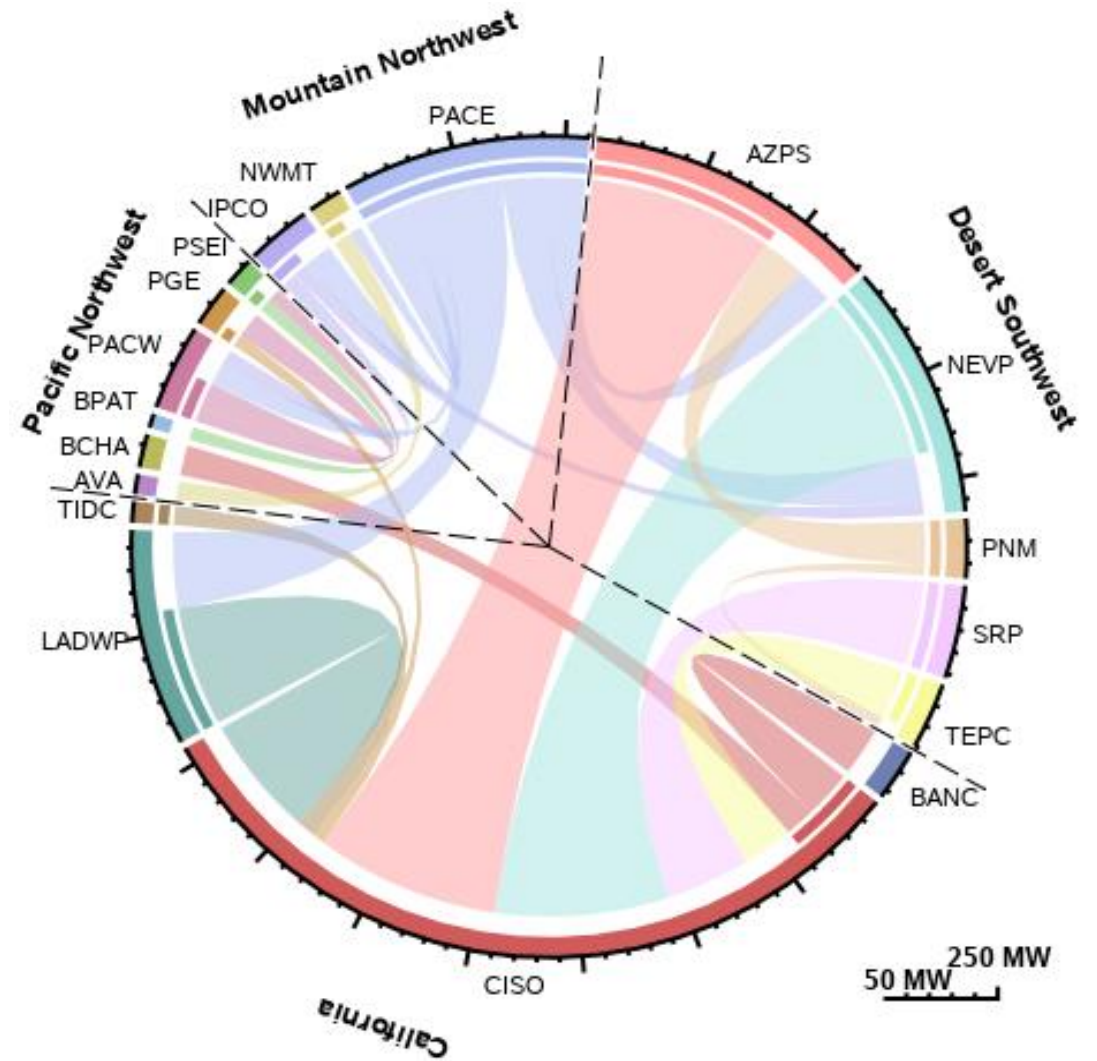
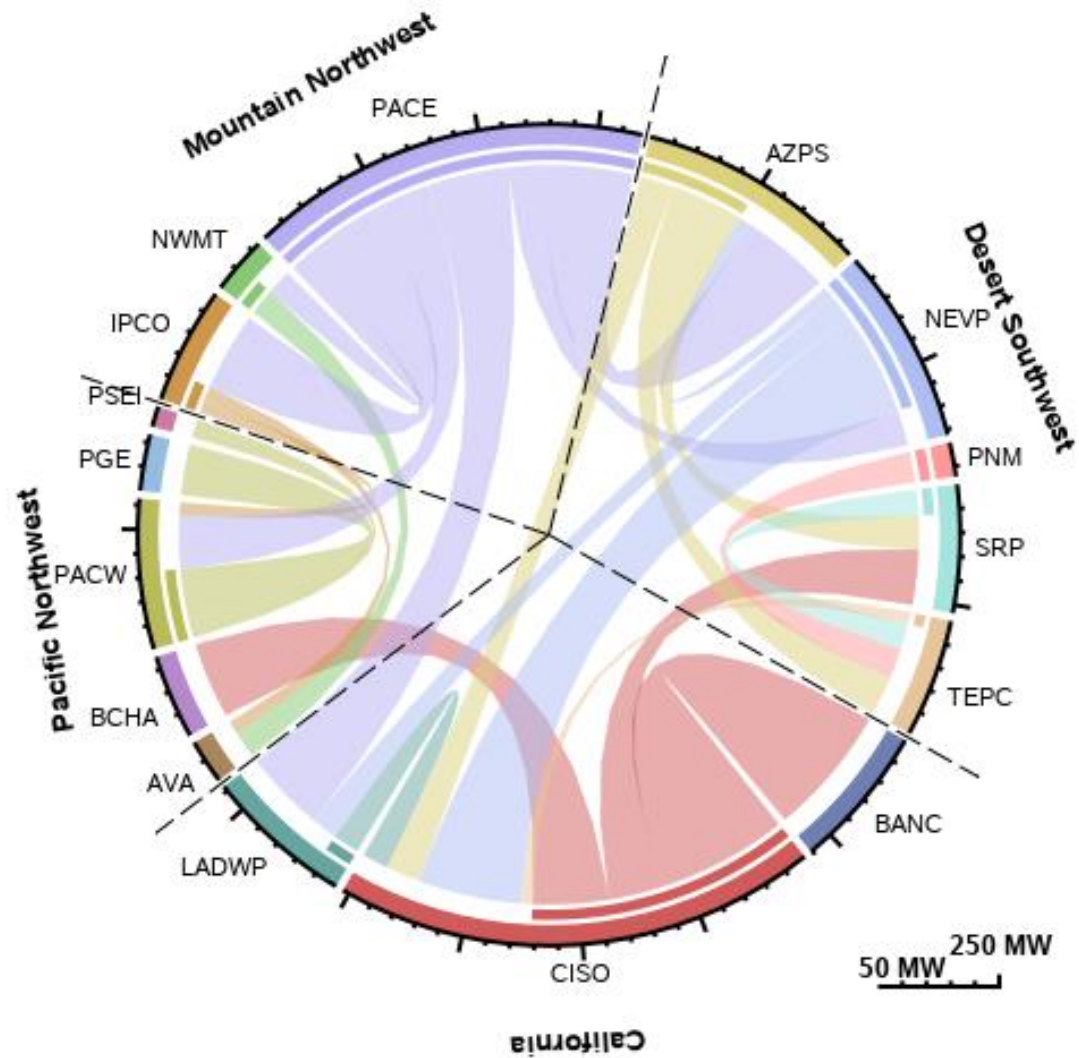


Expansion of the Western Energy Imbalance Market (WEIM) helped improve the overall structure and performance of the real-time market

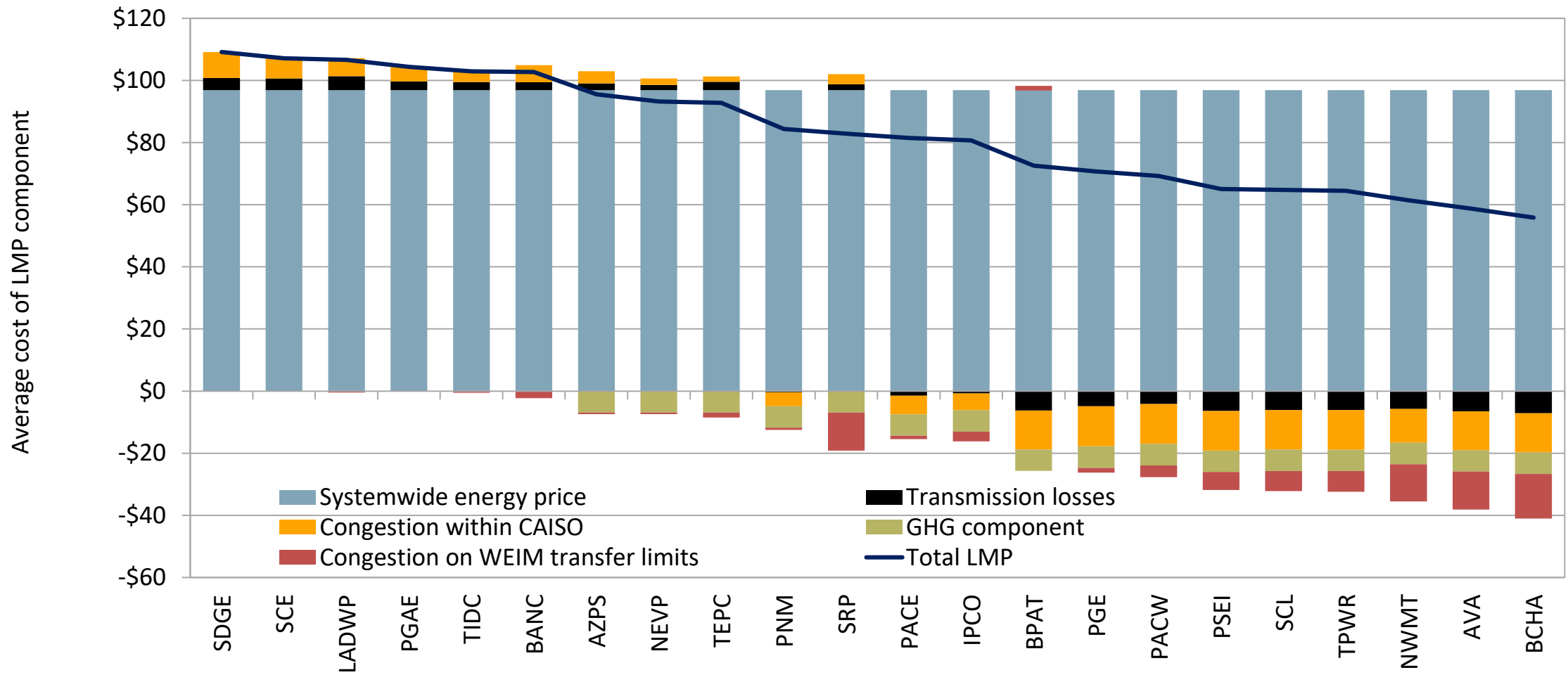


- Two new members of the WEIM in 2020
- Five new members of the WEIM in 2021
- Four new members in 2022:
 - Avista Utilities
 - Bonneville Power Administration
 - Tacoma Power
 - Tucson Electric Power
- Northwest prices regularly lower than the rest of the system due to limited transfer capability
- Peak California area prices exceed other areas due to GHG and congestion

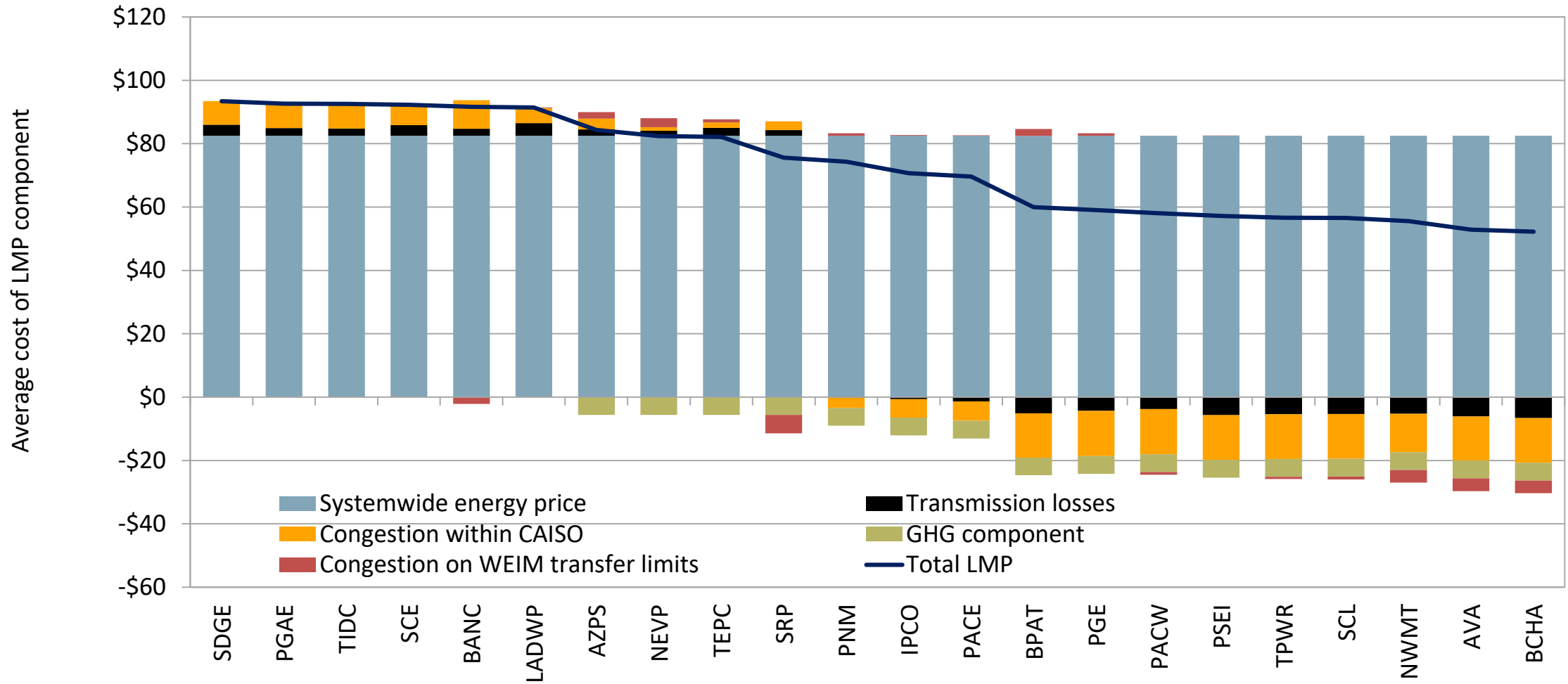
Average 15-minute WEIM exports mid-day and peak hours Q3 2022



Impact of congestion and greenhouse gas on 15-minute prices (Q3)

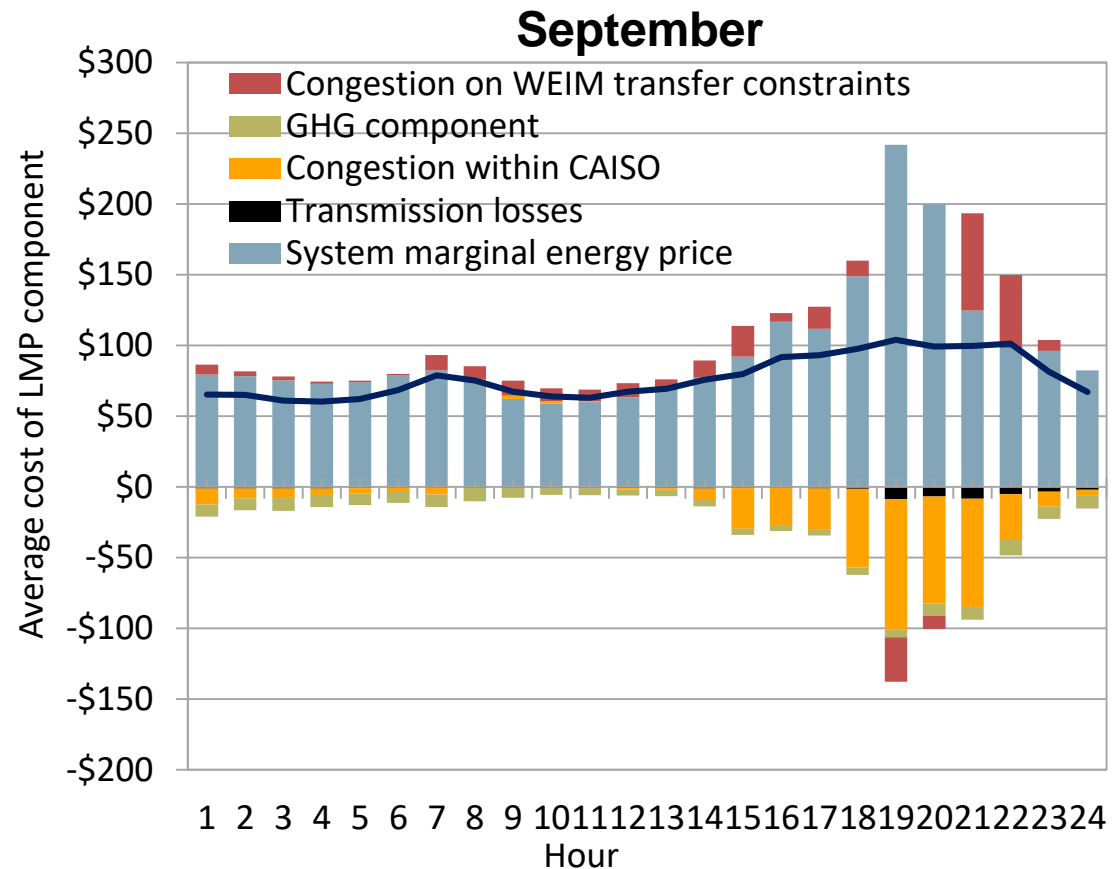
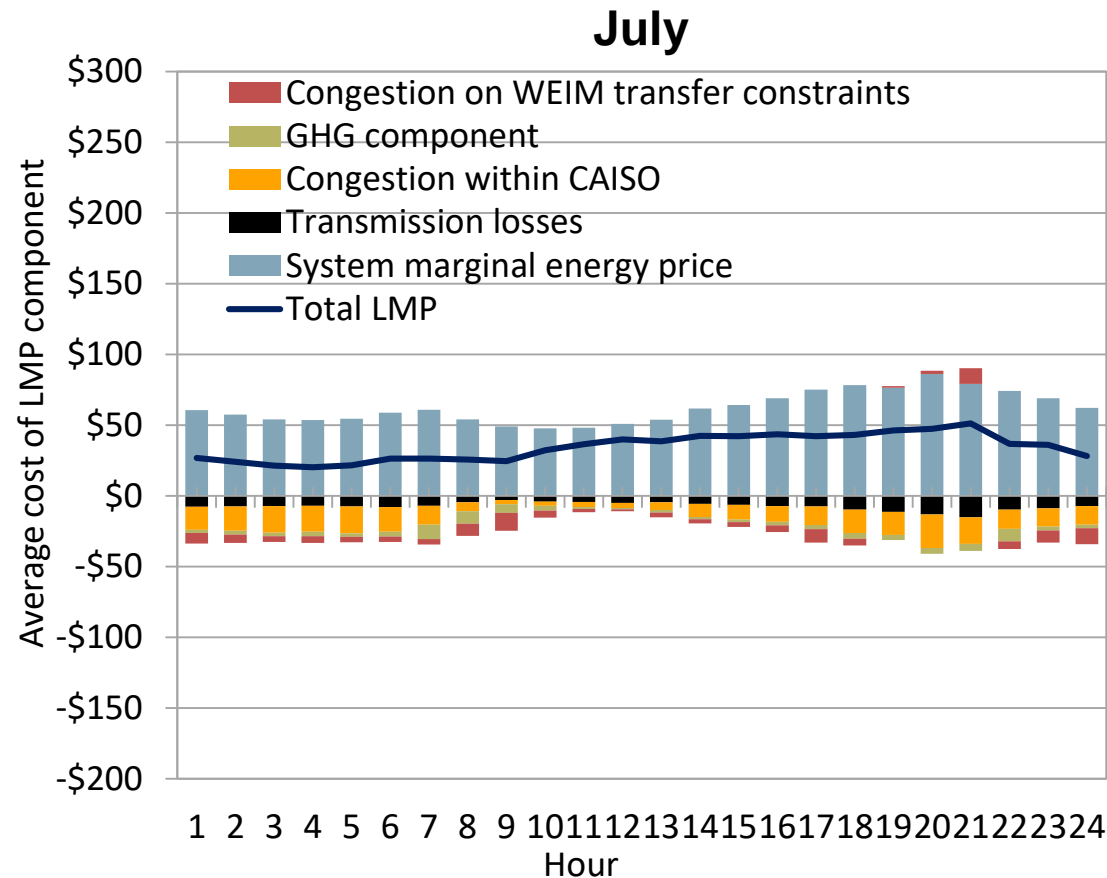


Impact of congestion and greenhouse gas on 5-minute prices (Q3)

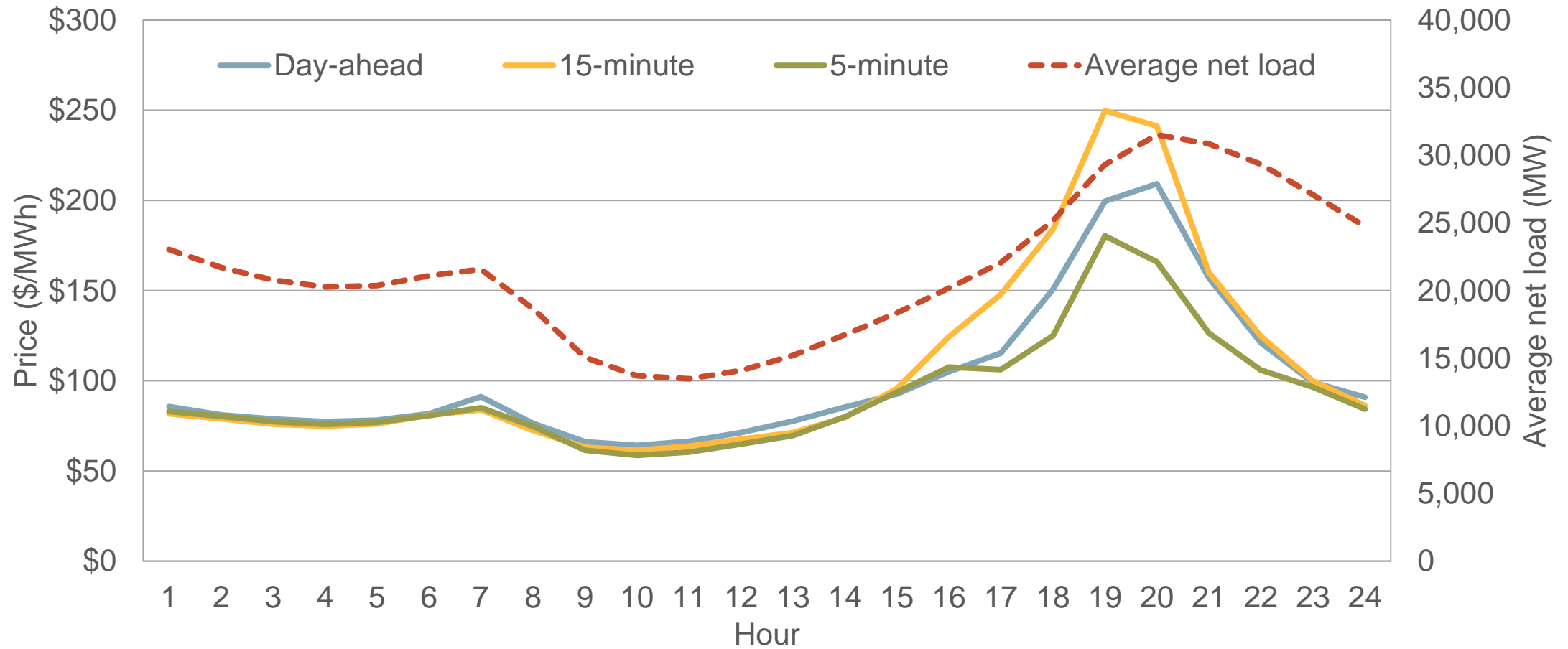


Changes in hourly price decomposition show the impact of an updated loss calculation

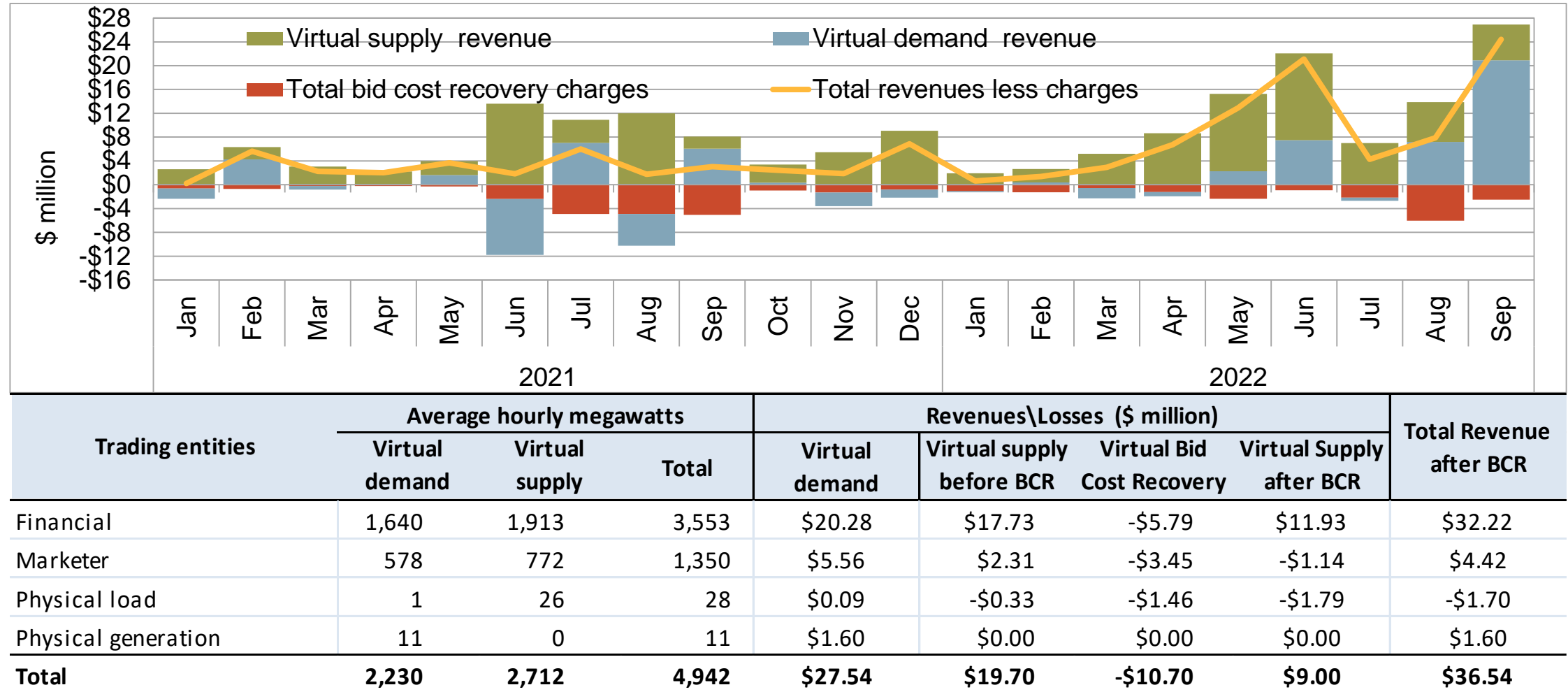
Bonneville Power Administration average 5-minute price by component



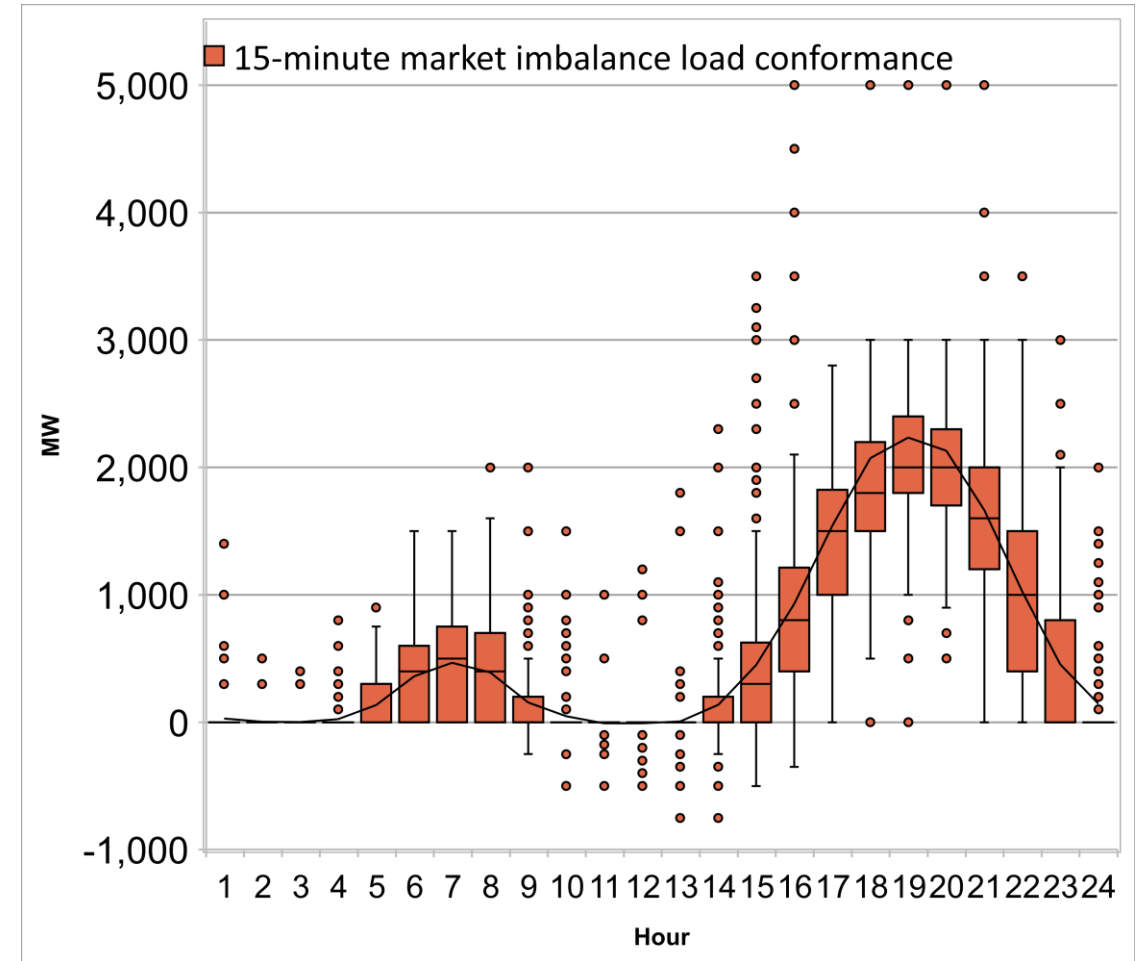
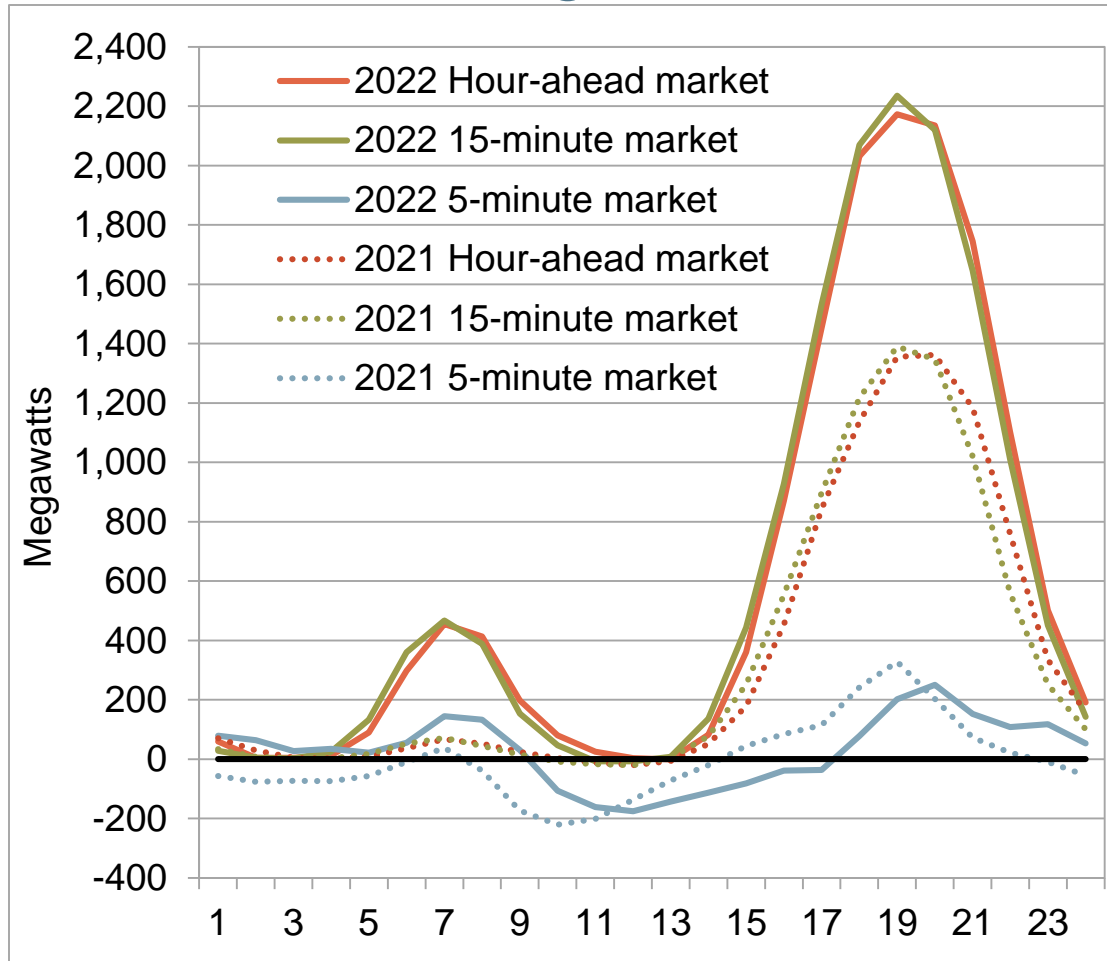
Average hourly CAISO prices mirror net load, with day-ahead prices lower than 15-minute, higher than 5-minute in peak hours



Convergence bidding net profits increase to \$37 million in Q3 alone, close to the total of \$38 million for full year of 2021 (\$45 million in 2020)



Load adjustment by grid operators increased, particularly in ramping hours and during the heatwave

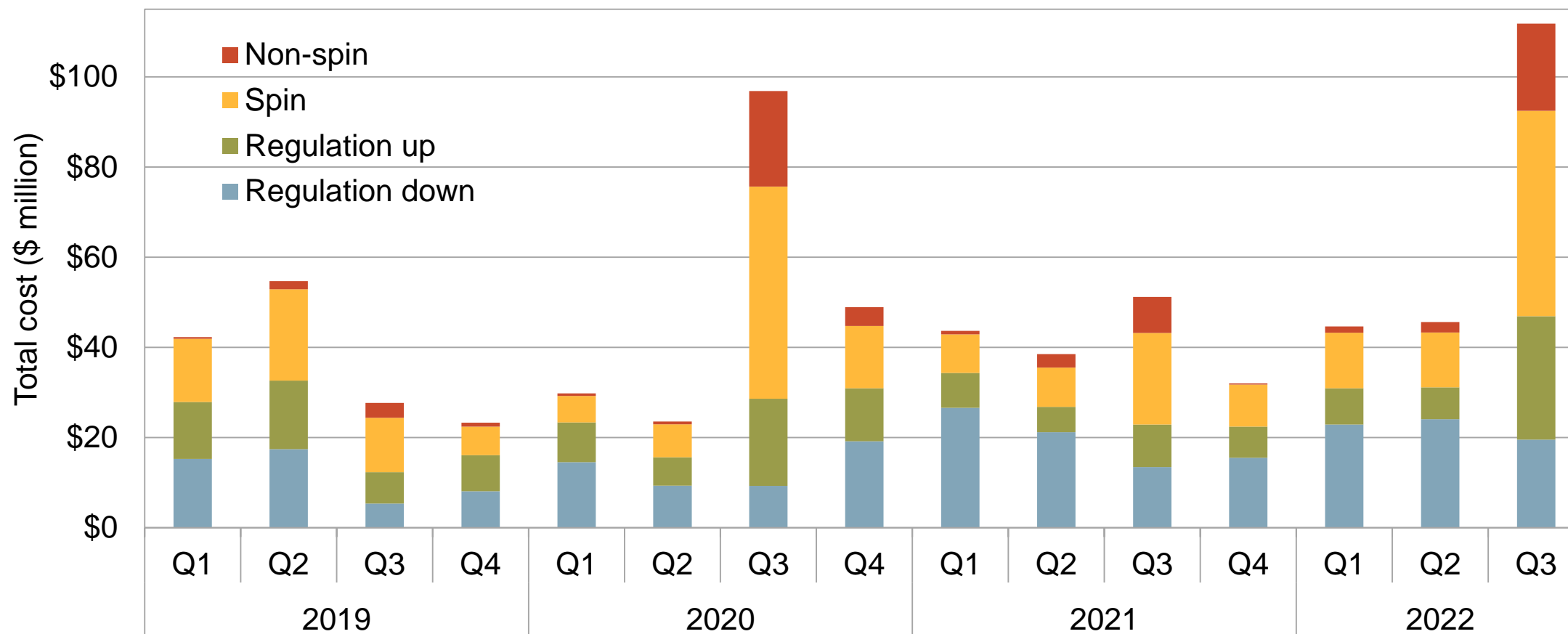


[Analysis-LoadConformanceImpactonResourceSufficiencyEvaluation.pdf \(caiso.com\)](#)

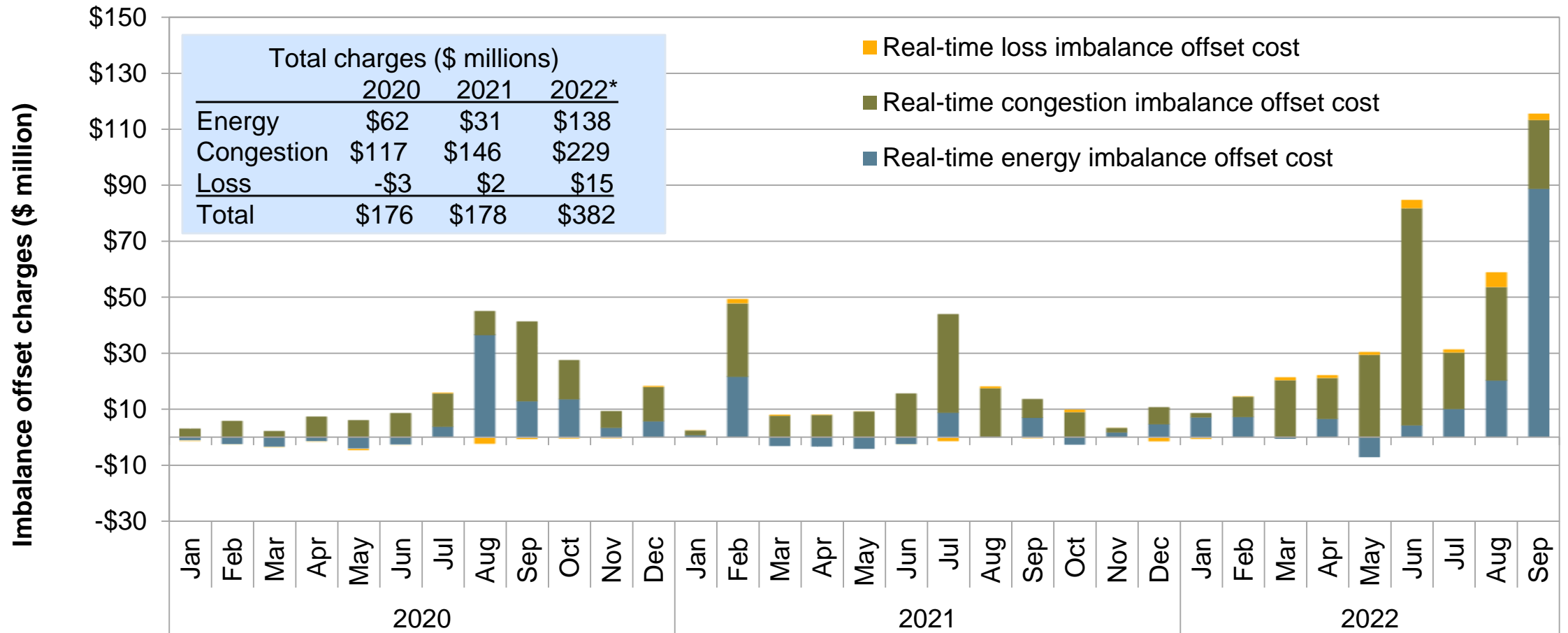
Flexible ramping capacity

- Designed to enhance reliability and market performance by procuring real-time ramping capacity to help manage variability and uncertainty
- Flexible ramping prices were very frequently zero
- Minimum area constraint implemented in November 2020, only in the 15-minute market
 - added to the 5-minute market on February 16, 2022
 - Frequently binding in CAISO, but not other areas
- DMM supports the ISO's planned Feb 2023 implementation of (nodal procurement):
 - Reduces procurement of capacity from resources not able to meet system uncertainty because of resource characteristics or congestion
 - This change will likely increase the effectiveness of the product to manage net load volatility and prevent power balance violations
- Uncertainty over load and the future availability of resources to meet that load contributes to operators needing to enter systematic and large imbalance conformance adjustments

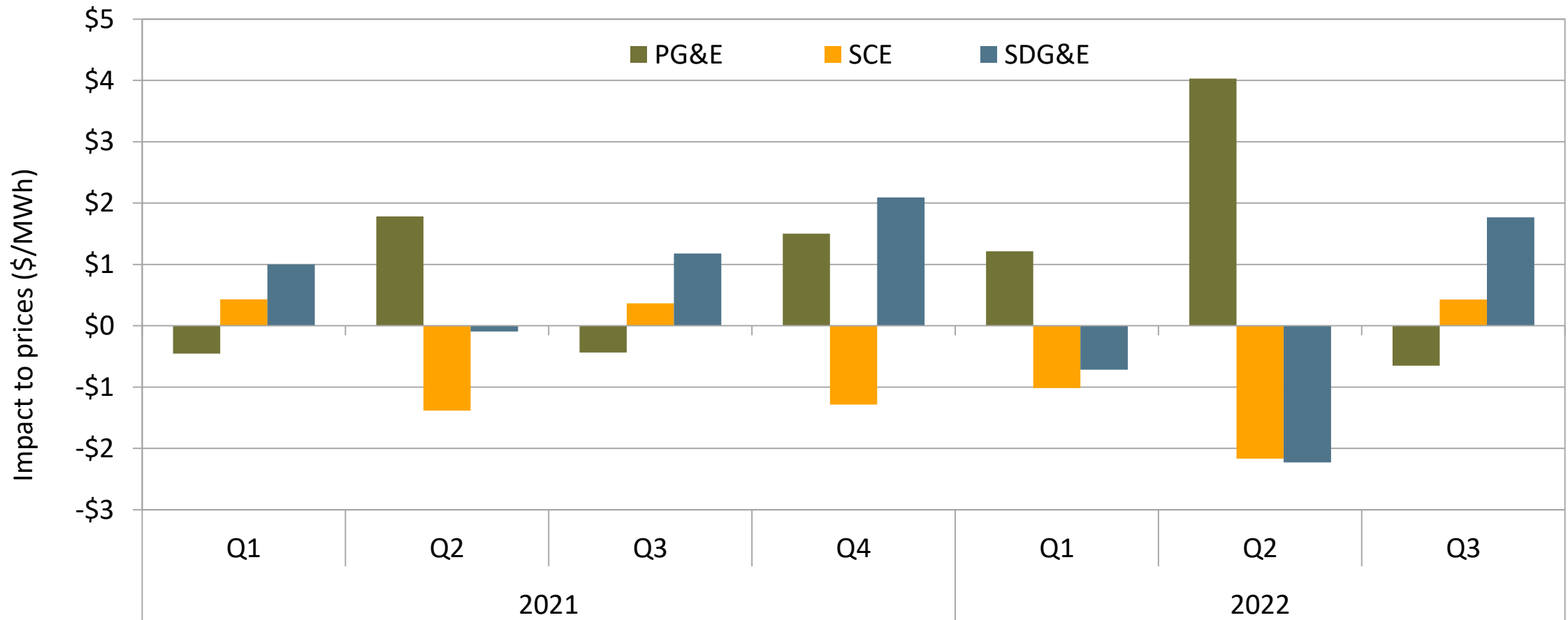
Ancillary service costs increased to \$112 million, with higher prices and higher operating reserve and regulation requirements



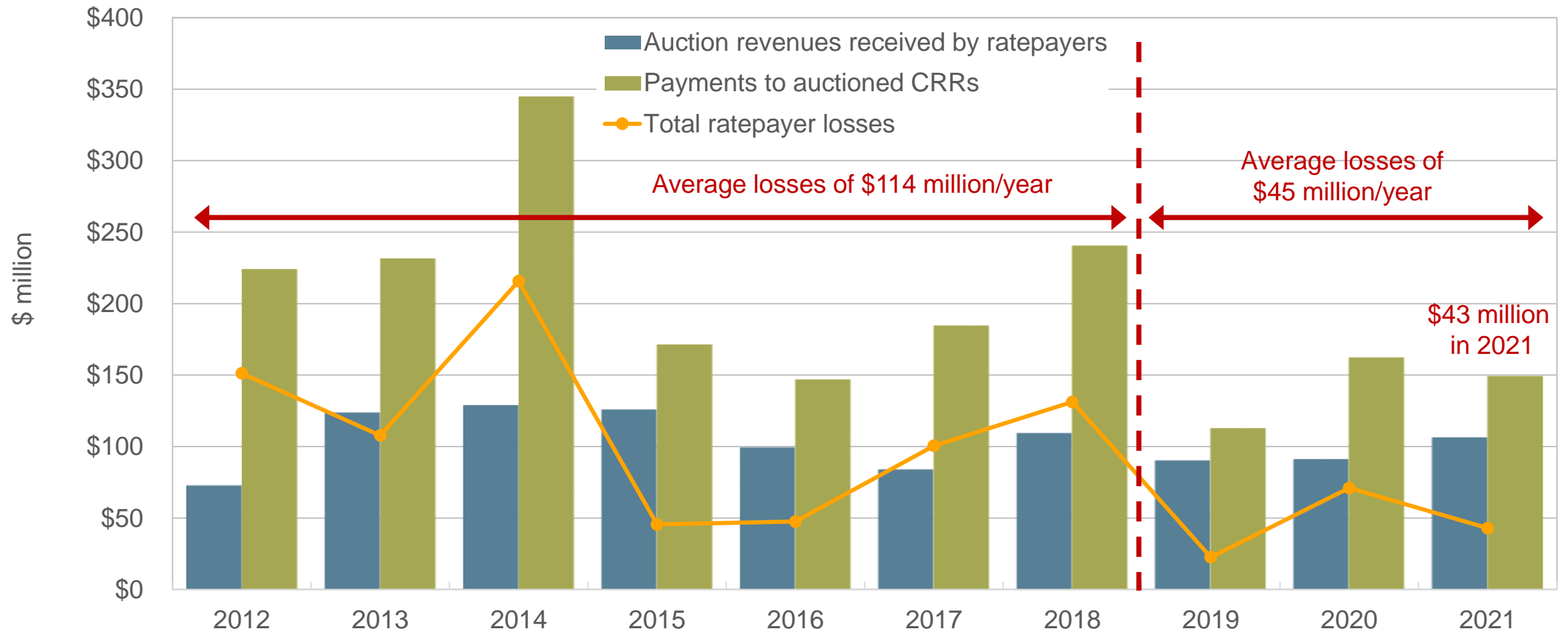
Real-time imbalance offset costs increased to \$206 million, record high energy offsets in September (\$89 million)



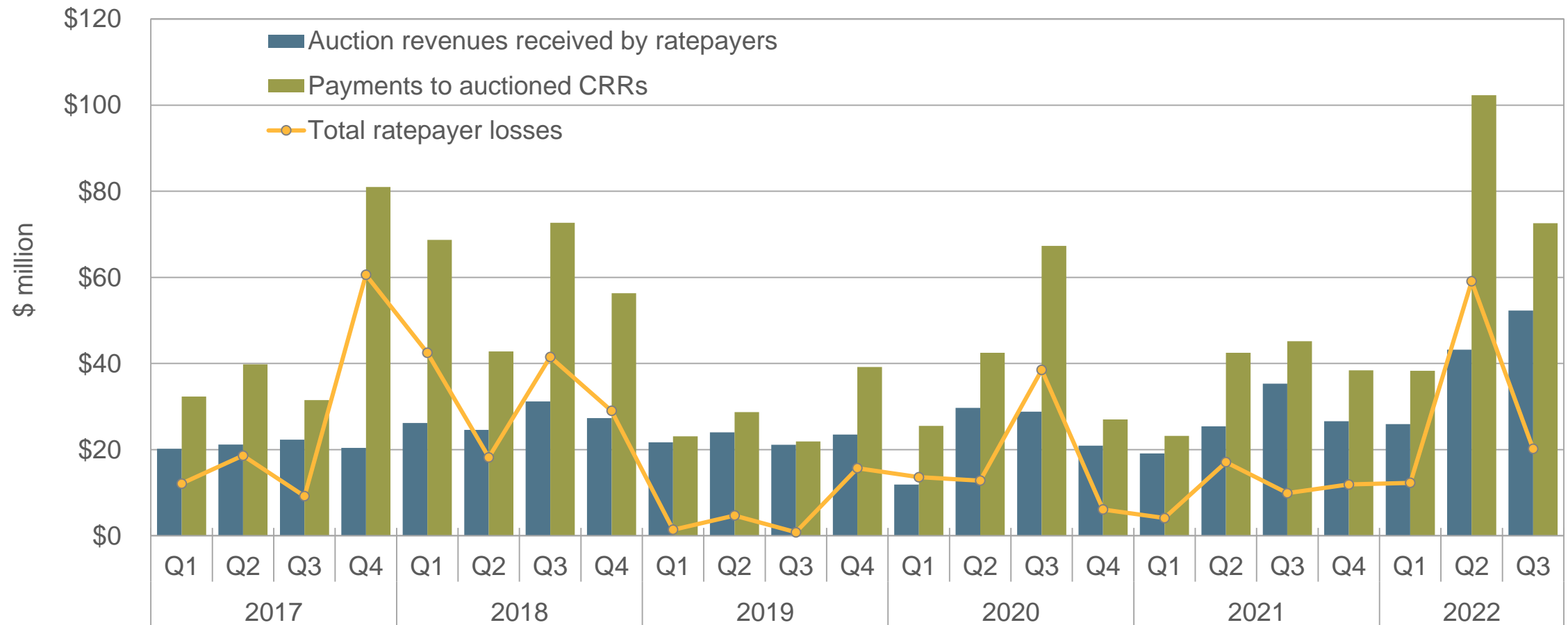
Day-ahead congestion rent rose to \$238 million in Q3 2022 from \$166 million in Q3 2021



Transmission ratepayers losses from auctioned CRRs have been reduced by changes made in 2019, but still averaging \$45 million per year through 2021



Payouts to congestion revenue rights sold in the California ISO auction exceeded auction revenues by \$20 million in Q3, \$90 million year to date



WEIM transfer constraint congestion had greater impact on prices than internal constraint congestion in all areas outside of CAISO, lowering prices in Northwest

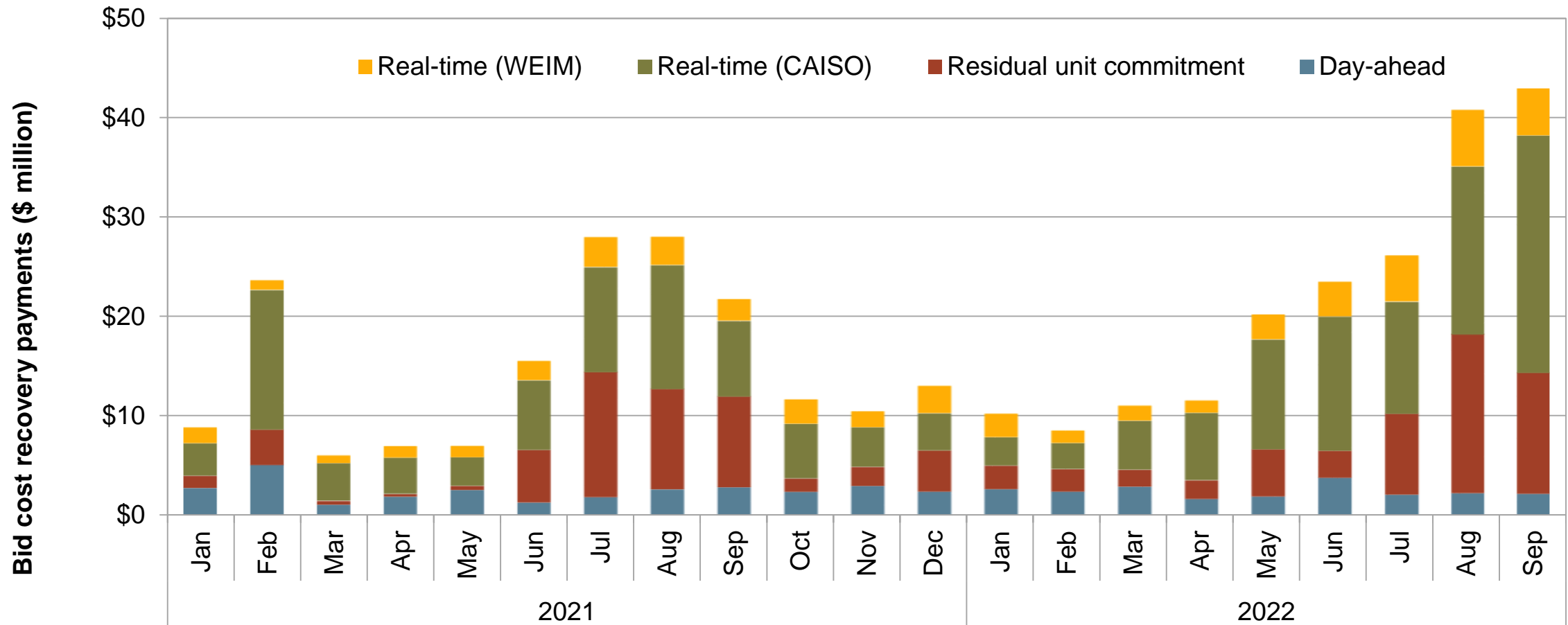
	15-minute market		5-minute market	
	Congestion Frequency	Price Impact (\$/MWh)	Congestion Frequency	Price Impact (\$/MWh)
Turlock Irrigation District	0%	-\$0.49	0%	\$0.03
BANC	0%	-\$1.87	0%	-\$1.34
L.A. Dept. of Water and Power	0%	-\$0.41	0%	\$0.17
Arizona Public Service	0%	-\$0.50	1%	\$2.01
NV Energy	1%	-\$0.52	2%	\$2.84
Public Service Company of NM	1%	-\$0.77	1%	\$0.75
PacifiCorp East	6%	-\$1.09	5%	\$0.14
Idaho Power	7%	-\$2.74	5%	-\$0.10
Tucson Electric Power	7%	-\$1.62	9%	\$1.00
PacifiCorp West	22%	-\$3.40	10%	-\$1.51
NorthWestern Energy	19%	-\$11.14	13%	-\$3.72
Avista	21%	-\$11.22	14%	-\$3.55
Salt River Project	23%	-\$12.20	22%	-\$5.70
Portland General Electric	32%	-\$1.33	16%	-\$0.38
Bonneville Power Admin.	47%	\$1.90	40%	\$1.19
Tacoma Power	47%	-\$5.81	42%	-\$1.15
Puget Sound Energy	47%	-\$4.93	42%	-\$0.48
Seattle City Light	47%	-\$5.61	42%	-\$1.35
Powerex	49%	-\$13.28	67%	-\$4.12

WEIM RSE Phase 1 enhancements implementation in June

- Intertie uncertainty removed from the capacity test on June 1.
 - Net load uncertainty removed from the capacity test on February 15, 2022.
- Exclude long start units that are off-line and short start units that fail to start from capacity test.
- Account for the state-of-charge of batteries from the market run immediately prior to the test hour.*
- Reduce CAISO import/exports awards counted in test based on transmission profile e-Tags submitted at T-40.*
- Flexibility test requirement now accounts for any power balance constraint shortage during the interval immediately prior to the test hour.
- Demand response actions taken which aren't accounted for in real-time market can be submitted as an adjustment to load forecast used in test.
- CAISO excluded from distribution of potential revenues from failures of the balancing test.

**** DMM analysis indicates these changes were not implemented correctly.***

Estimated bid cost recovery payments increased to about \$167 million (CAISO) and \$27 million (WEIM) in Q1-Q3 2022, exceeding 2021



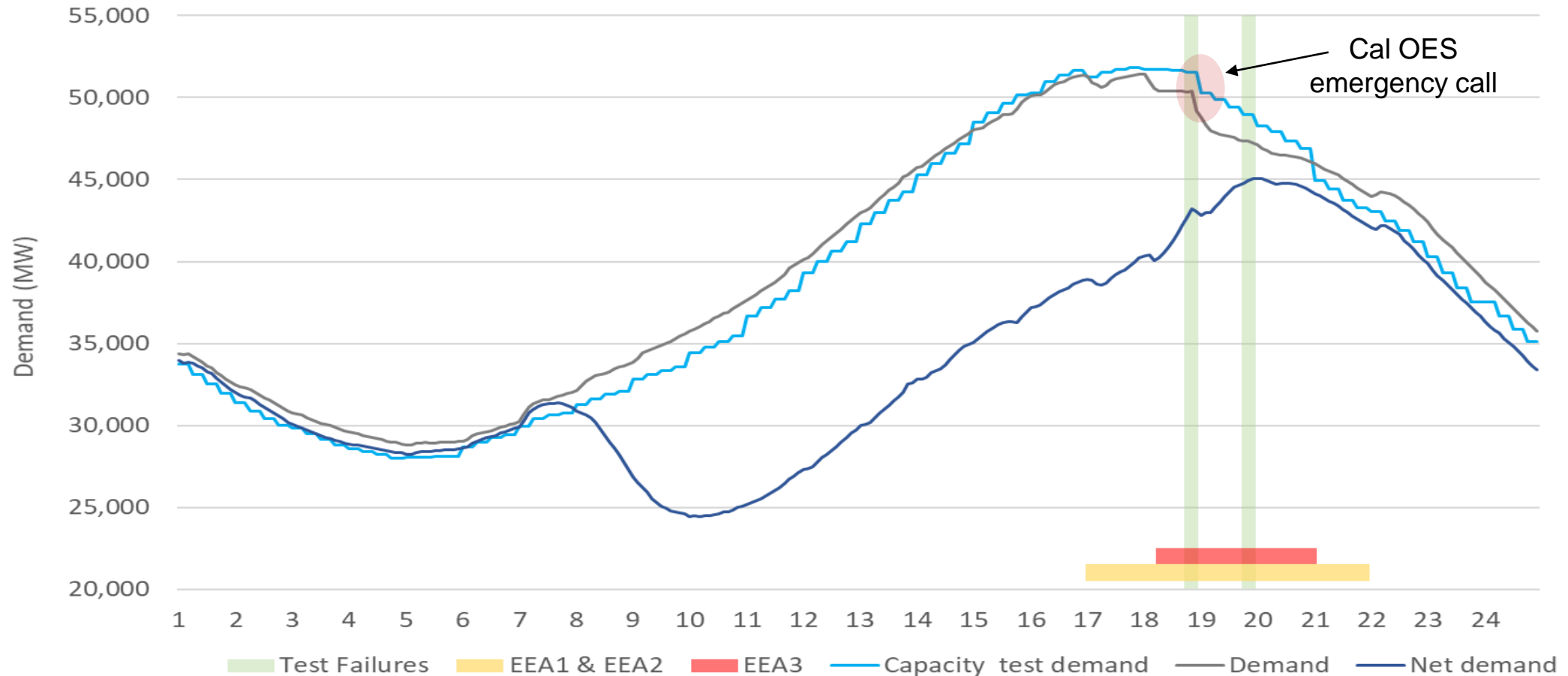
Western region heat wave

- **Extreme temperatures and energy demand** across the entire western region resulted in demand for electricity well in excess of current resource planning targets over an extended period
- **High bilateral market price indices** reflected regional market conditions and triggered increase in CAISO bid cap and penalty price to \$2,000
- **Balancing areas declaring emergencies were able to import supplemental energy**, both through emergency assistance from other balancing areas and WEIM imports
- **CAISO supply was additionally supplemented** by out of market imports, non-market capacity procured through California's strategic reserve, and through voluntary demand reduction

Western regional heatwave – CAISO exports

- **CAISO operators raised both real-time imbalance conformance and operator adjustments** in the day-ahead market's residual unit commitment process to extraordinarily high levels
 - Doing so helped to ensure that the market would not clear lower priority exports that would not be supported by dispatched physical capacity
- The market optimization appropriately prioritized load over lower priority exports in the day-ahead market residual unit commitment process
- **Low priority exports cleared the real-time market inappropriately**, requiring CAISO operators to take manual action and increasing CAISO demand in the real-time
 - The CAISO implemented a market enhancement on October 13 to resolve the market issue in the real-time market

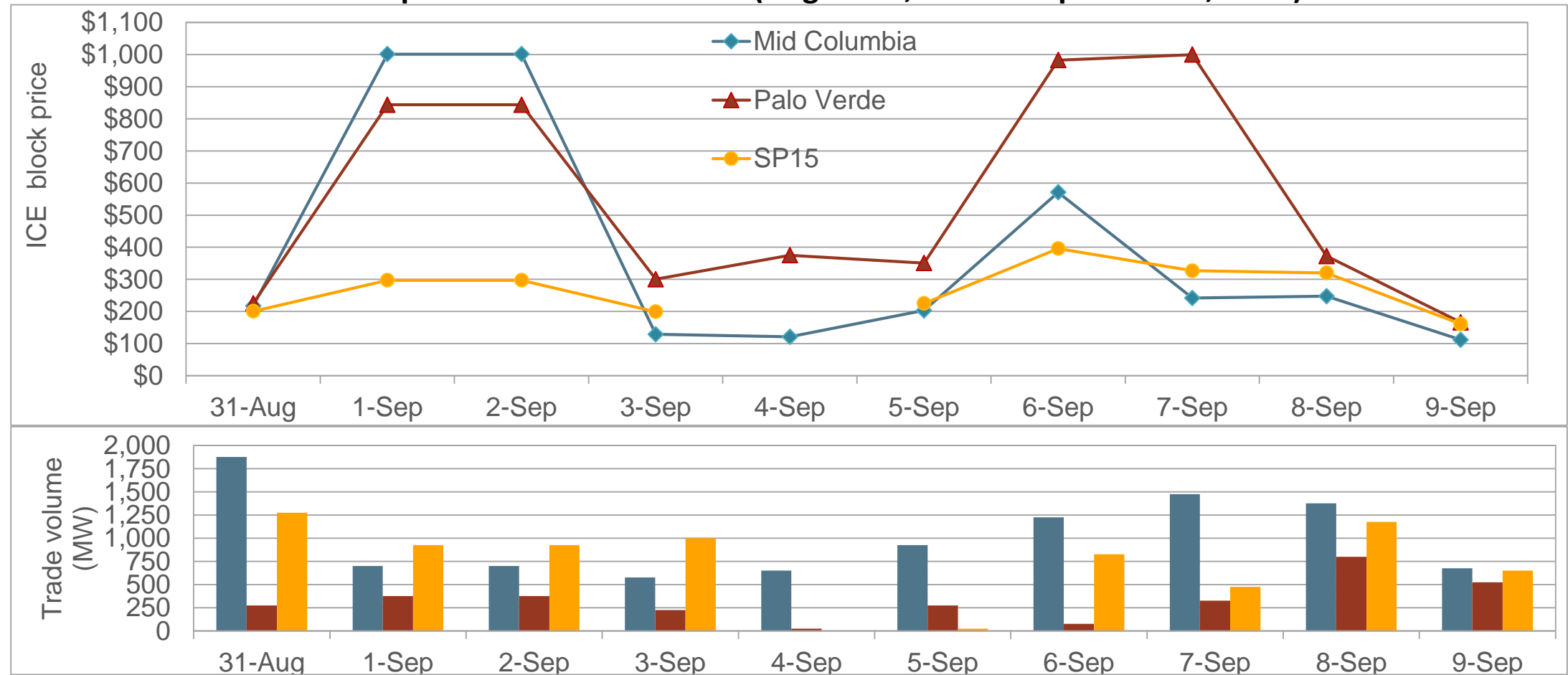
Extraordinary levels of demand response and voluntary conservation caused CAISO load to drop well below forecast



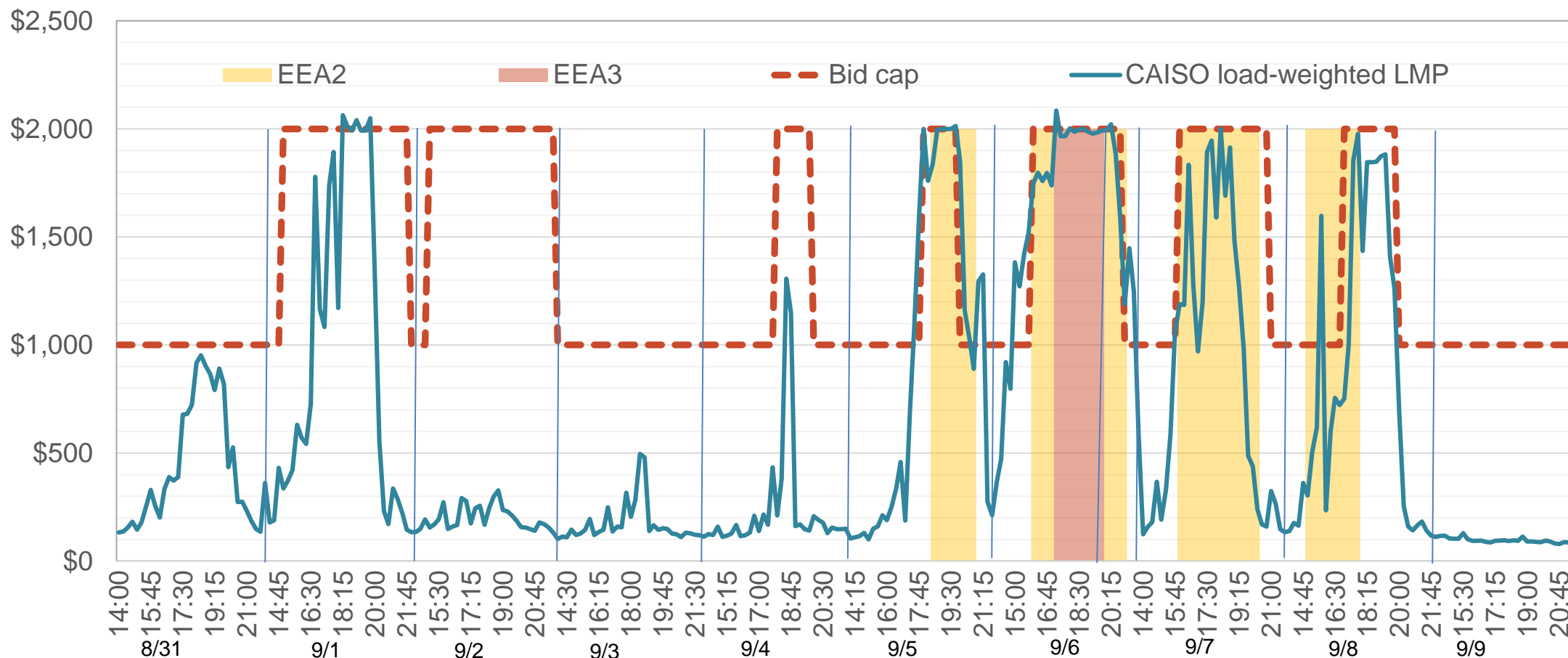
<http://www.caiso.com/Documents/SummerMarketPerformanceReportforSeptember2022.pdf>

High bilateral market price indices at trading hubs outside CAISO triggered increase in CAISO bid cap and penalty price to \$2,000

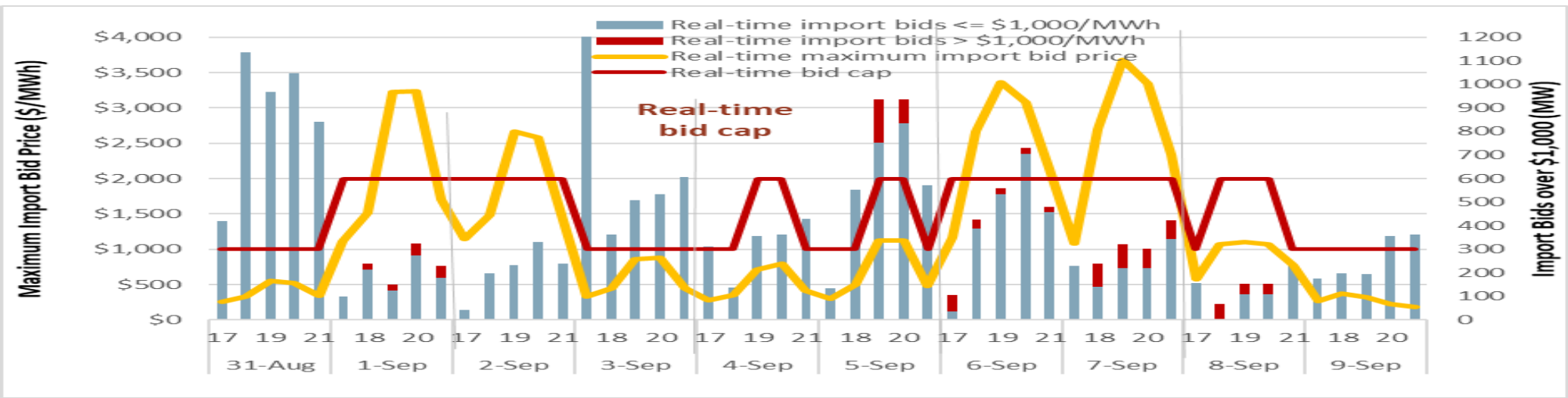
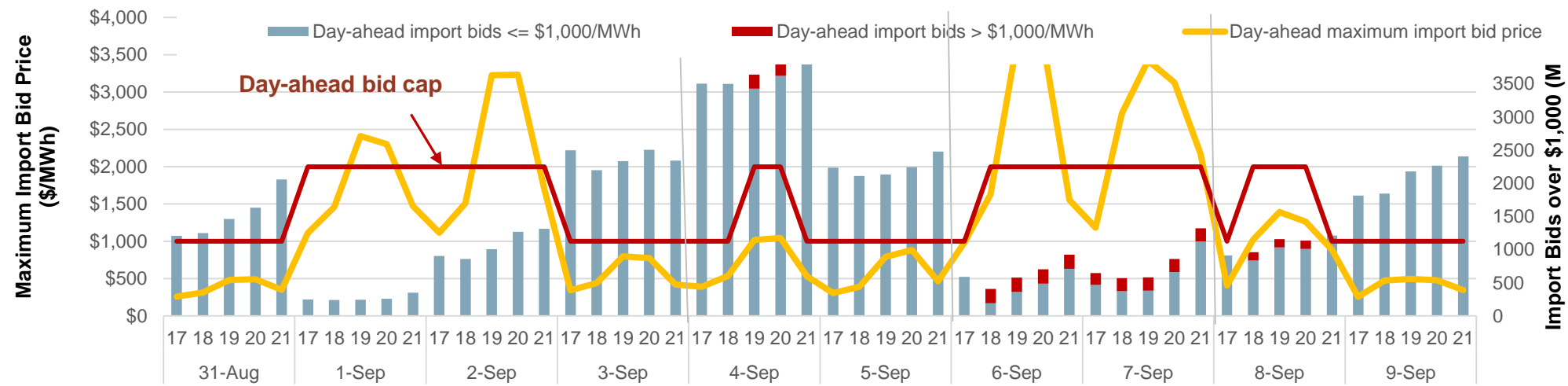
Bilateral prices and trade volume (August 31, 2022 – September 9, 2022)



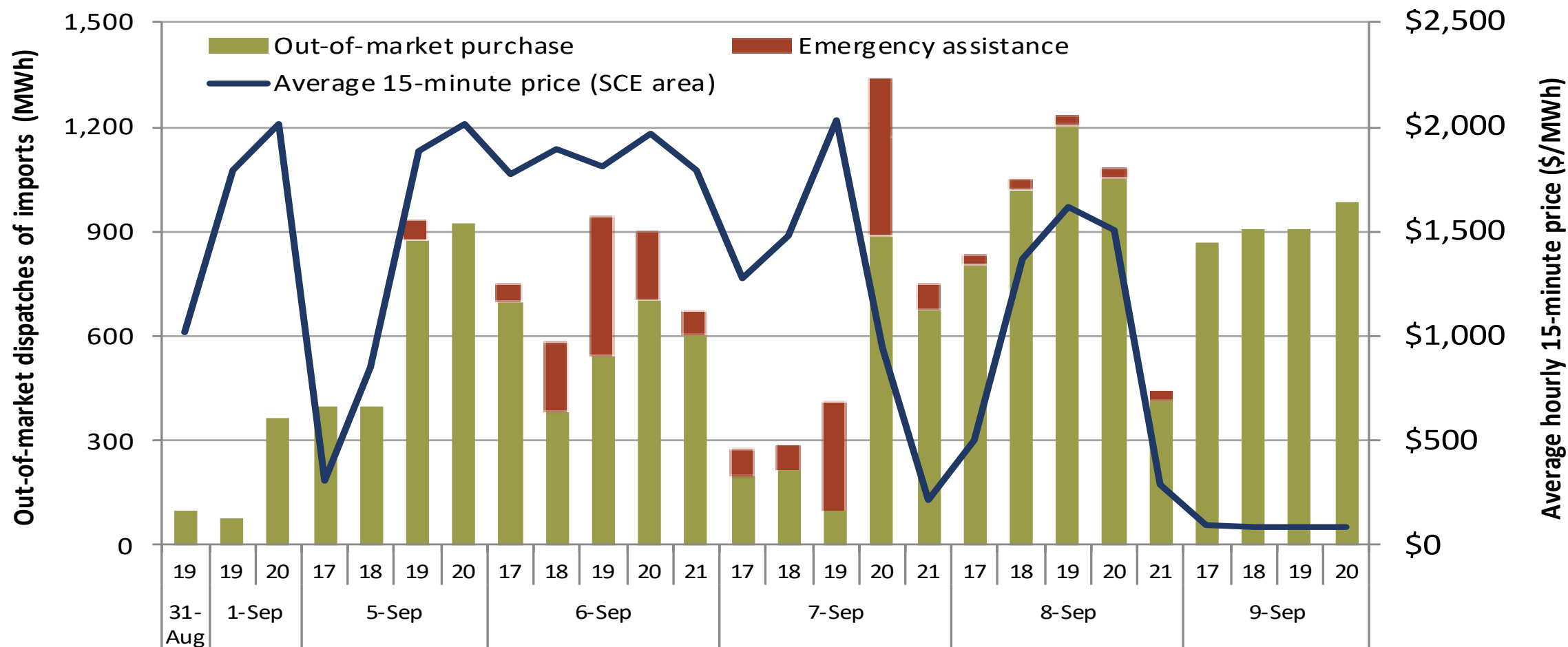
Hours with \$2,000/MWh bid cap closely matched hours when EEA2 and EEA3 were declared on September 5 to September 7



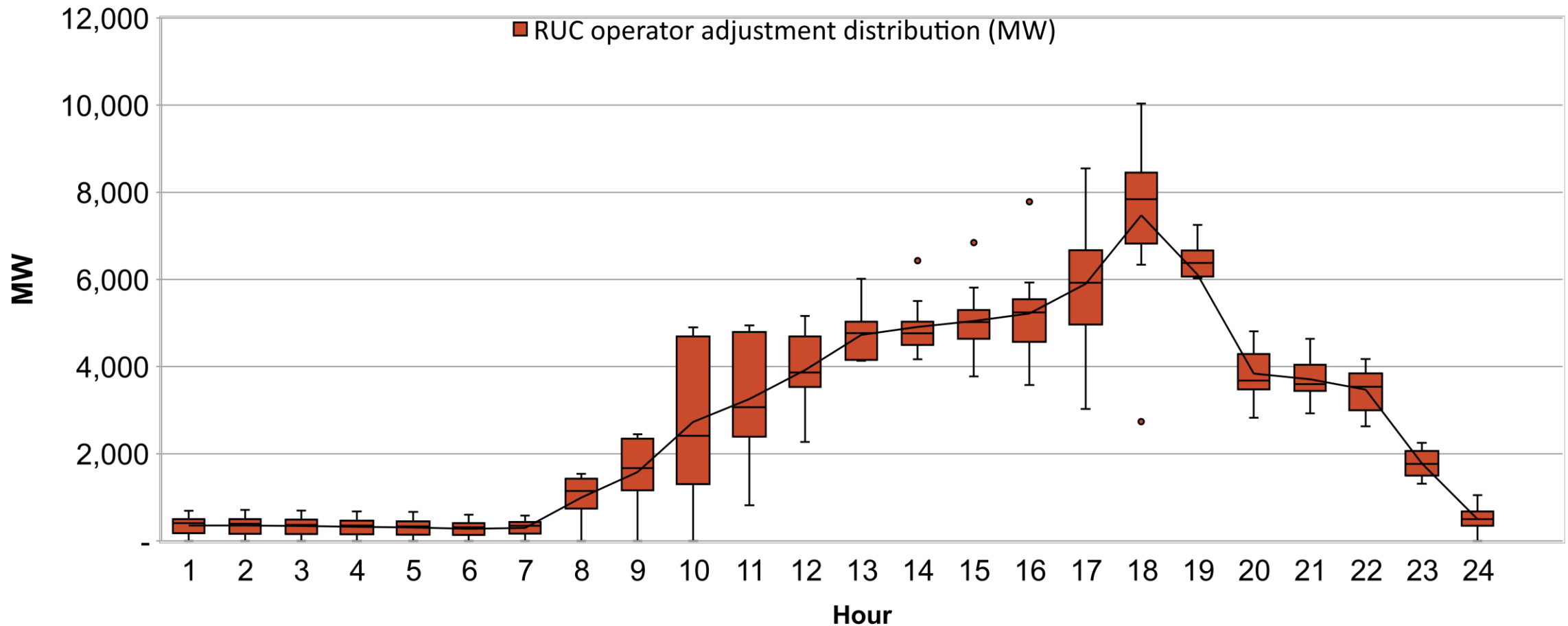
\$2,000 bid cap attracted limited quantity of additional imports into CAISO market



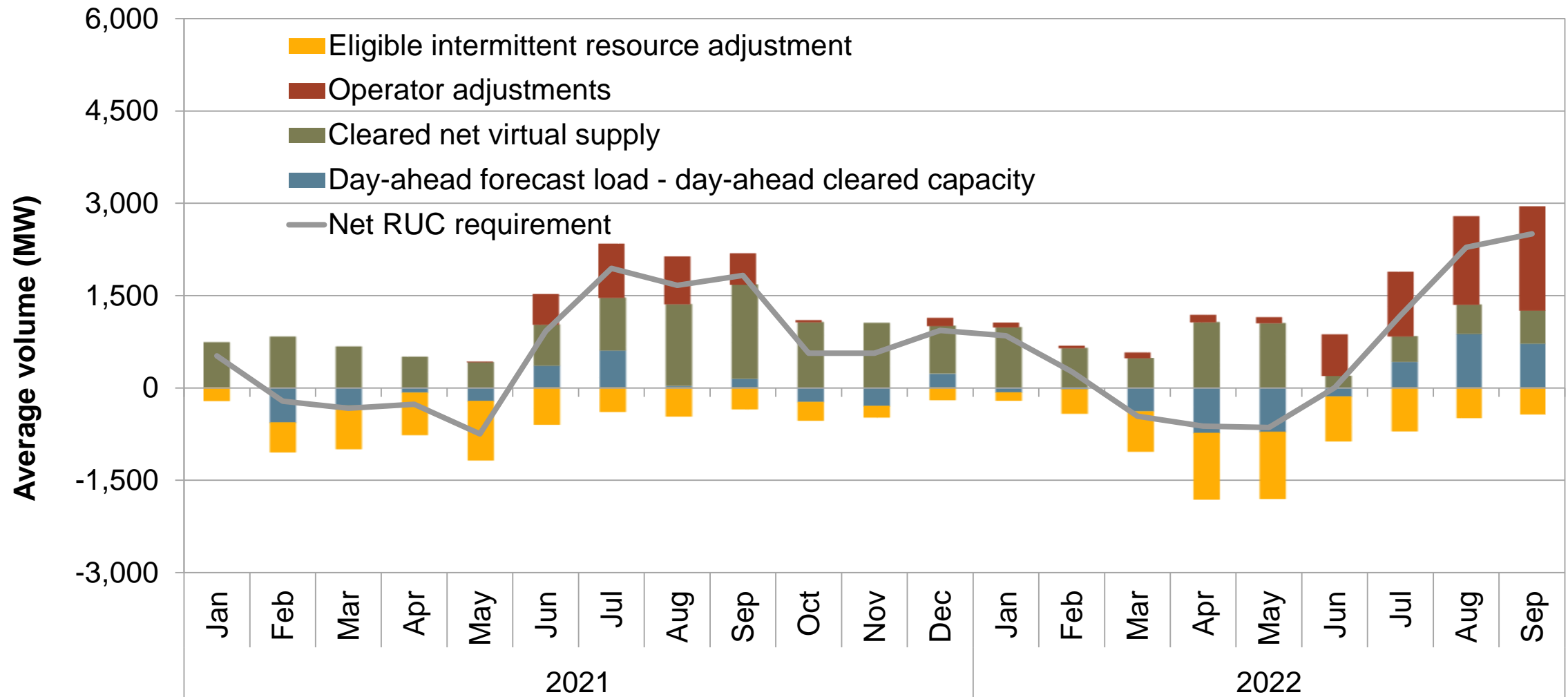
CAISO scheduled additional real-time imports through out-of-market and emergency energy purchases



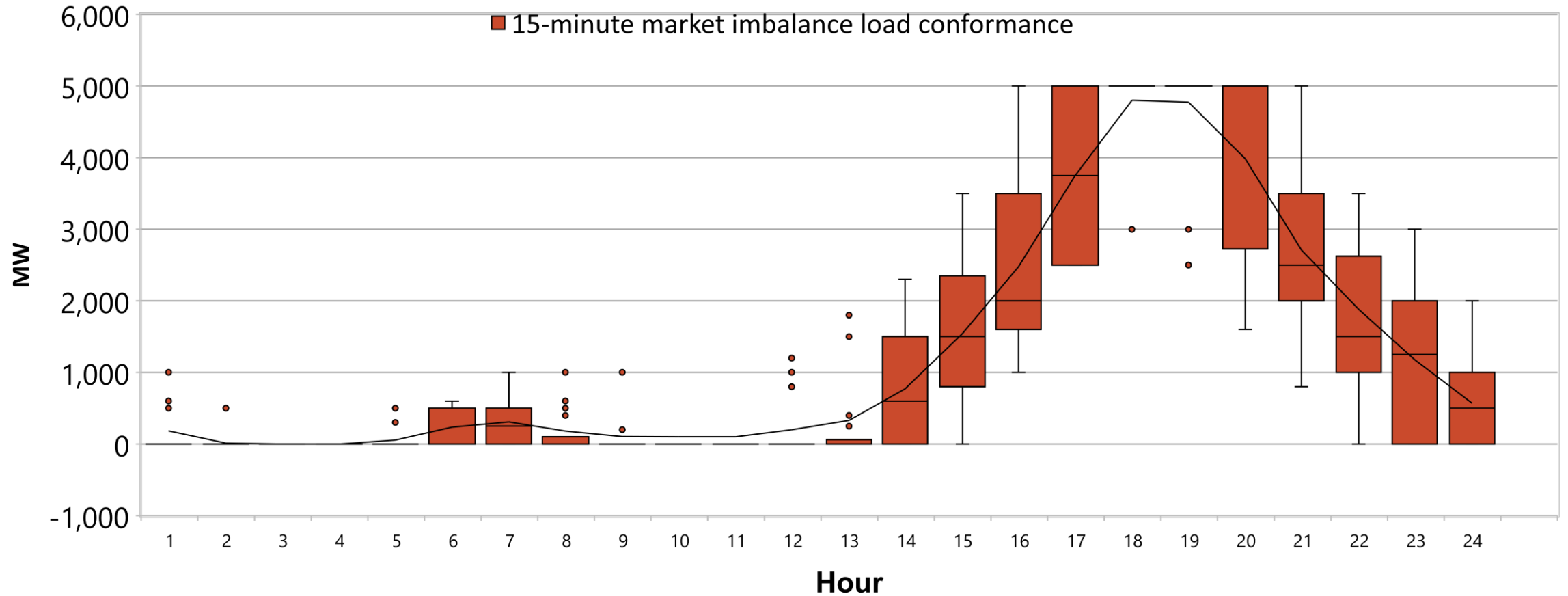
Residual unit commitment (RUC) hourly distribution of operator load adjustments (August 31, 2022 – September 09, 2022)



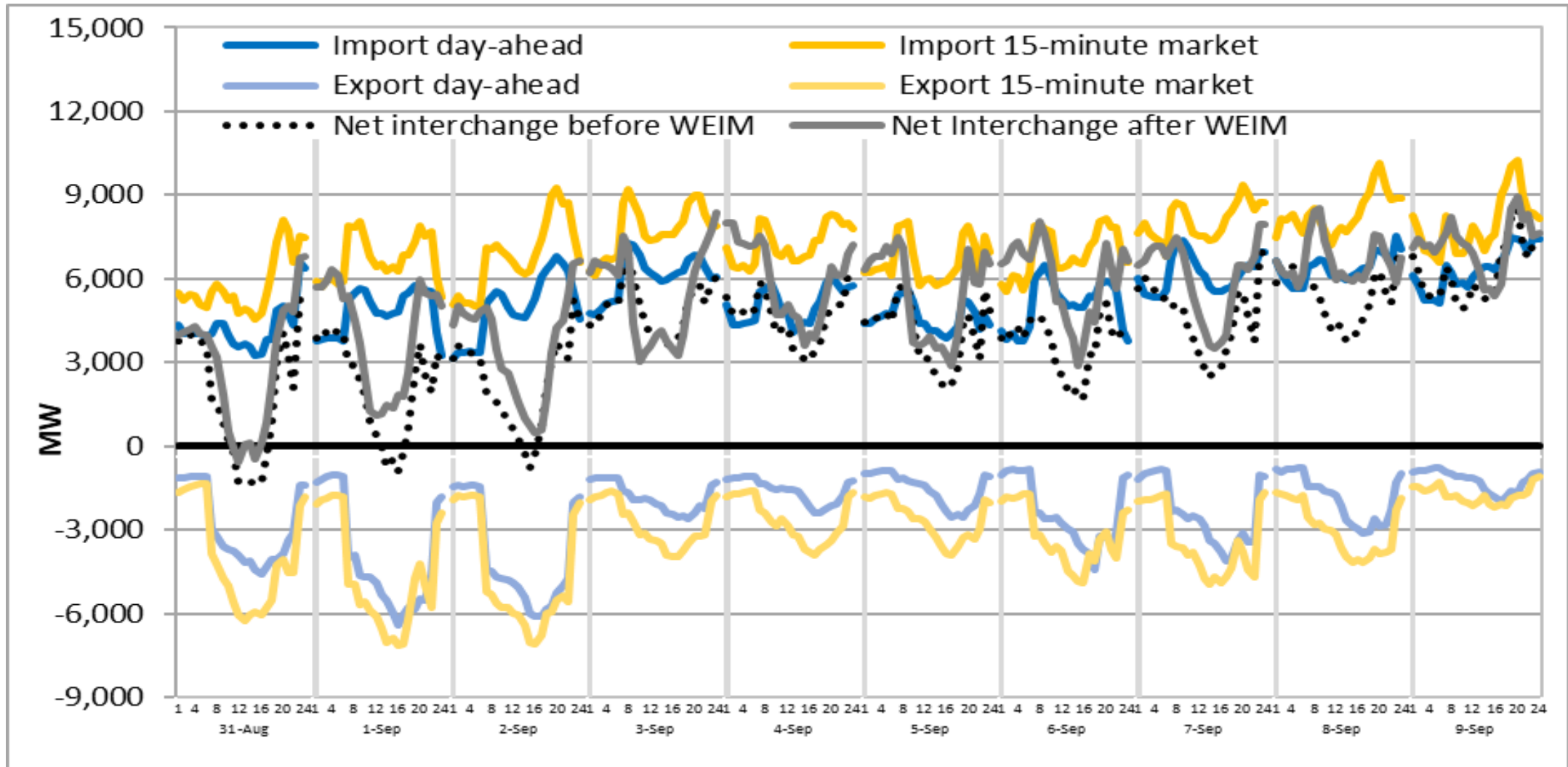
Determinants of residual unit commitment procurement



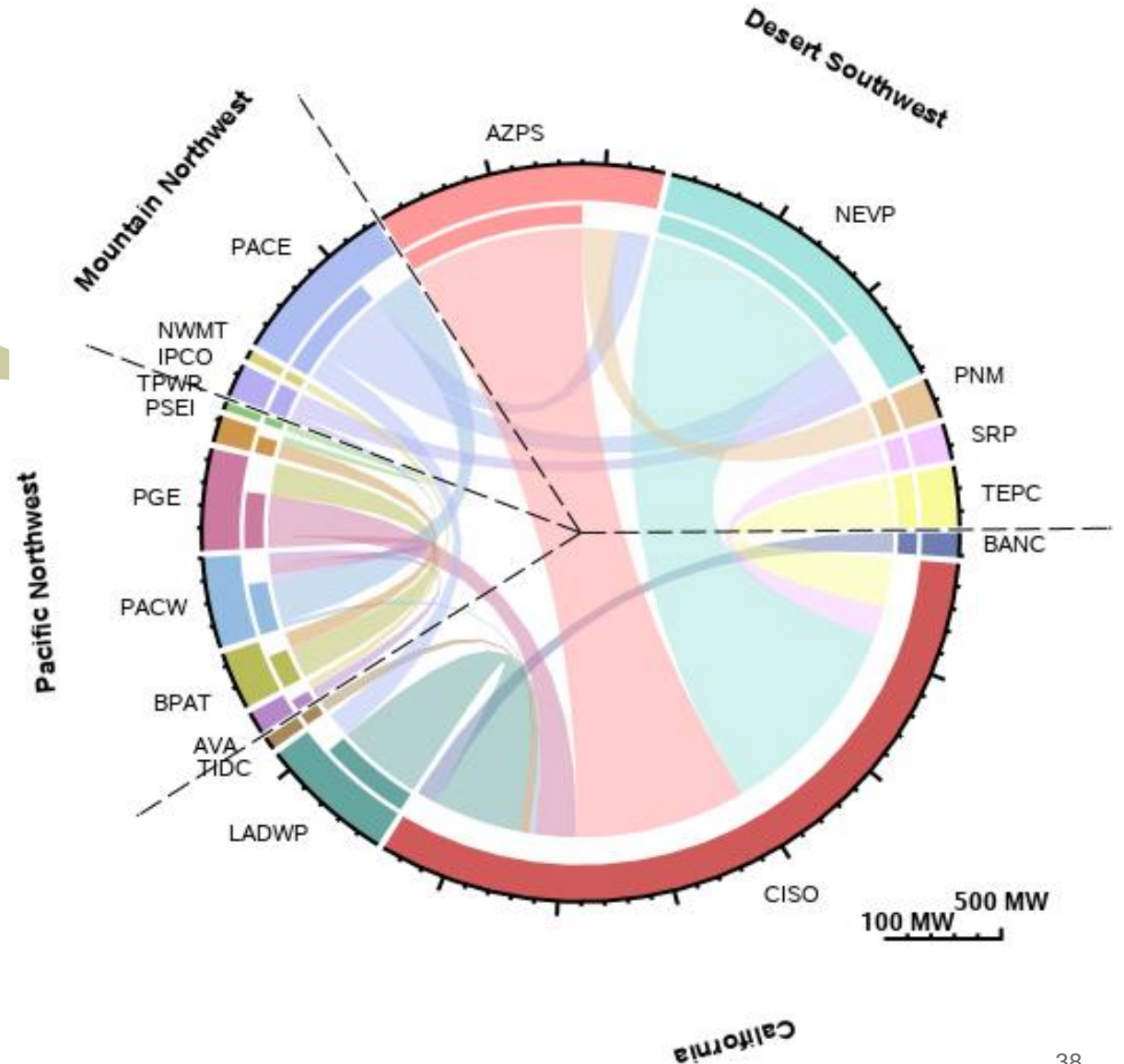
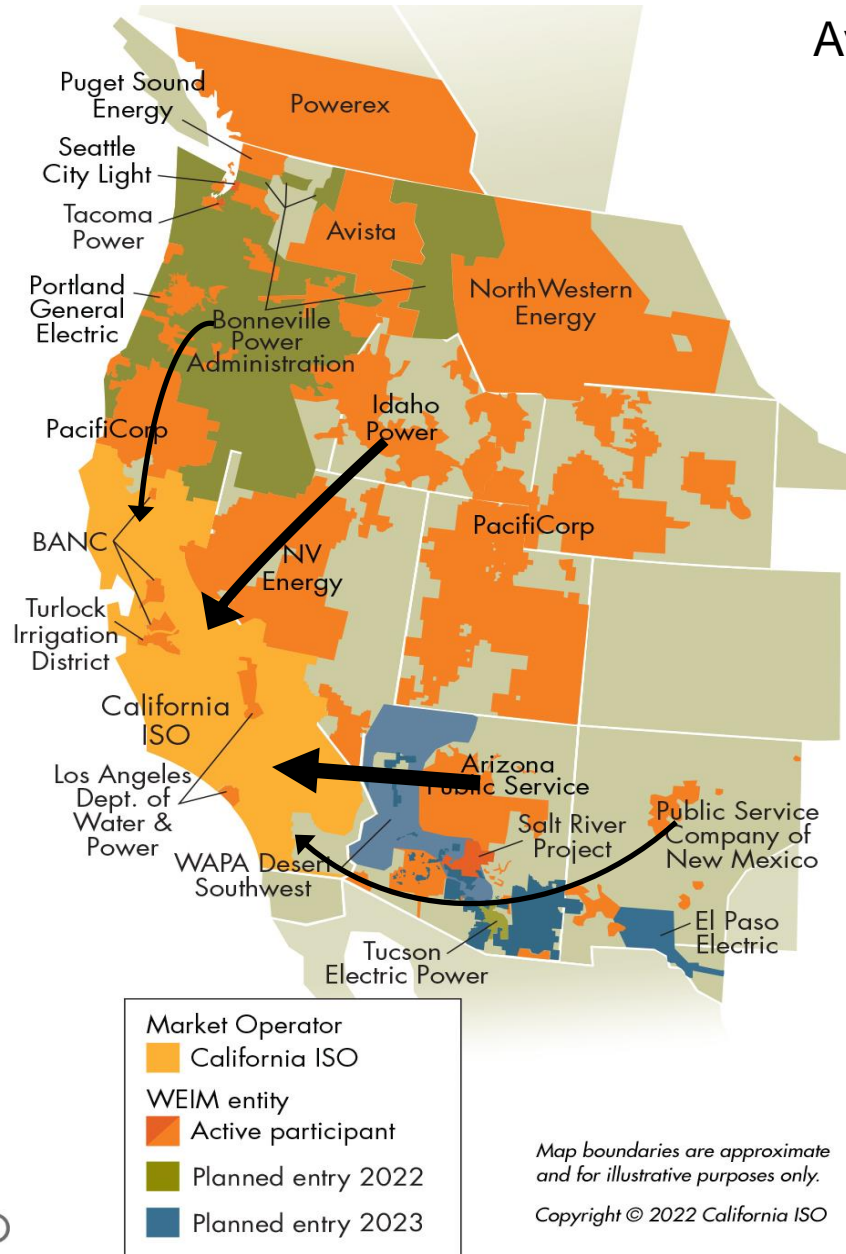
15-minute market hourly distribution of operator load adjustments (August 31, 2022 – September 09, 2022)



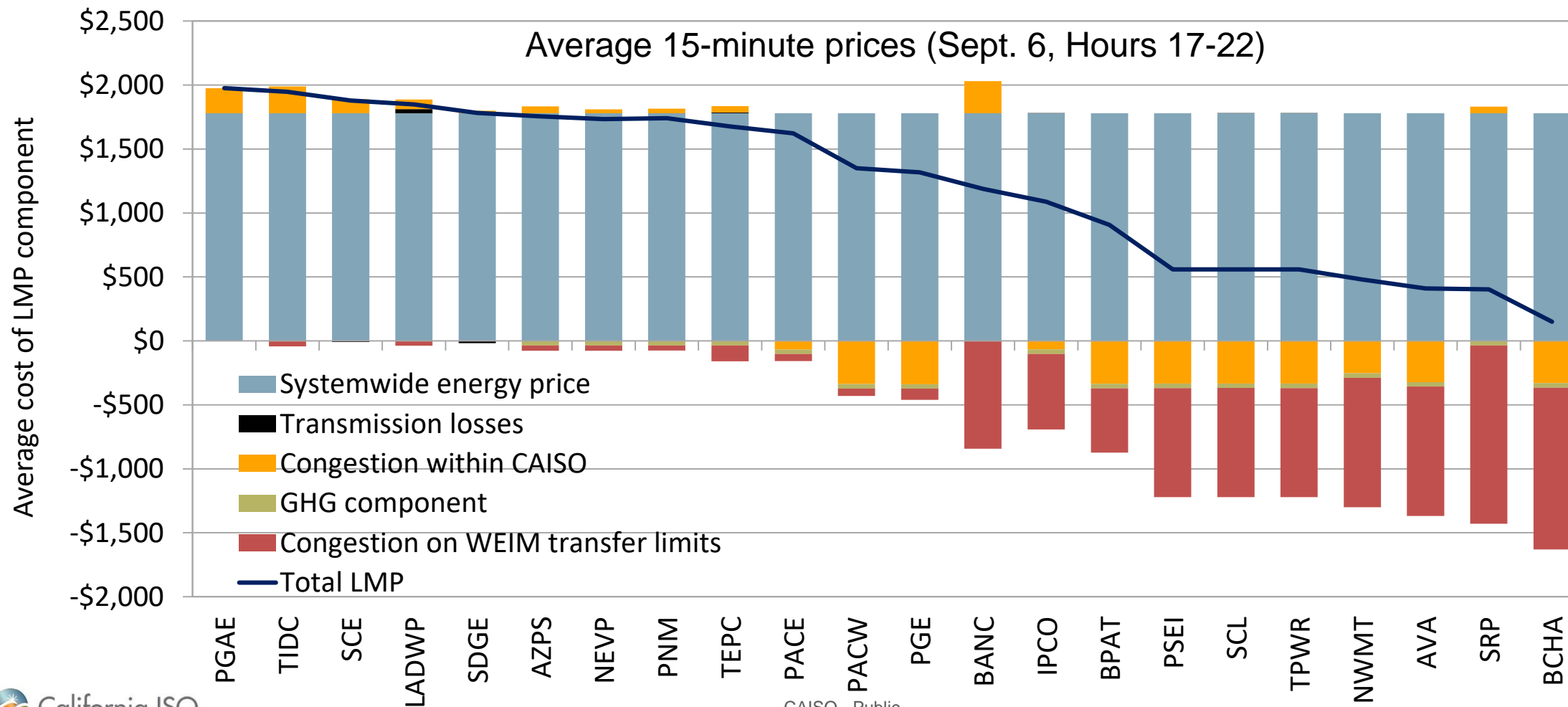
Average hourly net interchange (August 31, 2022 – September 09, 2022)



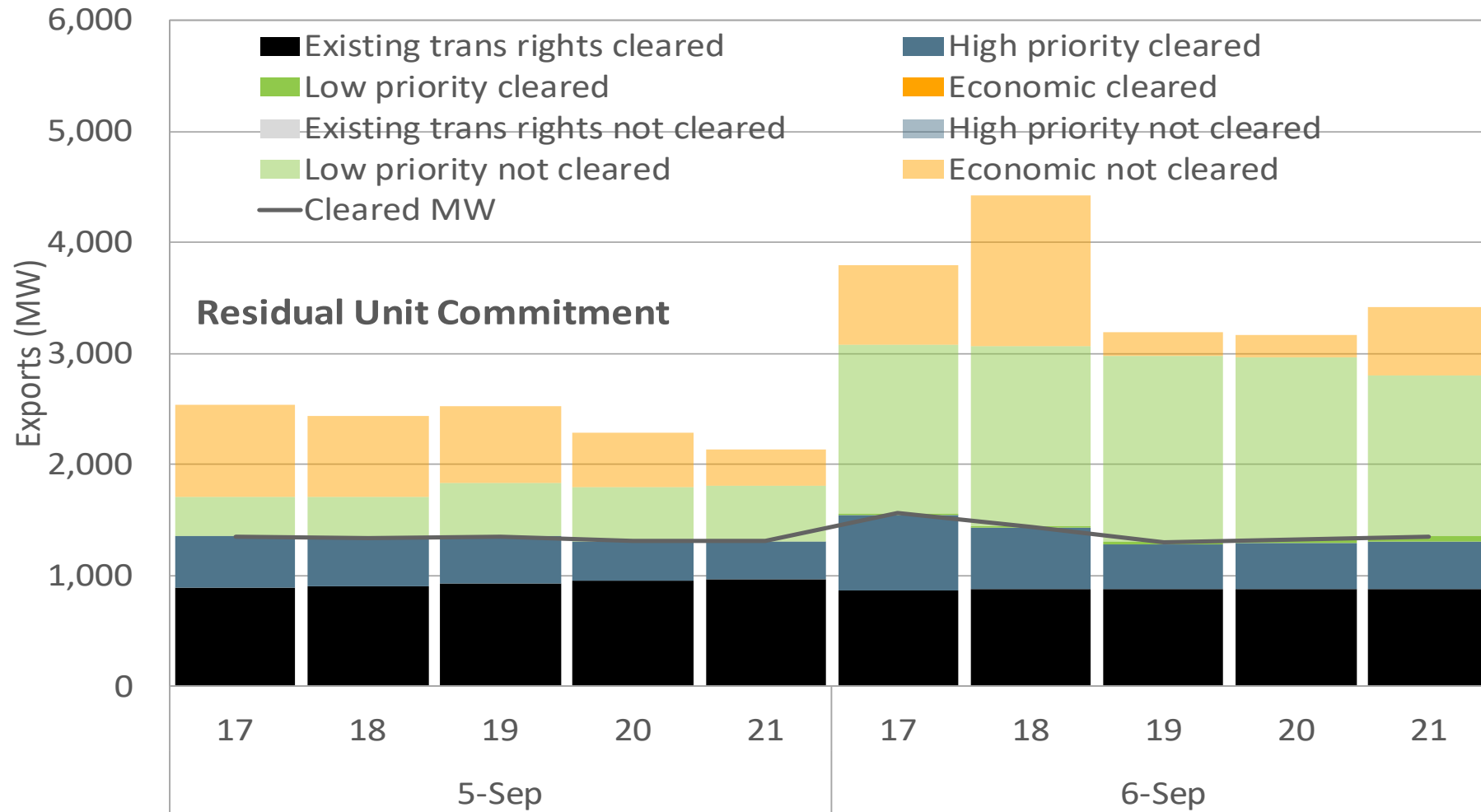
Average 15-minute WEIM transfers (peak hours Sept. 5-6)



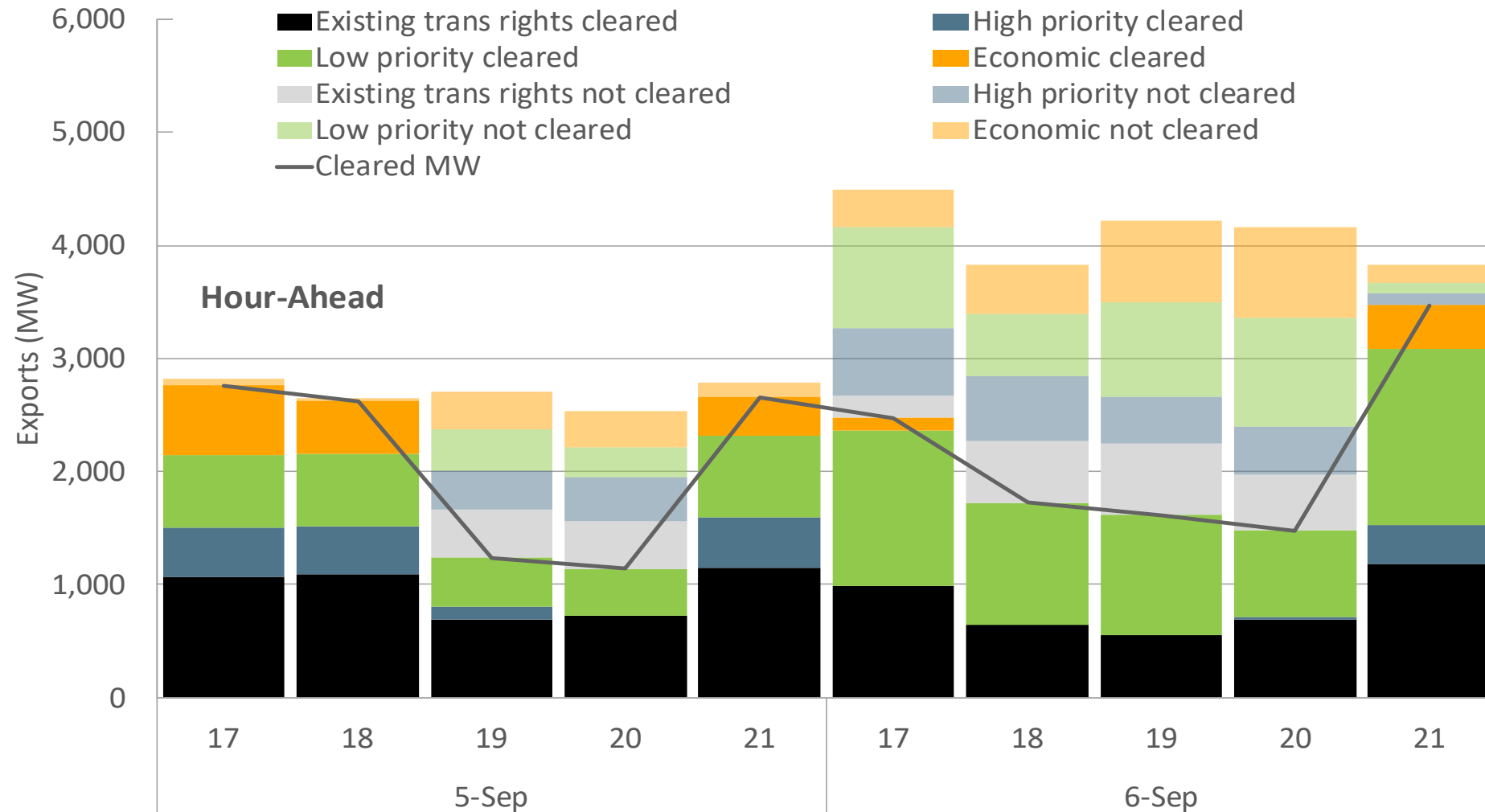
Average prices for WEIM transfers into CAISO exceeded \$1,700/MWh during net peak hours on September 6



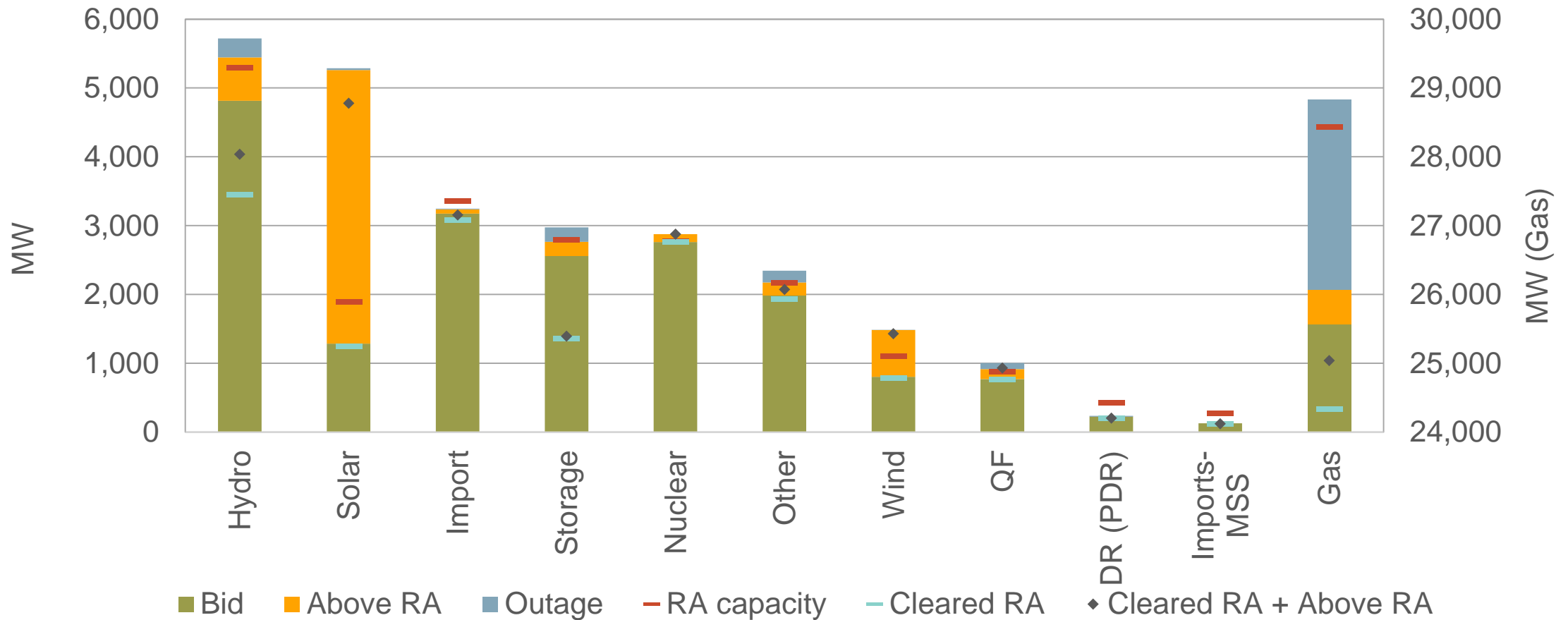
IFM schedules that did not receive RUC awards were primarily low priority self schedules and economic bids that cleared in IFM



HASP curtailed high priority exports while scheduling low priority exports



Average system RA capacity and availability in the real-time market by fuel type during EEA 2 and EEA 3 hours



Hourly average of resource adequacy imports scheduled by market

