



# Q4 2022 Report on Market Issues and Performance

March 28, 2023

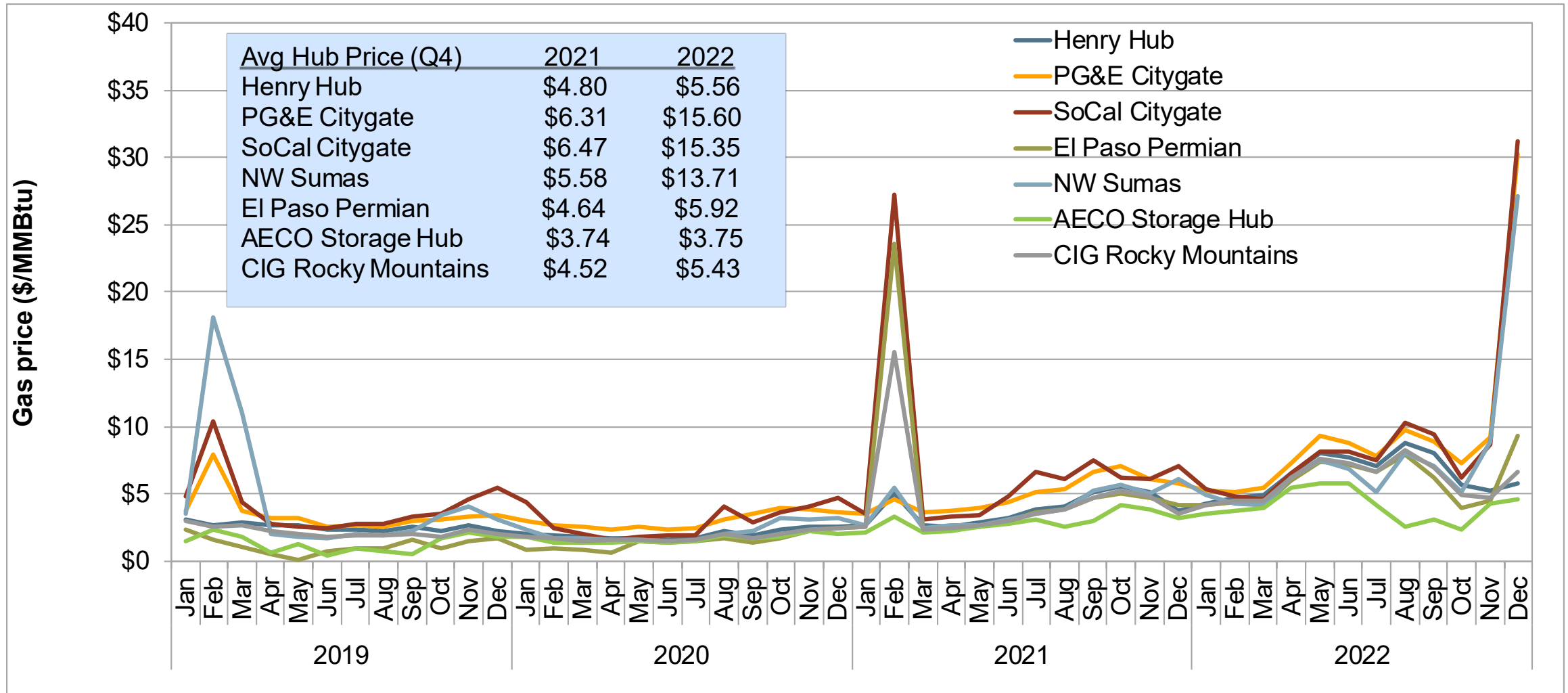
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Department of Market Monitoring

<http://www.caiso.com/Documents/2022-Fourth-Quarter-Report-on-Market-Issues-and-Performance-Mar-16-2023.pdf>  
<http://www.caiso.com/market/Pages/MarketMonitoring/Default.aspx>

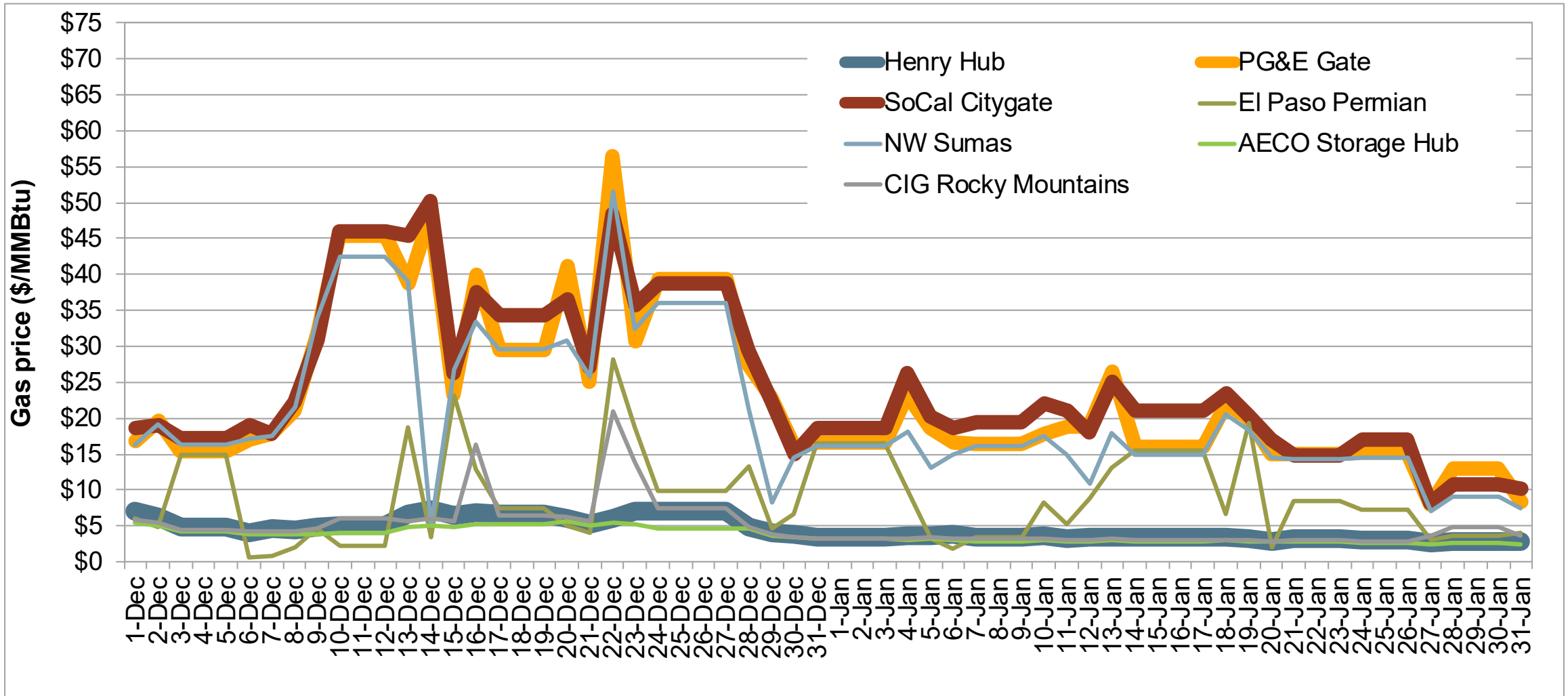
# Highlights of Q4 2022 market performance

- **Natural gas price increases raise wholesale electricity prices**
- ***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*

# Higher natural gas prices are driving higher electricity prices

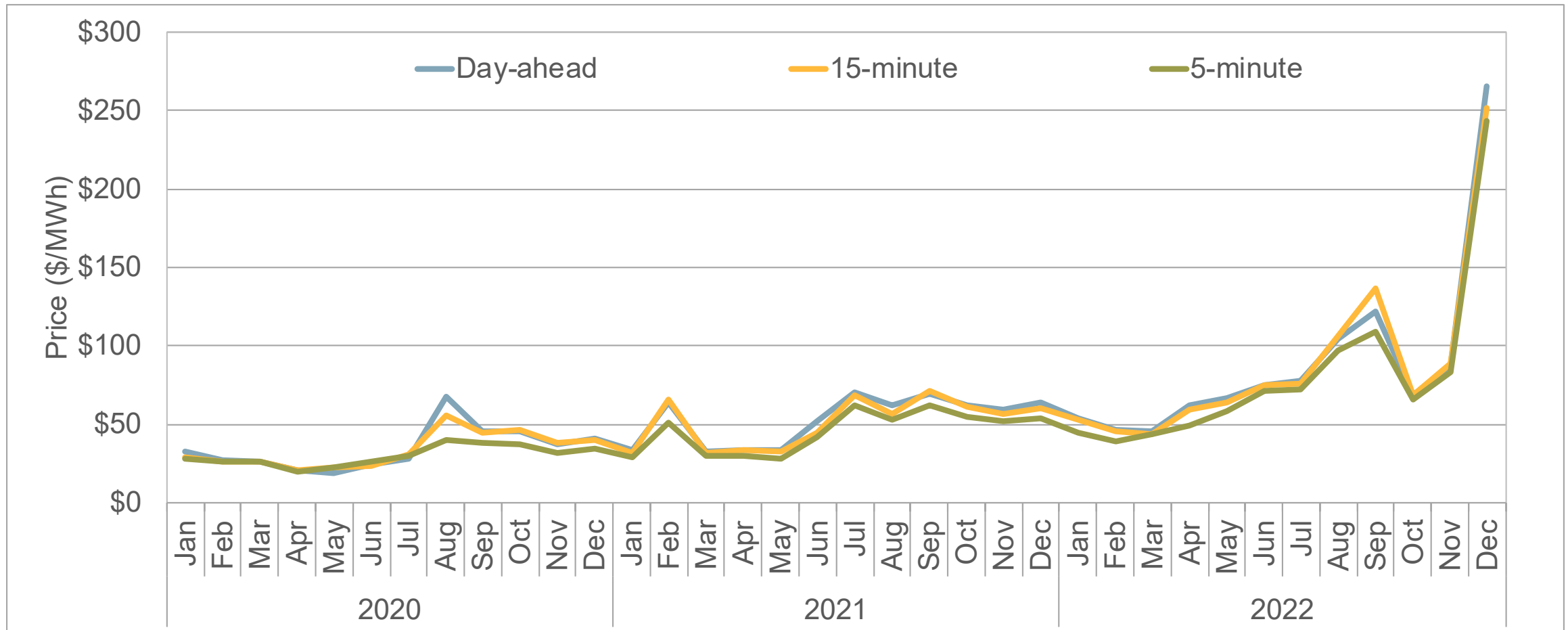


# Gas prices in California rose in December and remain high relative to national indices

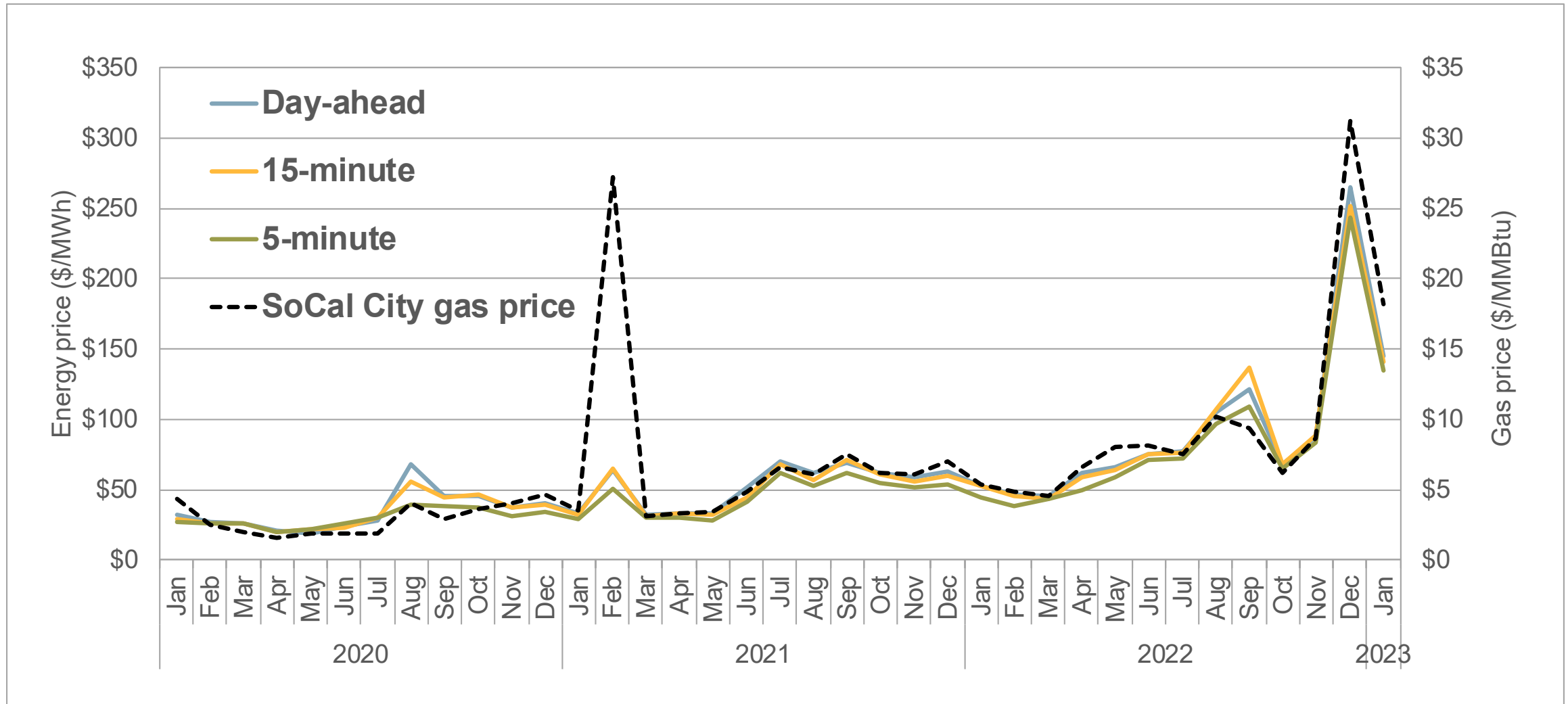


# CAISO prices increase with gas prices despite lower demand

Q4 CAISO day-ahead \$140/MWh, 15-minute \$136/MWh, 5-minute \$130/MWh

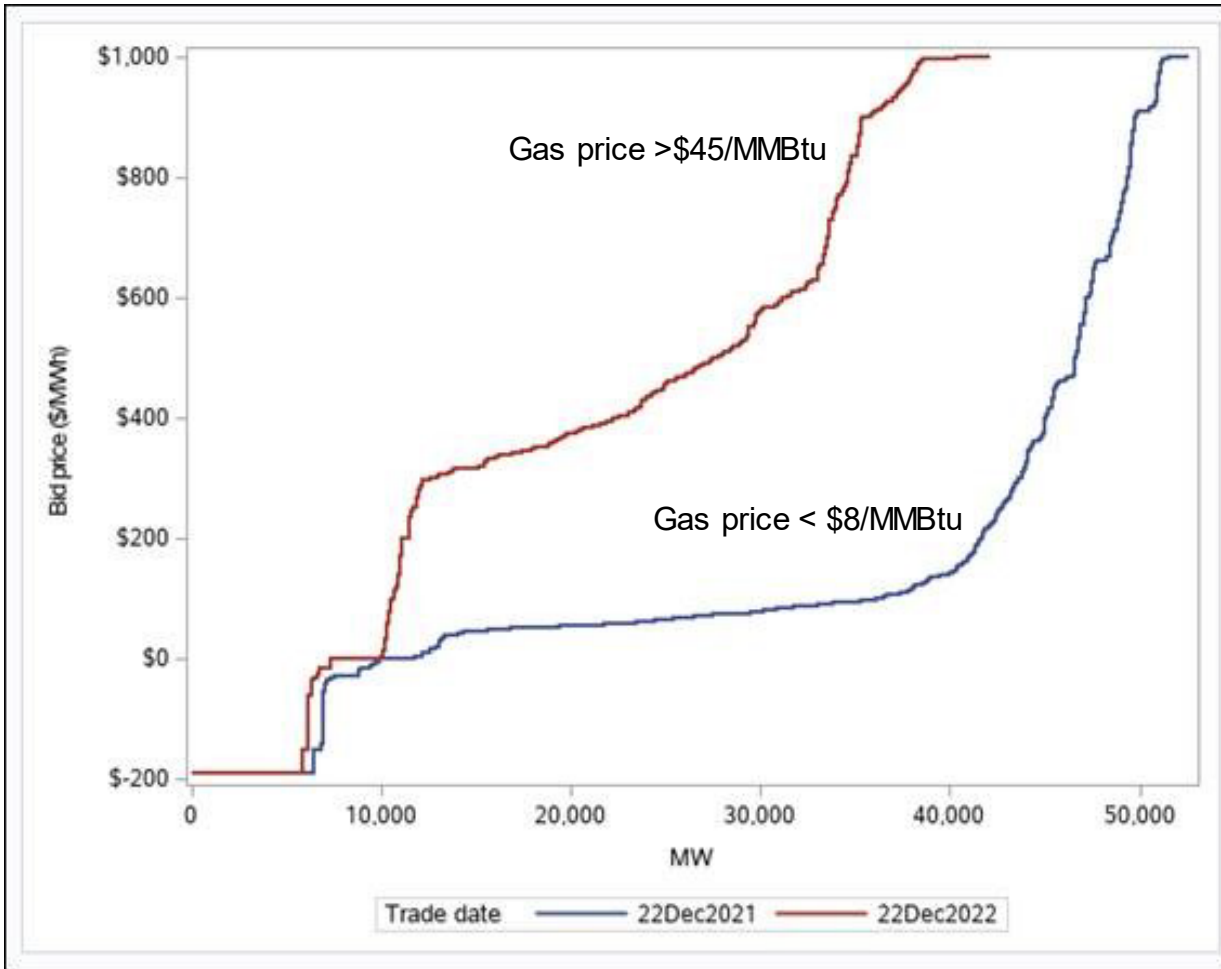


# As gas prices have continued to rise in 2022, so have electricity prices

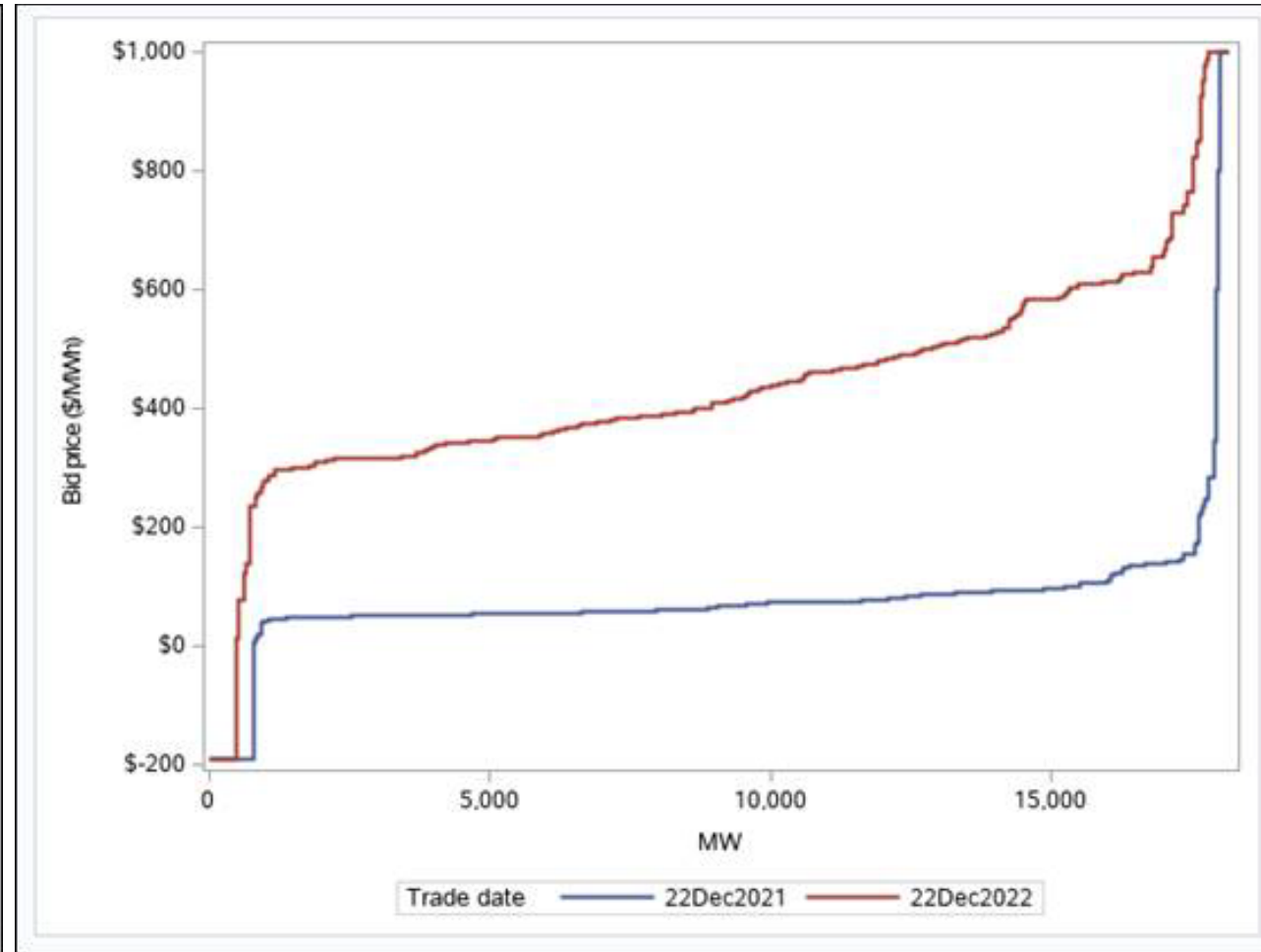


# Bids reflect higher marginal costs for both gas and non-gas resources

## All day-ahead supply

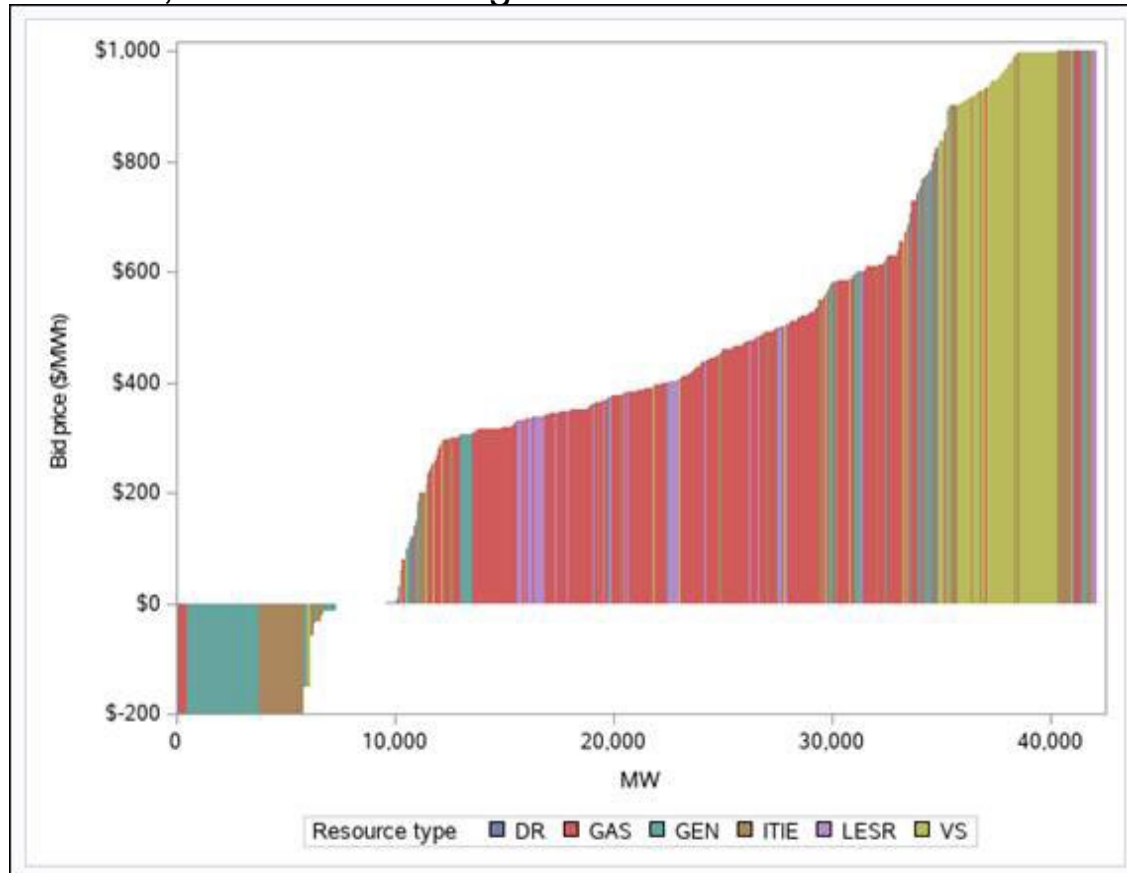


## Gas resource bids

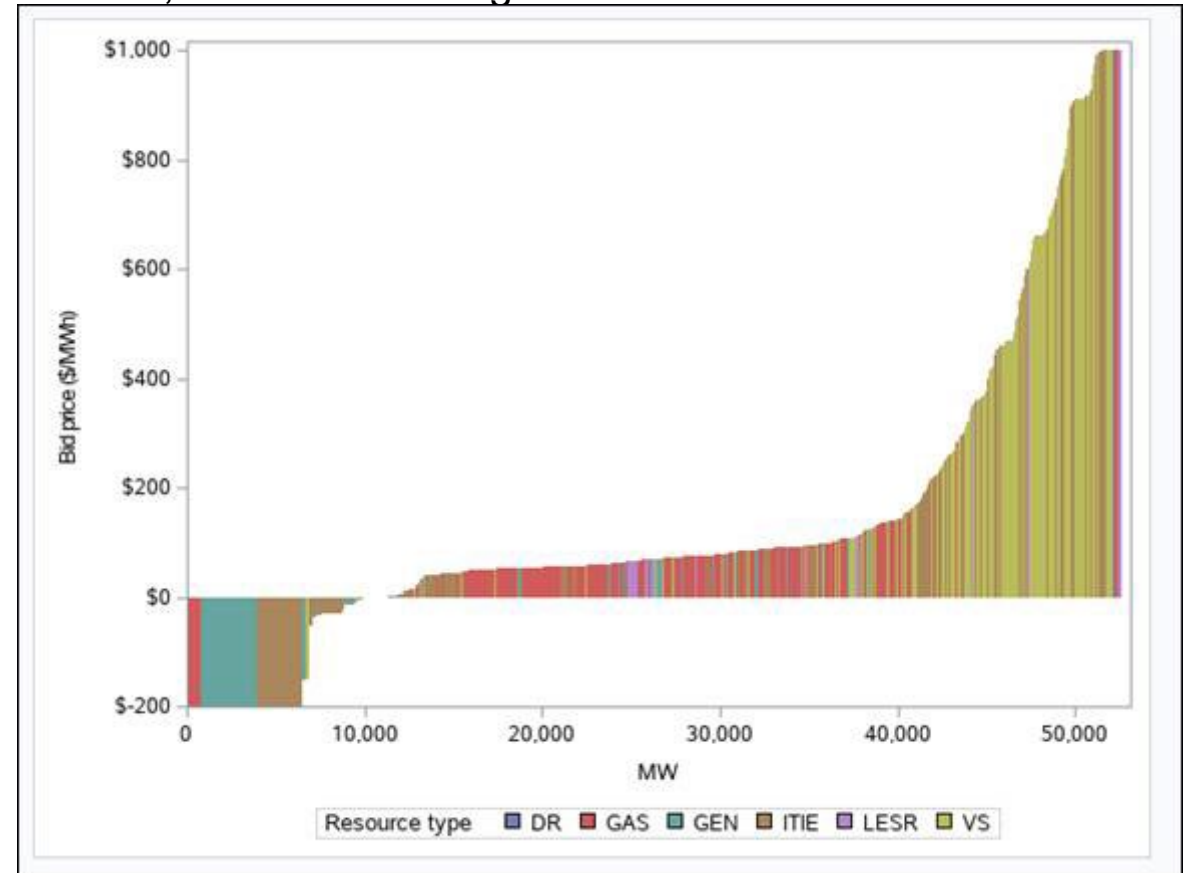


# Higher natural gas prices also raise bids and opportunity costs of non-gas resources

Dec 22, 2022 hour ending 18

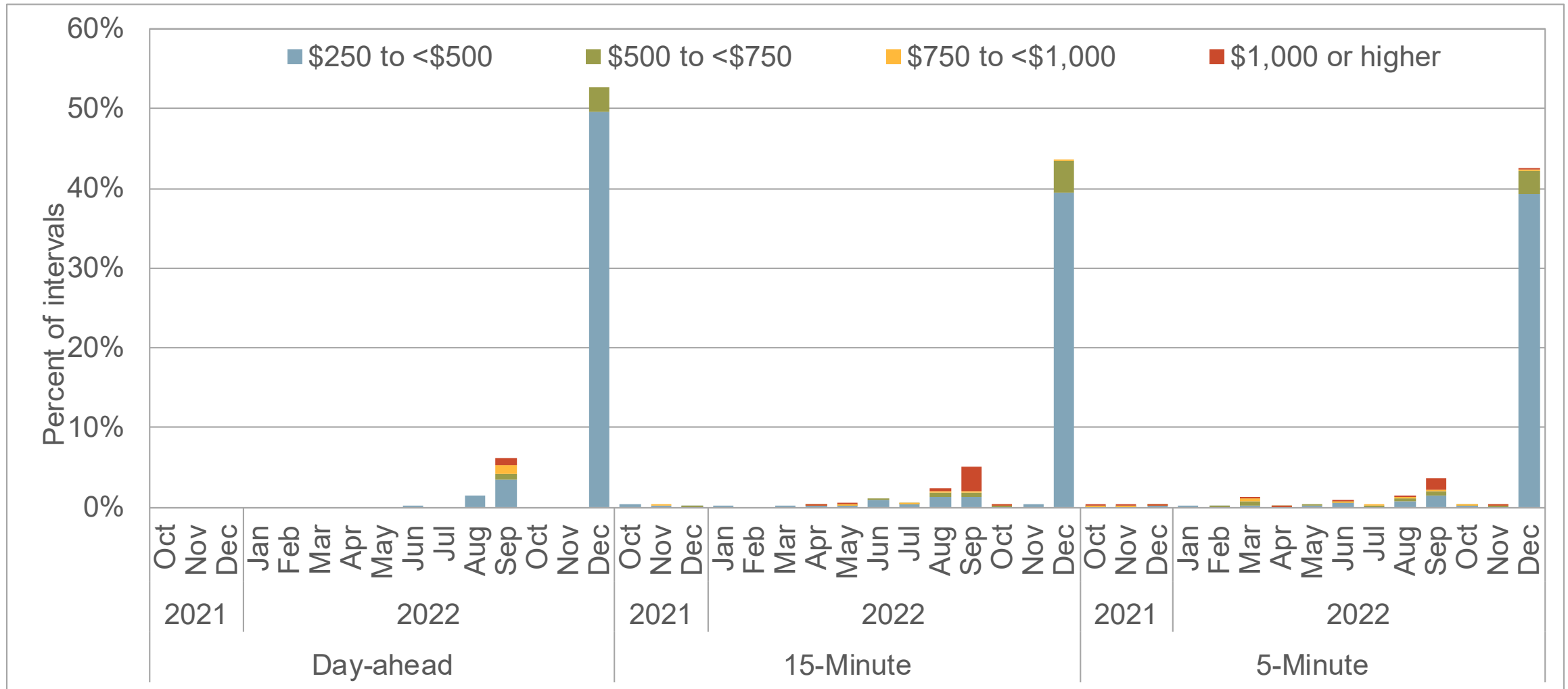


Dec 22, 2021 hour ending 18

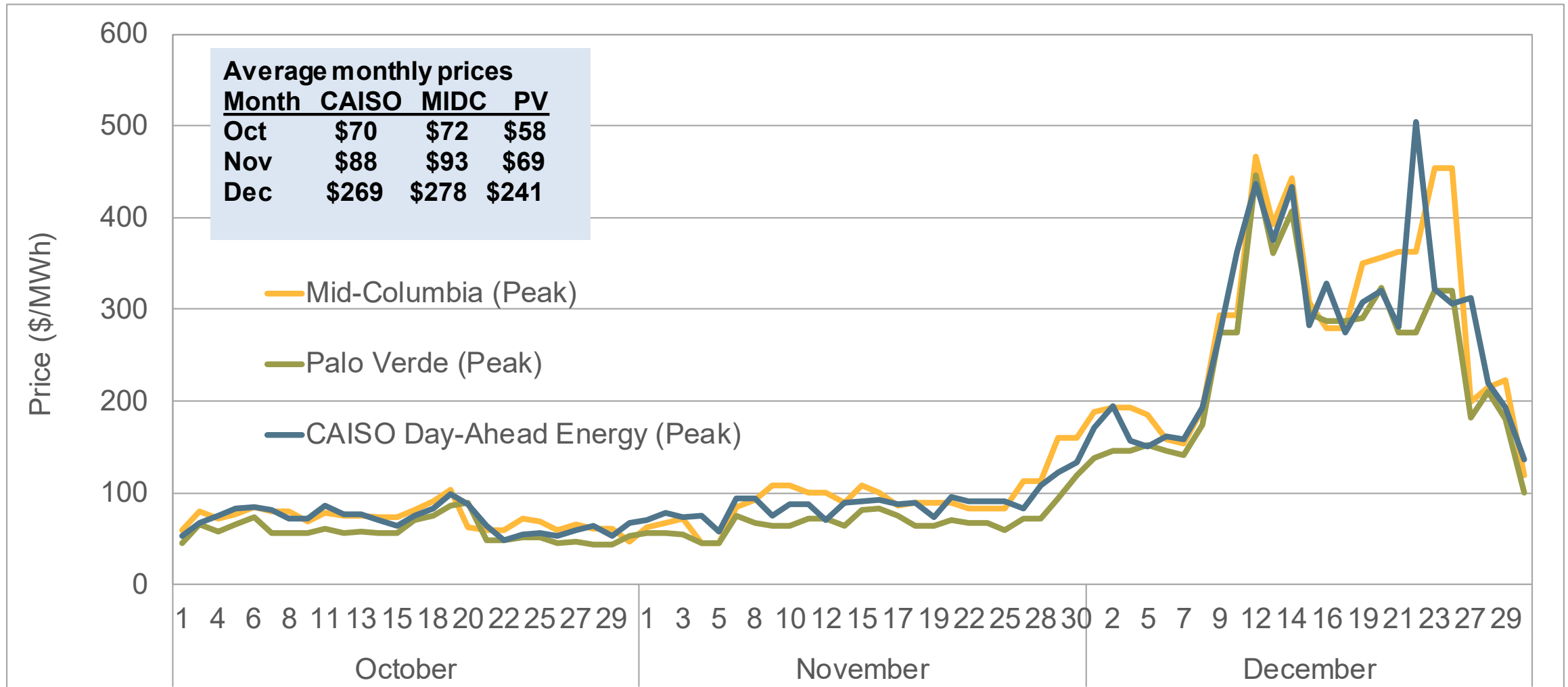




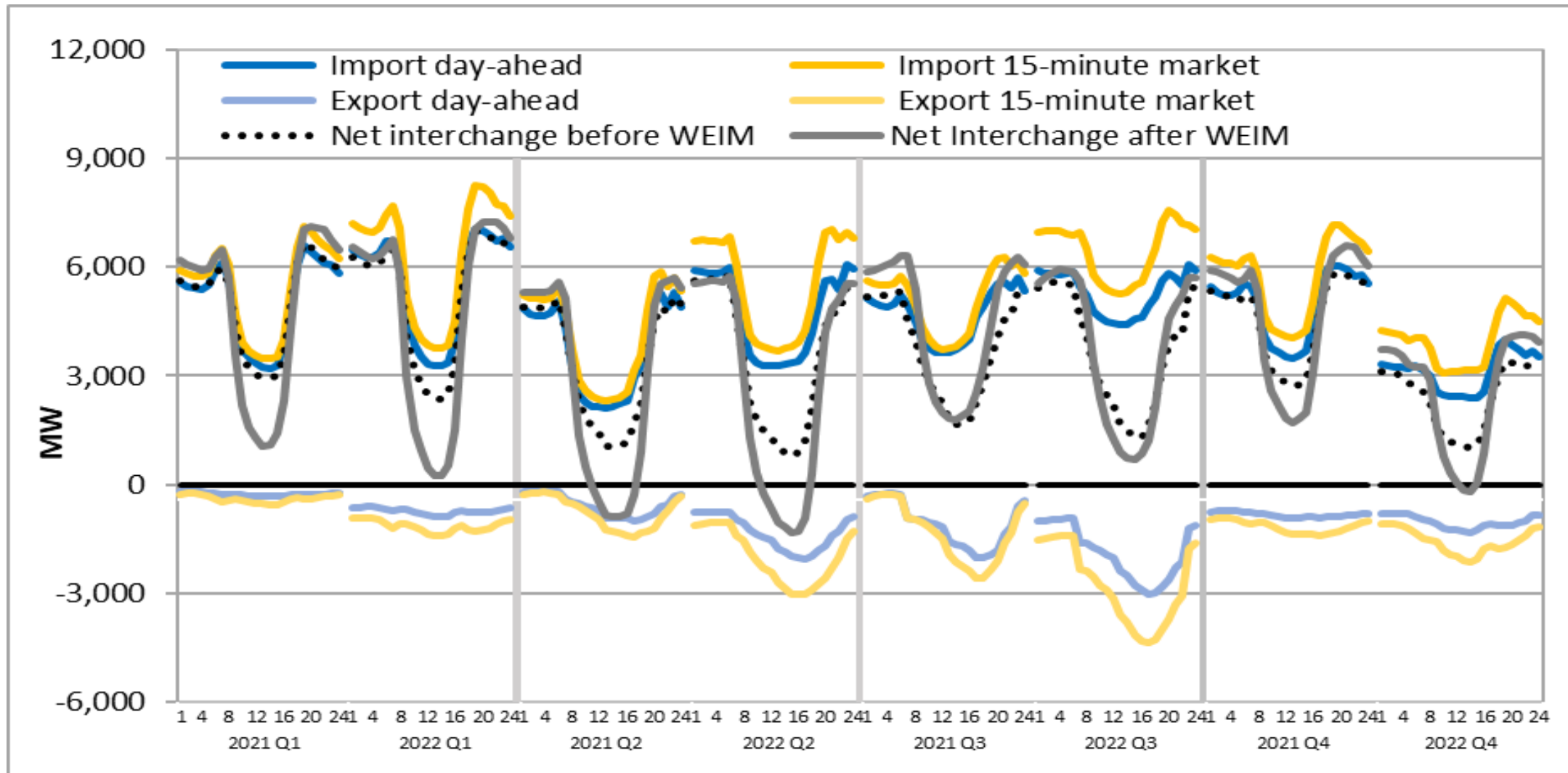
# Frequency of high CAISO prices (\$/MWh) by month



# Day-ahead California ISO and bilateral market prices Q4

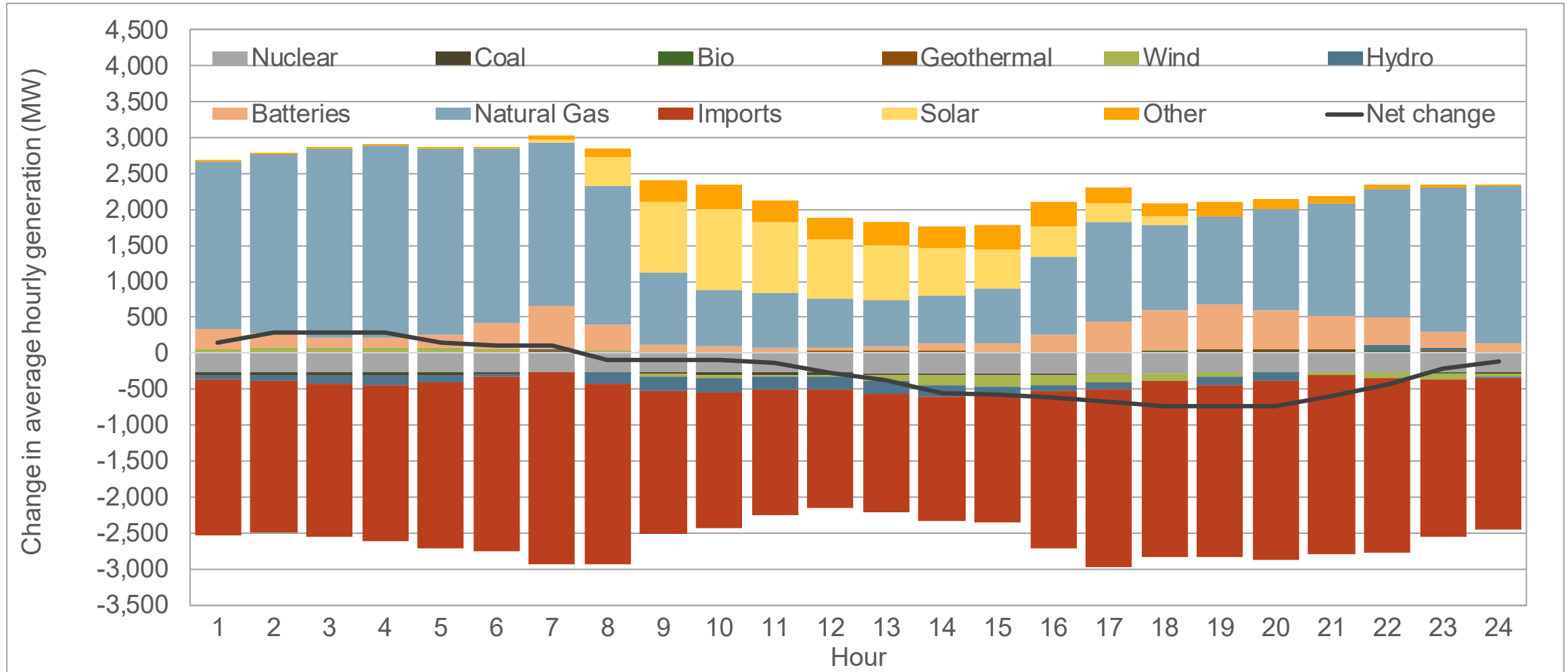


# Average imports decrease and exports increase in Q4

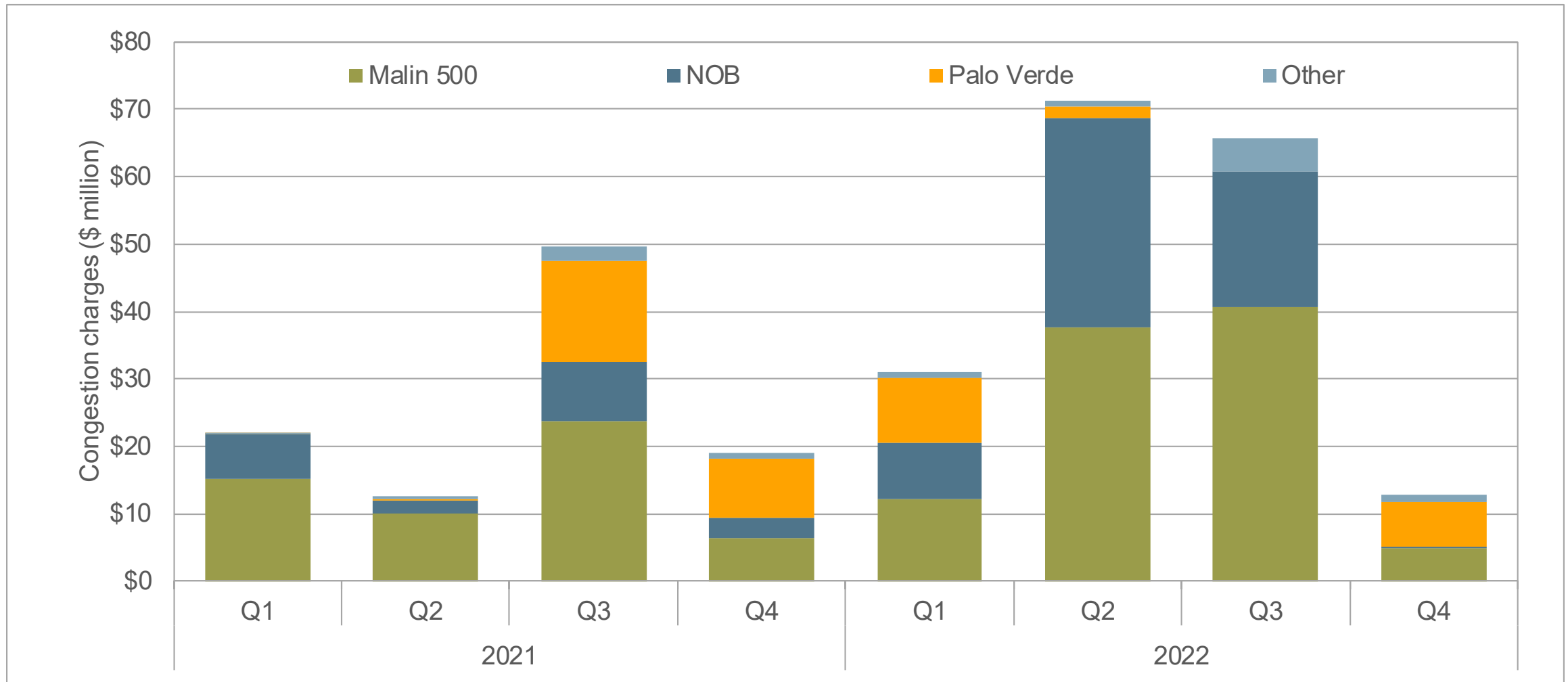


# Lower imports replaced by natural gas, solar and storage

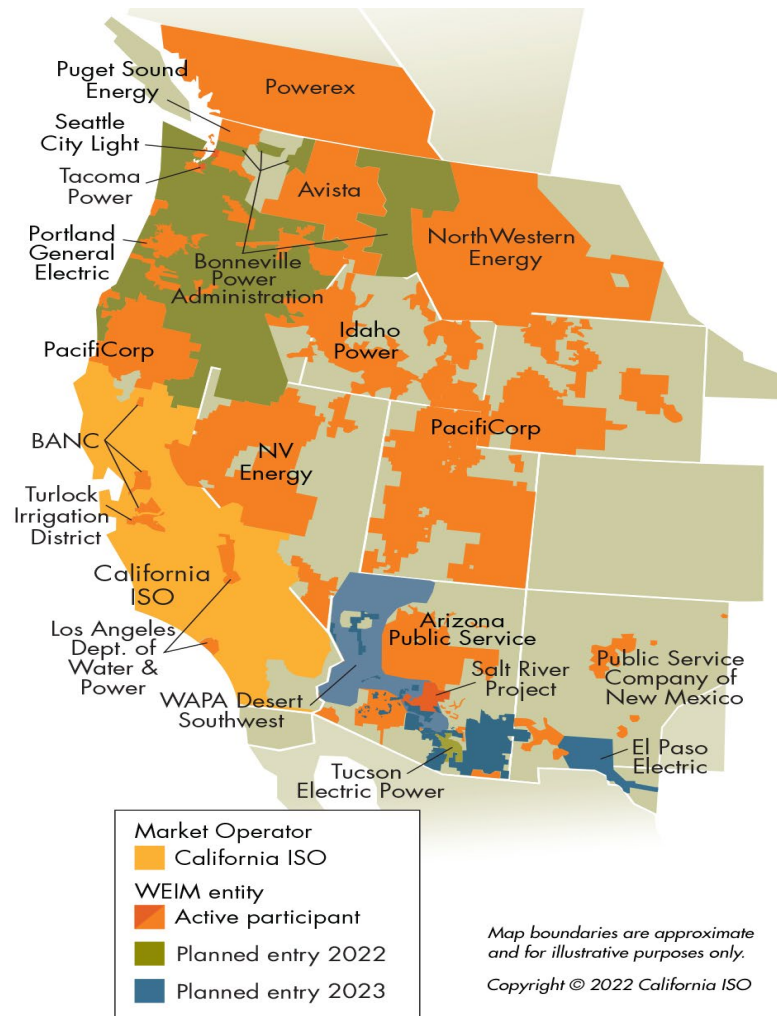
Change in average hourly generation by fuel type (Q4 2021 to Q4 2022)



# Day-ahead import congestion charges on major interties, declines

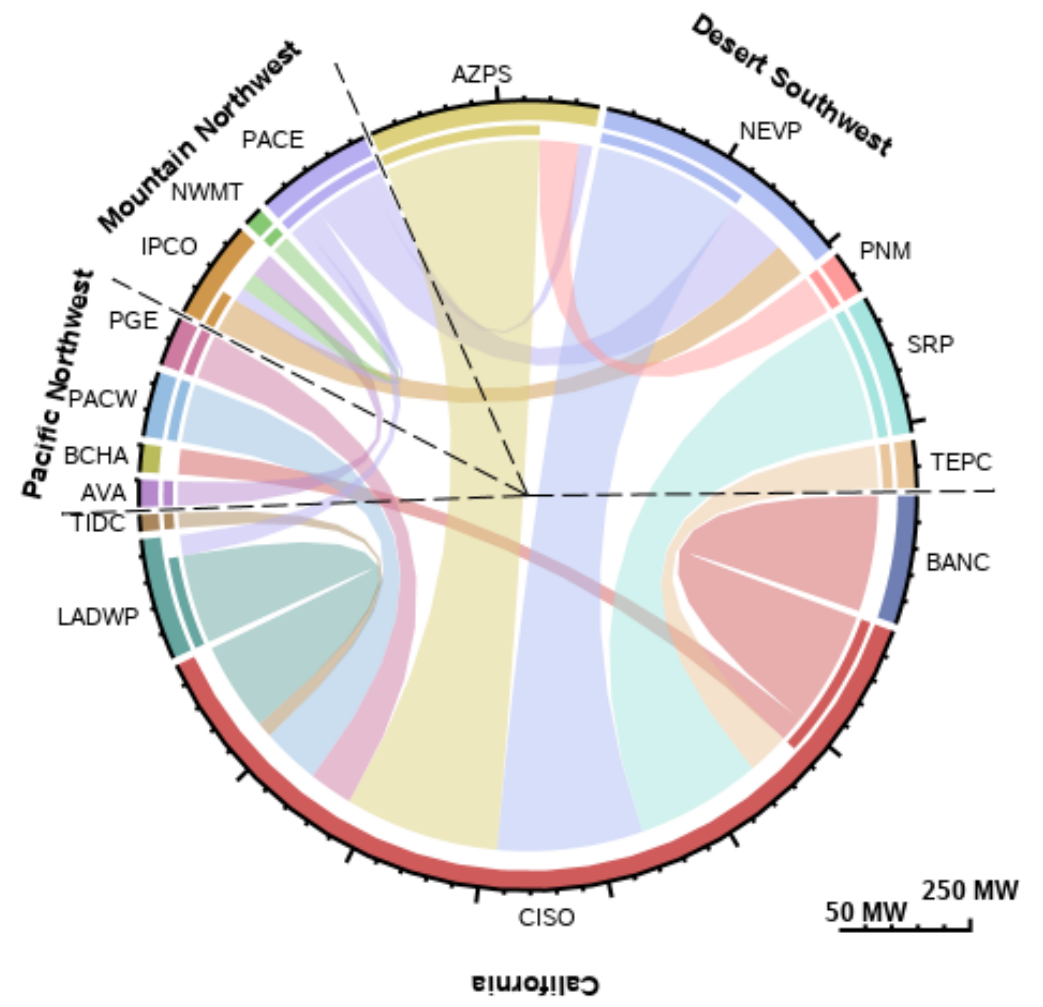
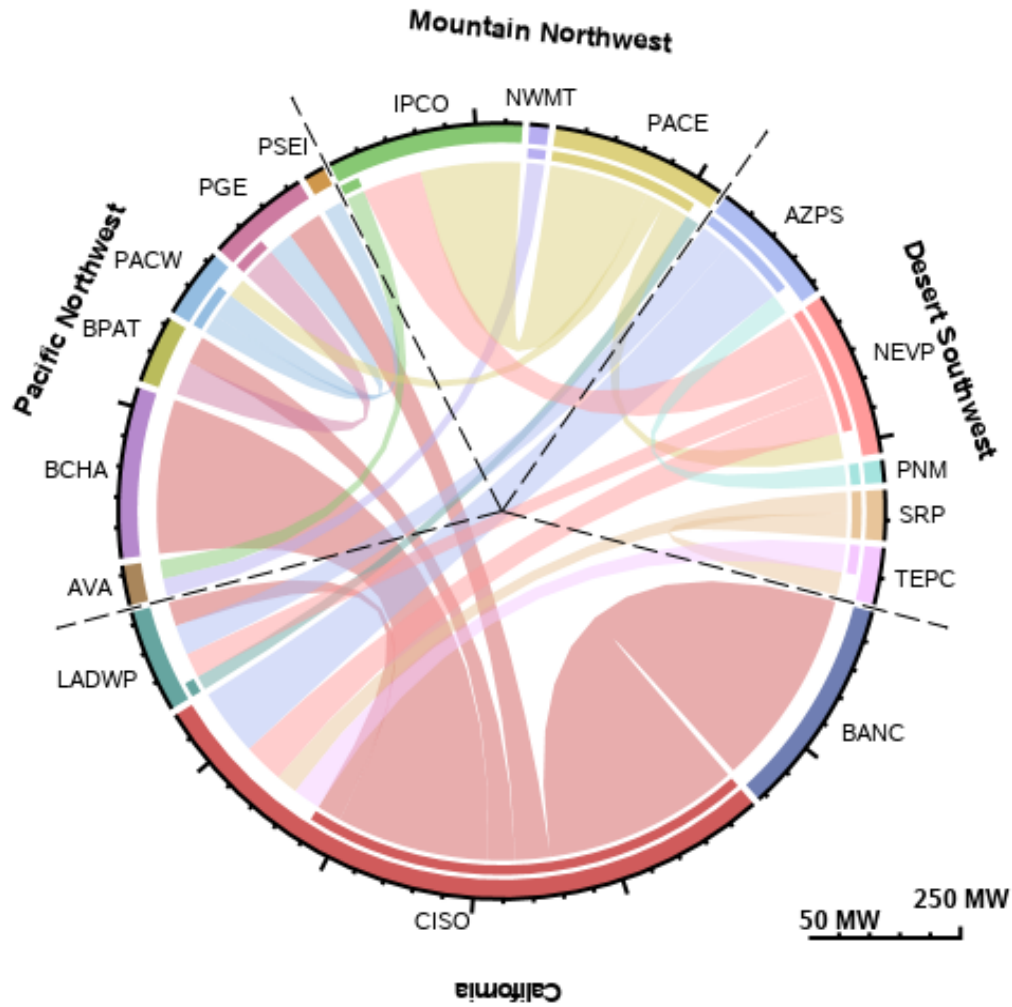


# Expansion of the Western Energy Imbalance Market (WEIM) helped improve the overall structure and performance of the real-time market

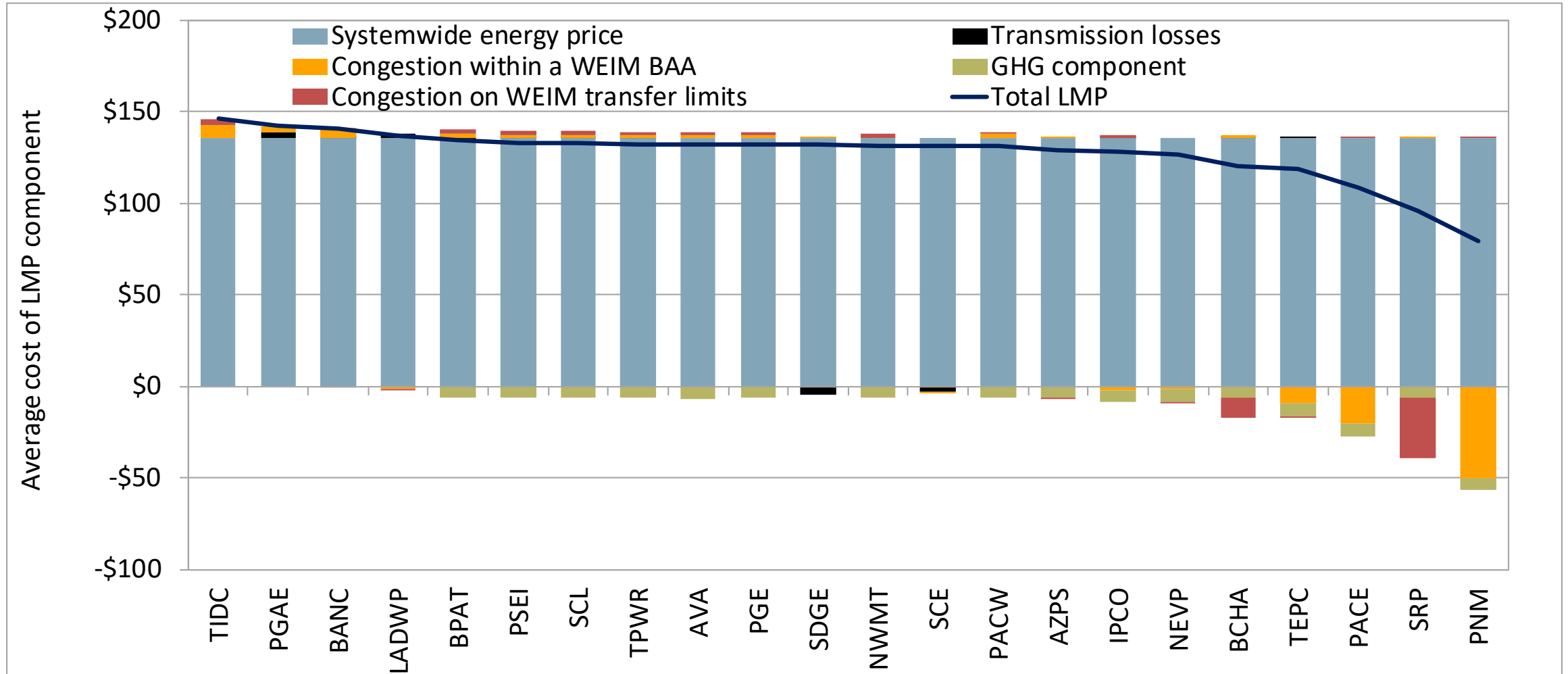


- Two new members of the WEIM in 2020
- Five new members of the WEIM in 2021
- Four new members in 2022:
  - Avista Utilities
  - Bonneville Power Administration
  - Tacoma Power
  - Tucson Electric Power
- Northwest prices regularly lower than the rest of the system due to limited transfer capability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

# Average 15-minute WEIM exports mid-day and peak hours Q4 2022

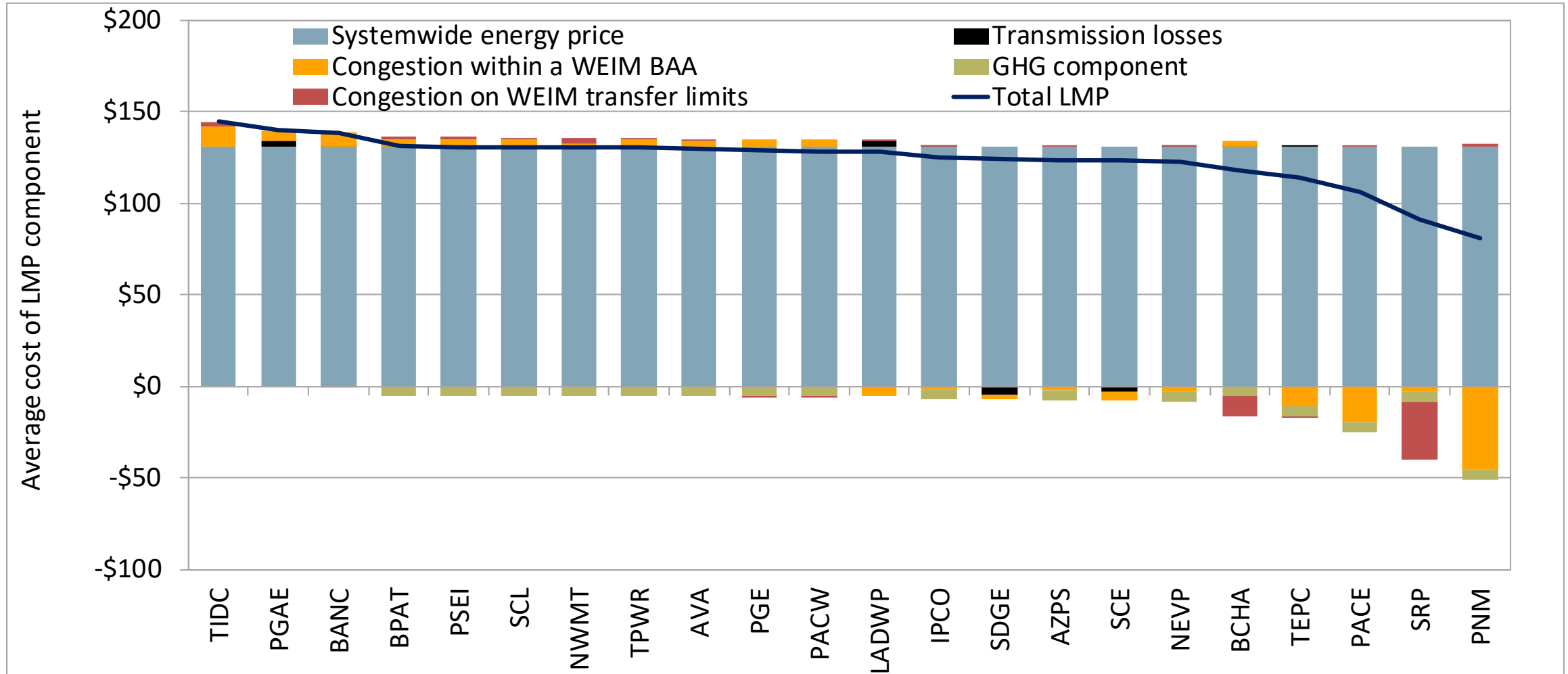


# Impact of congestion and greenhouse gas on 15-minute prices (Q4)

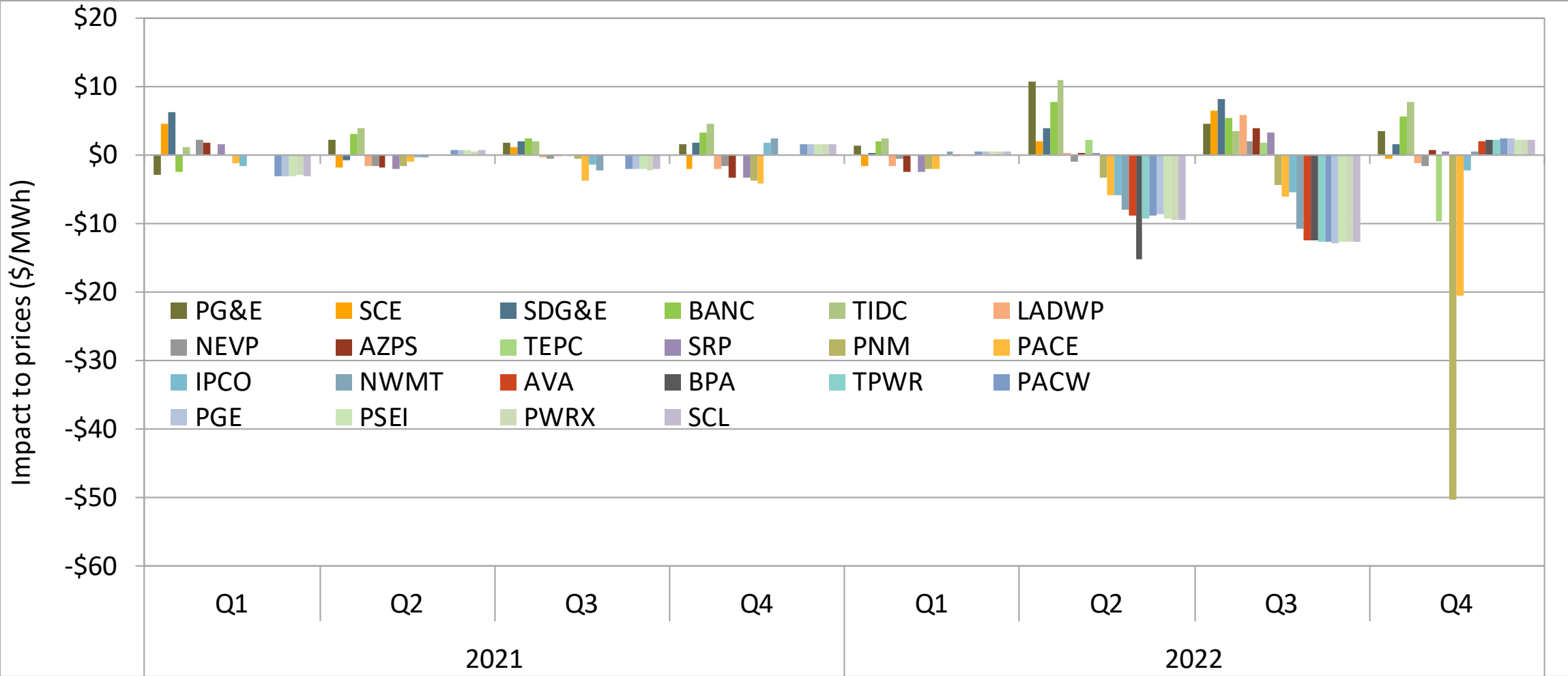




# Impact of congestion and greenhouse gas on 5-minute prices (Q4)



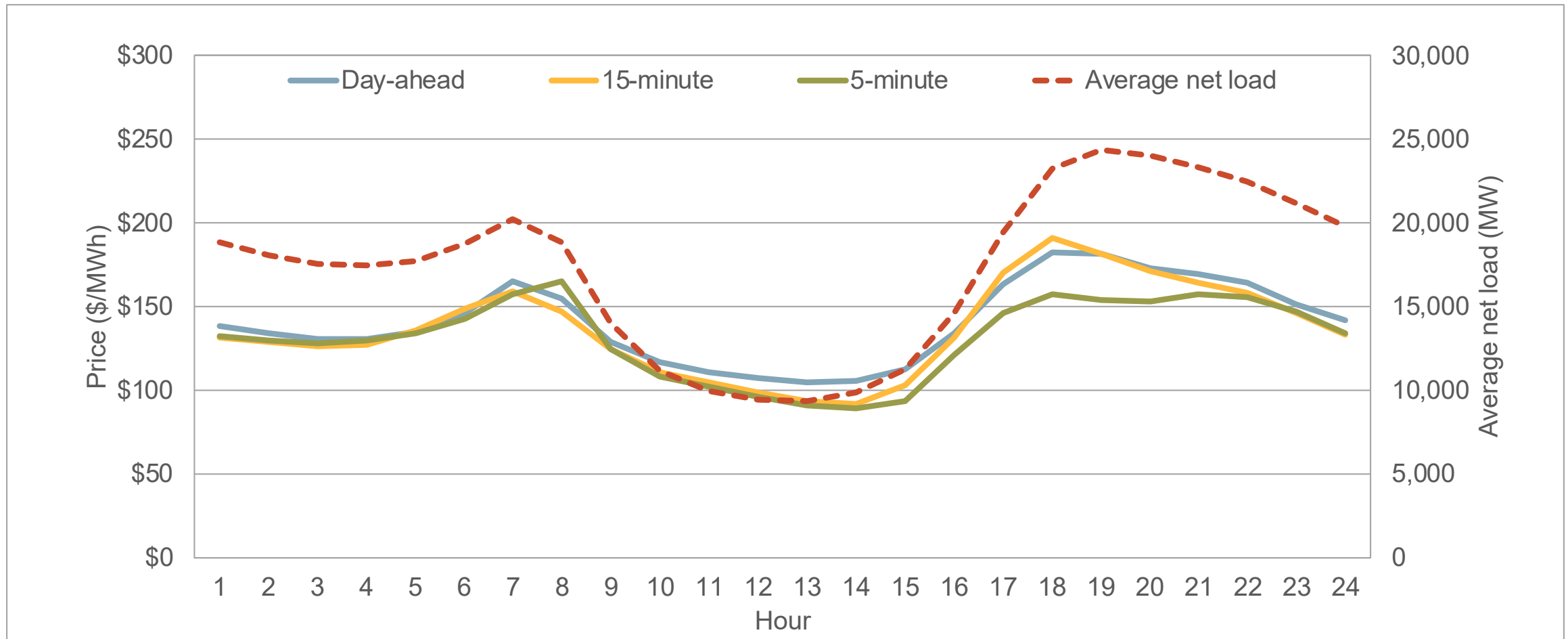
# Overall impact of internal congestion on price separation in the 15-minute market



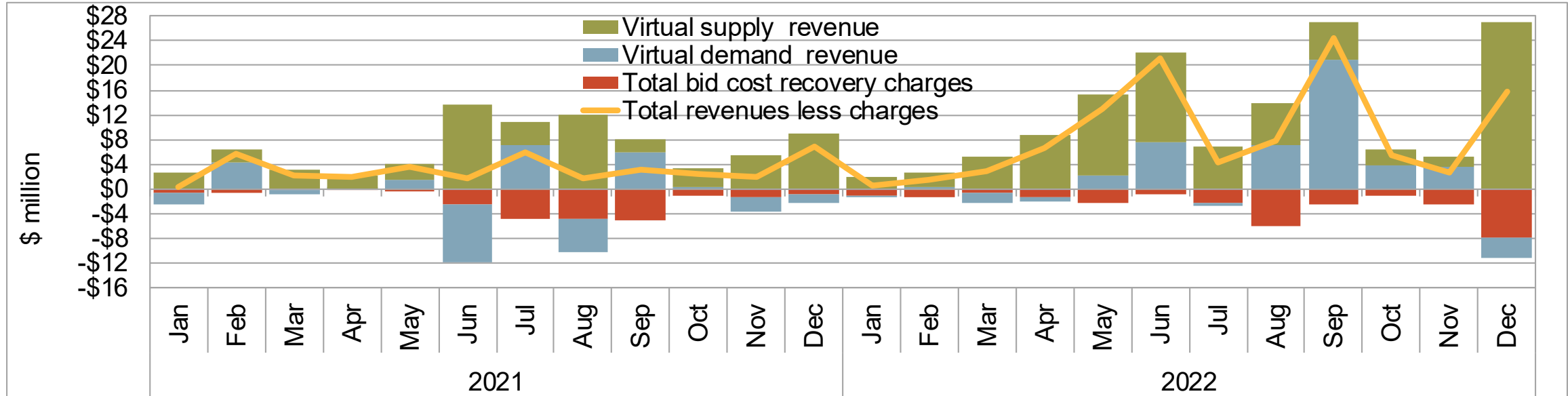
WEIM transfer constraint congestion had greater impact on prices than internal constraint congestion in most areas outside of CAISO, lowering prices in Northwest

	15-minute market		5-minute market	
	Congestion Frequency	Price Impact (\$/MWh)	Congestion Frequency	Price Impact (\$/MWh)
BANC	0%	-\$0.09	0%	-\$0.08
L.A. Dept. of Water and Power	0%	-\$0.06	0%	\$0.12
NV Energy	1%	-\$0.11	1%	\$0.28
Arizona Public Service	1%	-\$0.32	2%	\$0.49
PacifiCorp East	1%	\$0.07	2%	\$0.03
Public Service Company of NM	1%	\$0.65	2%	\$1.07
Tucson Electric Power	3%	-\$0.75	4%	-\$0.75
Turlock Irrigation District	7%	\$3.12	5%	\$2.30
Idaho Power	9%	\$1.57	7%	\$0.44
Avista	10%	\$1.54	7%	\$0.94
NorthWestern Energy	10%	\$2.25	7%	\$2.93
PacifiCorp West	17%	\$0.11	9%	-\$0.75
Portland General Electric	18%	\$1.05	10%	-\$0.51
Bonneville Power Admin.	25%	\$3.11	21%	\$1.86
Salt River Project	27%	-\$33.31	26%	-\$32.42
Tacoma Power	29%	\$1.57	28%	\$0.98
Puget Sound Energy	30%	\$1.89	29%	\$1.53
Seattle City Light	30%	\$1.82	29%	\$1.08
Powerex	51%	-\$10.75	72%	-\$10.88

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

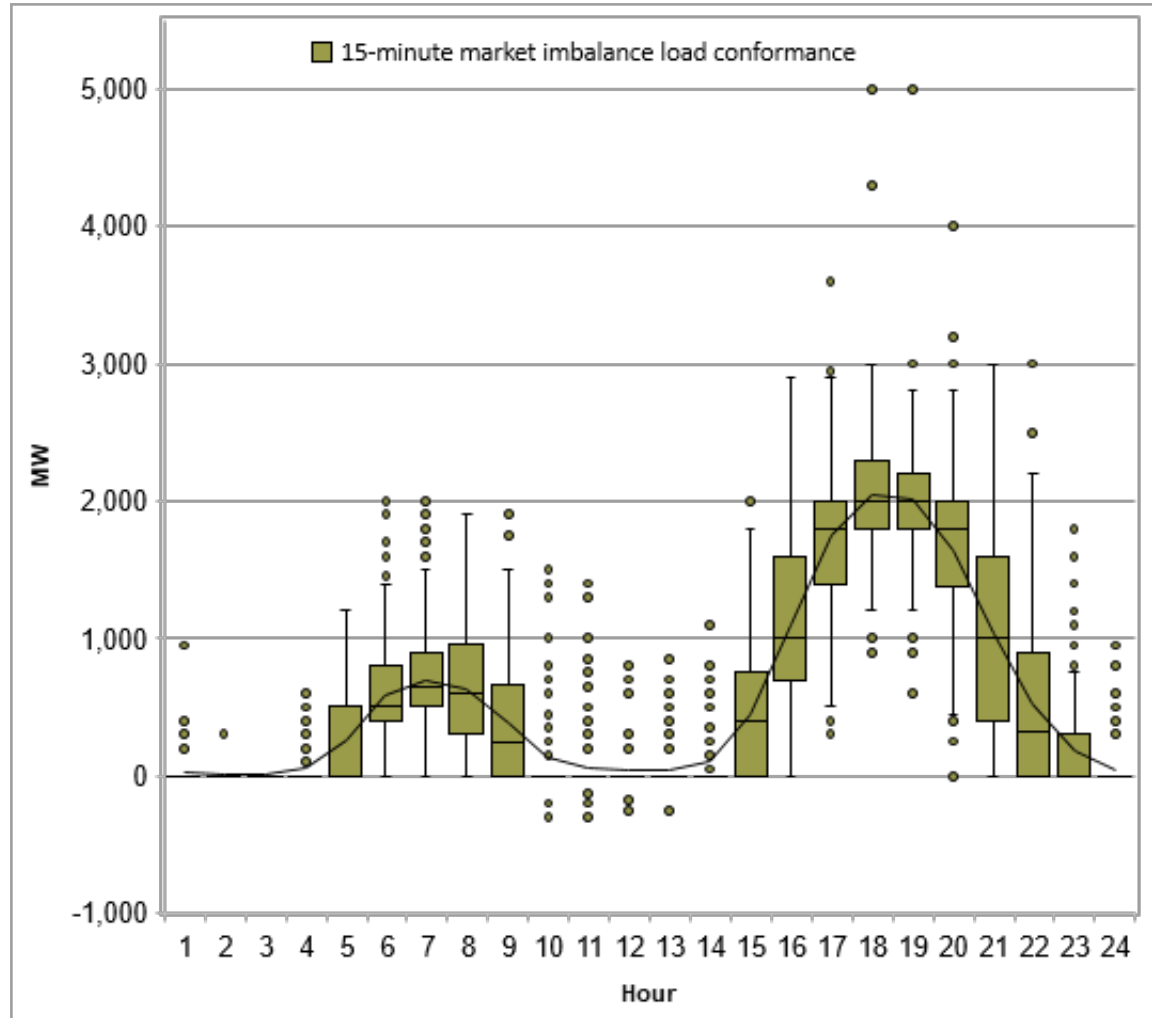
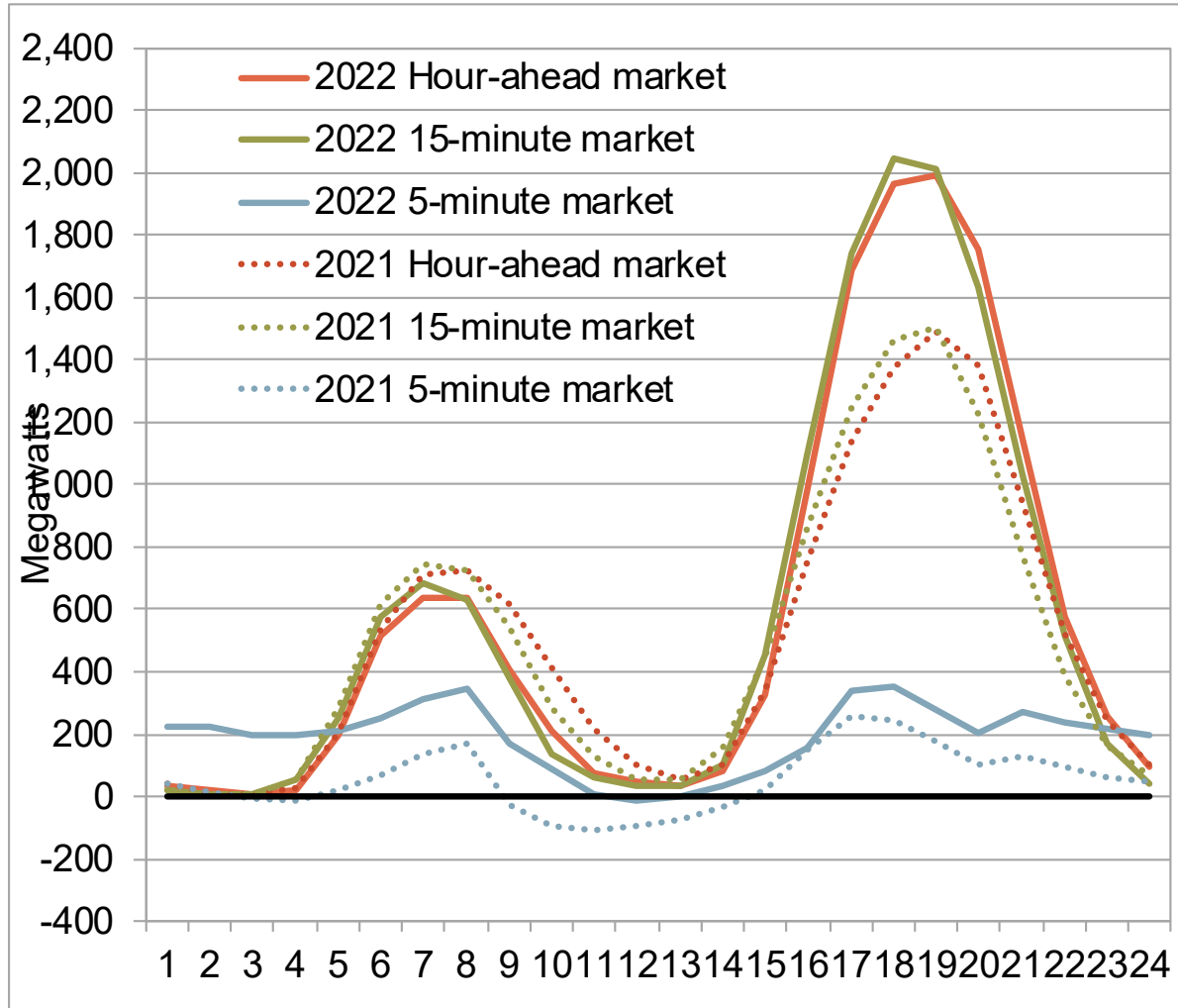


# Convergence bidding net profits increase to \$24 million in Q4, \$106 million in 2022



Trading entities	Average hourly megawatts			Revenues\Losses (\$ million)				Total Revenue after BCR
	Virtual demand	Virtual supply	Total	Virtual demand	Virtual supply before BCR	Virtual Bid Cost Recovery	Virtual Supply after BCR	
Financial	1,470	1,923	3,393	\$1.55	\$22.96	-\$7.42	\$15.55	\$17.10
Marketer	458	668	1,126	\$2.57	\$7.89	-\$3.24	\$4.65	\$7.22
Physical load	0	19	19	\$0.00	\$0.34	-\$0.75	-\$0.41	-\$0.41
Physical generation	15	0	15	\$0.05	\$0.00	\$0.00	\$0.00	\$0.05
<b>Total</b>	<b>1,943</b>	<b>2,610</b>	<b>4,553</b>	<b>\$4.18</b>	<b>\$31.20</b>	<b>-\$11.41</b>	<b>\$19.79</b>	<b>\$23.97</b>

# Load adjustment by grid operators increased, particularly in ramping hours

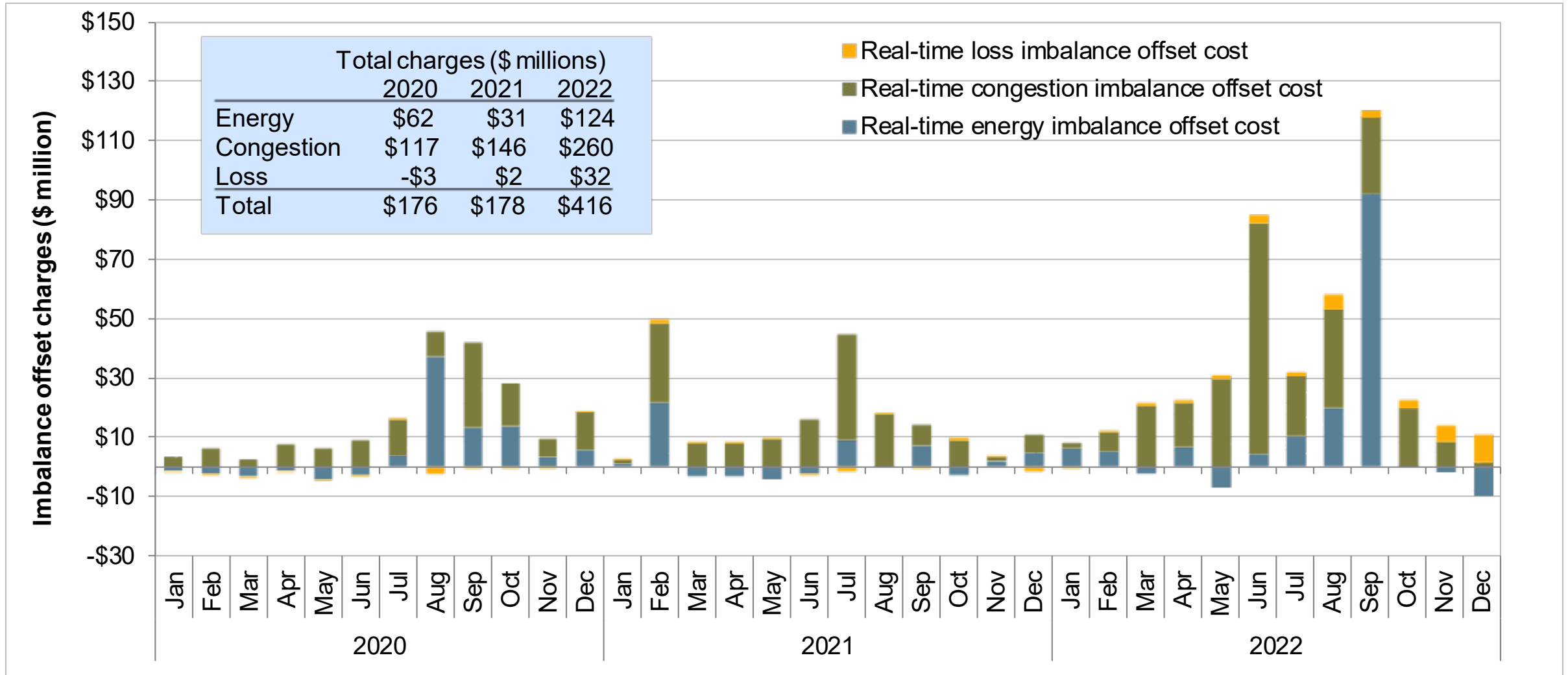


[Analysis-LoadConformanceImpactonResourceSufficiencyEvaluation.pdf \(caiso.com\)](#)

# Flexible ramping capacity

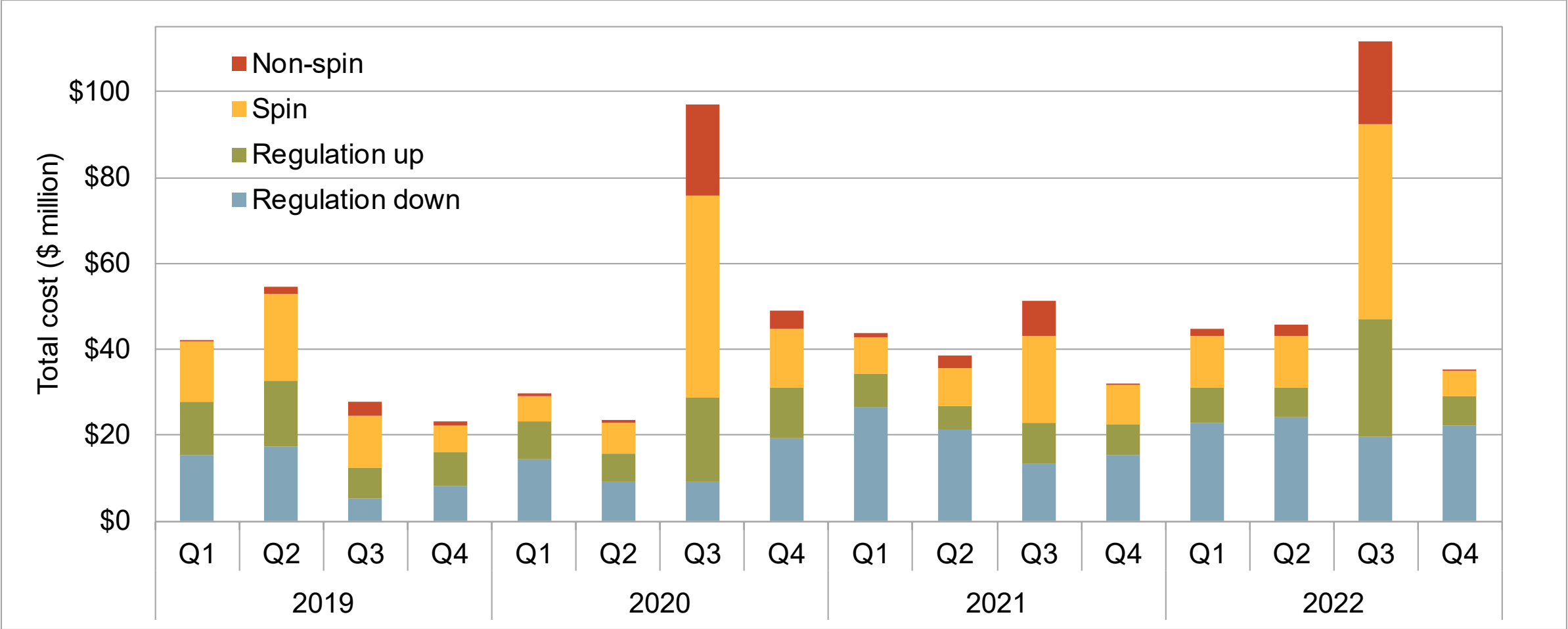
- Designed to enhance reliability and market performance by procuring real-time ramping capacity to help manage variability and uncertainty
- Flexible ramping prices were very frequently zero
- Minimum area constraint implemented in November 2020, only in the 15-minute market
  - added to the 5-minute market on February 16, 2022
  - Frequently binding in CAISO, but not other areas
- DMM supported the ISO's Feb 2023 implementation of (nodal procurement):
  - Reduces procurement of capacity from resources not able to meet system uncertainty because of resource characteristics or congestion
  - DMM will publish an evaluation of both nodal procurement and quantile regression of uncertainty in the Q1 2023 report.
- 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

# Real-time imbalance offset costs increased to \$36 million in Q4, \$416 million in 2022

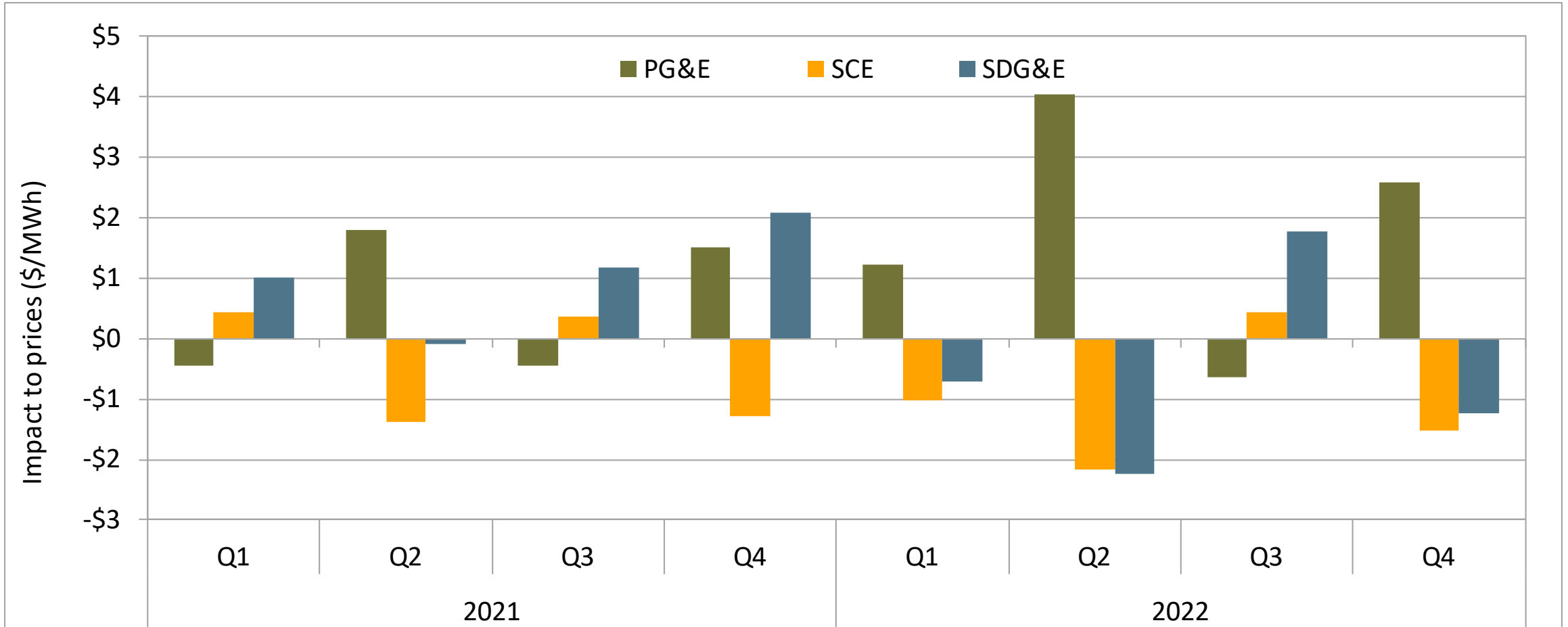




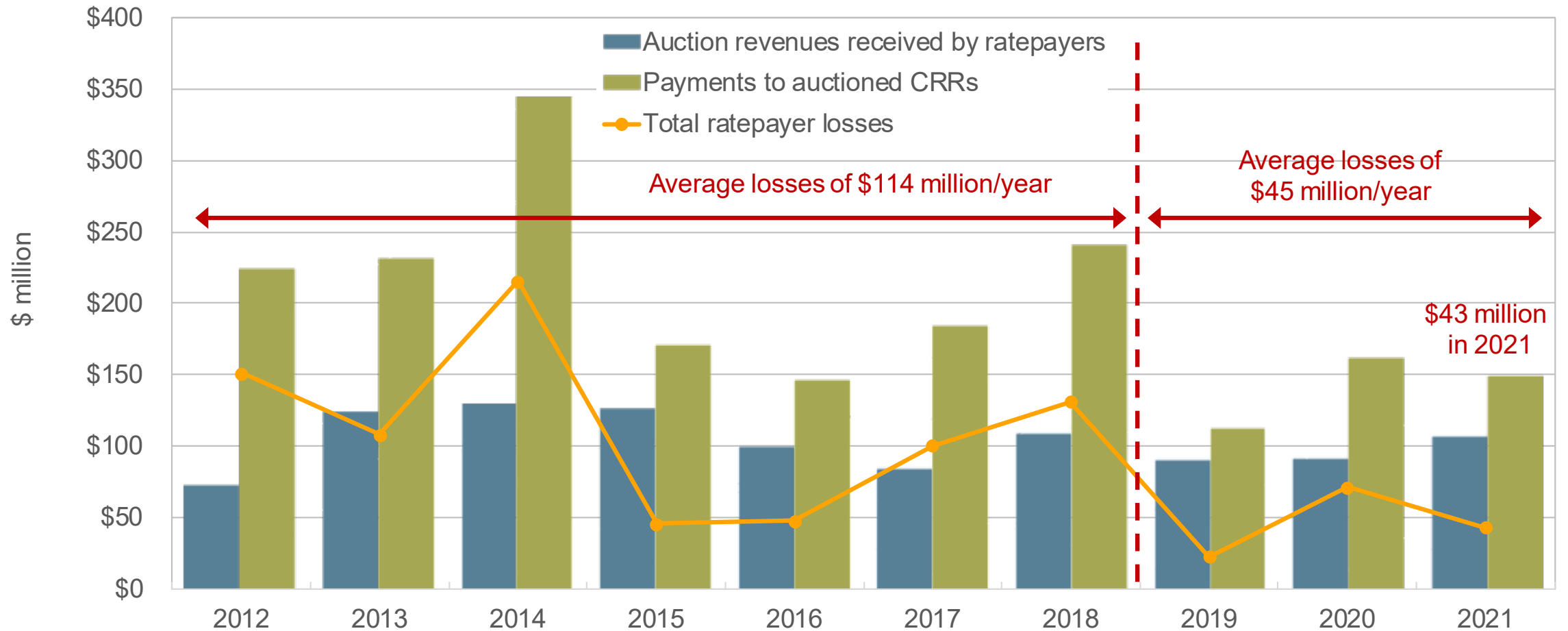
# Ancillary service costs increased to \$237 million in 2022, \$35 million in Q4, with higher regulation down and lower operating reserve requirements



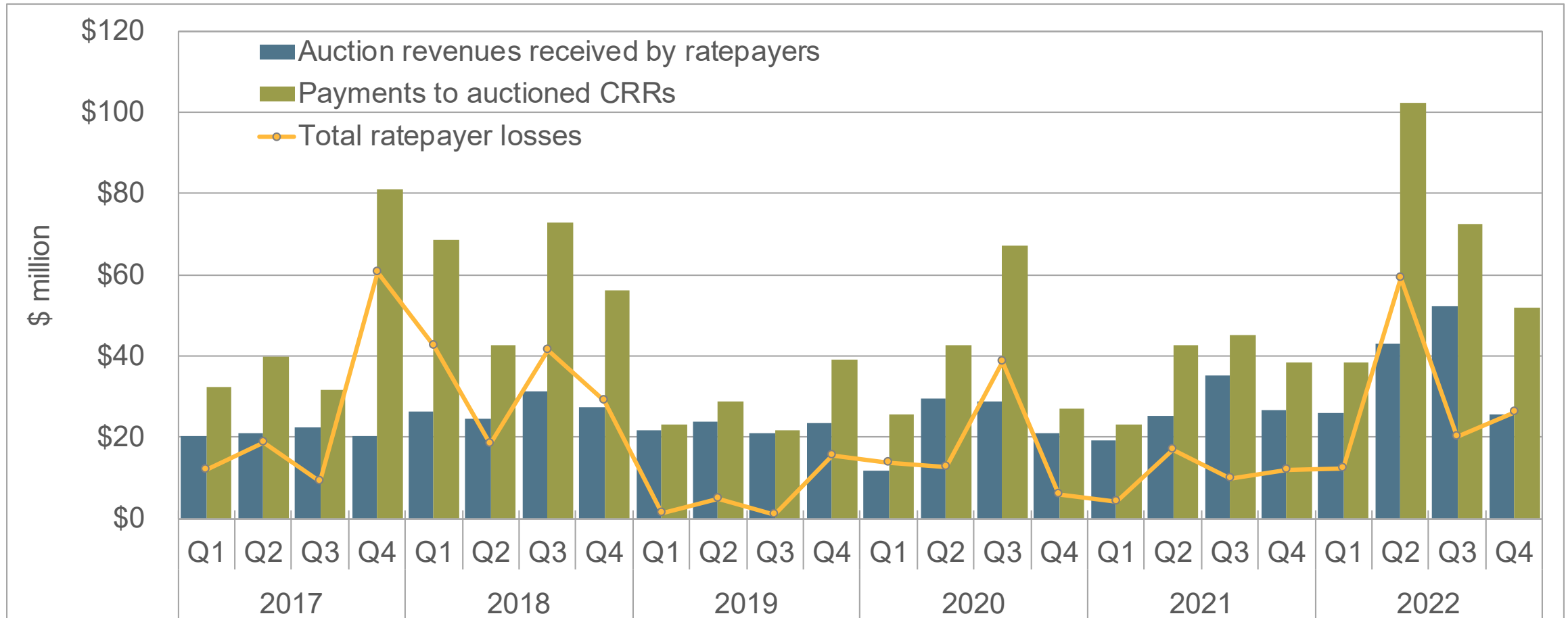
Day-ahead congestion rent rose to \$374 million in Q4 2022, from \$155 million in Q4 2021, for \$1.0 billion in 2022



# 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 \$26 million in Q4, \$118 million in 2022

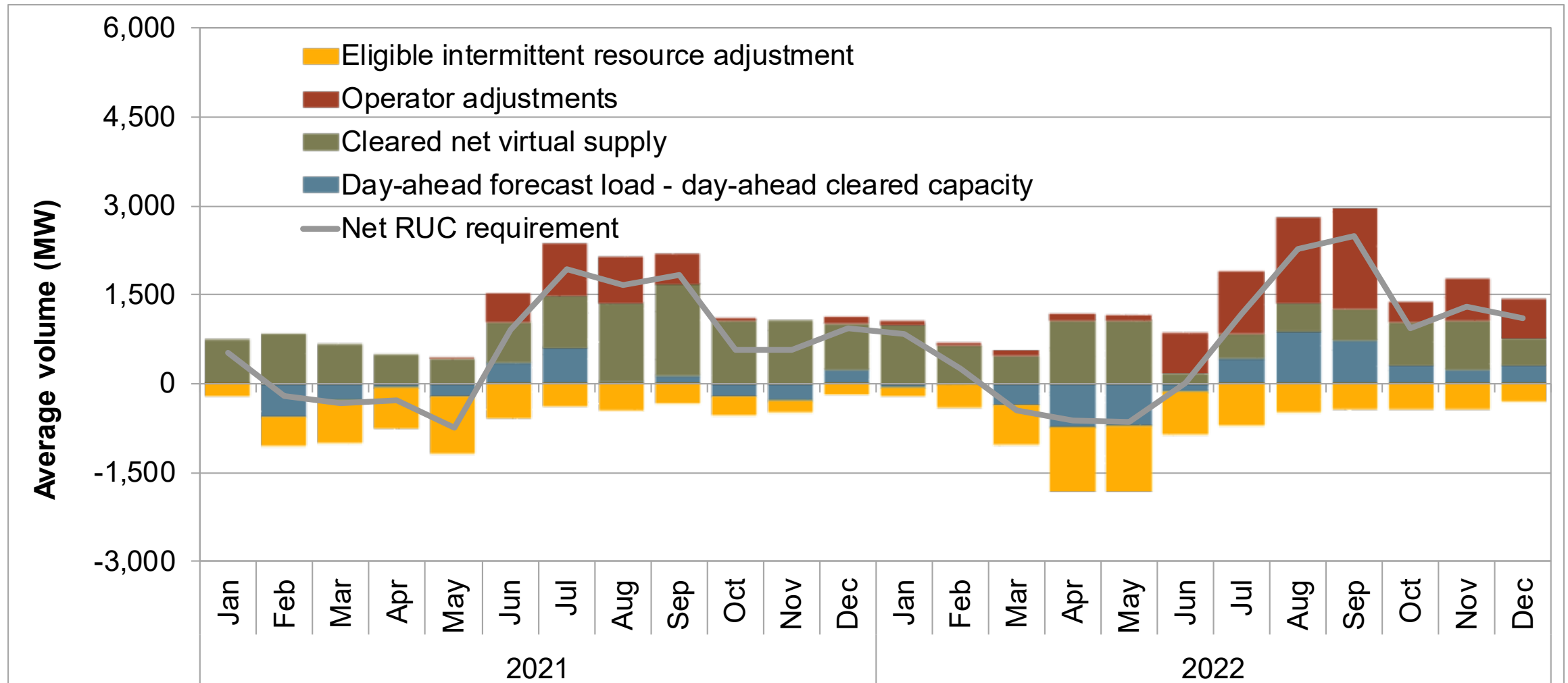


# WEIM RSE Phase 1 enhancements implementation in June

- 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.\*
  - Fixed: counting above maximum capacity or double counting ancillary service capacity
- 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.***

# Determinants of residual unit commitment procurement



Bid cost recovery payments increased to \$91 million (CAISO) and \$17 million (WEIM) in Q4, for historically high \$258 million and \$44 million in 2022.

