



2019 Q1 Report

July 2, 2019

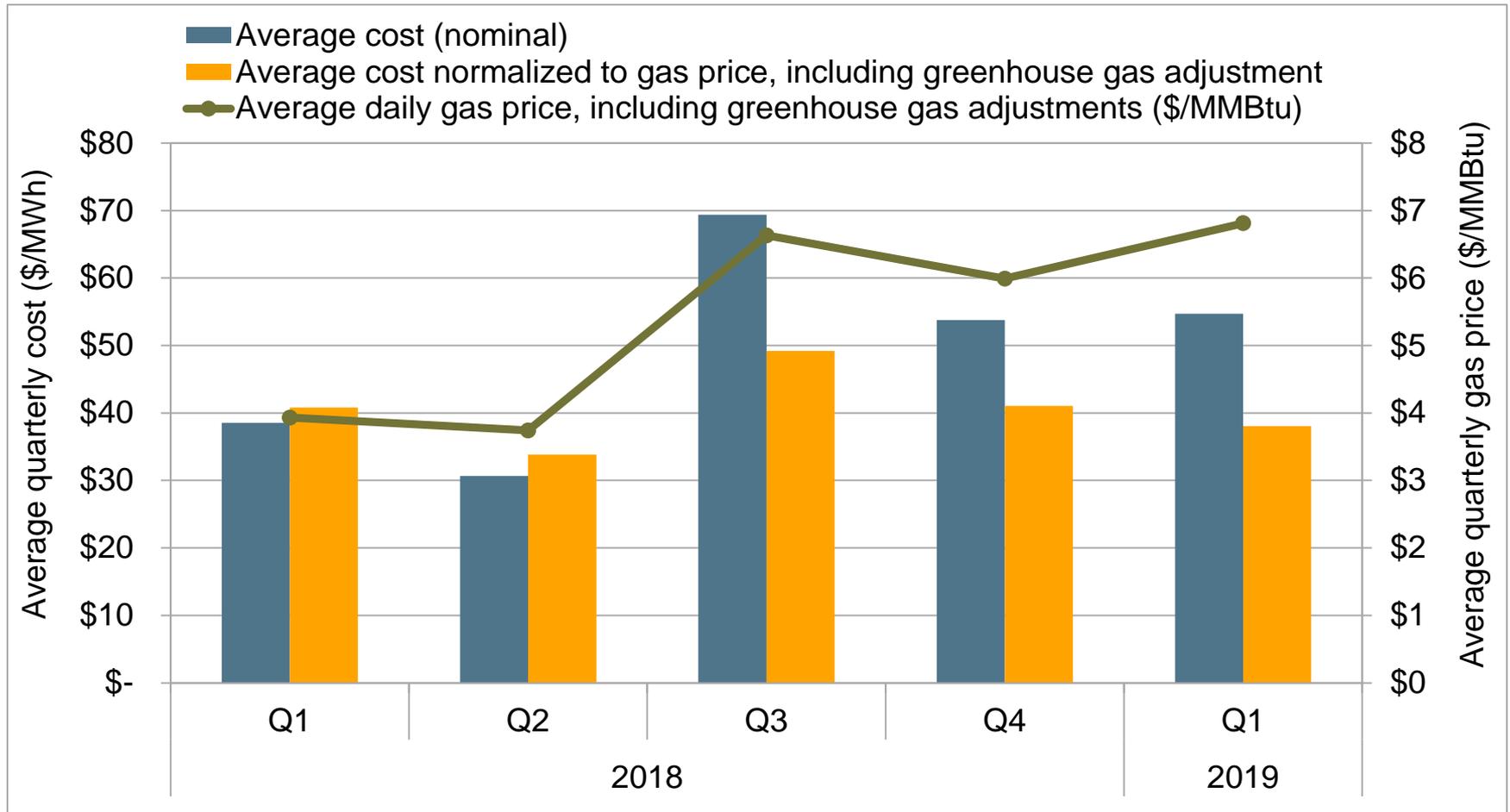
Department of Market Monitoring, California ISO

Amelia Blanke, Ph.D., Manager of Monitoring and Reporting

<http://www.caiso.com/Documents/2019FirstQuarterReportOnMarketIssuesAndPerformance.pdf>

<http://www.caiso.com/market/Pages/MarketMonitoring/AnnualQuarterlyIssuesPerformanceReports/Default.aspx>

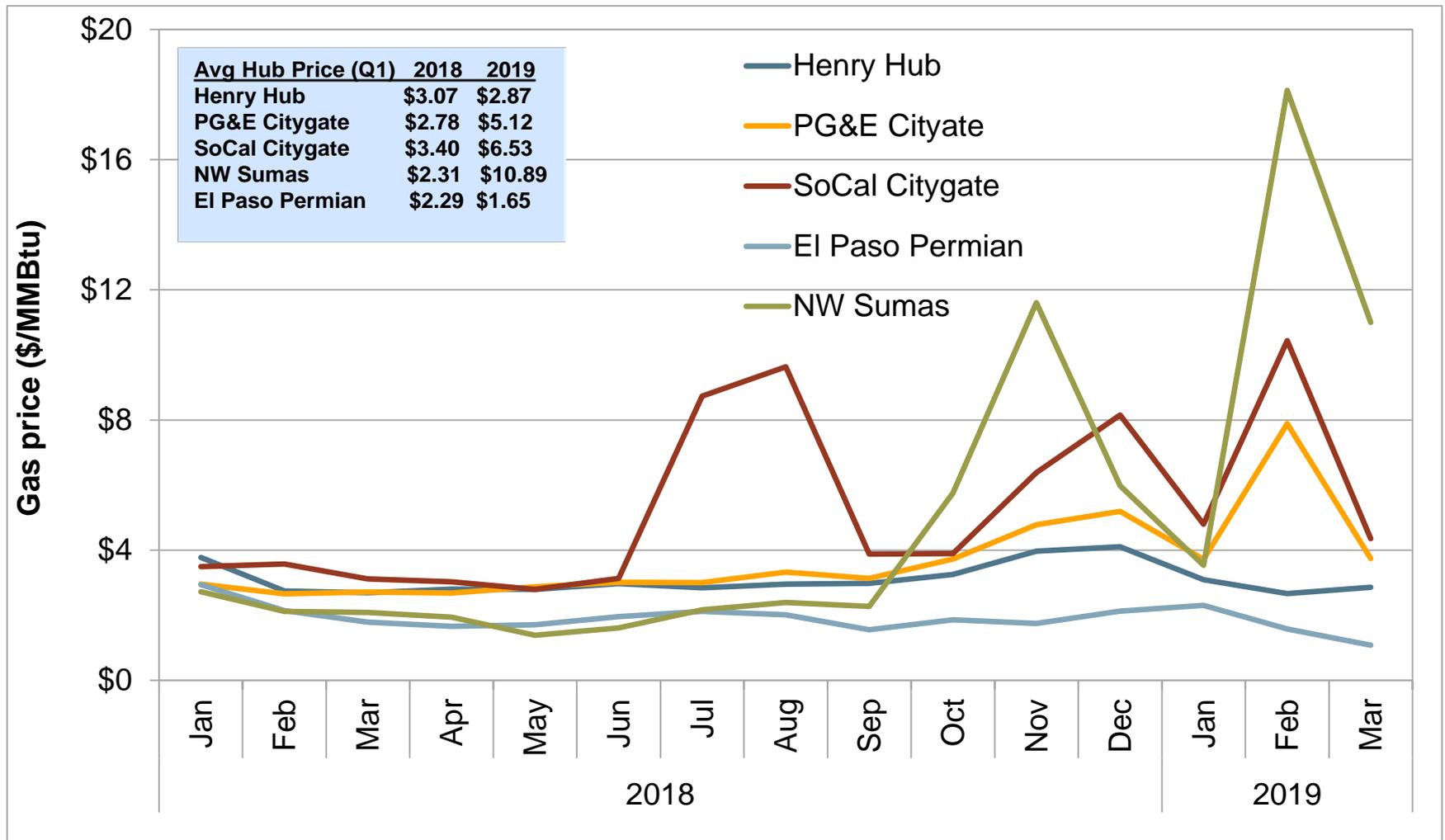
Total CAISO Q1 wholesale costs increased 42% over Q1 2018, due to increase in gas cost of about 73%



Total Q1 CAISO wholesale costs totaled \$2.7 billion or about \$55/MWh

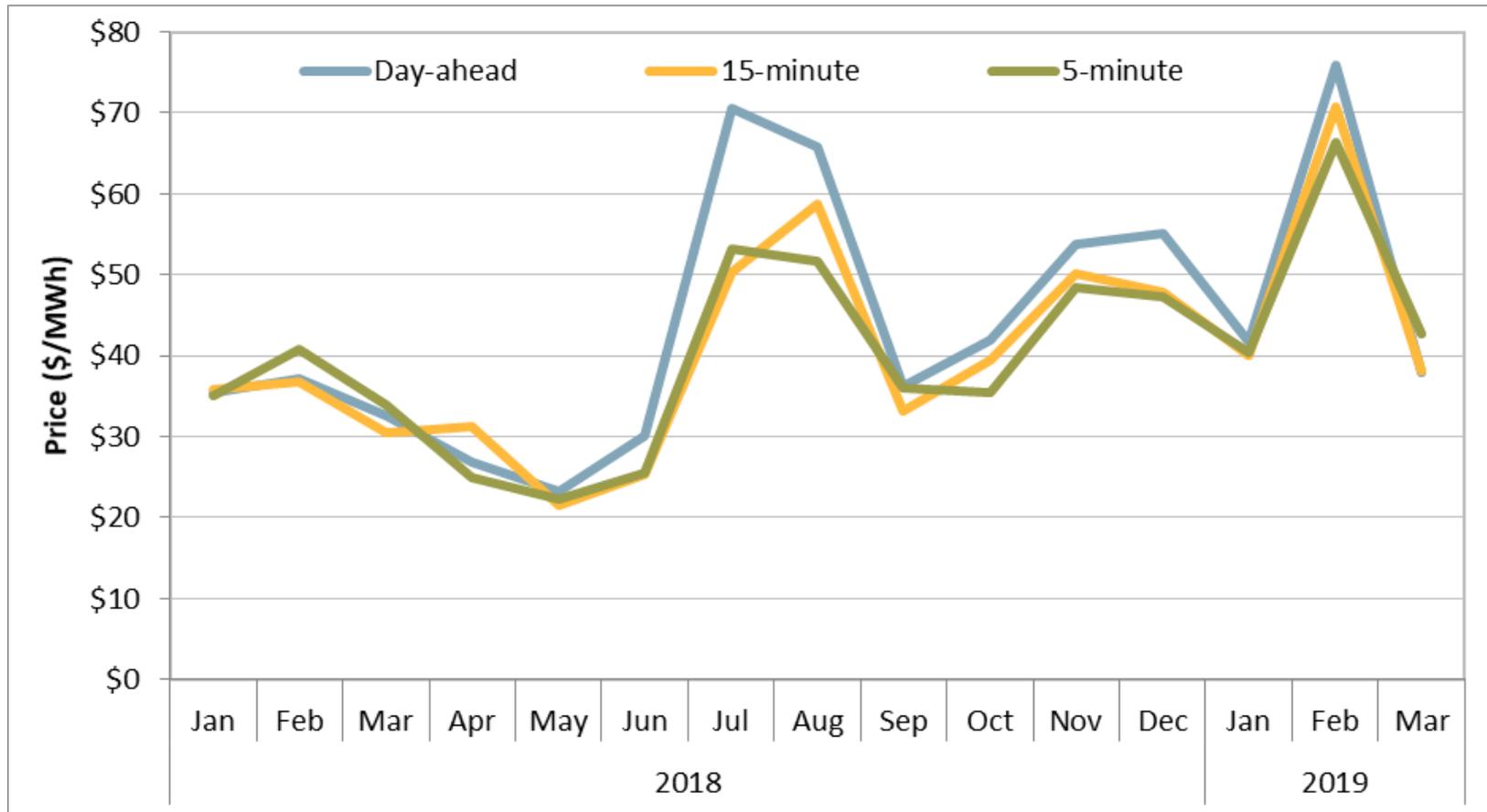
	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Change Q1 2018- Q1 2019
Day-ahead energy costs	\$ 35.05	\$ 27.66	\$ 64.52	\$ 51.47	\$ 52.18	\$ 17.13
Real-time energy costs (incl. flex ramp)	\$ 1.14	\$ 0.61	\$ 1.33	\$ (0.14)	\$ 0.54	\$ (0.60)
Grid management charge	\$ 0.43	\$ 0.43	\$ 0.43	\$ 0.43	\$ 0.42	\$ (0.01)
Bid cost recovery costs	\$ 0.41	\$ 0.34	\$ 1.27	\$ 0.57	\$ 0.57	\$ 0.15
Reliability costs (RMR and CPM)	\$ 0.76	\$ 0.68	\$ 0.63	\$ 0.90	\$ 0.06	\$ (0.70)
Average total energy costs	\$ 37.79	\$ 29.72	\$ 68.18	\$ 53.22	\$ 53.76	\$ 15.97
Reserve costs (AS and RUC)	\$ 0.71	\$ 0.95	\$ 1.19	\$ 0.53	\$ 0.94	\$ 0.23
Average total costs of energy and reserve	\$ 38.51	\$ 30.67	\$ 69.36	\$ 53.76	\$ 54.70	\$ 16.19

Gas prices are up about 73% from Q1 2018 in CAISO

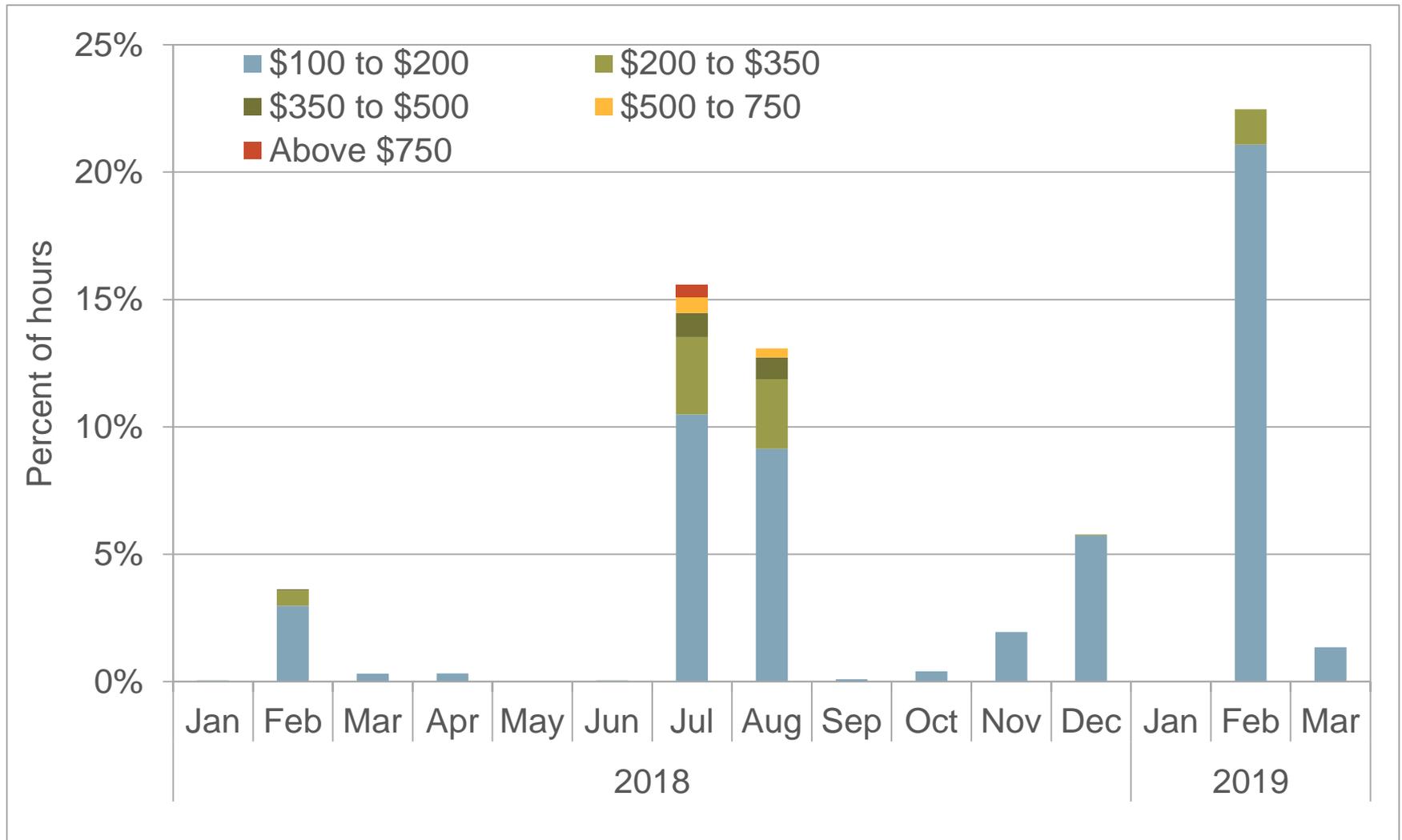


Energy prices increased compared to the same quarter in 2018, driven by higher gas prices

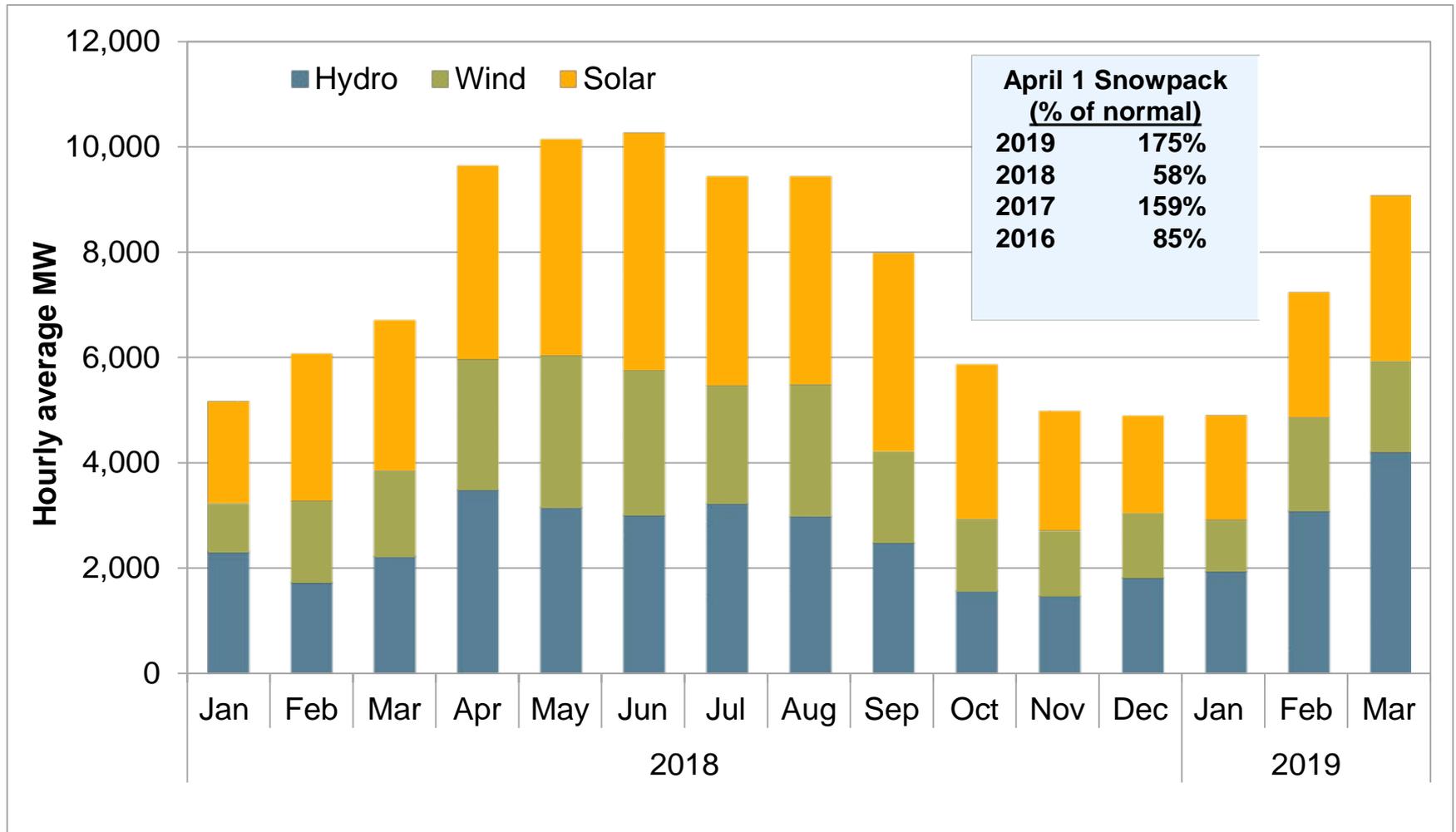
Average monthly prices (all hours) – system marginal energy price



Frequency of high day-ahead prices (MWh) by month

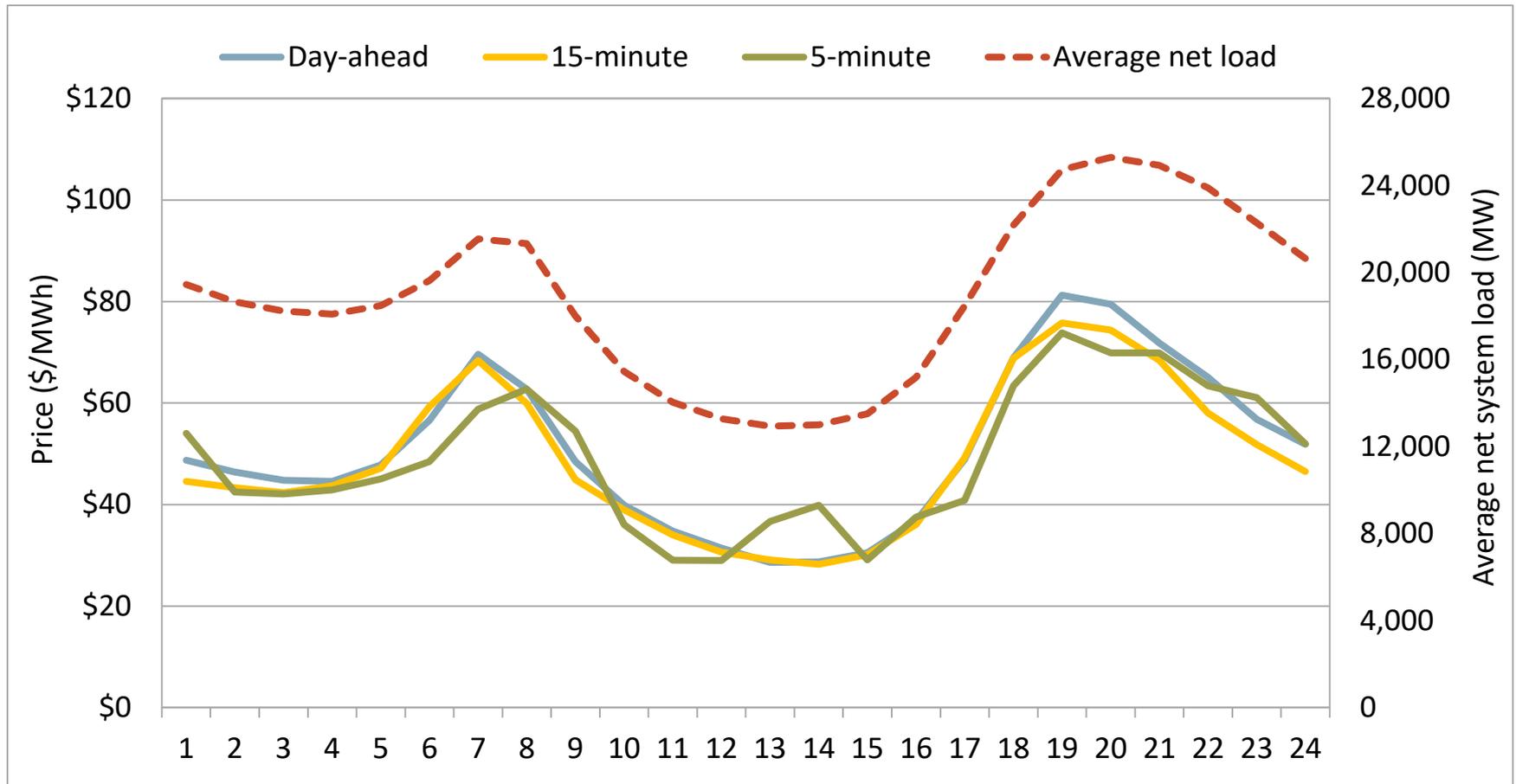


Total renewable production increases, hydro up ~47% from Q1 2018

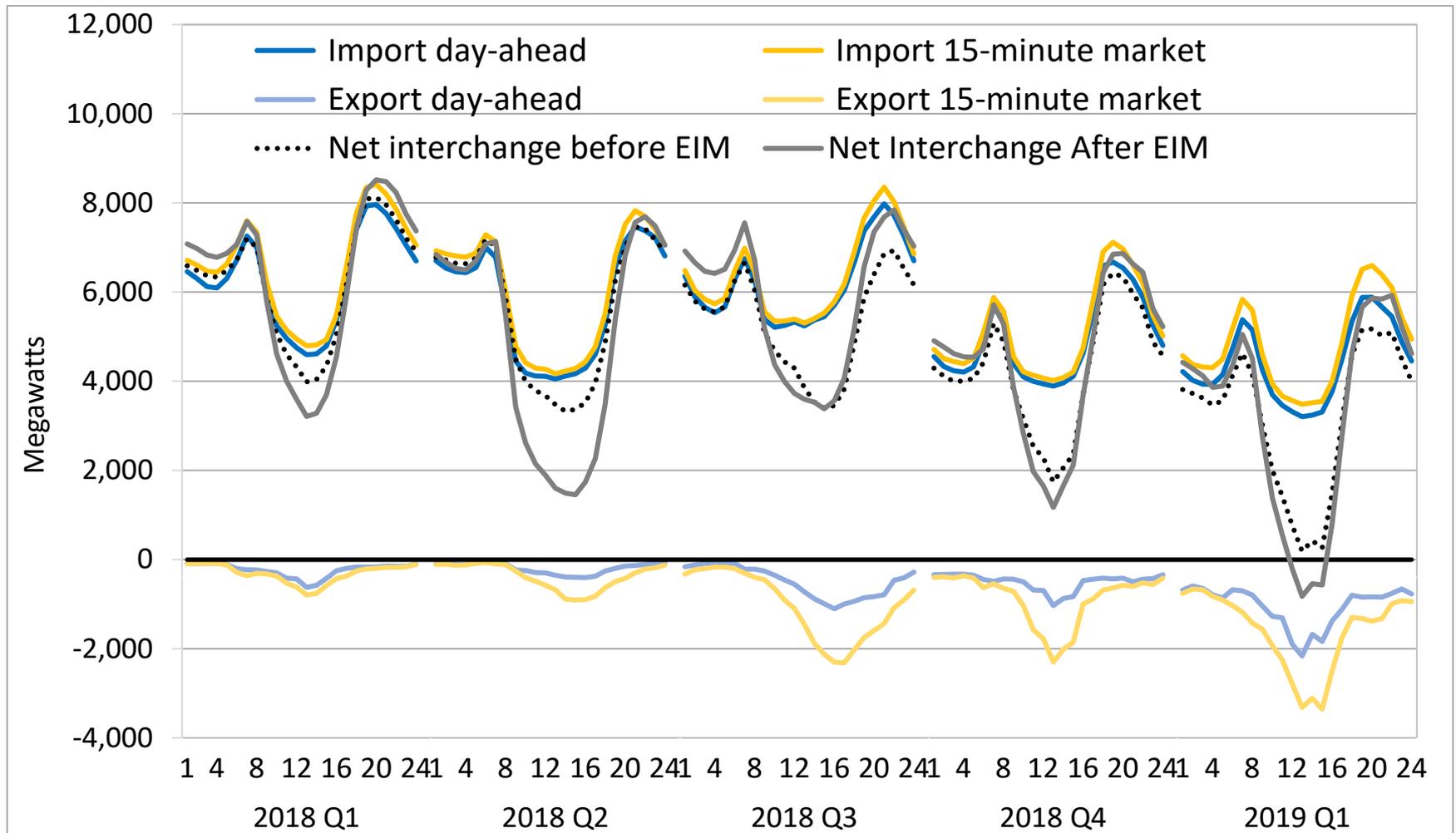


Average prices up in Q1 2019 over Q1 2018: day-ahead \$17/MWh, 15-min \$15/MWh, 5-min by \$13/MWh

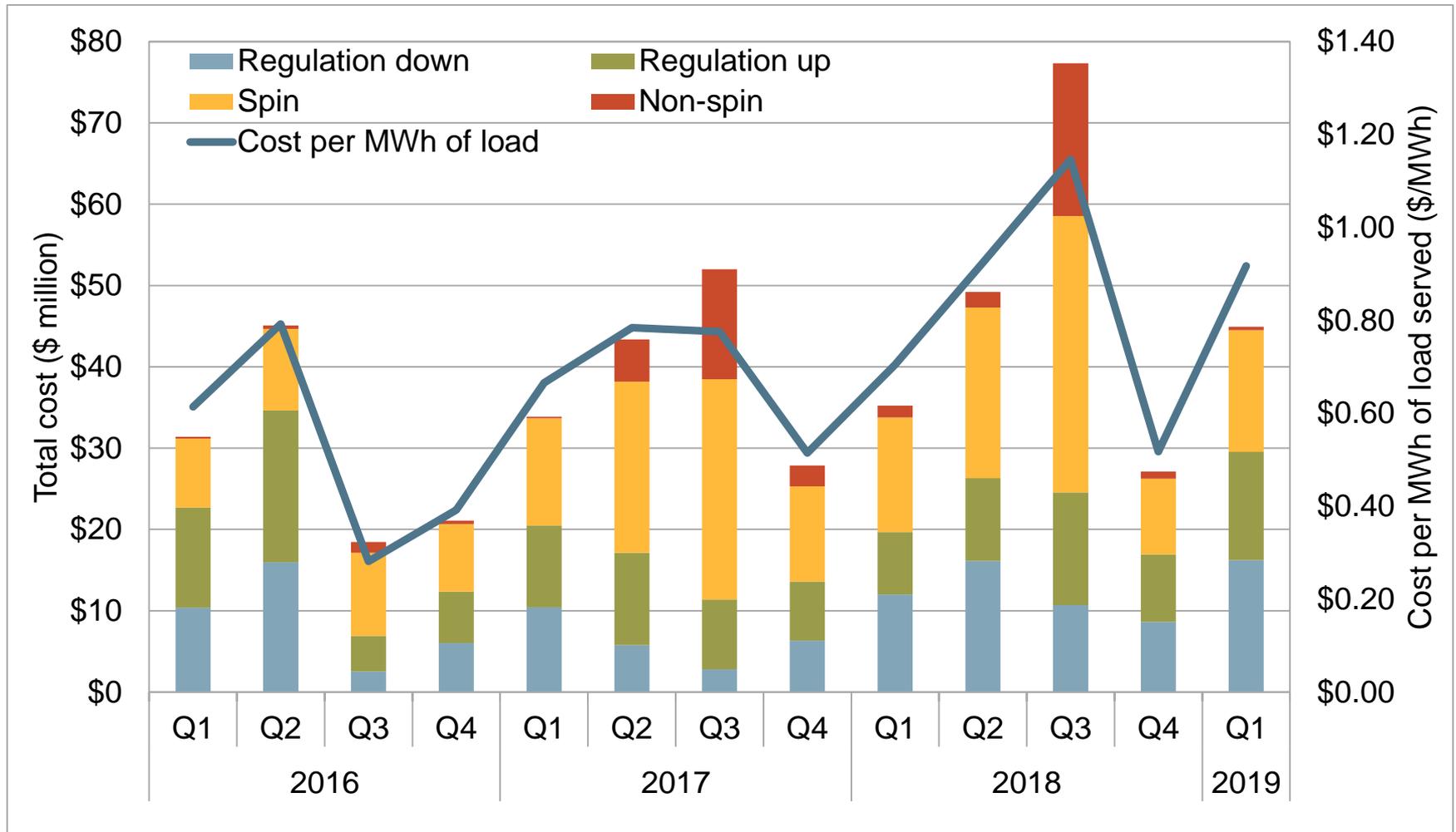
Hourly system marginal energy prices



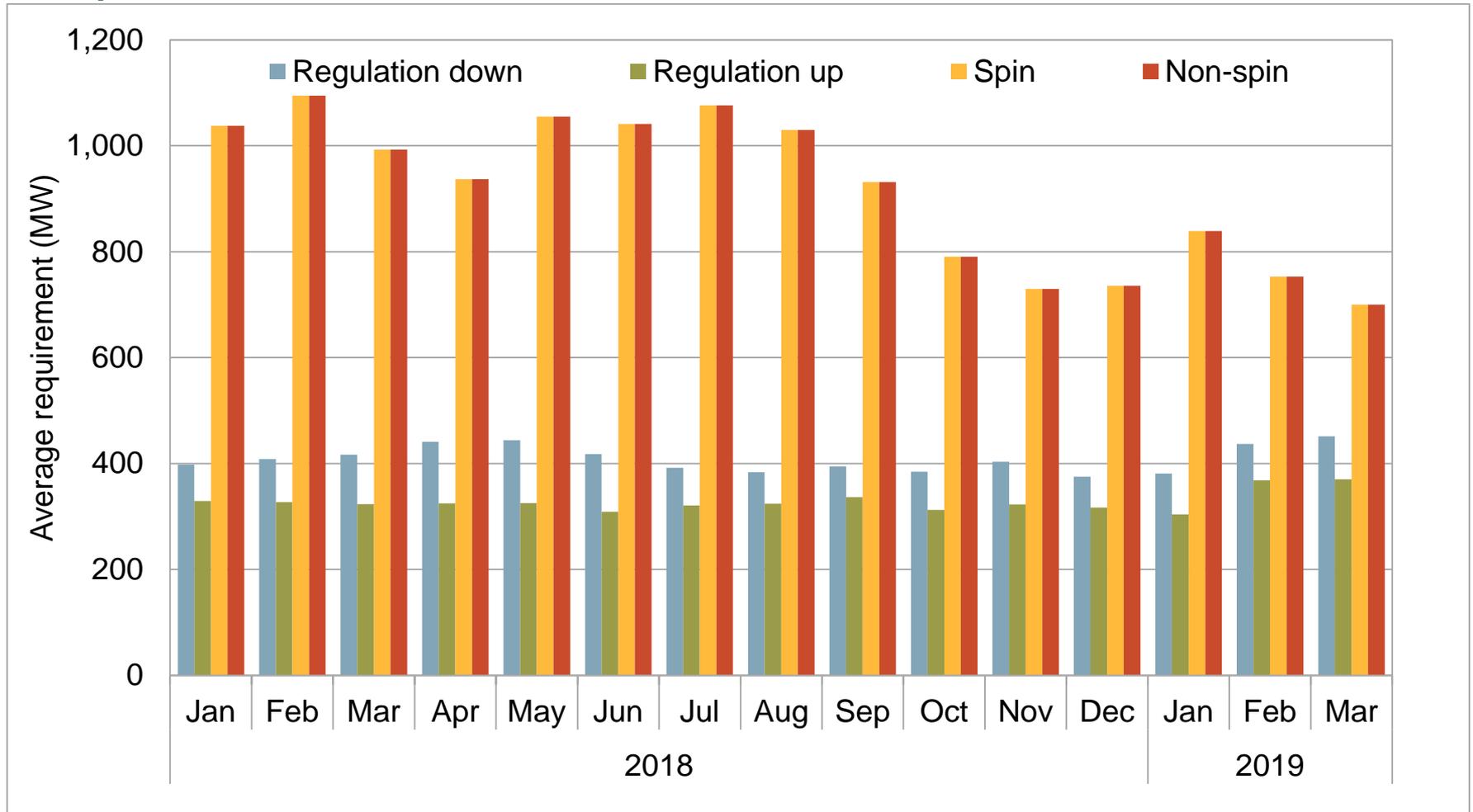
ISO became a net exporter on average during peak solar hours (12 to 15)



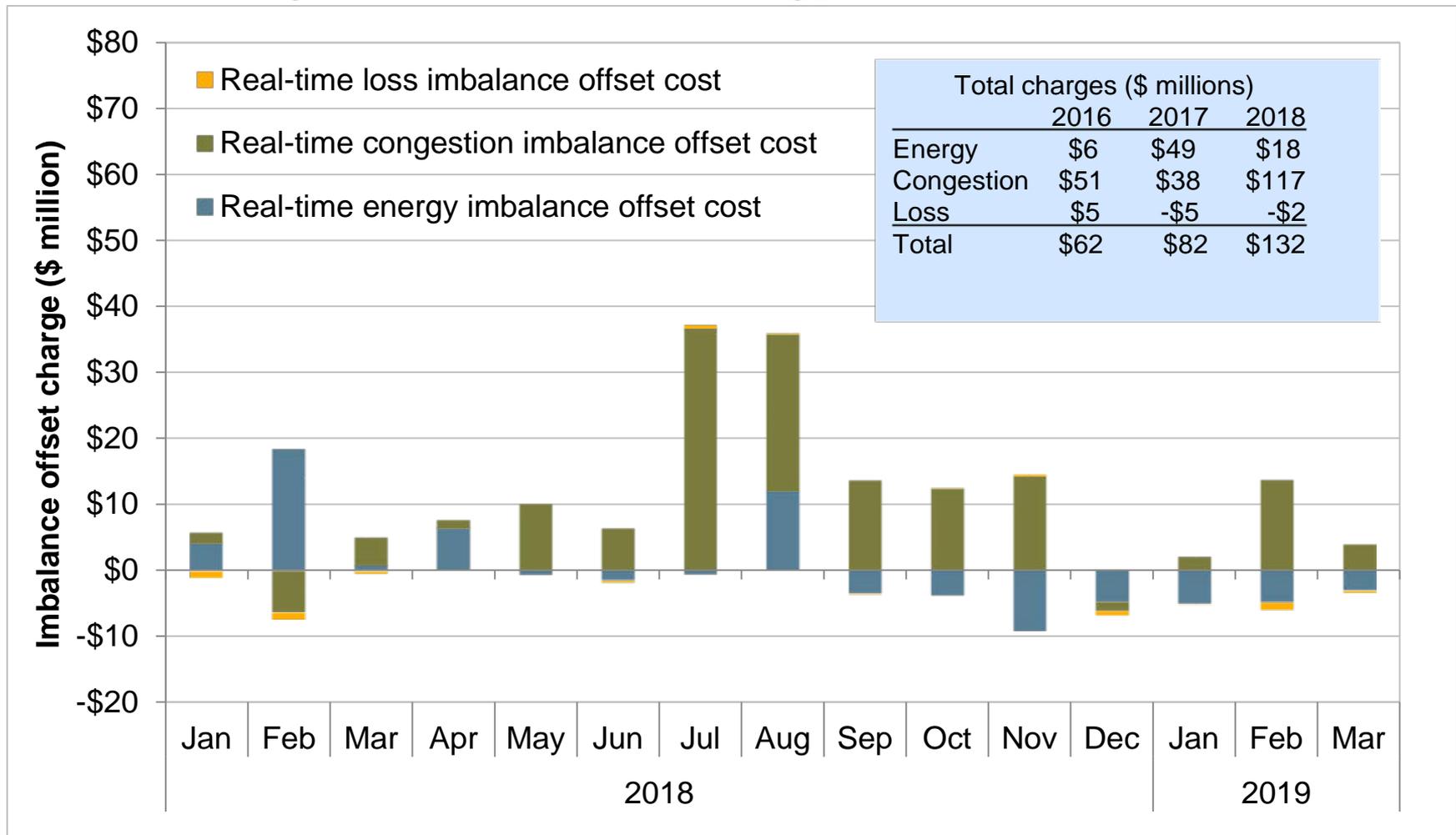
Ancillary services costs \$45 million, up from \$27m in Q4 and \$35 m in Q1 2018.



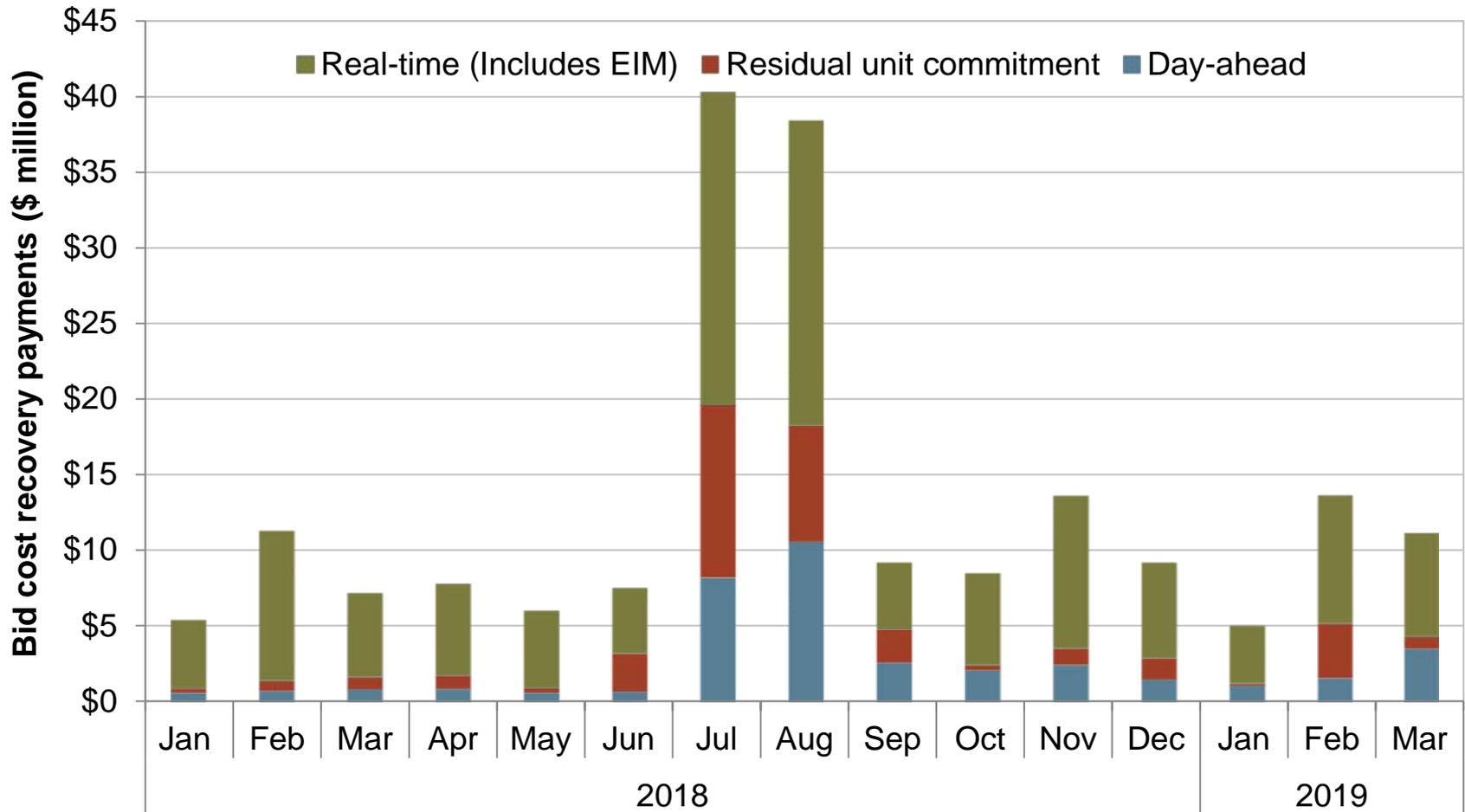
Average monthly day-ahead ancillary service requirements



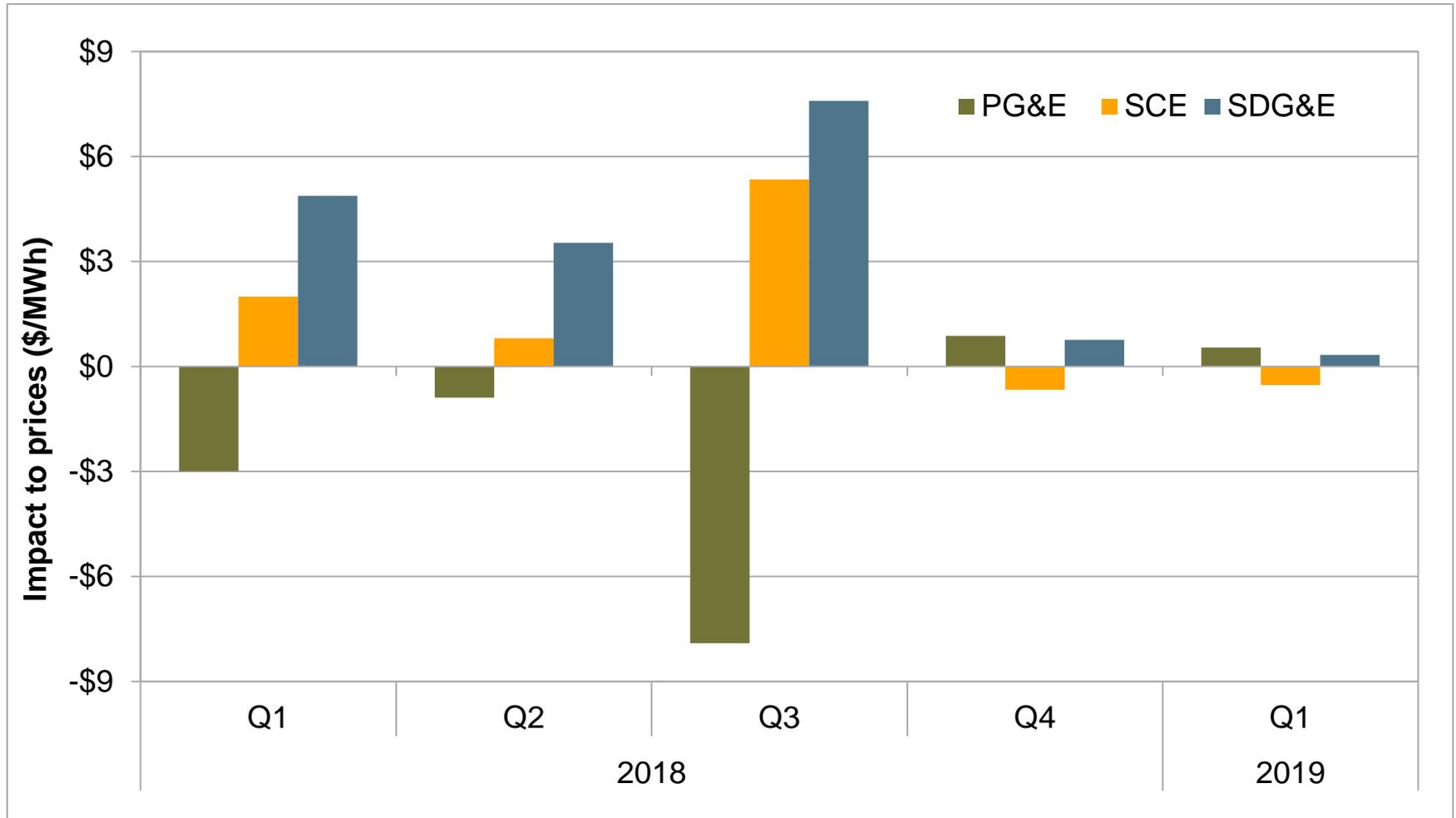
Offset costs total \$6 million in Q1: \$20m congestion - \$13m energy - \$1m loss offset



Q1 bid cost recovery \$30 million, \$5 million above Q1 2018



Overall impact of congestion on price separation in the day-ahead market

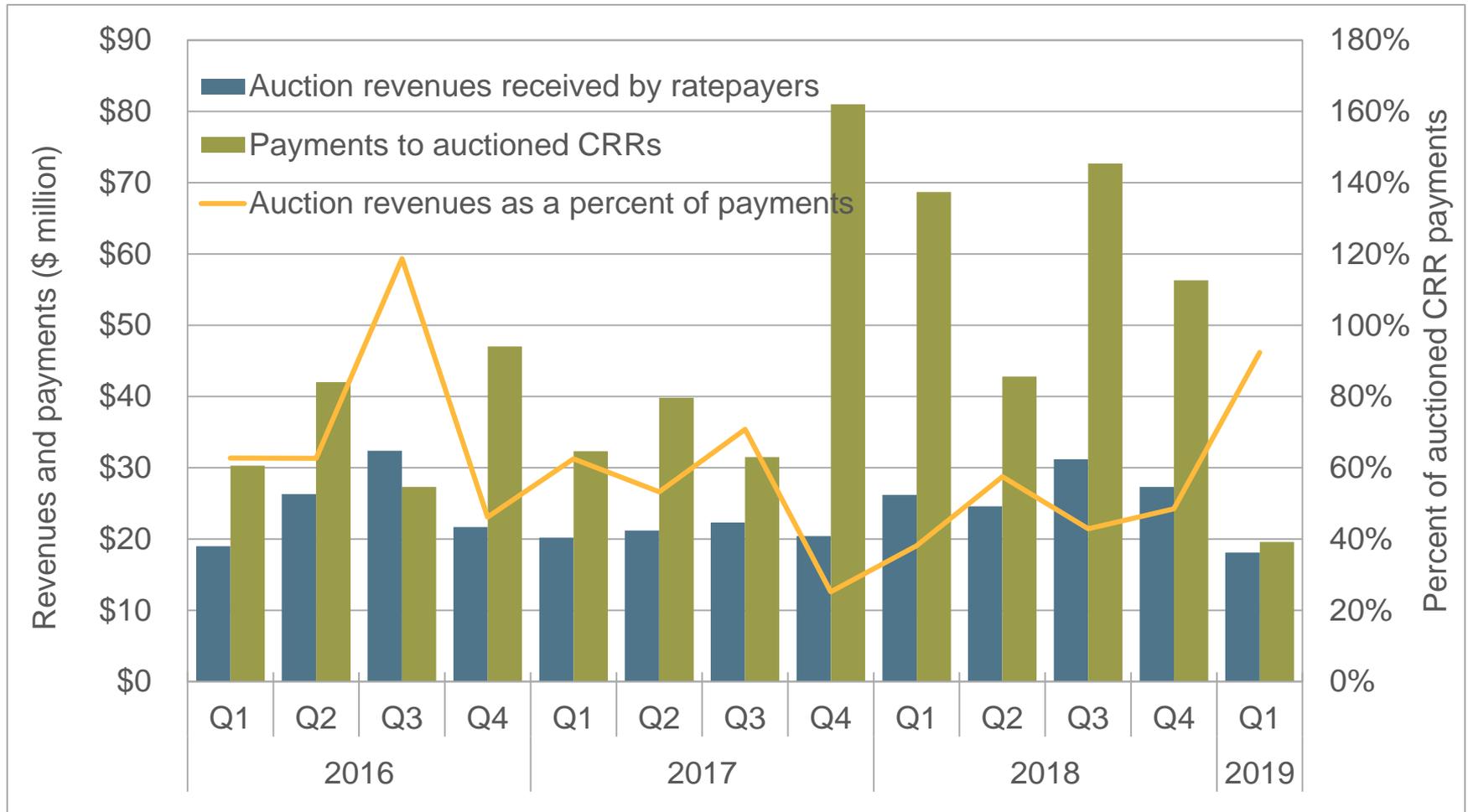


Congestion revenue right auction changes implemented January 2019

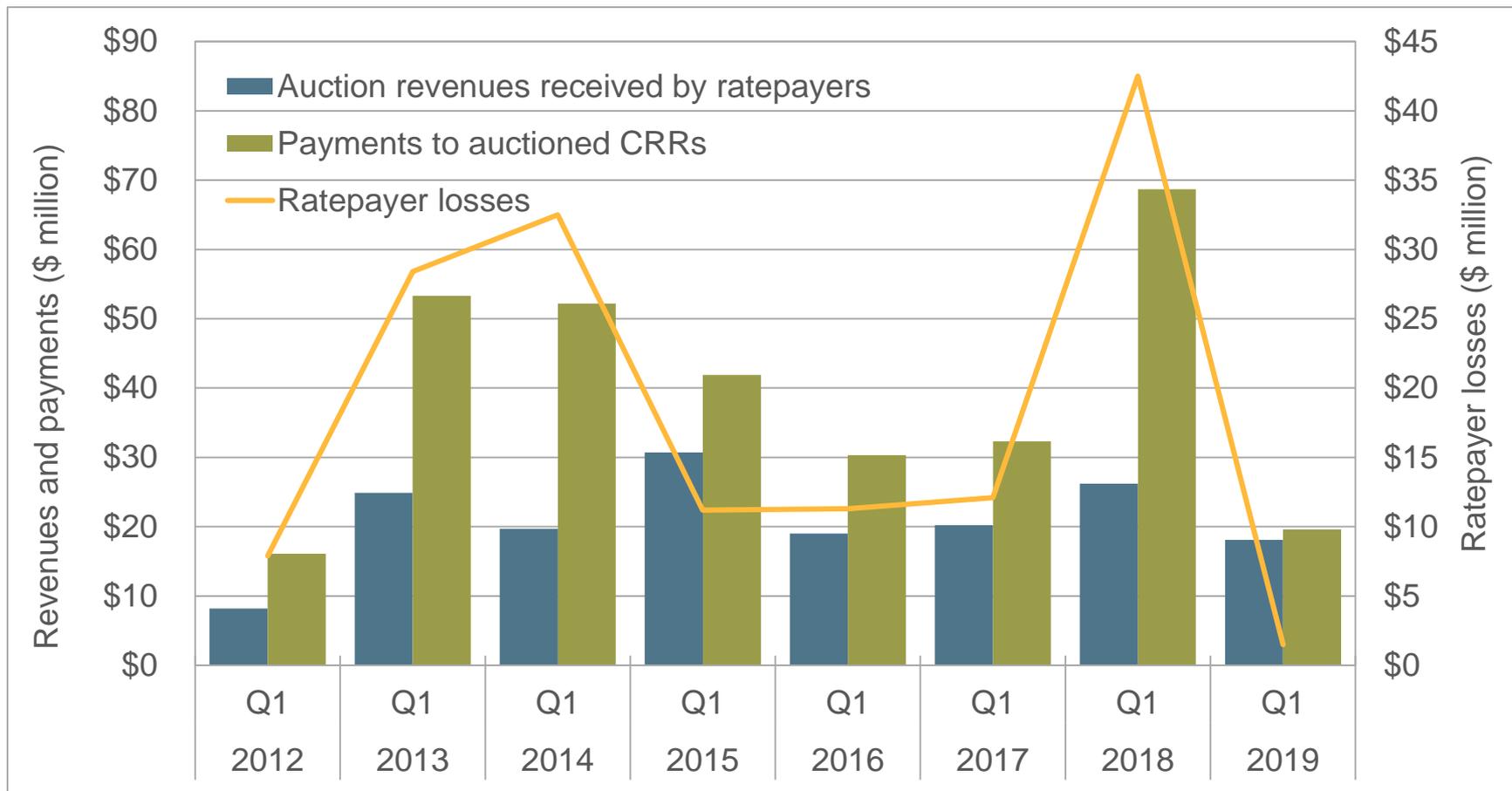
- **Track 1A:**
 - Significantly reduces the number and pairs of nodes at which congestion revenue rights can be purchased in the auction.
 - Designed to limit auction sales to pairs of nodes with physical generation / load due to potential use as hedges for actual sales and trading of energy.
- **Track 1B.**
 - Limits the net payments to CRR holders if payments exceed congestion charges collected in the day-ahead market on a targeted constraint-by-constraint basis.

Auction revenues and payments to non-load-serving entities

Q1 payments \$1.5 million over cost in auction



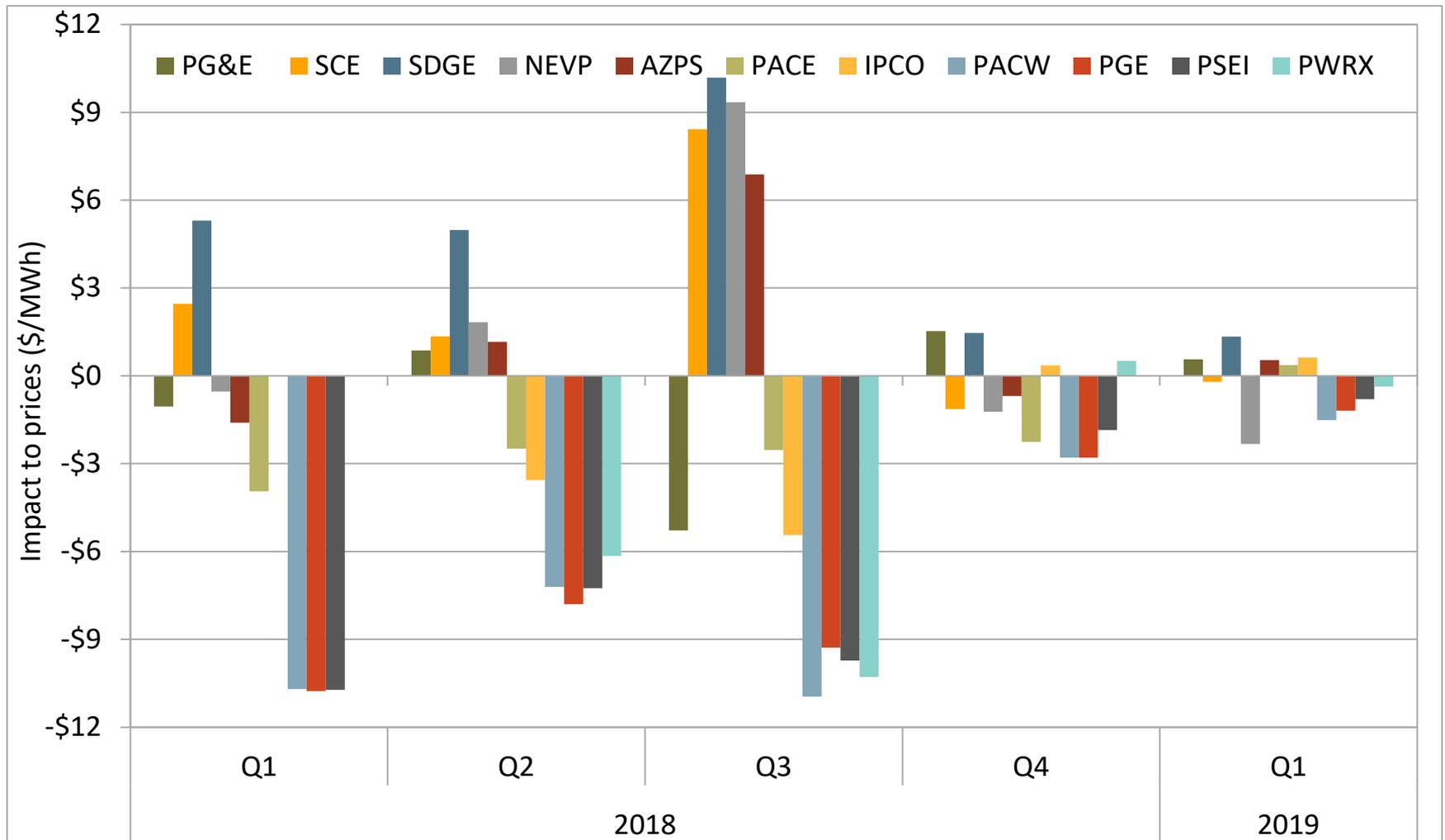
Q1 auction revenues and payments to non-load-serving entities (2012-2019)



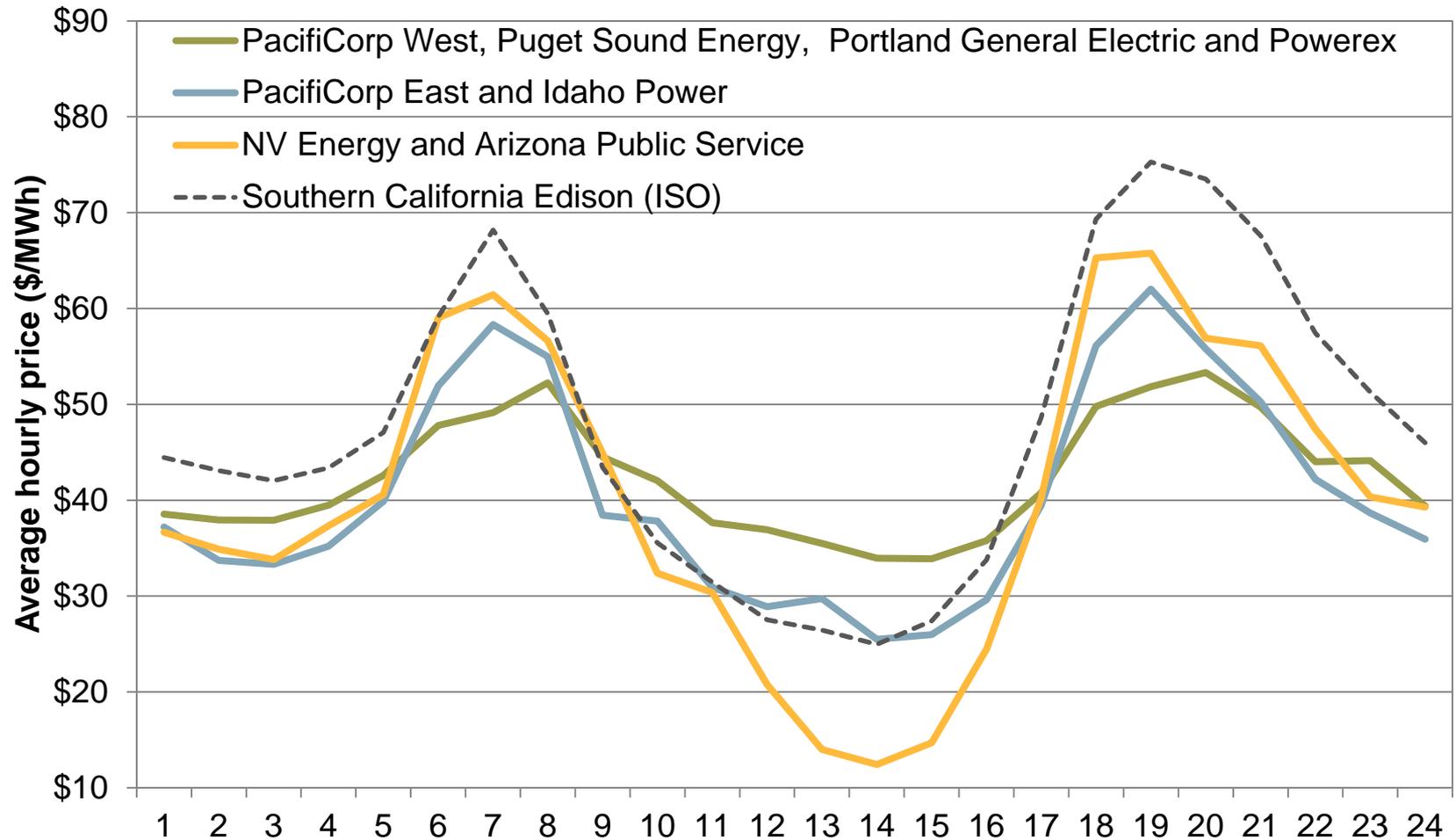
Track 1B changes ensure CRRs paid no more than congestion rent

- Total CRR payments, netted by scheduling coordinator from each constraint, are calculated over the month.
- Total congestion rent is calculated by constraint.
- If all SC CRR payments on constraint > congestion rent:
 - Offset = CRR payment – congestion rent
 - Charged to SCs with net positive flows on constraint
- DMM estimates track 1B reduced losses by ~\$8.8 million

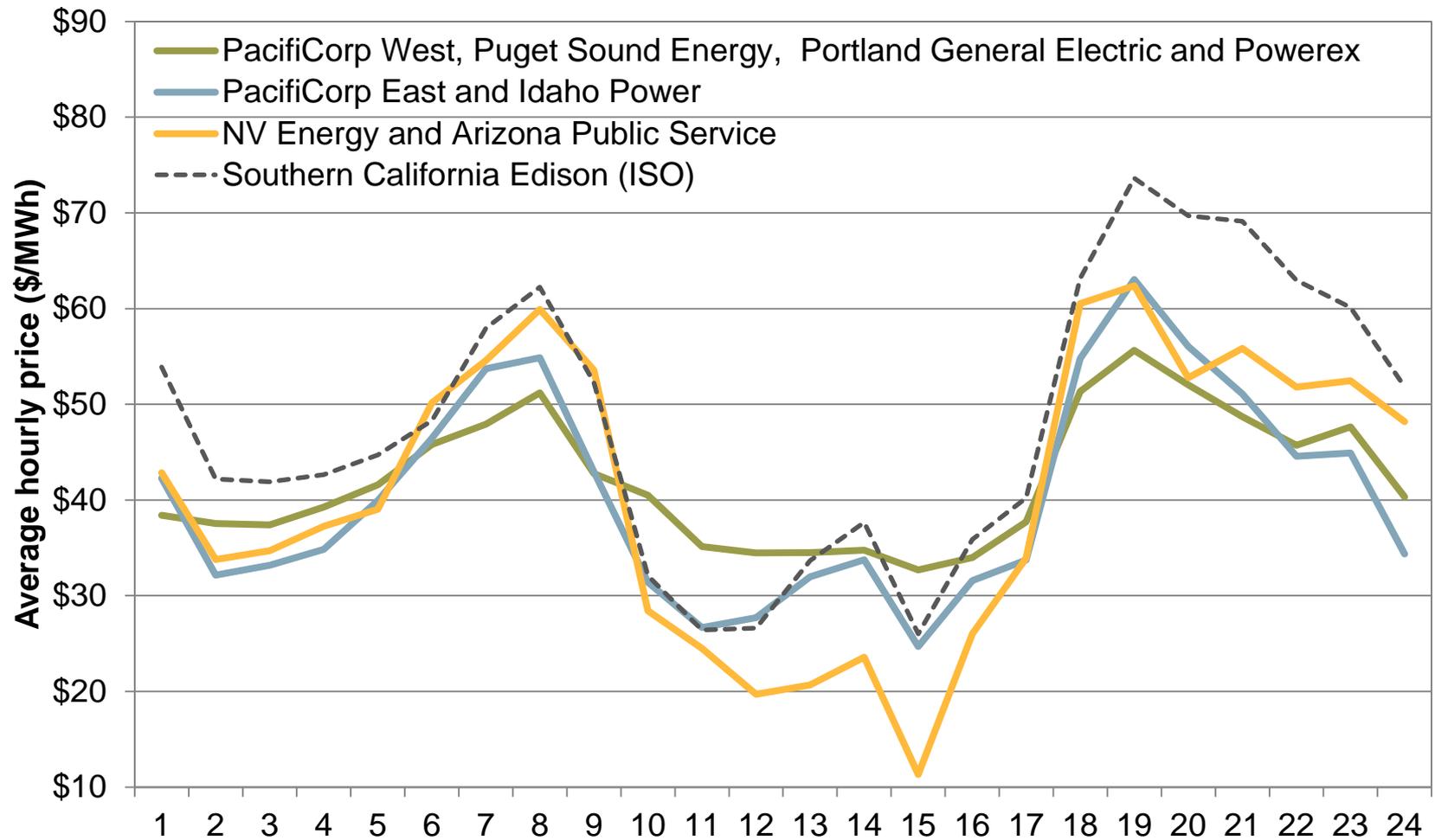
Impact of congestion on 15-minute prices



Hourly 15-minute market prices Q1 2019



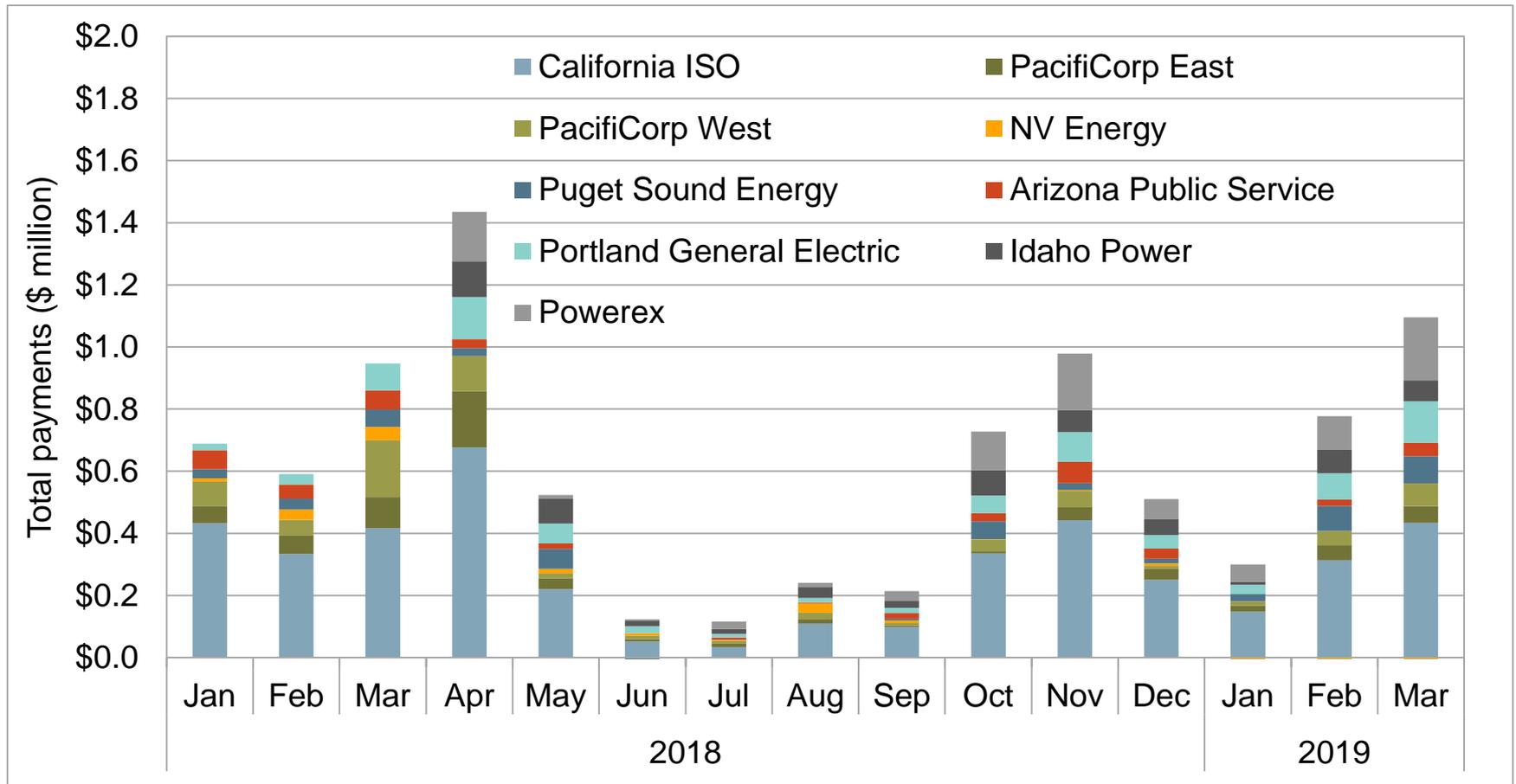
Hourly 5-minute market prices Q1 2019



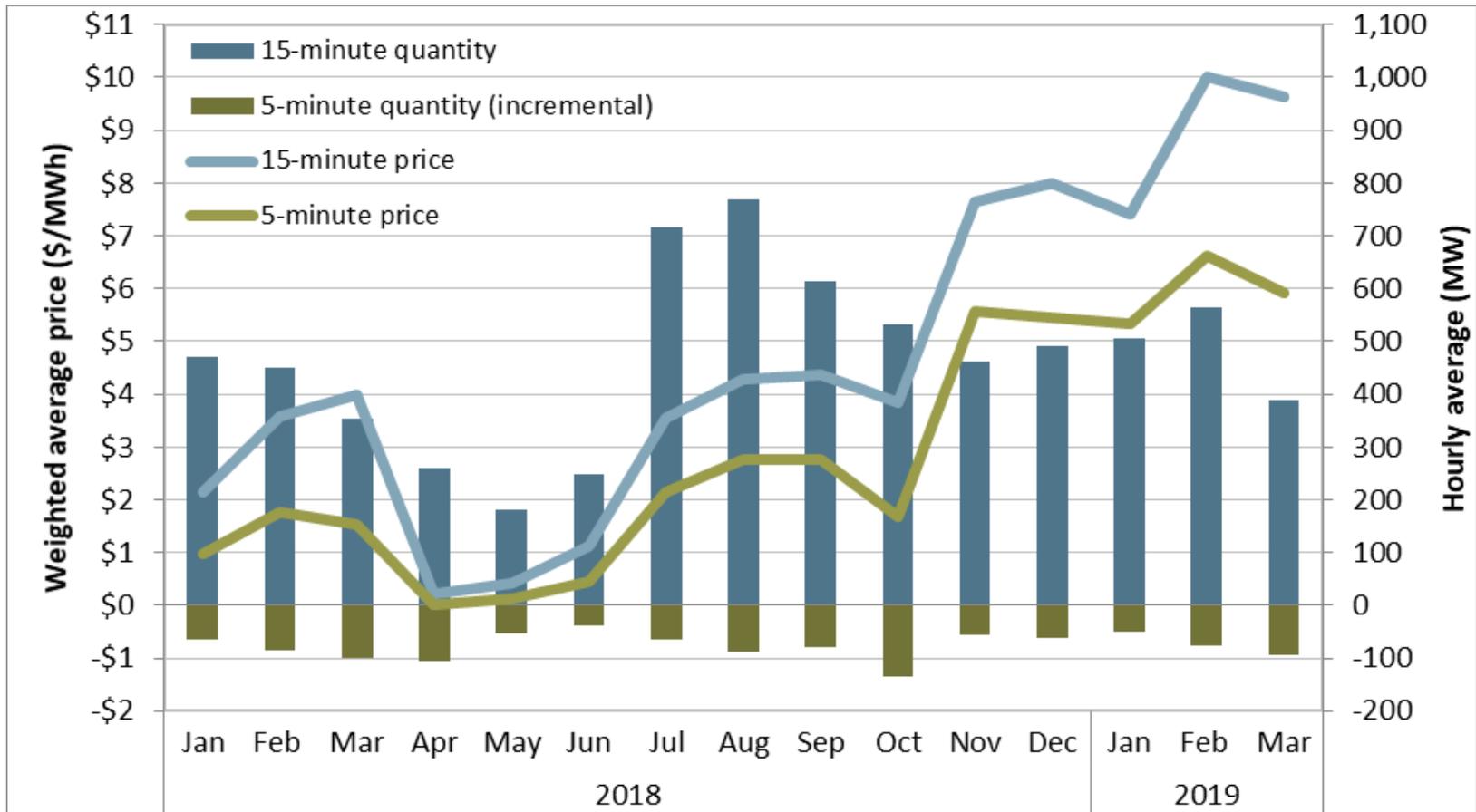
Estimated average EIM wholesale energy costs per MWh

	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Change Q1 2018- Q1 2019
Real-time energy costs	\$ 0.42	\$ 0.41	\$ 0.58	\$ 0.39	\$ 0.36	\$ (0.06)
Imbalance offset costs	\$ (0.17)	\$ (0.35)	\$ (0.27)	\$ (0.25)	\$ (0.33)	\$ (0.16)
Flexible ramping costs	\$ 0.03	\$ 0.02	\$ 0.00	\$ 0.02	\$ 0.02	\$ (0.01)
Grid management charge	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.02	\$ 0.02	\$ (0.00)
Bid cost recovery costs	\$ 0.09	\$ 0.06	\$ 0.04	\$ 0.03	\$ 0.03	\$ (0.05)
Average total energy costs (\$/MWh)	\$ 0.38	\$ 0.15	\$ 0.37	\$ 0.21	\$ 0.10	\$ (0.28)

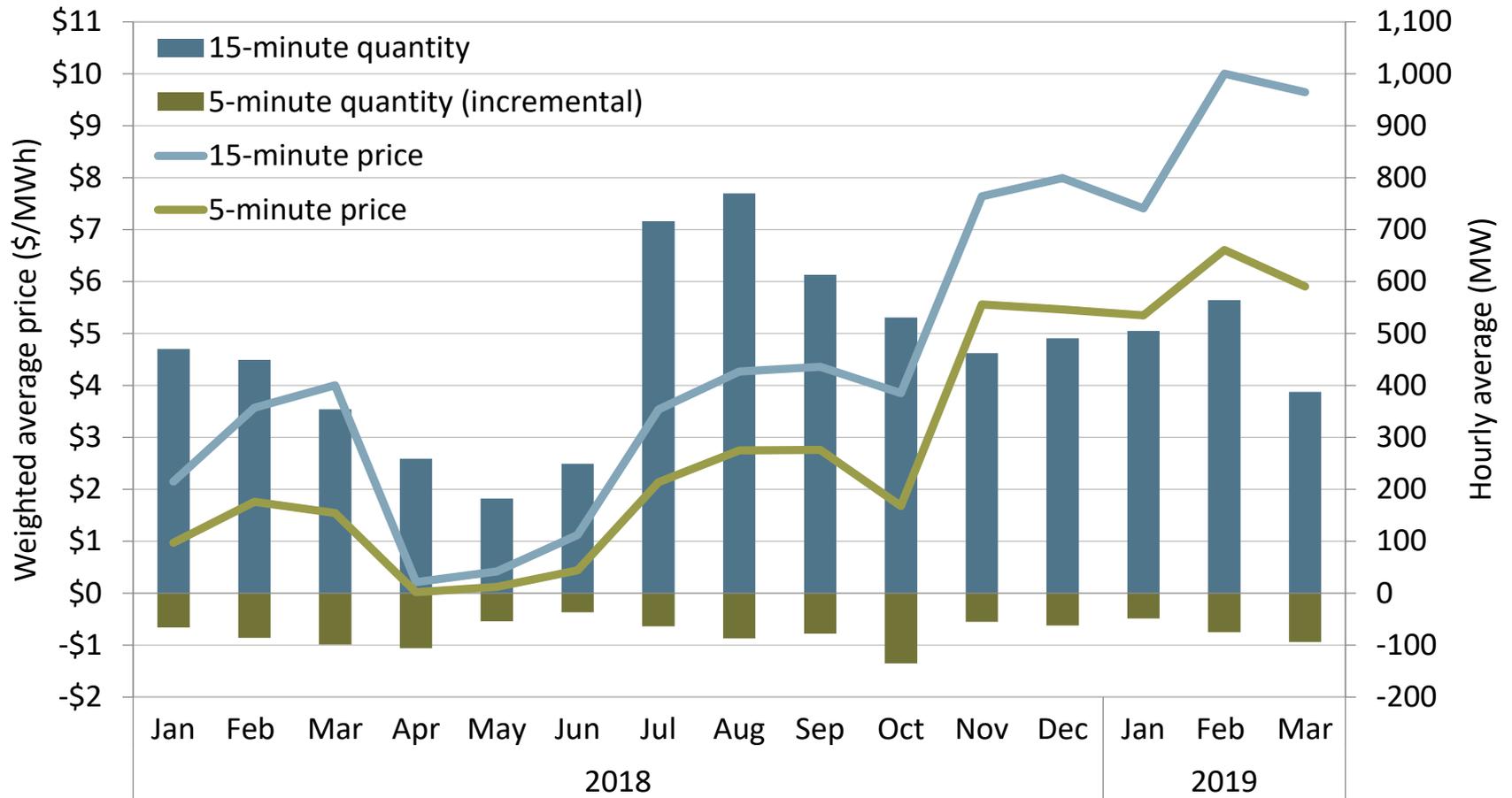
Monthly flexible ramping payments by balancing area



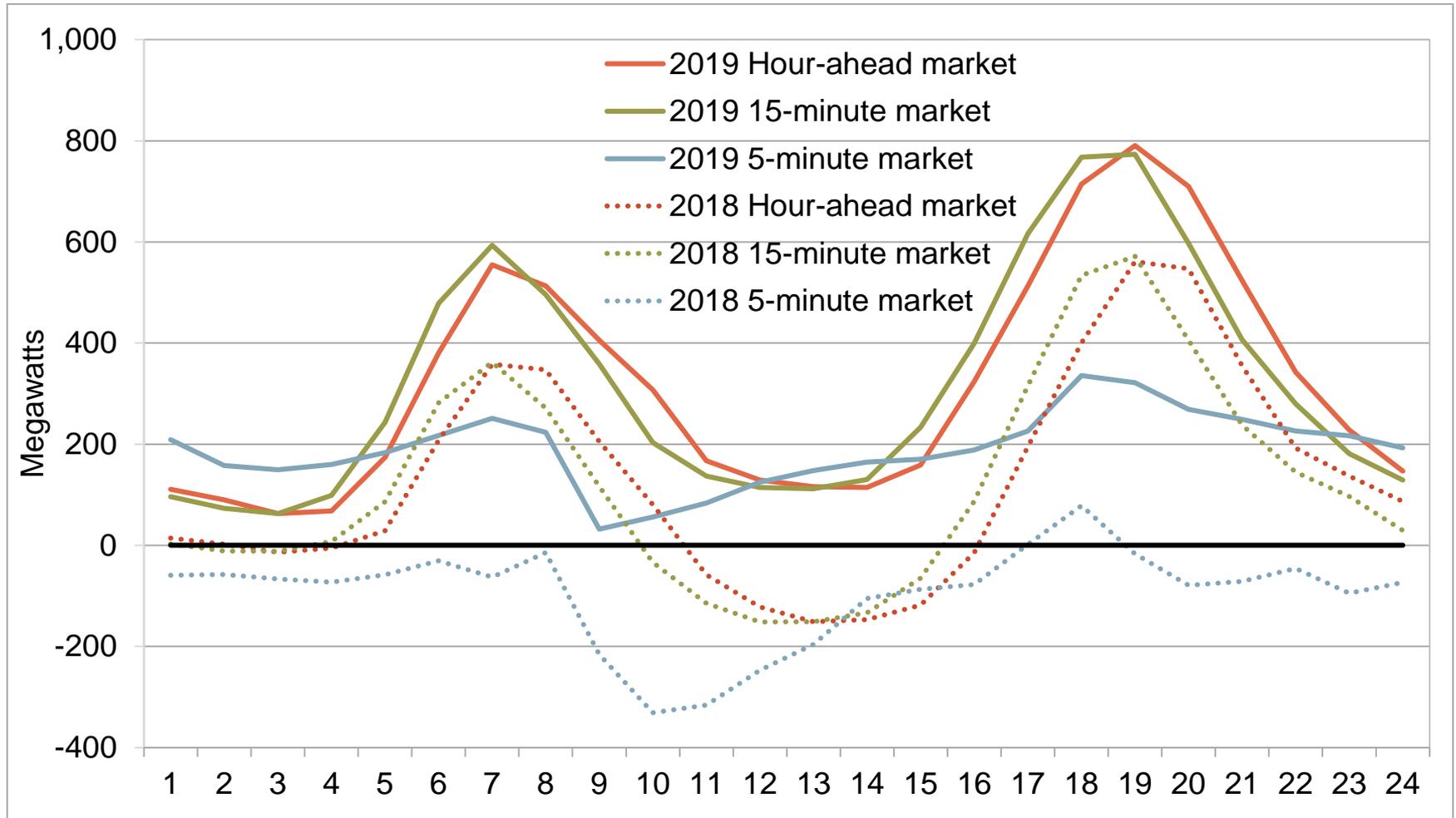
Energy imbalance market greenhouse gas price and cleared quantity



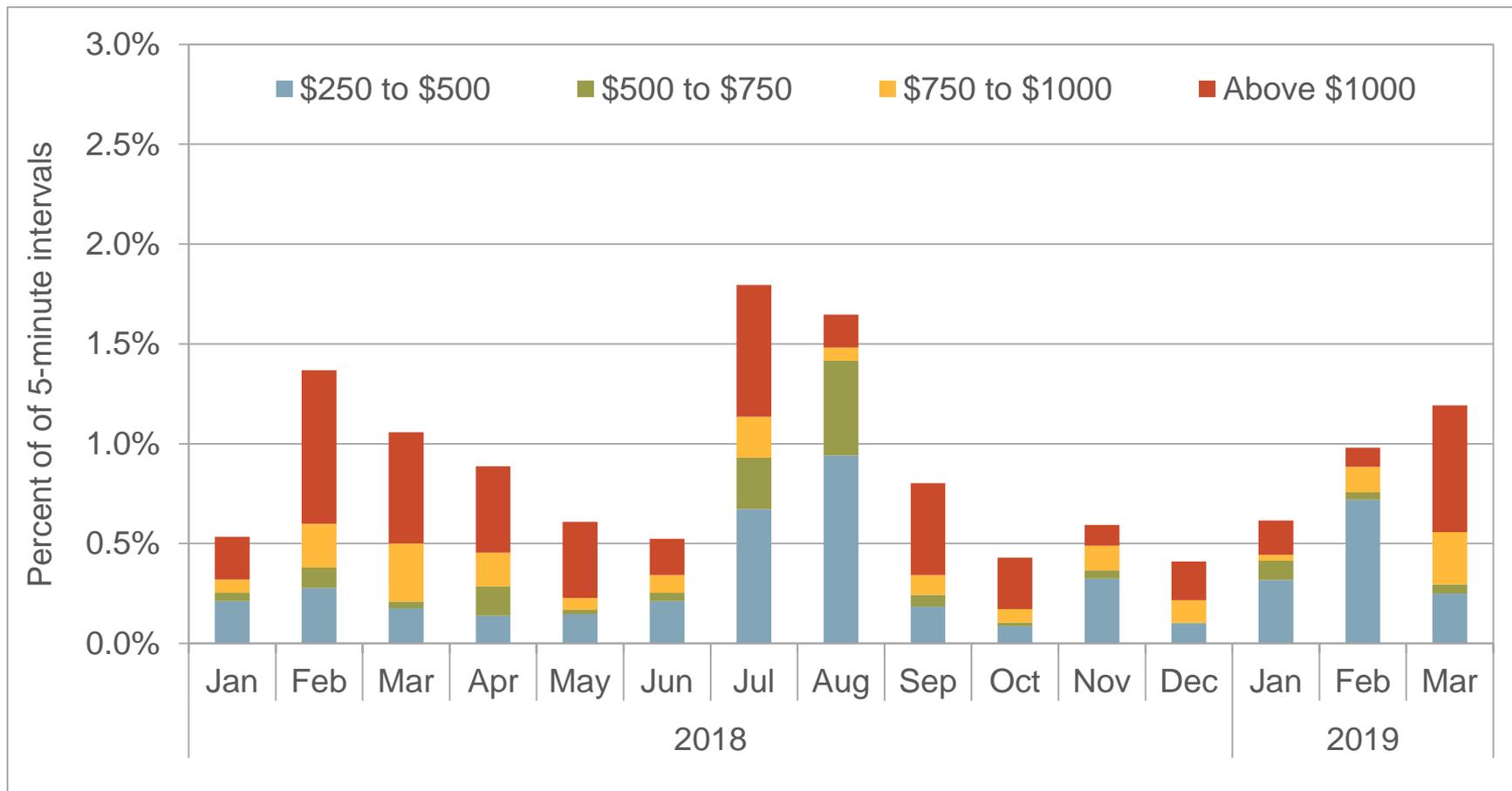
Hourly average EIM greenhouse gas megawatts by fuel type



Average hourly load adjustment (Q1 2019, Q1 2018)



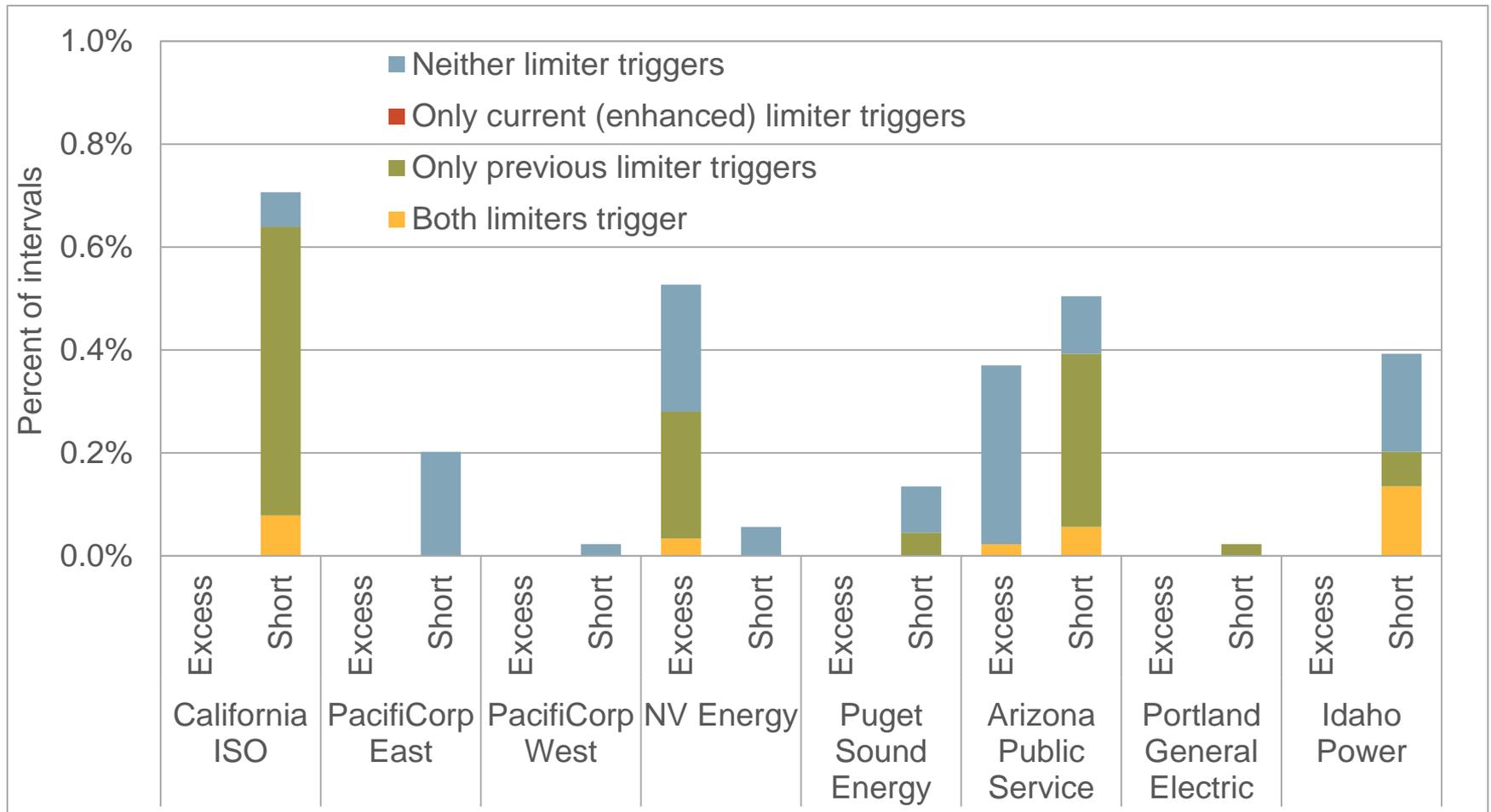
The ISO implemented an enhancement to the load conformance limiter, effective February 27, 2019



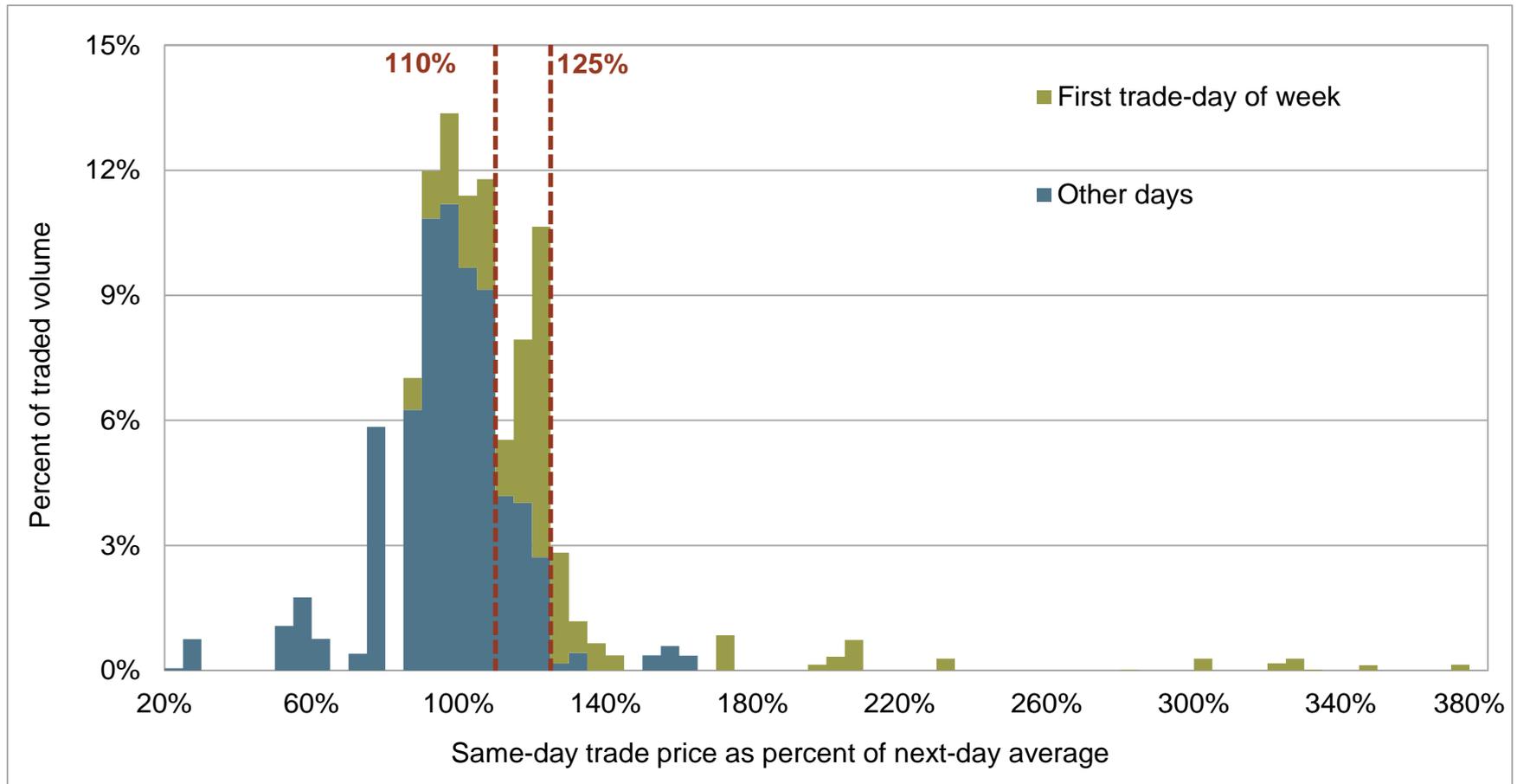
Average frequency and size of load adjustments Q1 2019

	Positive load adjustments			Negative load adjustments			Average hourly adjustment MW
	Percent of intervals	Average MW	Percent of total load	Percent of intervals	Average MW	Percent of total load	
California ISO							
15-minute market	58%	551	2.3%	1%	-298	1.4%	316
5-minute market	69%	304	1.3%	8%	-239	1.1%	190
PacifiCorp East							
15-minute market	0.2%	172	2.9%	3%	-61	1.2%	-2
5-minute market	7%	66	1.2%	22%	-81	1.6%	-14
PacifiCorp West							
15-minute market	0.3%	50	1.9%	0.3%	-53	2.0%	0
5-minute market	2%	59	2.3%	7%	-46	1.8%	-2
NV Energy							
15-minute market	0.4%	96	2.4%	0.2%	-100	2.9%	0
5-minute market	5%	68	1.7%	15%	-93	2.7%	-11
Puget Sound Energy							
15-minute market	0.2%	38	1.0%	9%	-47	1.6%	-4
5-minute market	1%	34	1.0%	57%	-46	1.5%	-26
Arizona Public Service							
15-minute market	91%	122	4.2%	3%	-85	3.4%	109
5-minute market	91%	122	4.2%	3%	-84	3.5%	108
Portland General Electric							
15-minute market	0.4%	45	1.5%	0%	N/A	N/A	0
5-minute market	22%	27	1.1%	3%	-38	1.4%	5
Idaho Power							
15-minute market	0.2%	56	2.8%	0.1%	-83	4.7%	0
5-minute market	7%	49	2.8%	10%	-57	3.3%	-2

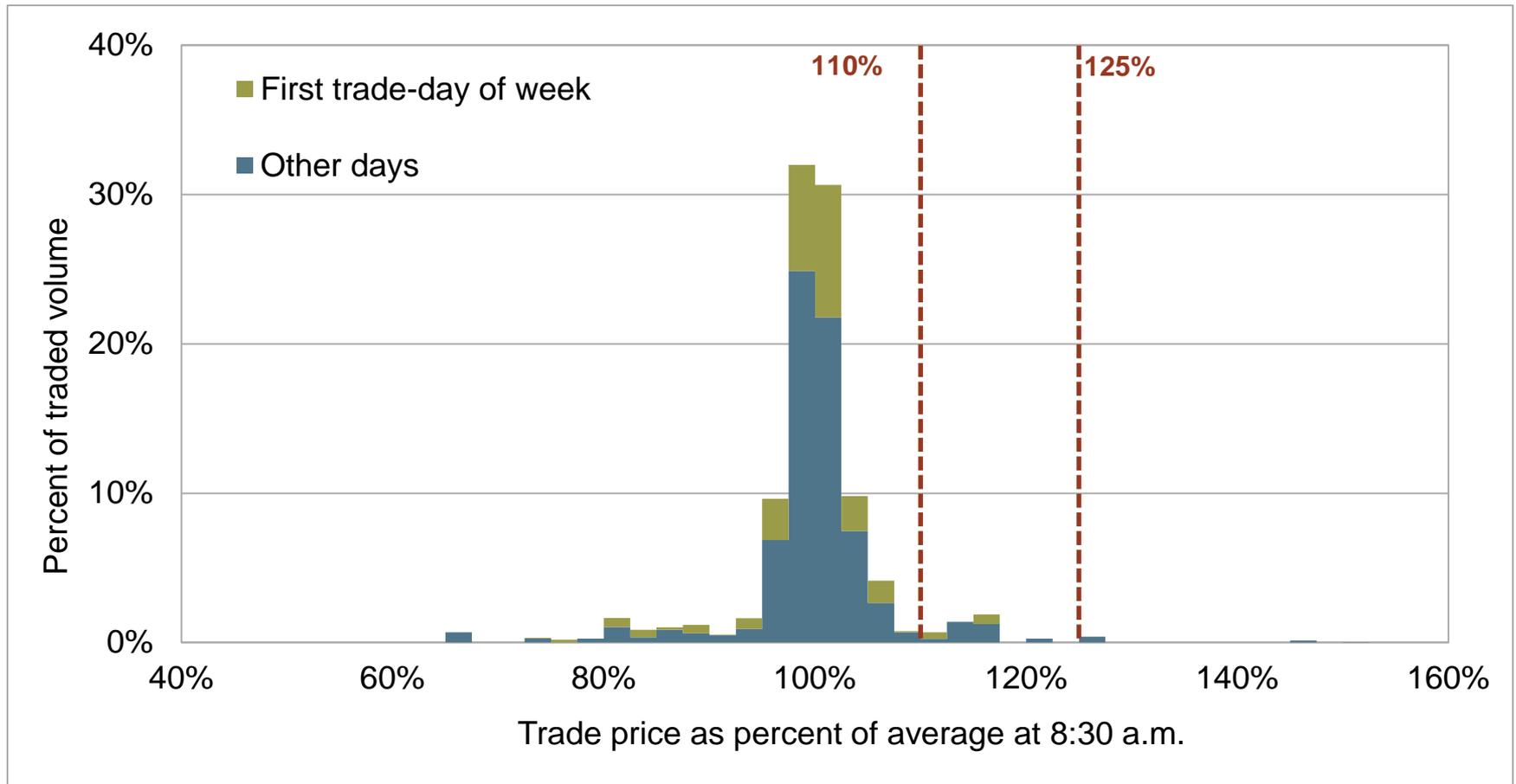
Frequency of load conformance limiter in the 5-minute market (March 2019)



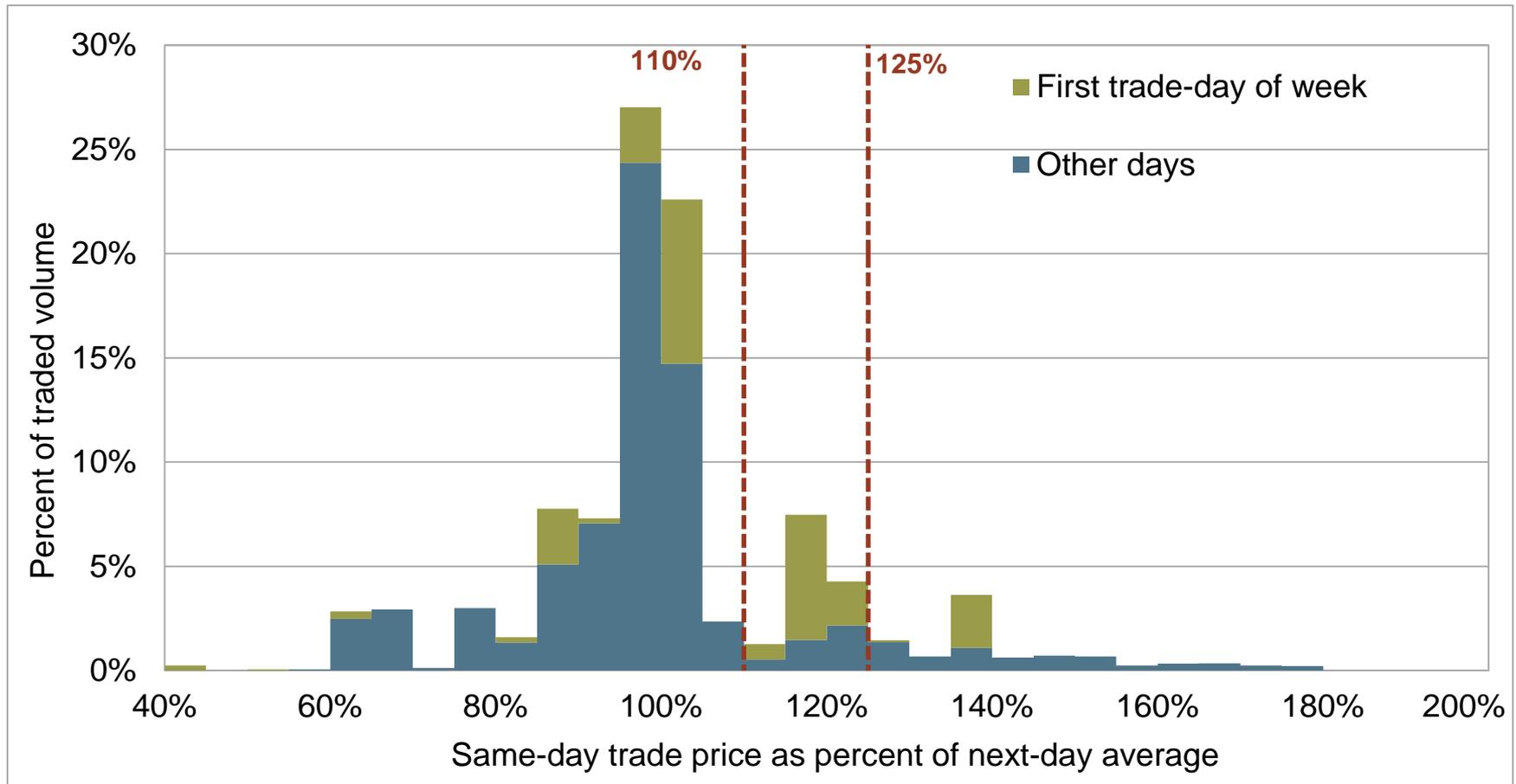
SoCal Citygate same-day trade prices compared to next-day index (January – March)



SoCal Citygate same-day prices as a percent of updated same-day averages (Jan - Mar)



PG&E Citygate same-day trade prices compared to next-day index (January – March)



PG&E Citygate same-day prices as a percent of updated same-day averages (Jan - Mar)

