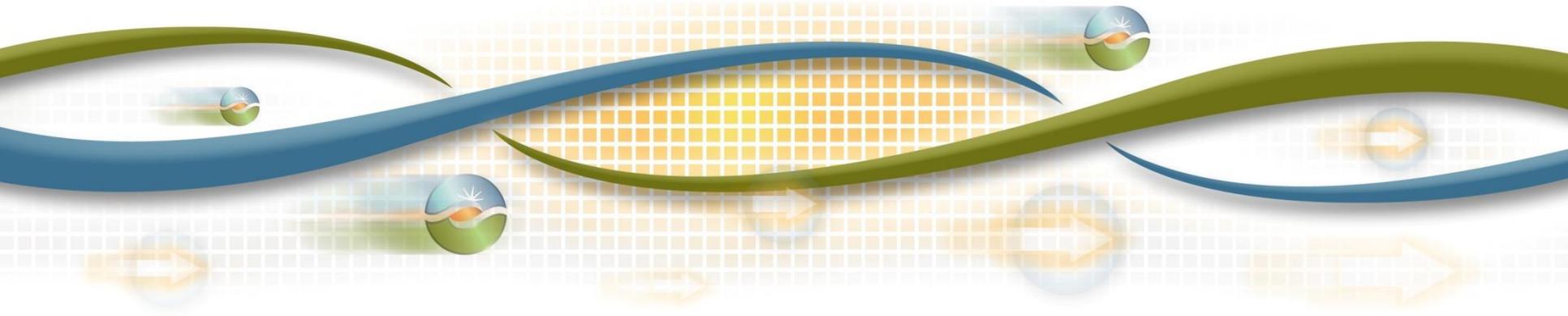




Highlights of fourth quarter report - 2016

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California ISO

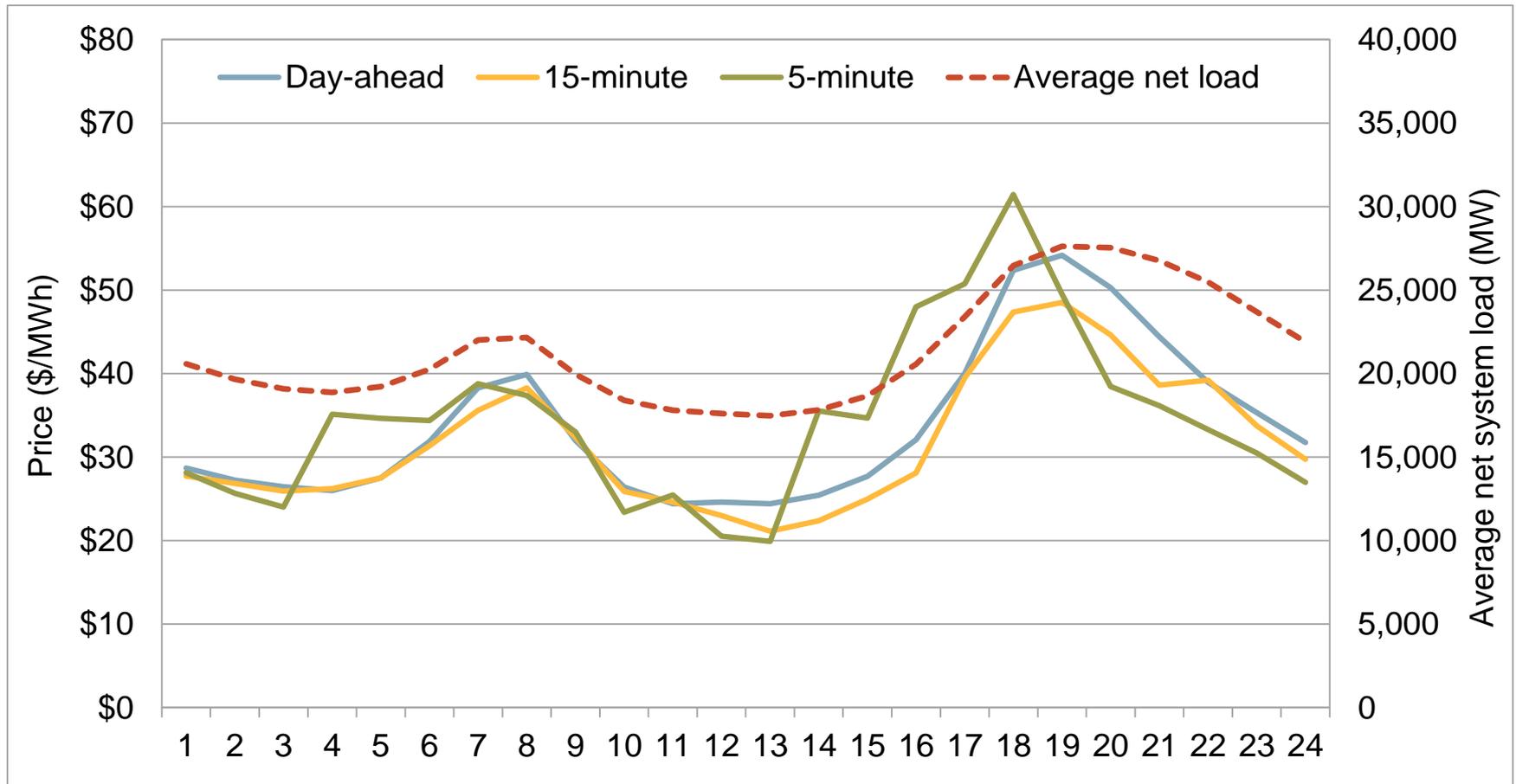
Web Conference
March 22, 2017



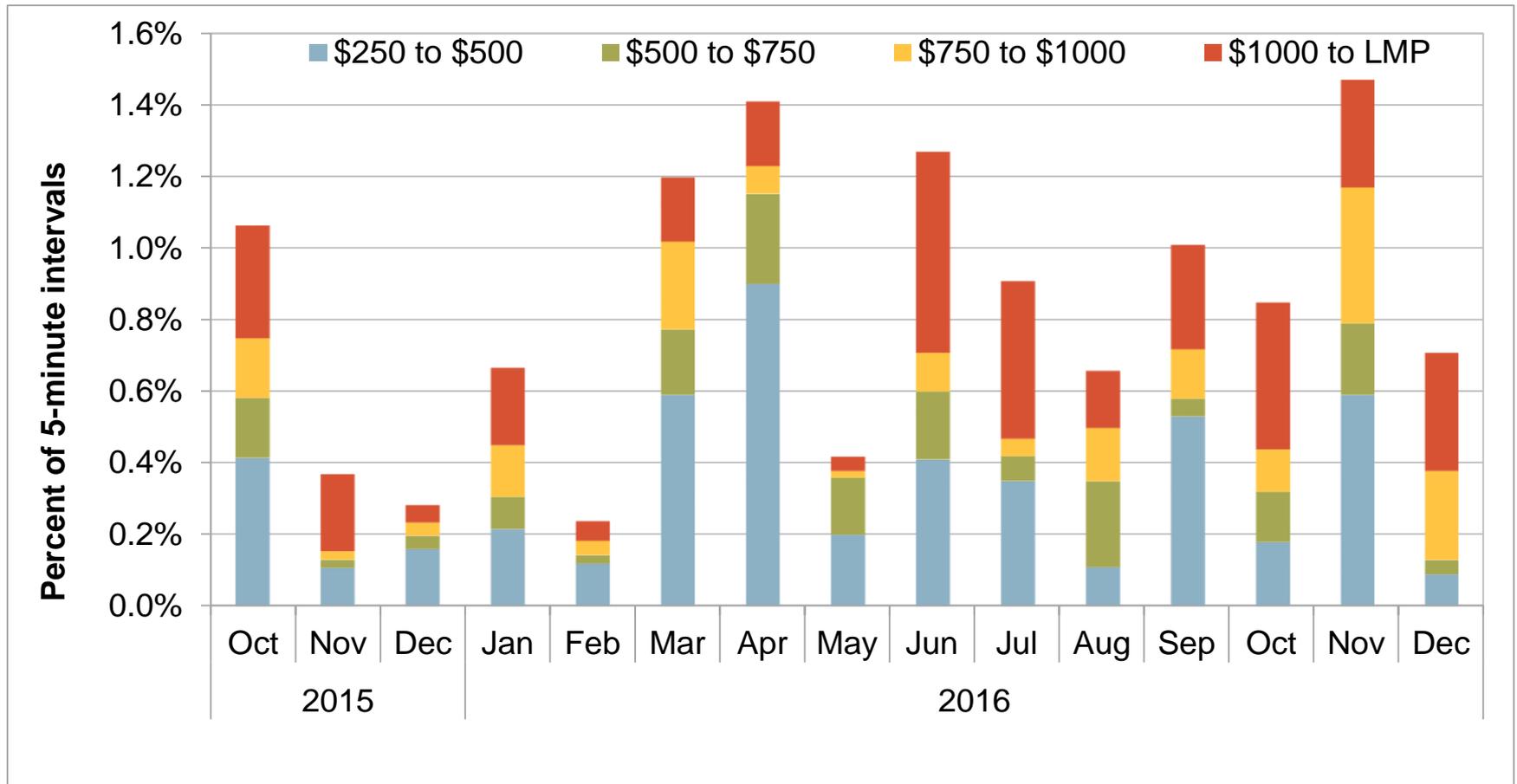
Discussion outline

- ISO market results
 - Market prices
 - Virtual bidding and CRR auction
- EIM market results
 - Market prices
 - Internal congestion and sufficiency test
 - Transfers
- Load adjustments
- Flexible ramping product
- Capacity procurement mechanism awards
- Regulation procurement changes

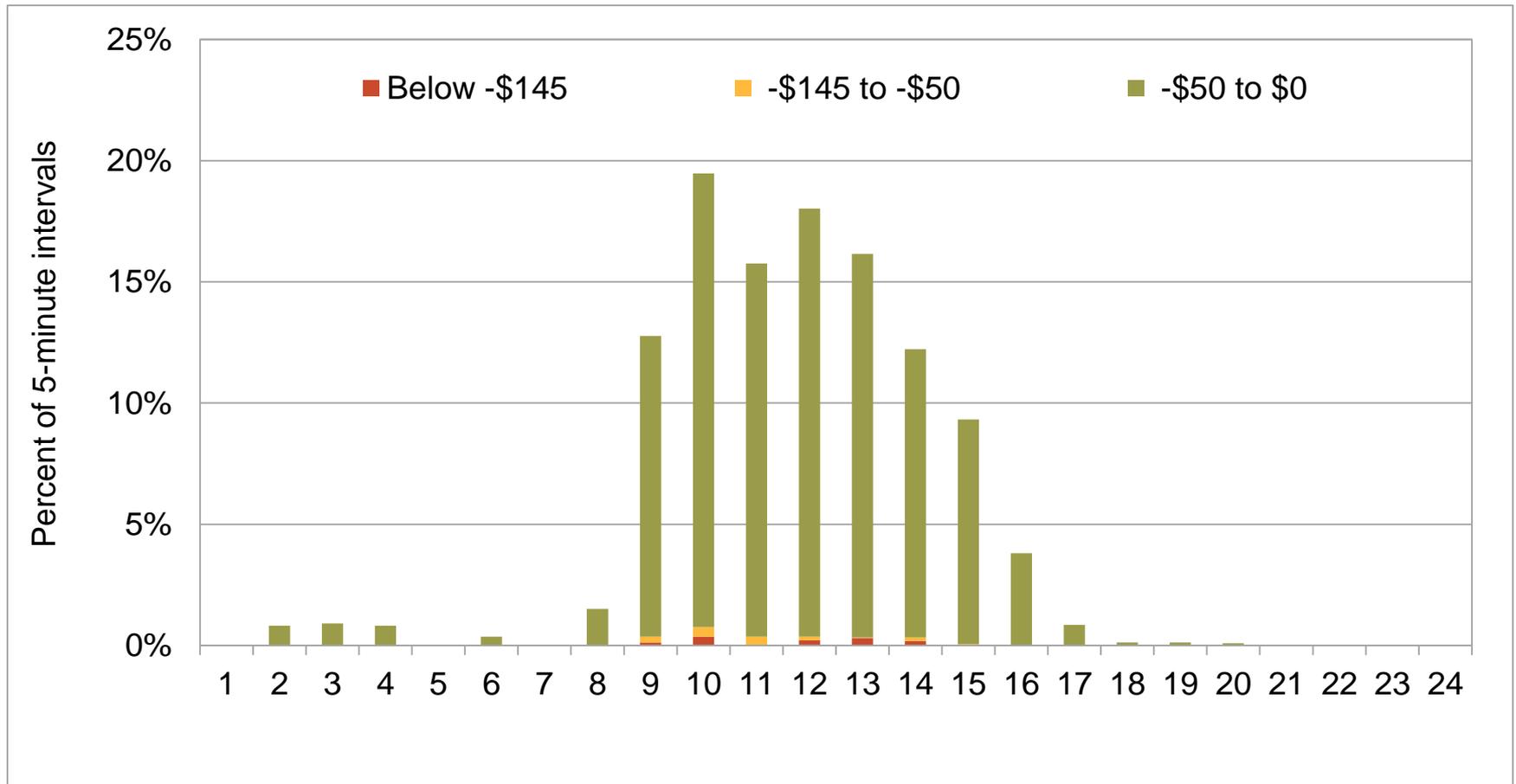
Hourly average 5-minute prices higher during ramp periods



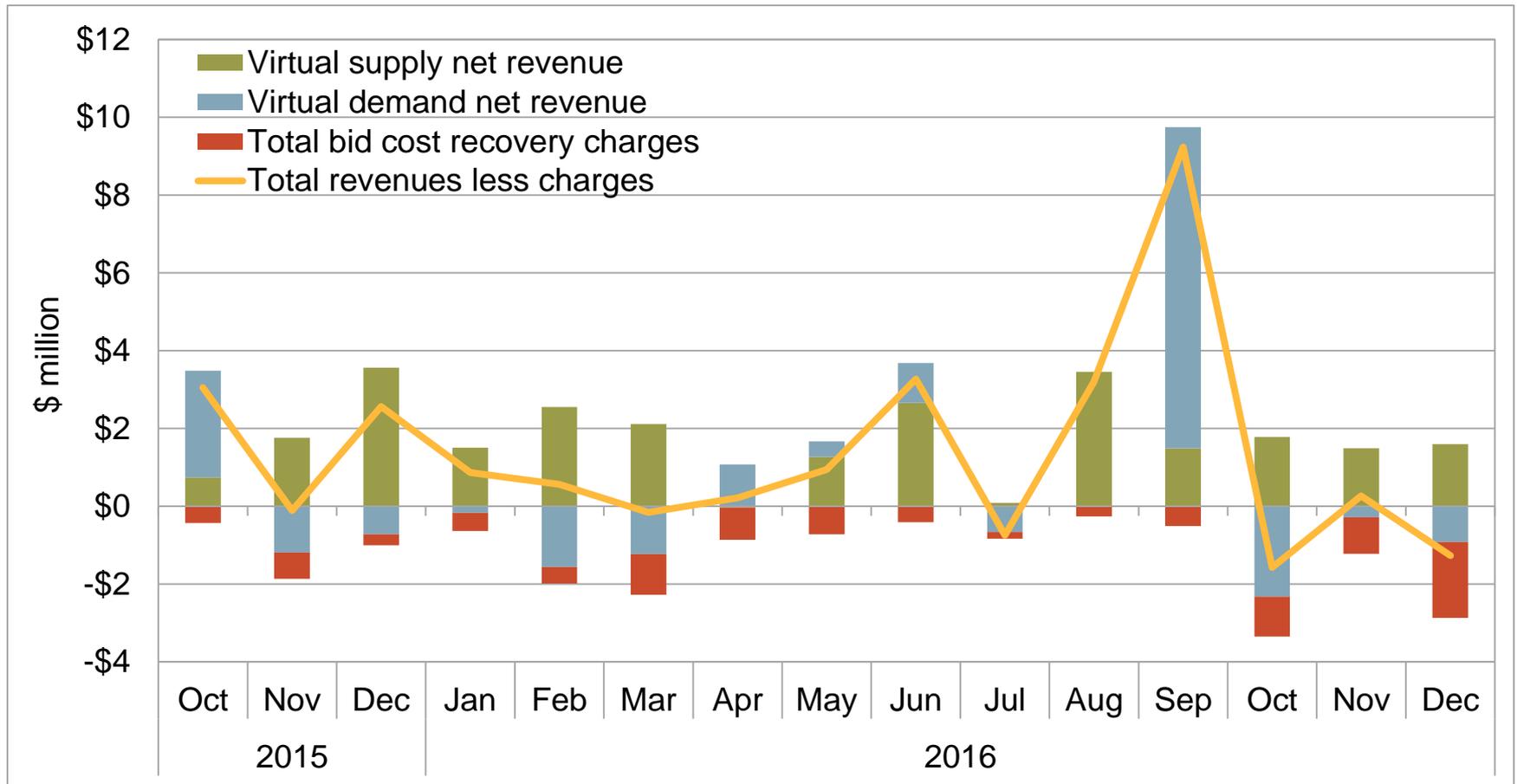
High prices increased in 5-minute market as renewable schedules differed in real time



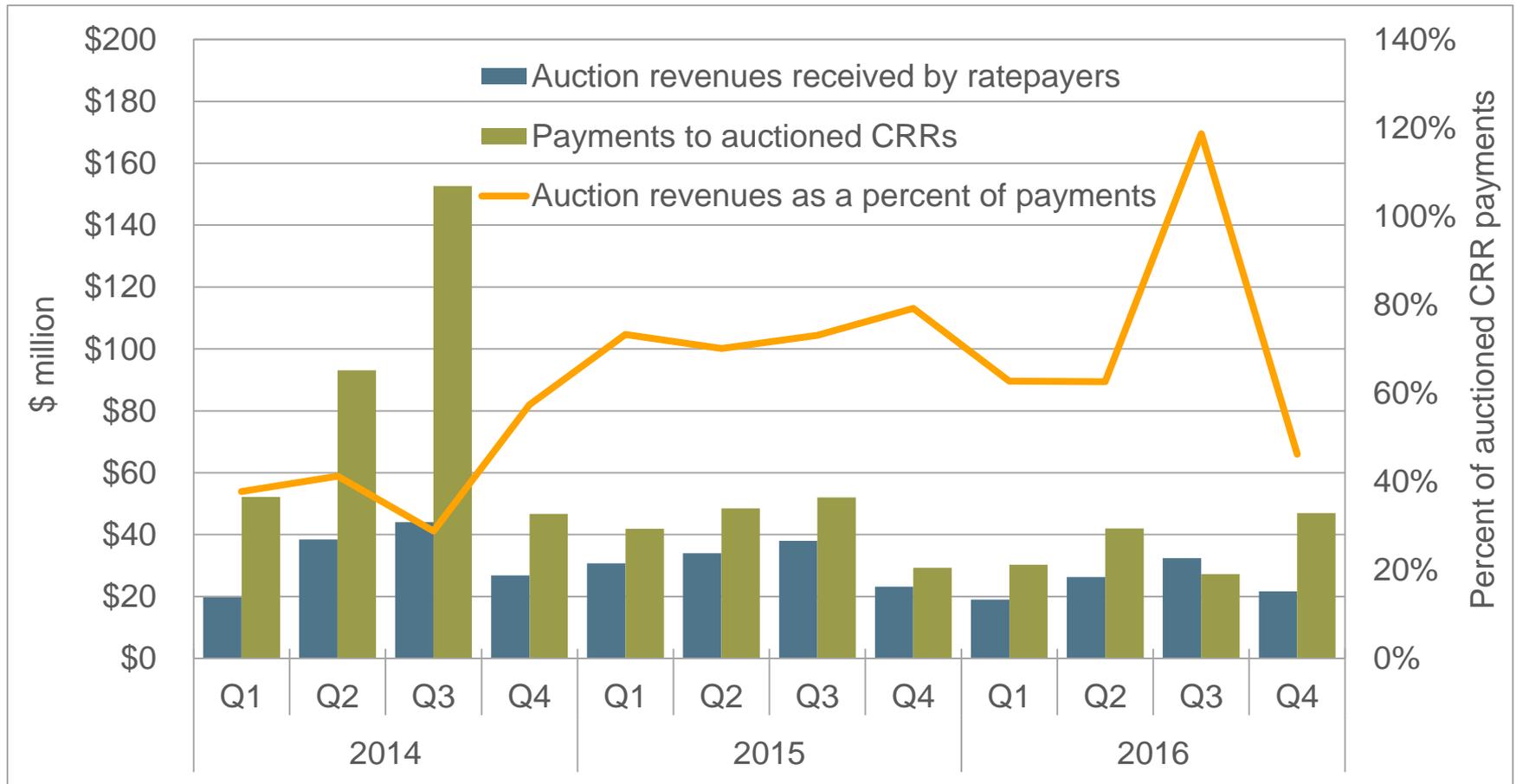
Negative price spikes were concentrated in solar hours



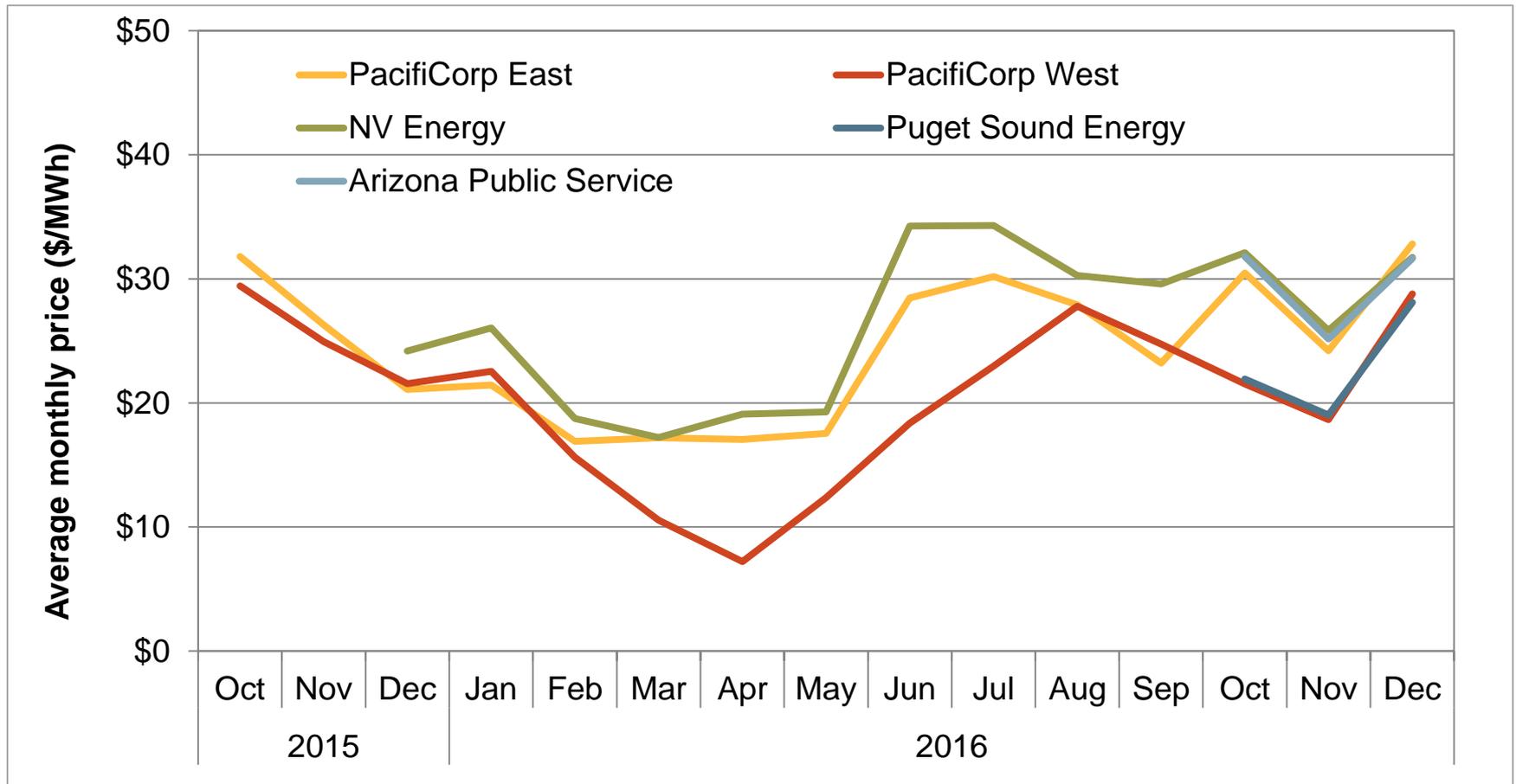
Virtual bidders made payments to the ISO when accounting for bid cost recovery in Q4



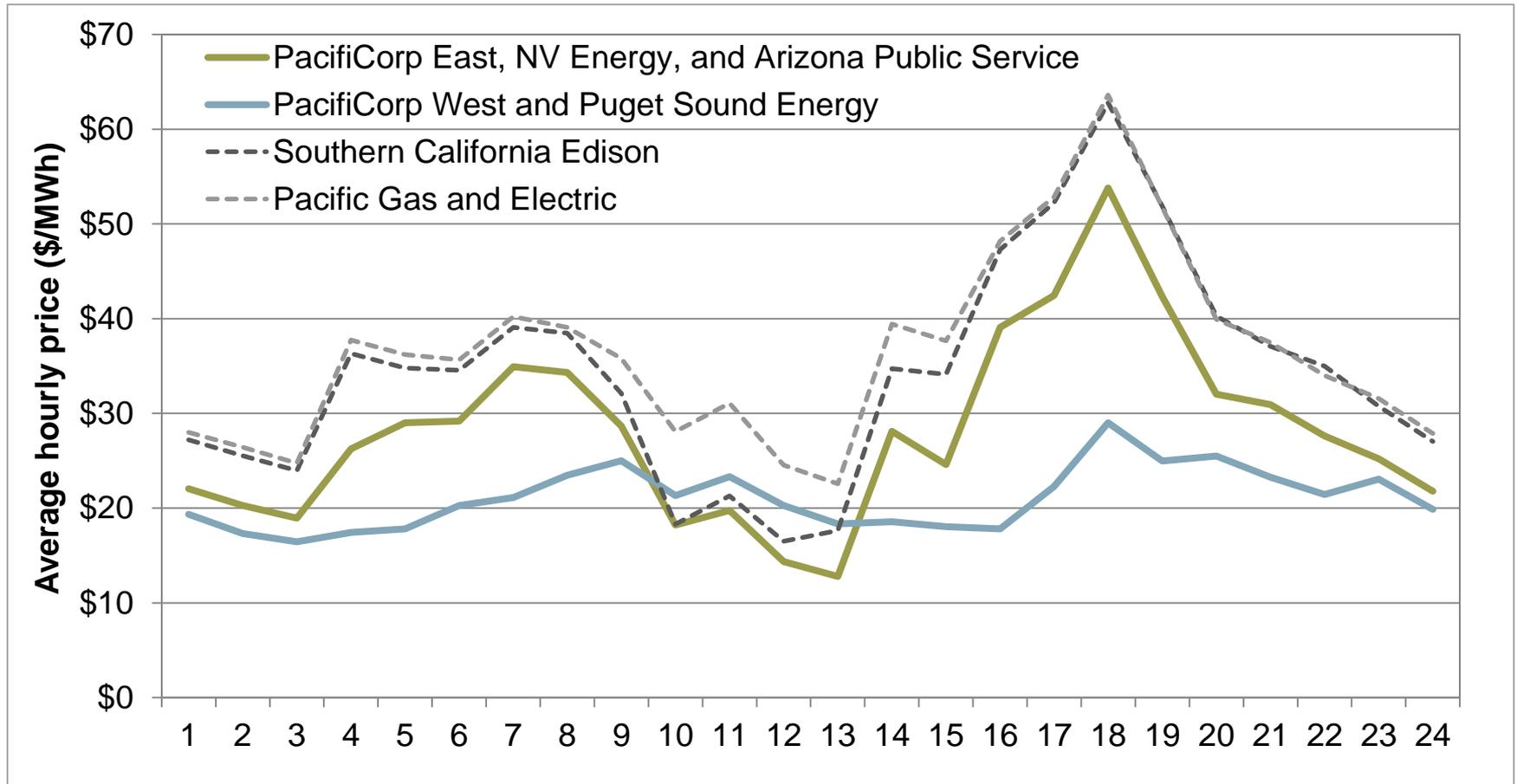
Auction revenues were less than 50 percent of the payments made to CRR holders in Q4



EIM prices were lower in Northwest areas because of congestion



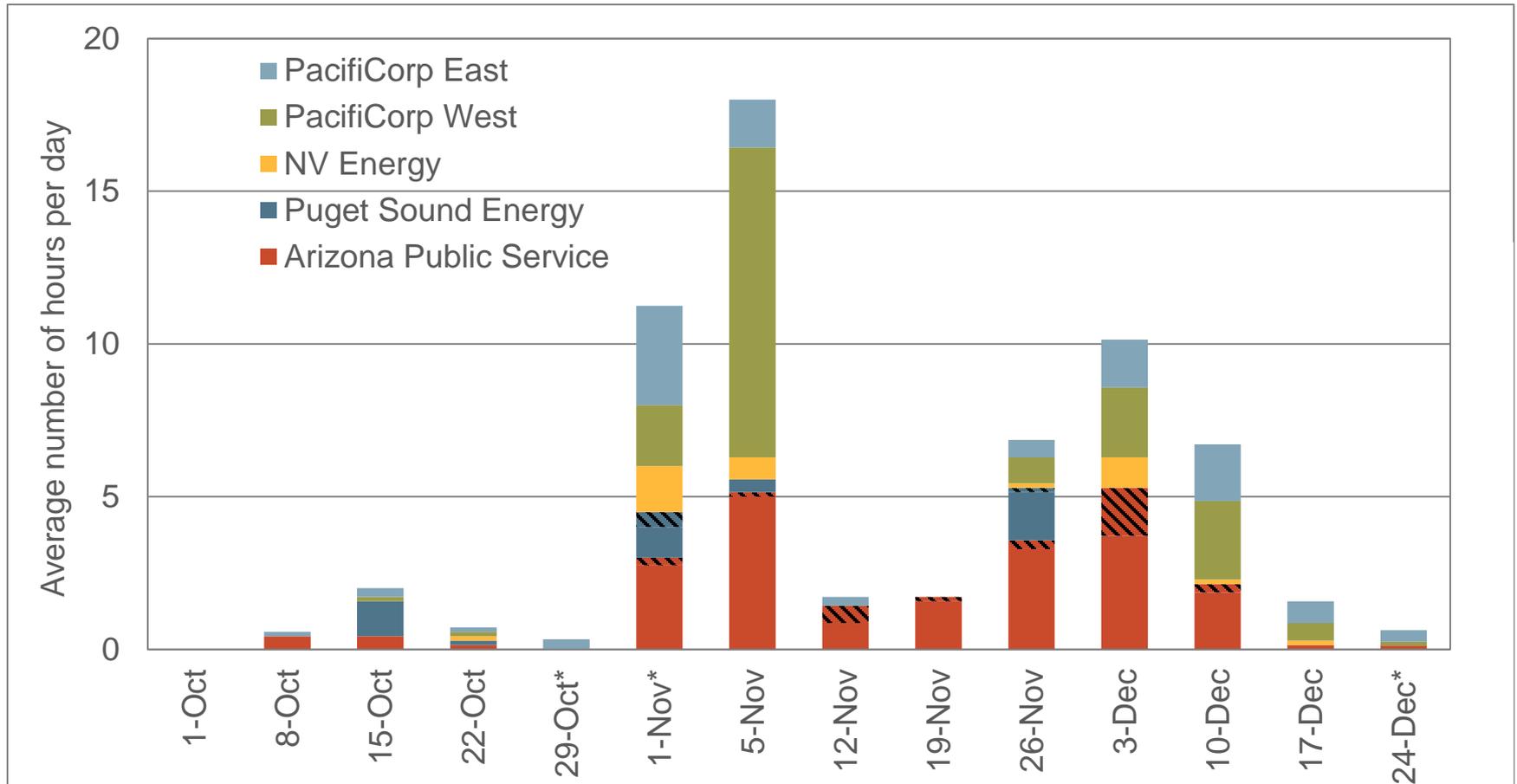
Hourly average ISO and EIM prices show price differences with Northwest areas



Intra-BAA area congestion increased in the fourth quarter in PacifiCorp East and NV Energy in both 15- and 5-minute markets

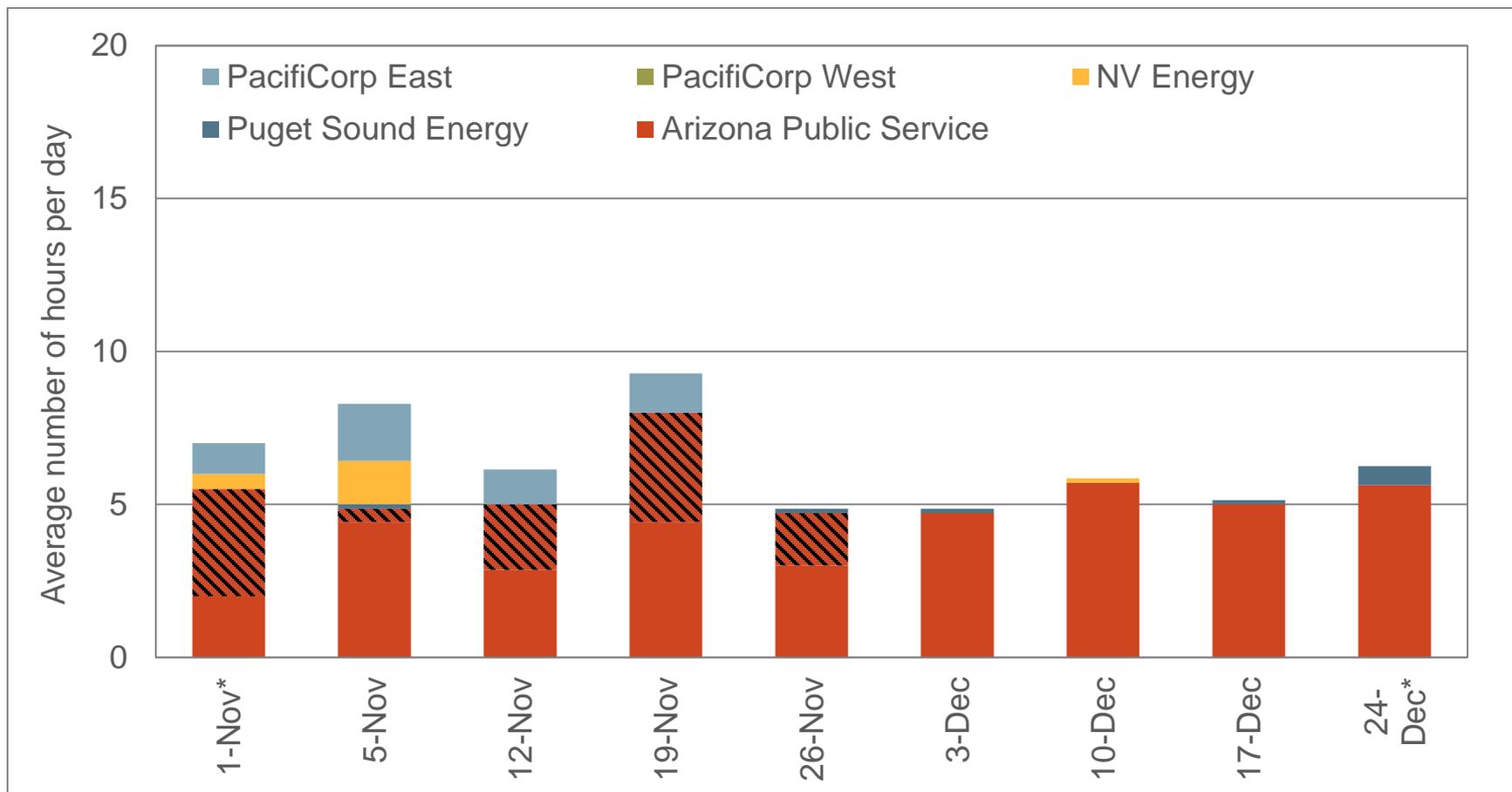
	2014		2015				2016			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
15-minute market (FMM)										
PacifiCorp East	0.1%	0.2%	0.2%	0.5%	2.6%	2.2%	0.2%	1.3%	14.9%	
PacifiCorp West	0.1%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.1%	0.1%	
NV Energy					0.0%	0.0%	0.1%	0.3%	3.2%	
Puget Sound Energy									0.0%	
Arizona Public Service									0.0%	
5-minute market (RTD)										
PacifiCorp East	0.0%	0.3%	0.2%	0.4%	2.3%	2.2%	0.2%	1.3%	15.2%	
PacifiCorp West	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	
NV Energy					0.0%	0.0%	0.2%	0.3%	3.2%	
Puget Sound Energy									0.0%	
Arizona Public Service									0.0%	

Upward failures of the flexible ramping sufficiency test increased at the end of the year



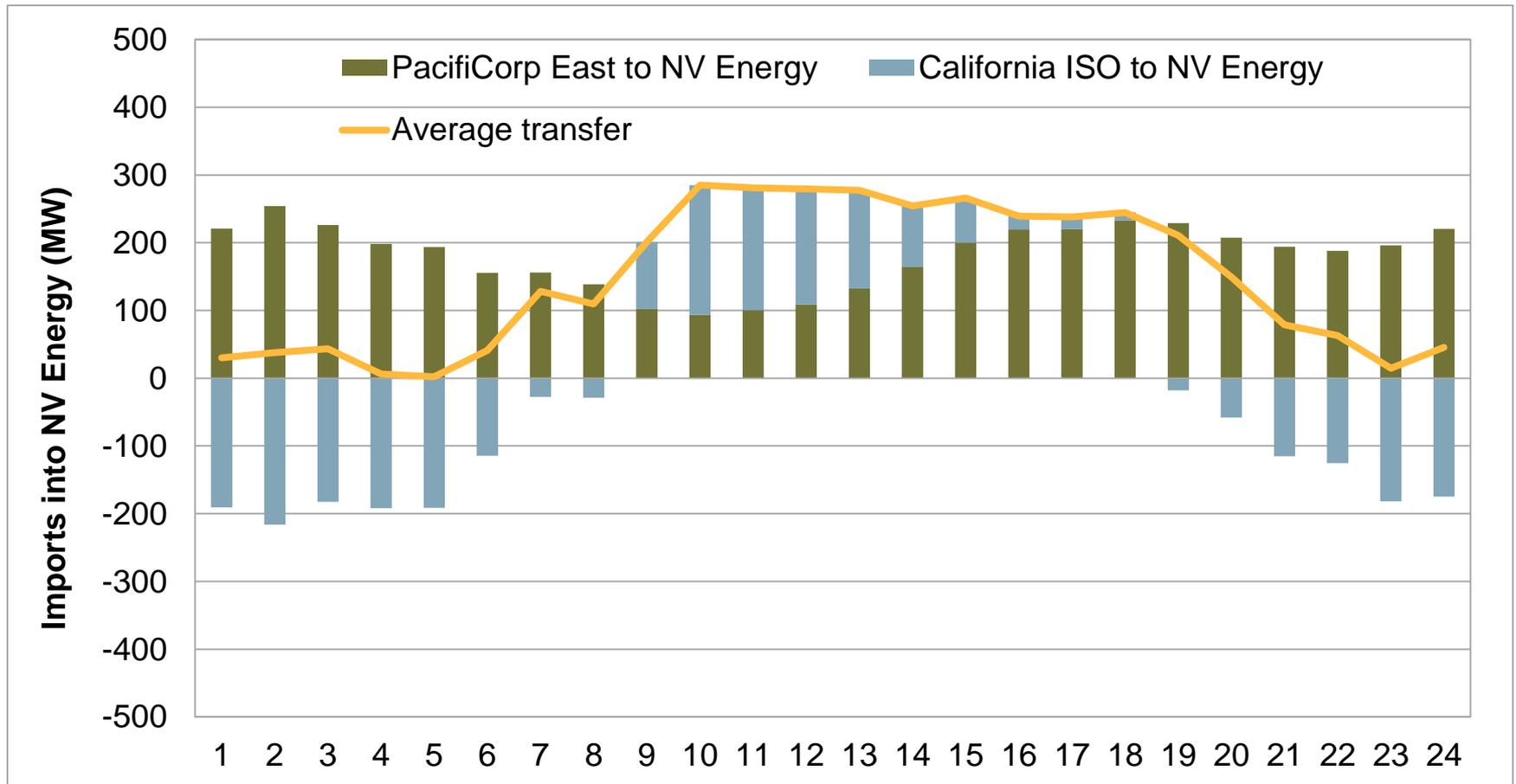
Note: shaded area represents incorrect sufficiency test failures

Arizona Public Service failed the downward sufficiency test frequently

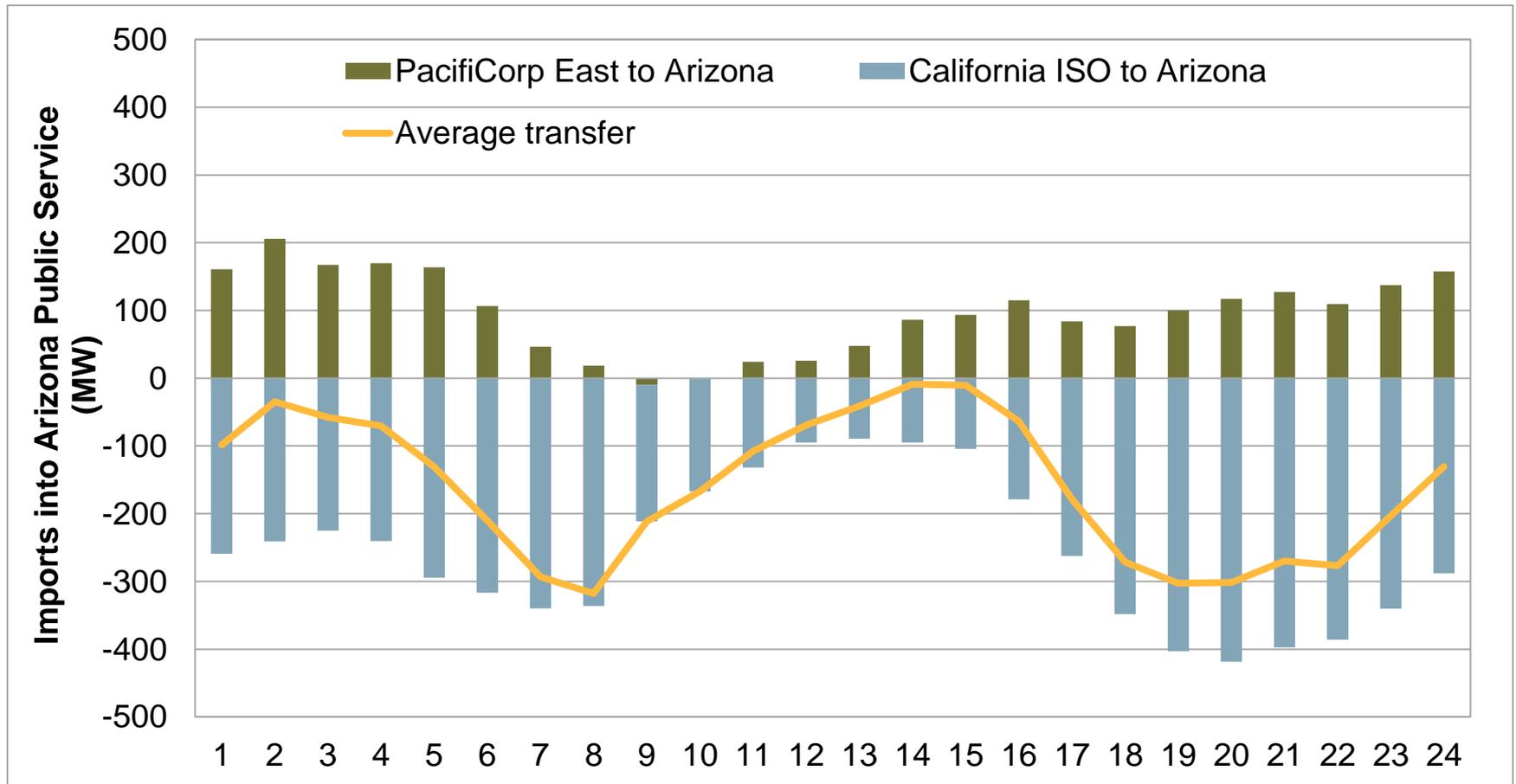


Note: shaded area represents incorrect sufficiency test failures

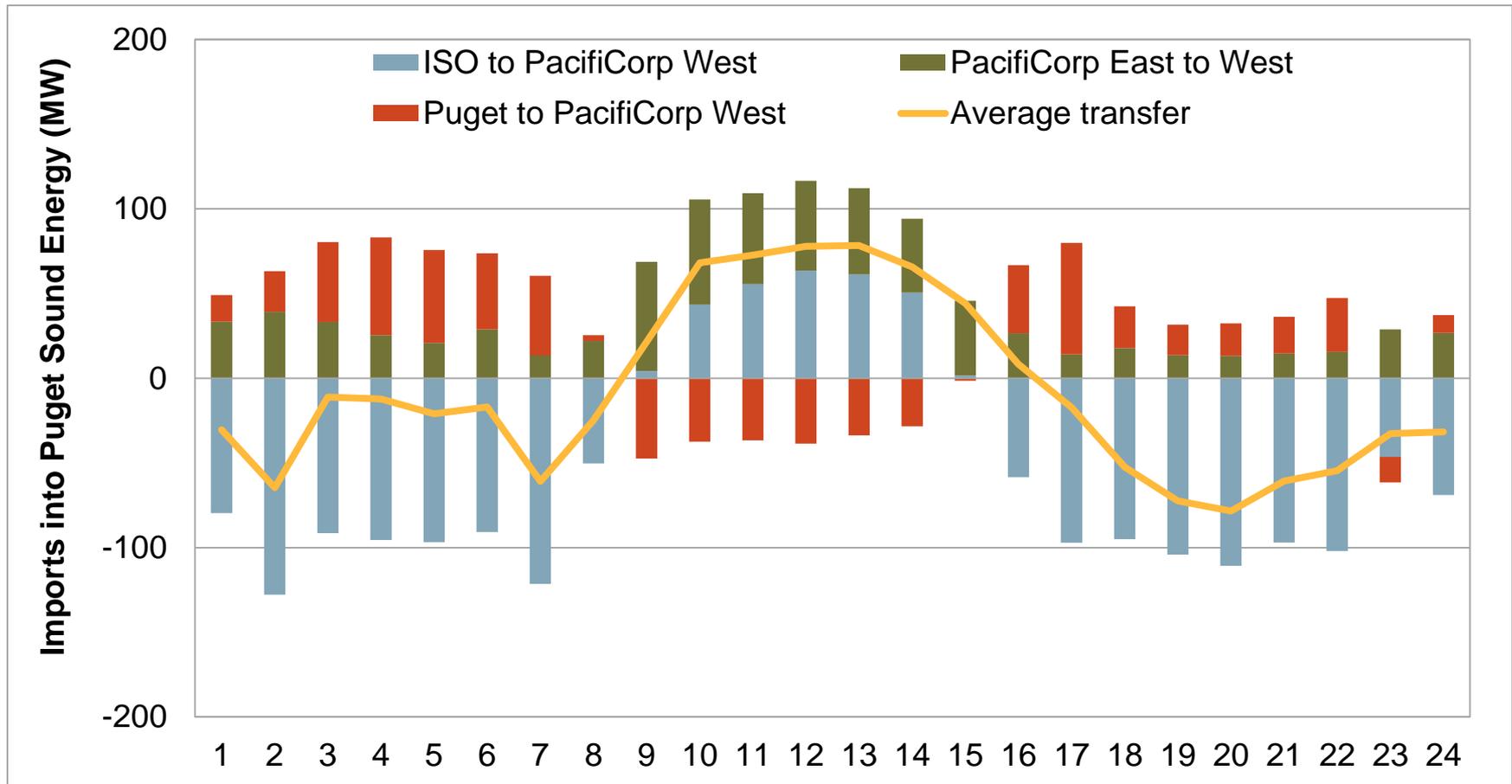
Transfers into NV Energy from PacifiCorp were imports and varied from ISO in Q4



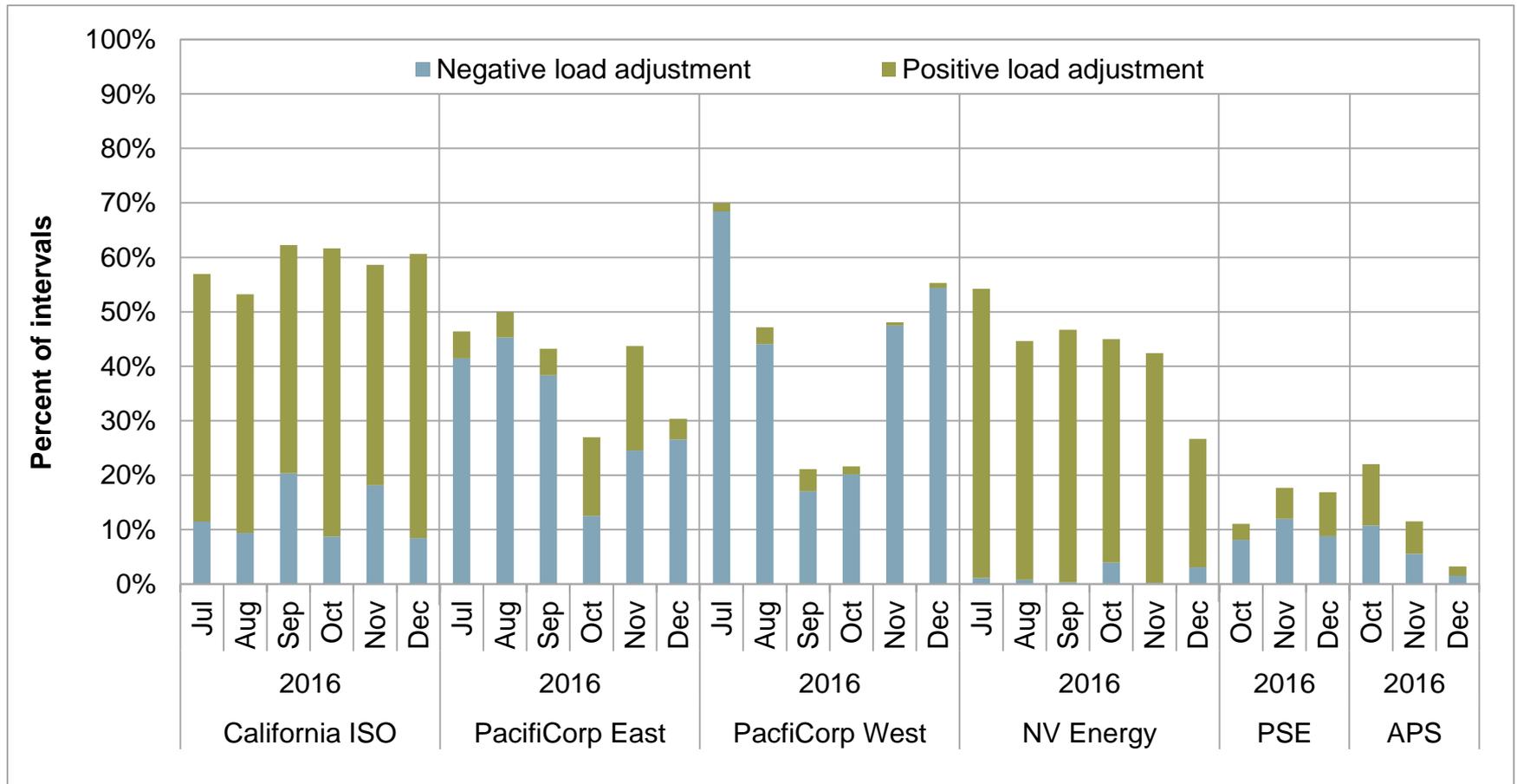
Transfers into APS from PacifiCorp were imports and were exports to ISO from APS



Transfers into PacifiCorp West were mirrors with ISO and Puget and imports from PACE



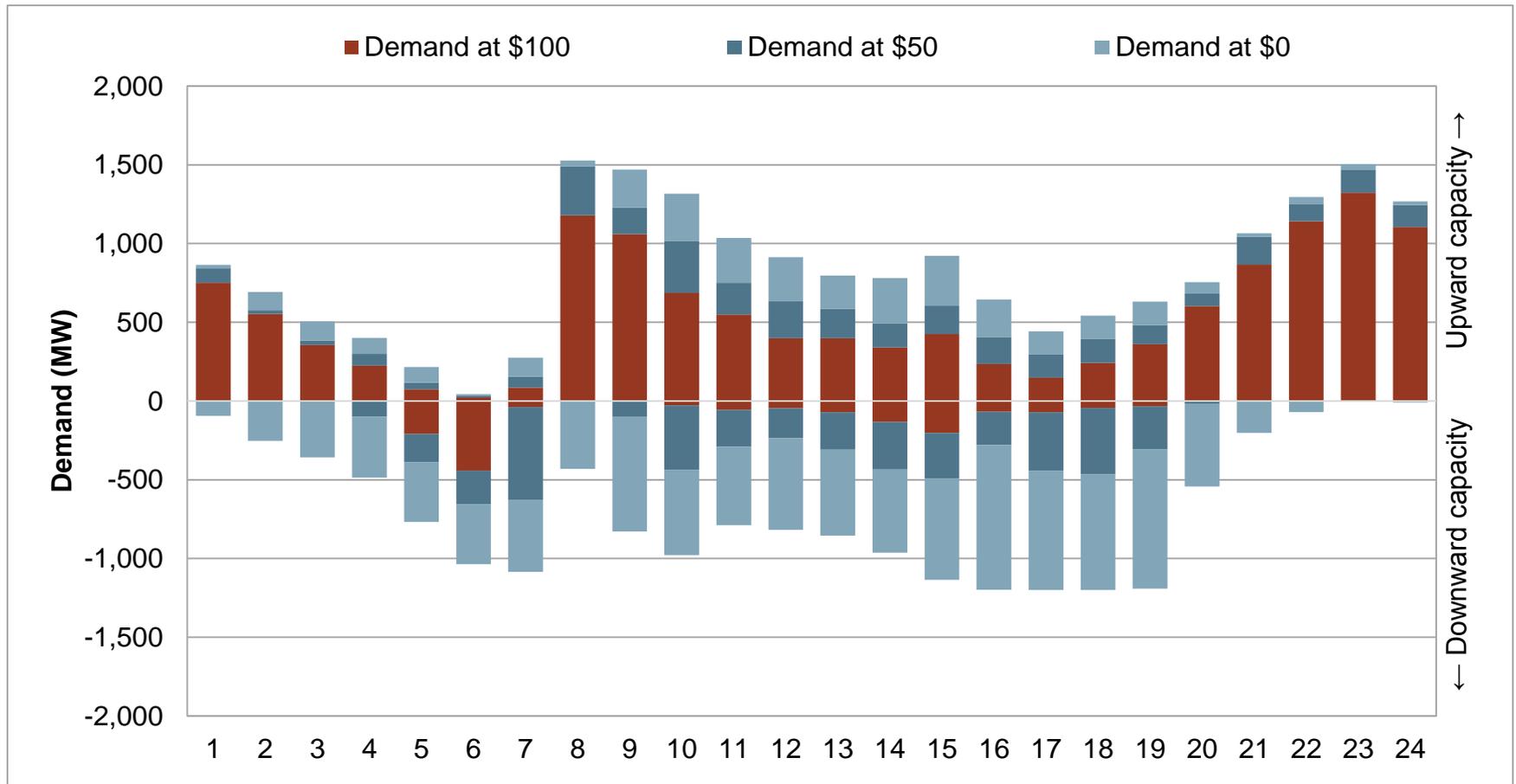
Load adjustments in 15-minute market were lowest in Puget and APS



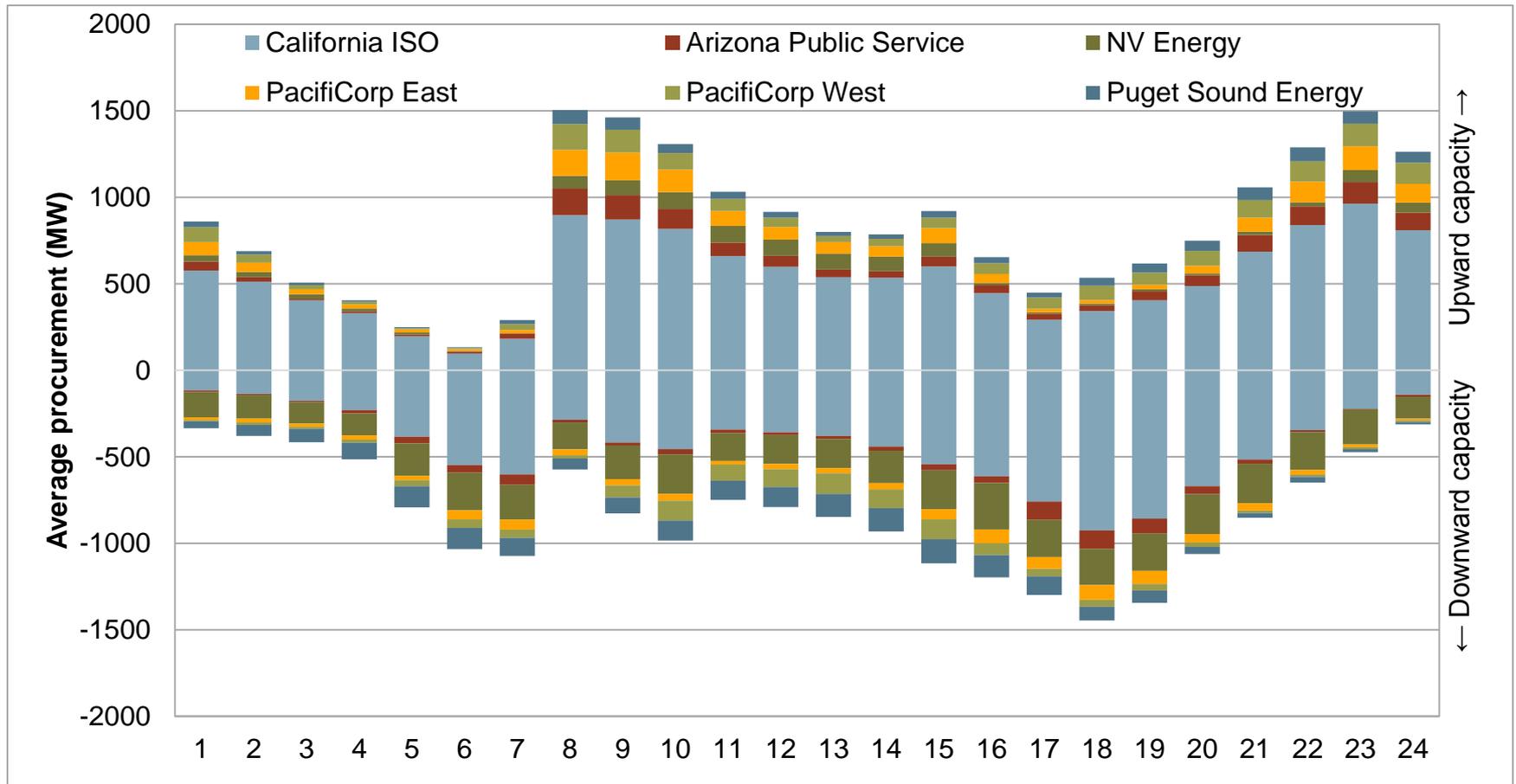
Load adjustments were of similar magnitudes across regions

	Positive load adjustments			Negative load adjustments			Average hourly bias MW
	Percent of intervals	Average MW	Percent of total load	Percent of intervals	Average MW	Percent of total load	
California ISO							
15-minute market	49%	529	2.1%	12%	-274	1.2%	226
5-minute market	54%	437	1.8%	25%	-279	1.2%	167
PacifiCorp East							
15-minute market	12%	114	2.4%	21%	-104	2.2%	-8
5-minute market	20%	107	2.2%	48%	-107	2.2%	-30
PacifiCorp West							
15-minute market	1%	50	1.9%	41%	-51	2.1%	-20
5-minute market	2%	54	2.3%	60%	-56	2.3%	-32
NV Energy							
15-minute market	36%	97	2.6%	2%	-195	5.3%	30
5-minute market	27%	69	1.8%	22%	-80	2.3%	1
Puget Sound Energy							
15-minute market	6%	77	2.3%	10%	-68	2.5%	-2
5-minute market	9%	68	2.1%	15%	-66	2.3%	-4
Arizona Public Service							
15-minute market	6%	105	3.0%	6%	-121	4.4%	-1
5-minute market	9%	107	3.1%	10%	-126	4.6%	-3

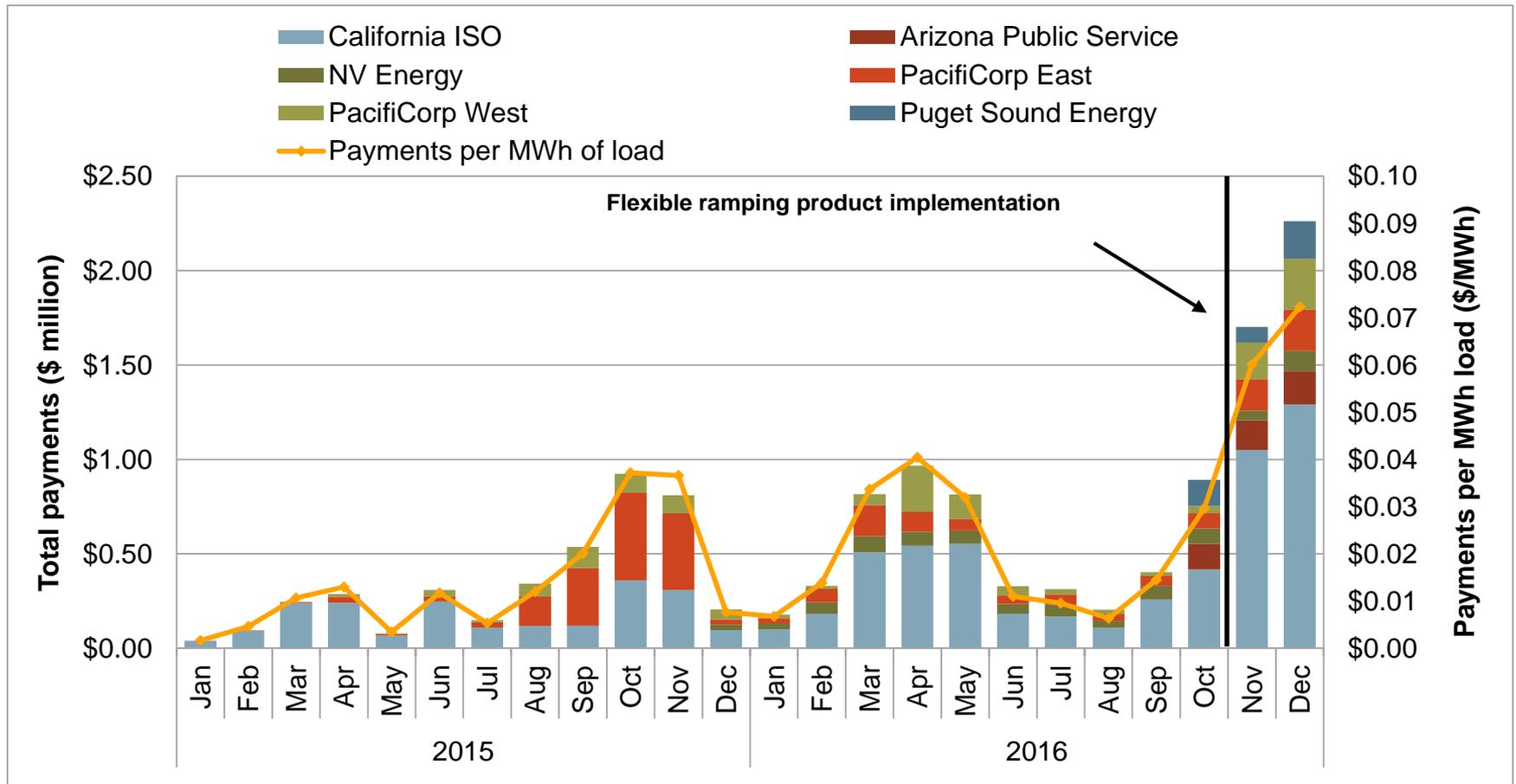
The flexible ramping product demand curves varied over the day and by product



Procurement of flexible ramping capacity was primarily in the ISO in the 15-minute market



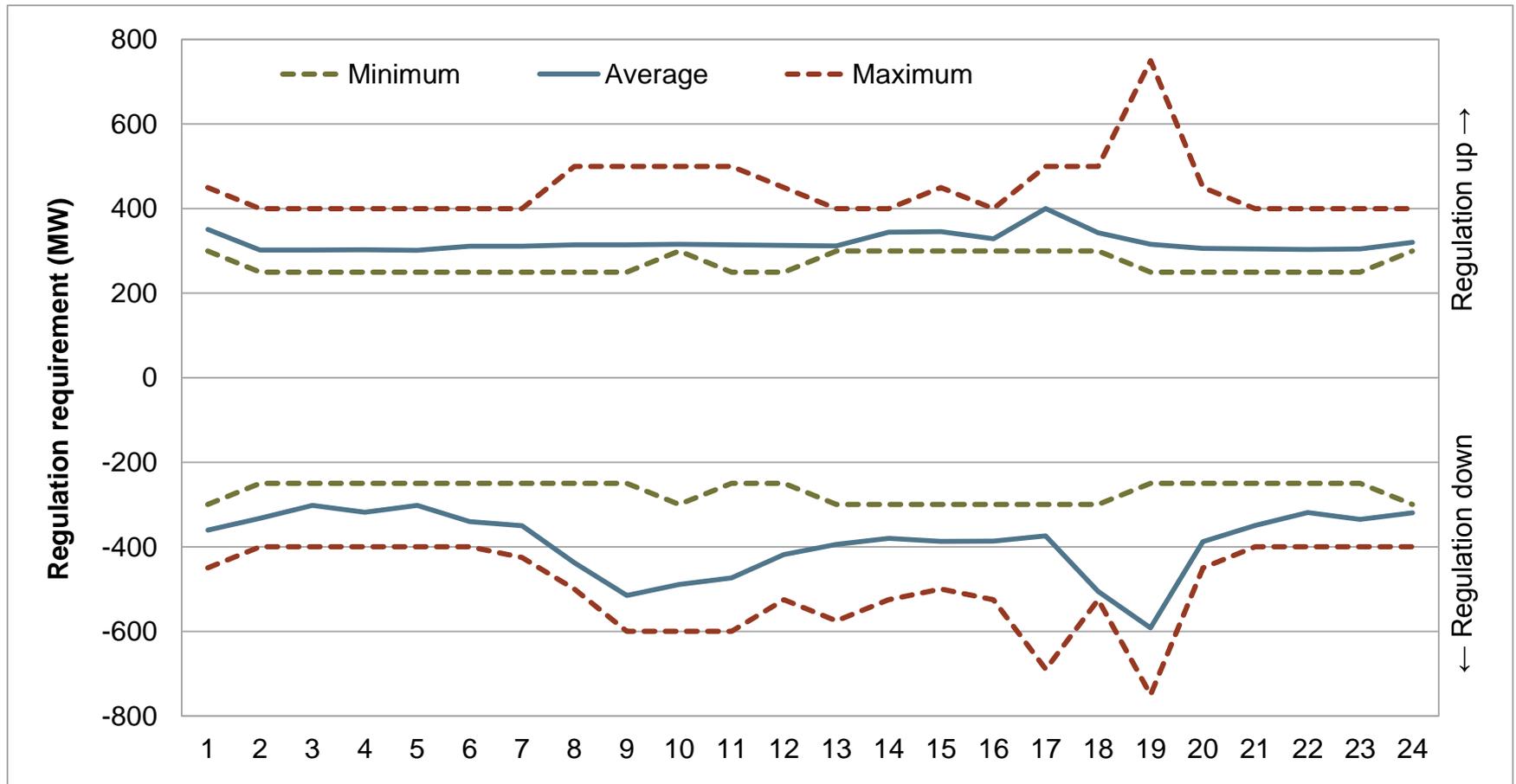
Flexible ramping costs increased with the implementation of product but remain small



The capacity procurement mechanism was used for different reasons in Q4

Resource	CPM designation (MW)	CPM designation dates	Price \$/kw-mon	Estimated cost \$ million	Local capacity area	Exceptional Dispatch CPM trigger
MANDALAY GEN STA. UNIT 2	20.01	11/8 - 1/6	\$6.31	\$0.25	SCE TAC	transmission outage in Santa Clara sub-area
MANDALAY GEN STA. UNIT 3	130.00	11/9 -12/9	\$6.31	\$0.82	System	Emergency event caused by a market disruption. Emergency event involved area control error and low system frequency.
Pio Pico Unit 1	102.67	11/9 -12/9	\$6.31	\$0.65	System	
Pio Pico Unit 2	102.67	11/9 -12/9	\$6.31	\$0.65	System	
Pio Pico Unit 3	102.67	11/9 -12/9	\$6.31	\$0.65	System	
Sentinel Unit 1	1.00	11/9 -12/9	\$6.31	\$0.01	System	
Sentinel Unit 2	1.00	11/9 -12/9	\$6.31	\$0.01	System	
Sentinel Unit 3	1.00	11/9 -12/9	\$6.31	\$0.01	System	
Sentinel Unit 6	1.00	11/9 -12/9	\$6.31	\$0.01	System	
DELTA ENERGY CENTER AGGREGATE	114.00	12/14 - 2/11	\$6.31	\$1.44	PG&E TAC	Transmission outage
Los Medanos Energy Center AGGREGATE	89.79	12/14 - 2/11	\$6.31	\$1.13	PG&E TAC	
MOSS LANDING POWER BLOCK 1	141.04	12/18 - 1/17	\$6.31	\$0.89	System	Cold temperatures, potential gas supply issues and potential loss of imports
Mountainview Gen Sta. Unit 3	36.37	12/19 - 2/16	\$1.90	\$0.14	SCE TAC	Outages in the West of Devers sub-area

The new regulation procurement approach can vary procurement by hour and month



The costs of procuring regulation increased only slightly compared to earlier in the year

