California ISO

Market Performance and Planning Forum

March 16, 2023

Reminders:

- This quarterly forum that engages stakeholders in review of market performance issues and in high level dialogue on release planning, implementation and new market enhancements. This is intended to foster open dialogue and sharing of ideas and perspectives
- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.

Instructions for raising your hand to ask a question

In person:

Please raise your hand for a mic and state your name and affiliation before making a comment.

Virtual Participation:

- Select the raise hand icon  located on the top right above the chat window. Use #2 when dialed into the meeting.
  - Please remember to state your name and affiliation before making your comment.
- If you need technical assistance during the meeting, please send a chat to the event producer.

Objective: Enable dialogue on implementation planning and market performance issues

- Review key market performance topics
- Share updates to 2023 release plans, resulting from stakeholders inputs
- Focus on implementation planning
  - Clarify timelines
  - Discuss external impacts
  - Policy discussions should occur in the initiative stakeholder process

Market Performance and Planning Forum

Agenda – March 16, 2023

1 p.m. – 4 p.m.

Time:	Topic:	Presenter:
1:00 – 1:05	Introduction, Agenda	Brenda Corona
1:05 – 3:00	Market Performance Update	Market Analysis and Forecasting
3:00 – 3:30	Policy Update	Gillian Biedler
3:30 – 4:00	Release Update	Trang Vo

Objective: Enable dialogue on implementation planning and market performance issues

- Review key market performance topics
- Share updates to 2023 release plans, resulting from stakeholders inputs
- Provide information on specific initiatives
  - –to support Market Participants in budget and resource planning
- Focus on implementation planning
  - – Clarify timelines
  - – Discuss external impacts
  - – Policy discussions should occur in the initiative stakeholder process

Market Update

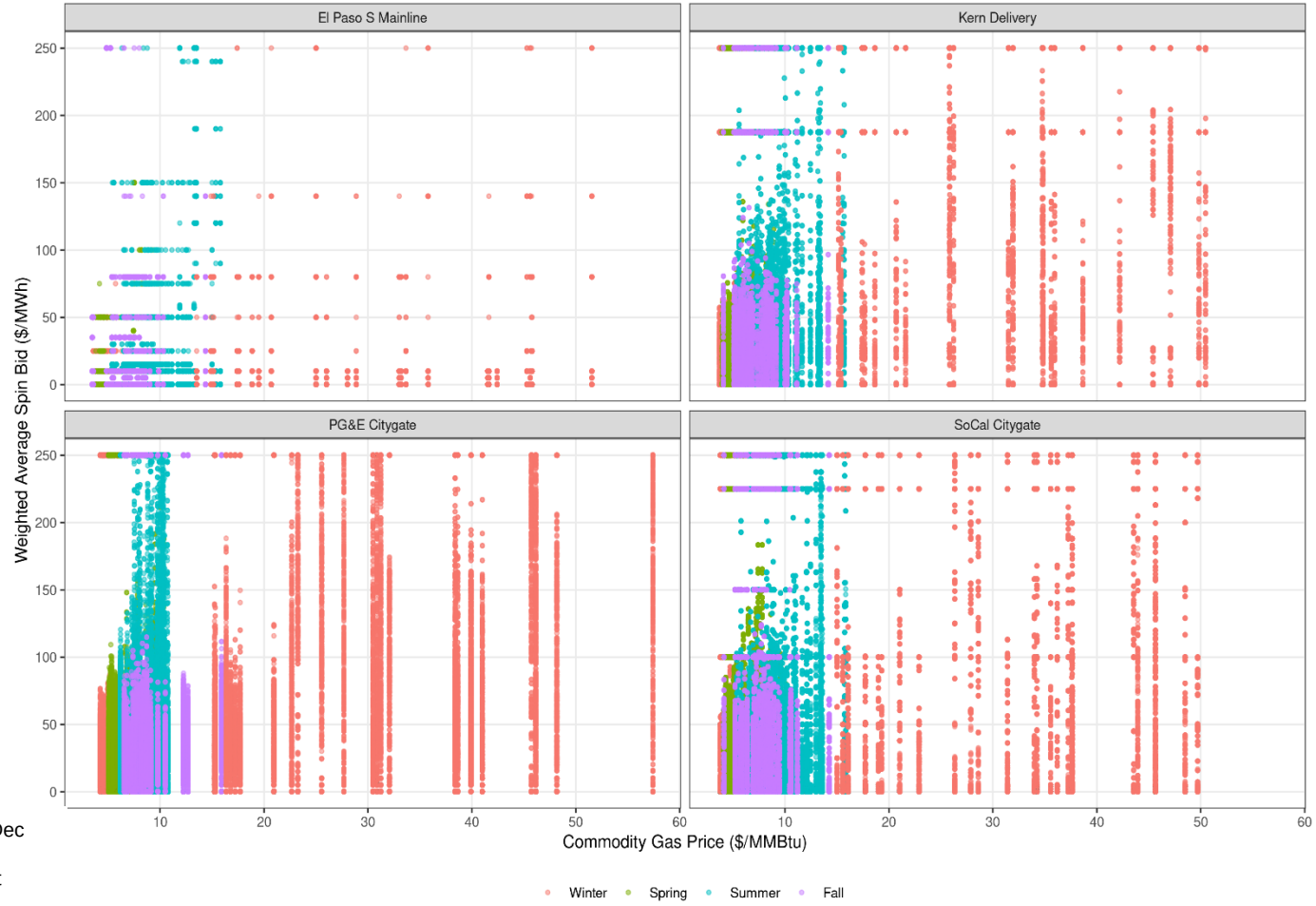
Market Analysis and Forecasting Department

Correlation analysis for spinning reserve bids

Spin Bid Correlation Analysis: Overview

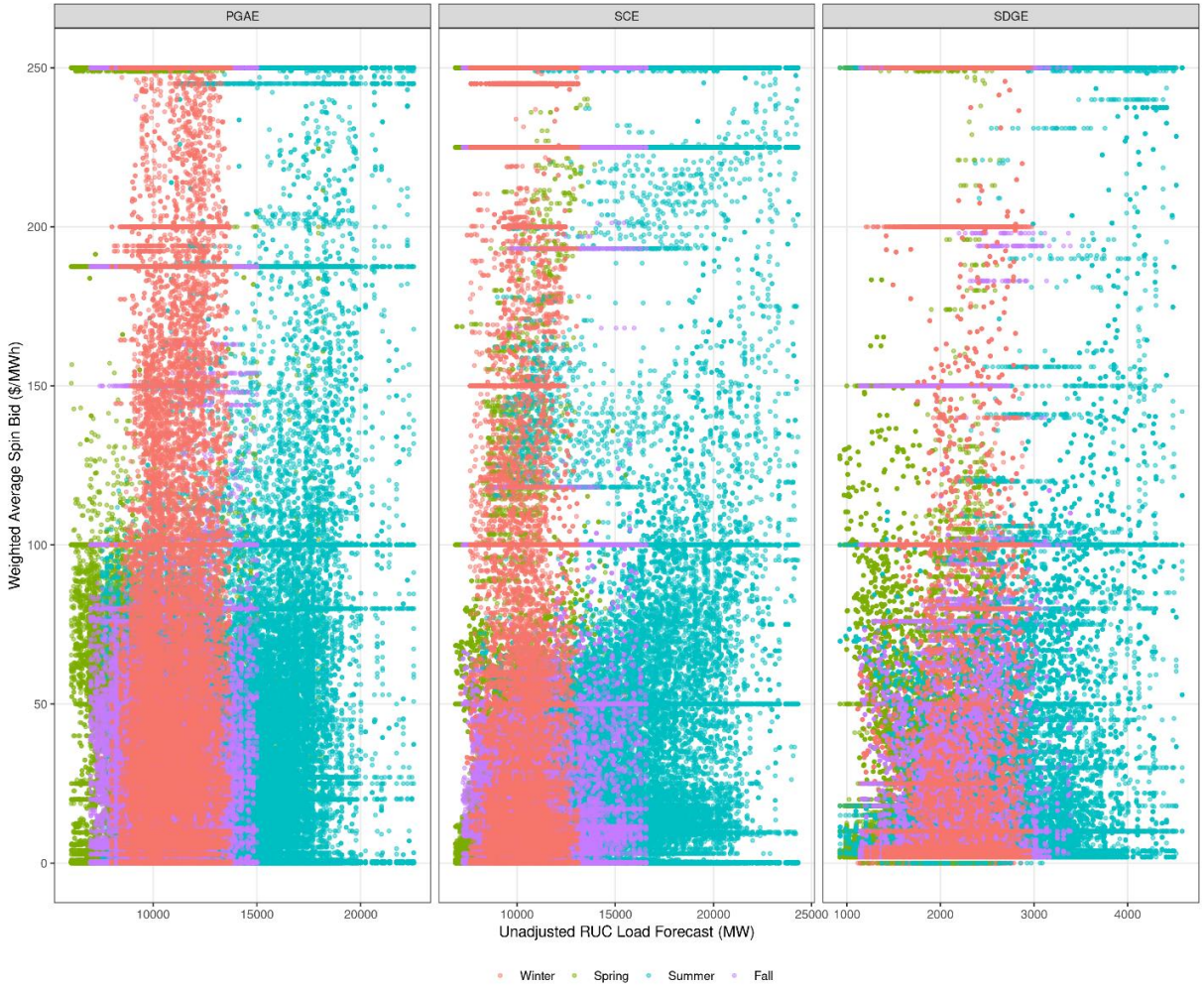
- Explore whether any Spin bids are correlated to either gas prices used for energy bids or demand levels. This was a topic discussed previously in the Day-Ahead market Enhancements
- Day-ahead spin bids were compared against the following datasets to analyze potential correlation:
  - Next-day gas prices (gas resources only)
  - Unadjusted RUC load forecast (all resources, mapped by UDC)
- Study timeframe: January – December 2022
- Analysis excluded self-scheduled spin bids

Spin bids vs. natural gas prices show weak linear relationships across seasons



- Winter: Jan – Feb, Dec
- Spring: Mar – May
- Summer: Jun – Sept
- Fall: Oct - Nov

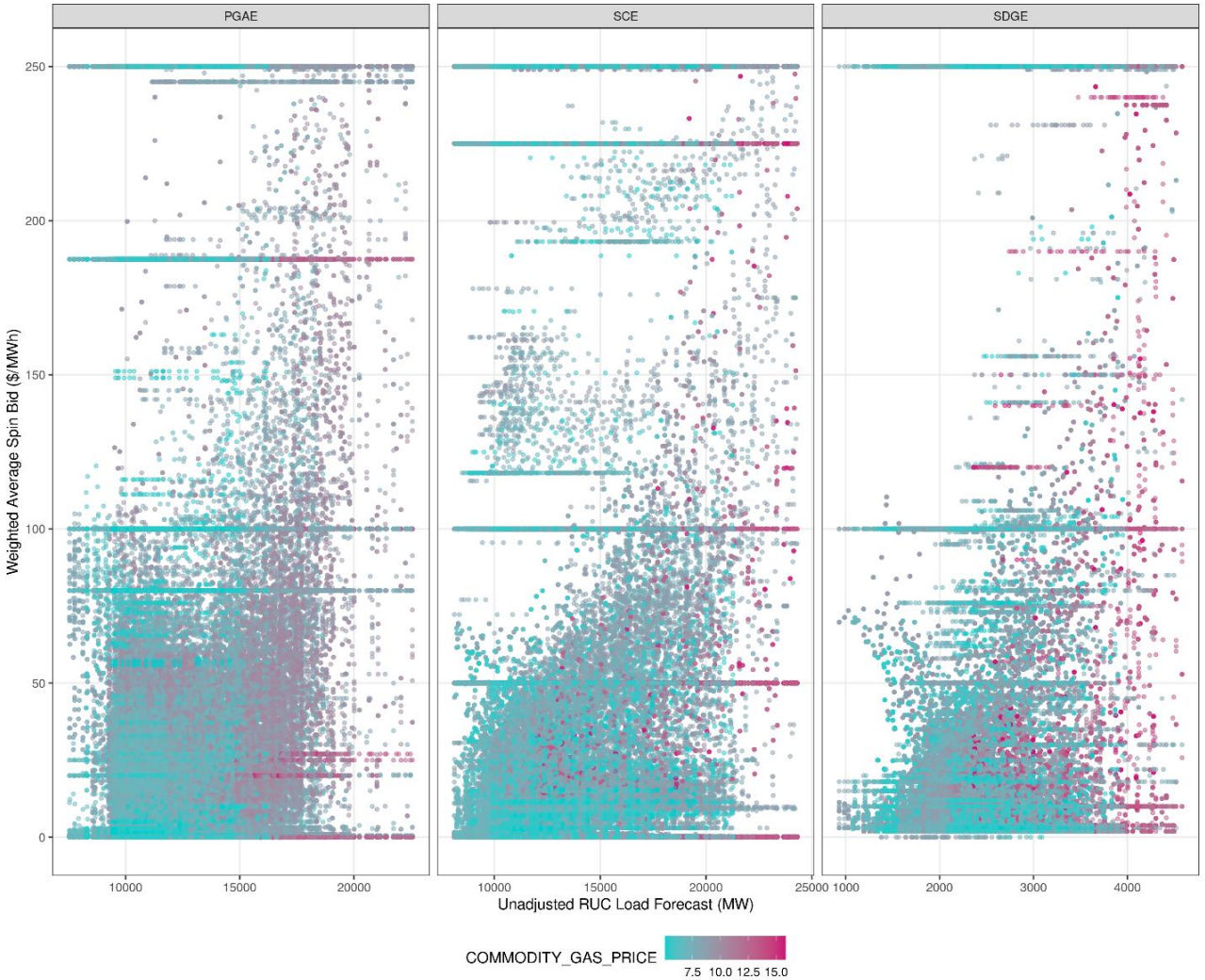
Spin bids vs. load forecasts also show weak linear relationships across seasons with minor exceptions



- Winter: Jan – Feb, Dec
- Spring: Mar – May
- Summer: Jun – Sept
- Fall: Oct - Nov

Spin bids vs. load forecasts with gas prices overlaid show the potential for a more complex relationship

summer 2022



Correlation coefficients can indicate the strength of a relationship between two datasets

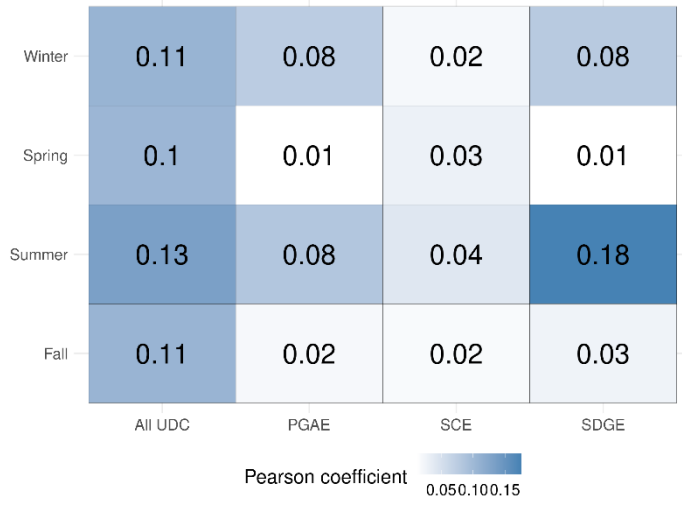
- Pearson coefficient, *r*
  - Measures linear relationship between two datasets (ratio between covariance of two variables and the product of their standard deviation)
  - Best for normally distributed data
  - 1.0 indicates a perfect correlation, negative values indicate anti-correlation

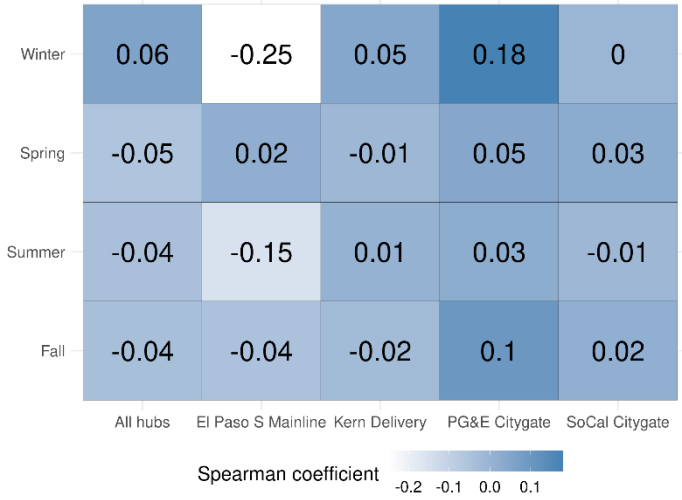
- Spearman coefficient, r_s
  - Measures monotonic relationship between two datasets (Pearson correlation between rank values of two variables)
  - Can be used on data that is not normally distributed
  - 1.0 indicates a perfect correlation, negative values indicate anti-correlation

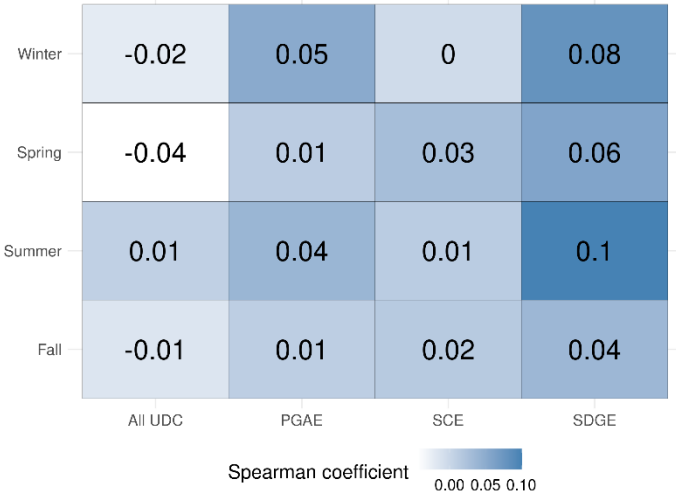
Correlation metrics show a weak relationship across seasons and features

Spin bids vs. gas prices

Spin bids vs. load forecasts







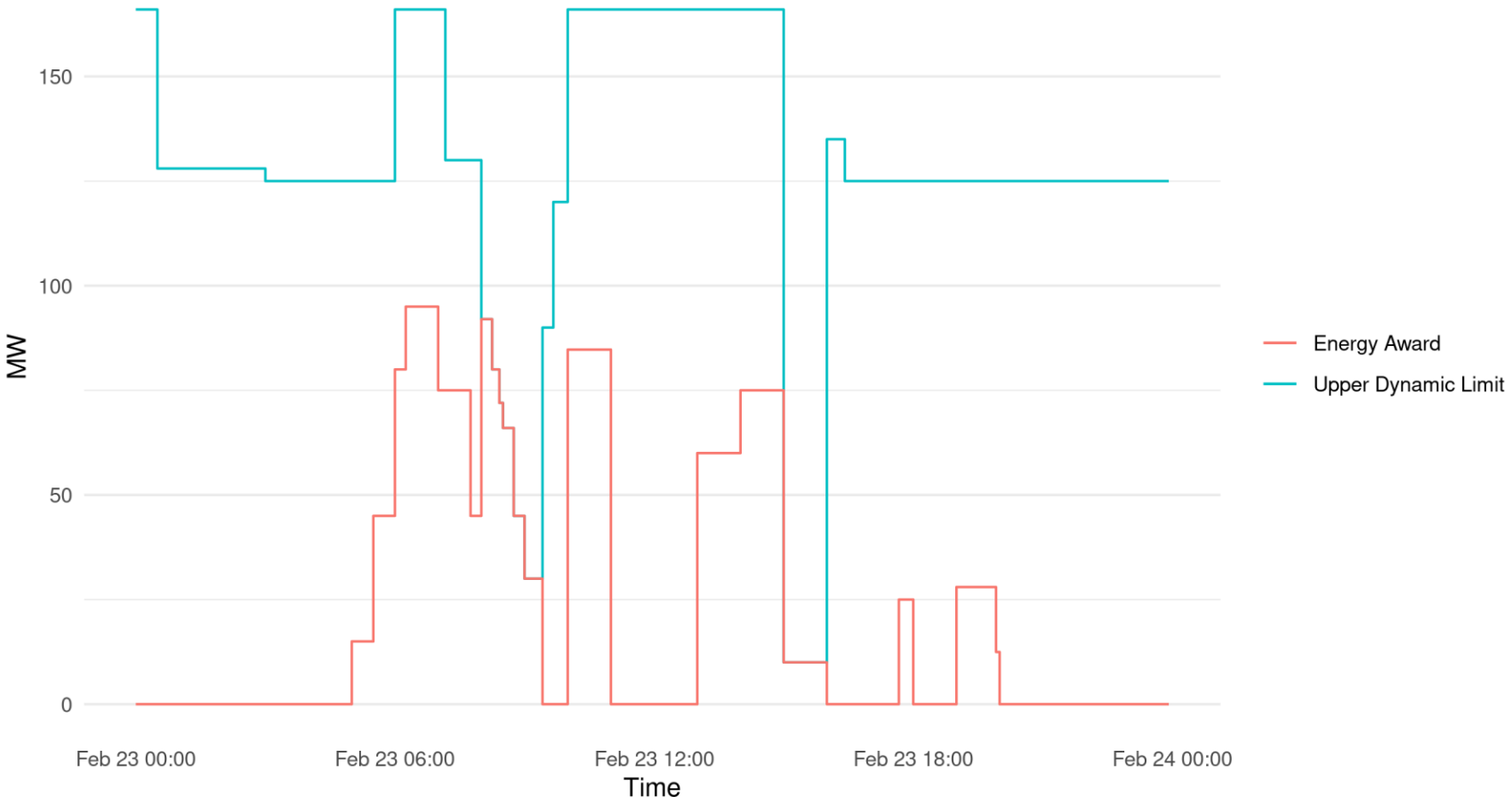
Hybrid Phase 2B:

Update on project implementation

Hybrid Resources Initiative

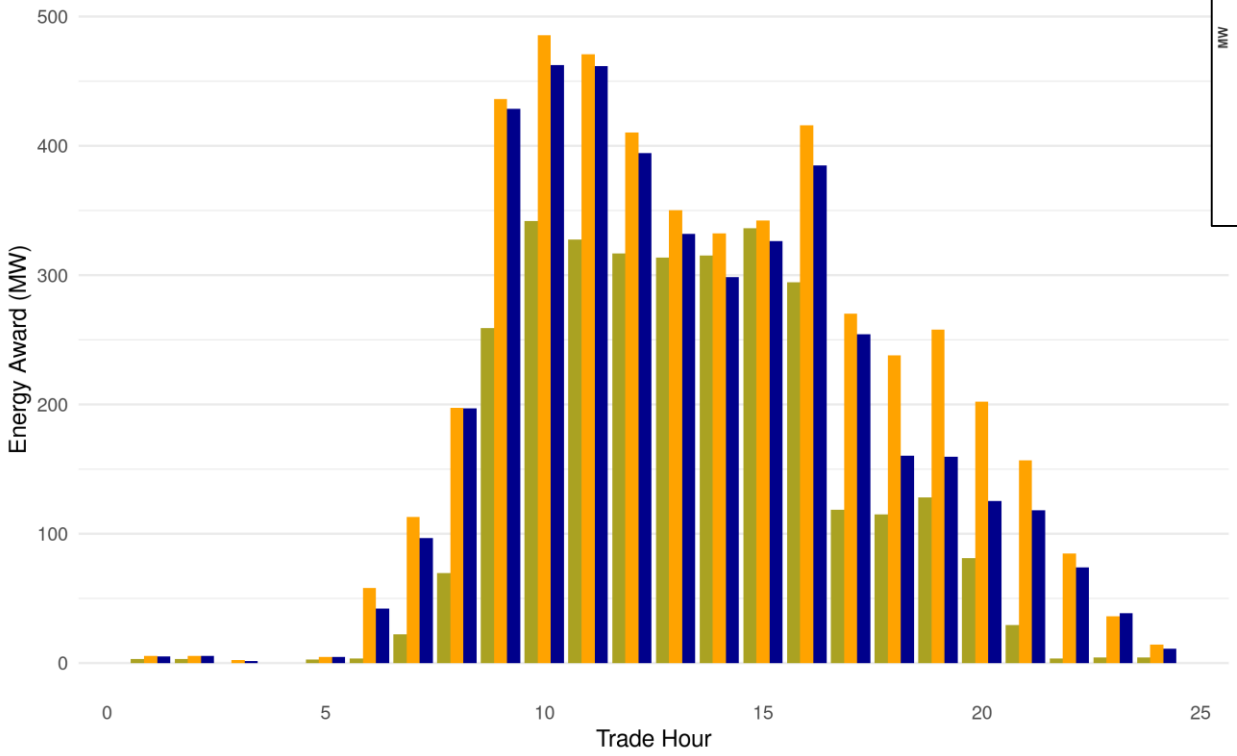
- Phase 1: Created co-located model
- Phase 2: Created hybrid resource model
  - Phase 2-A (Dec 15, 2021): Implemented ancillary services and high sustainable limit functionality
  - Phase 2-B (Feb 1, 2023):
    - Created hybrid dynamic limits
    - Implemented sub-ACC constraints
  - Phase 2-C (Summer 2023):
    - RIMS and Tie-gen enhancements
    - Not yet implemented

Hybrid dynamic limits reflect hybrid resources' operational capabilities on a 5-minute basis

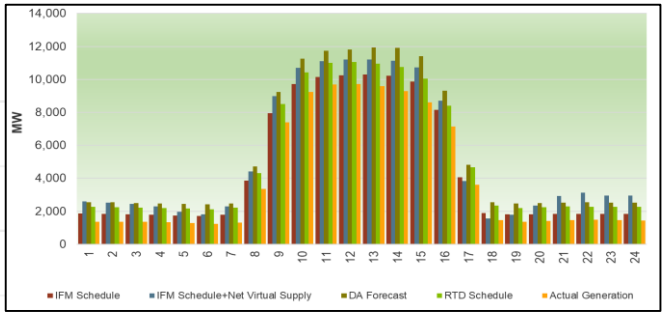


Hybrid resources' dispatch tends to more closely follow the pattern of VERs than energy storage

Hybrid dispatch

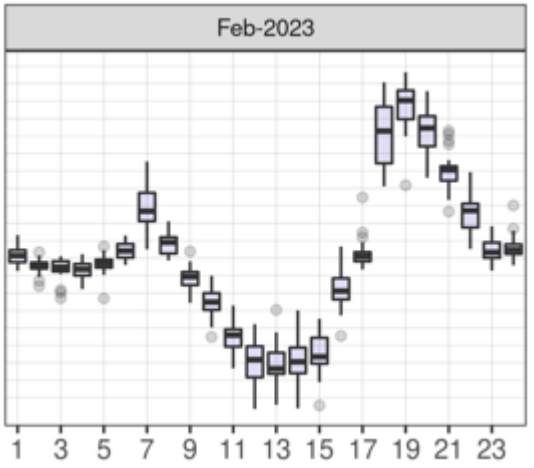


VER dispatch



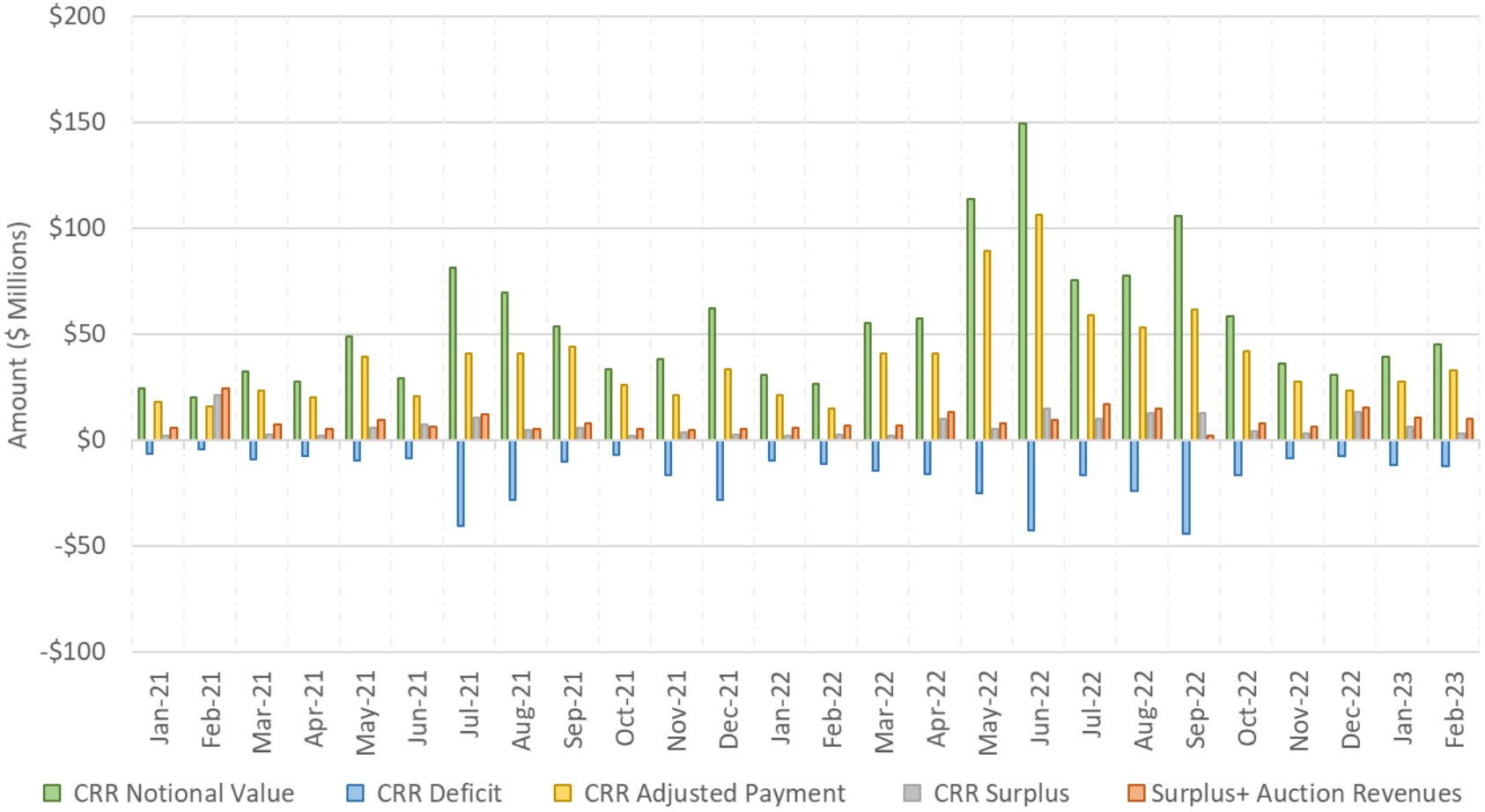
IFM
RTPD
RTD

Energy storage dispatch

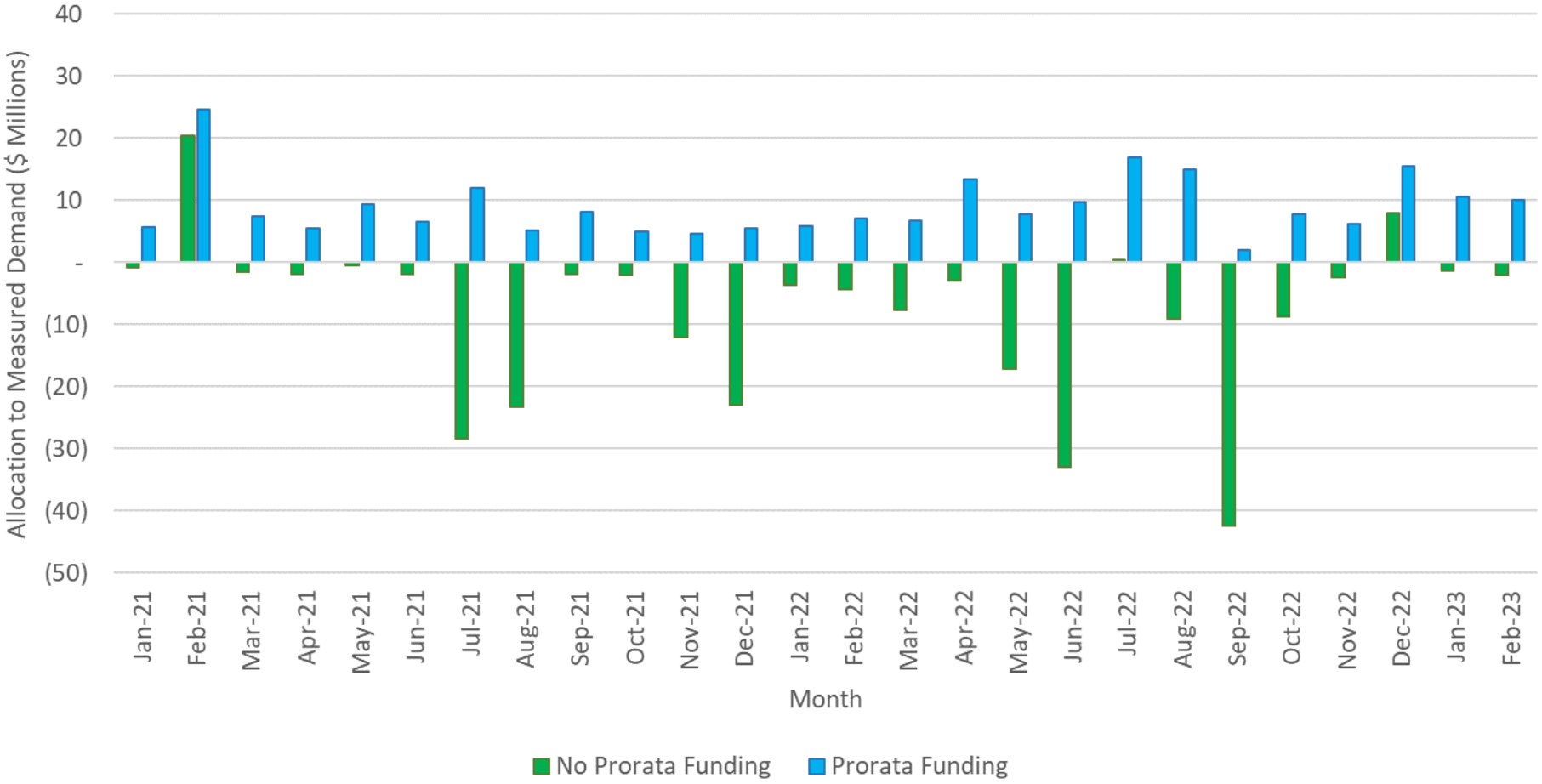


CRR Update

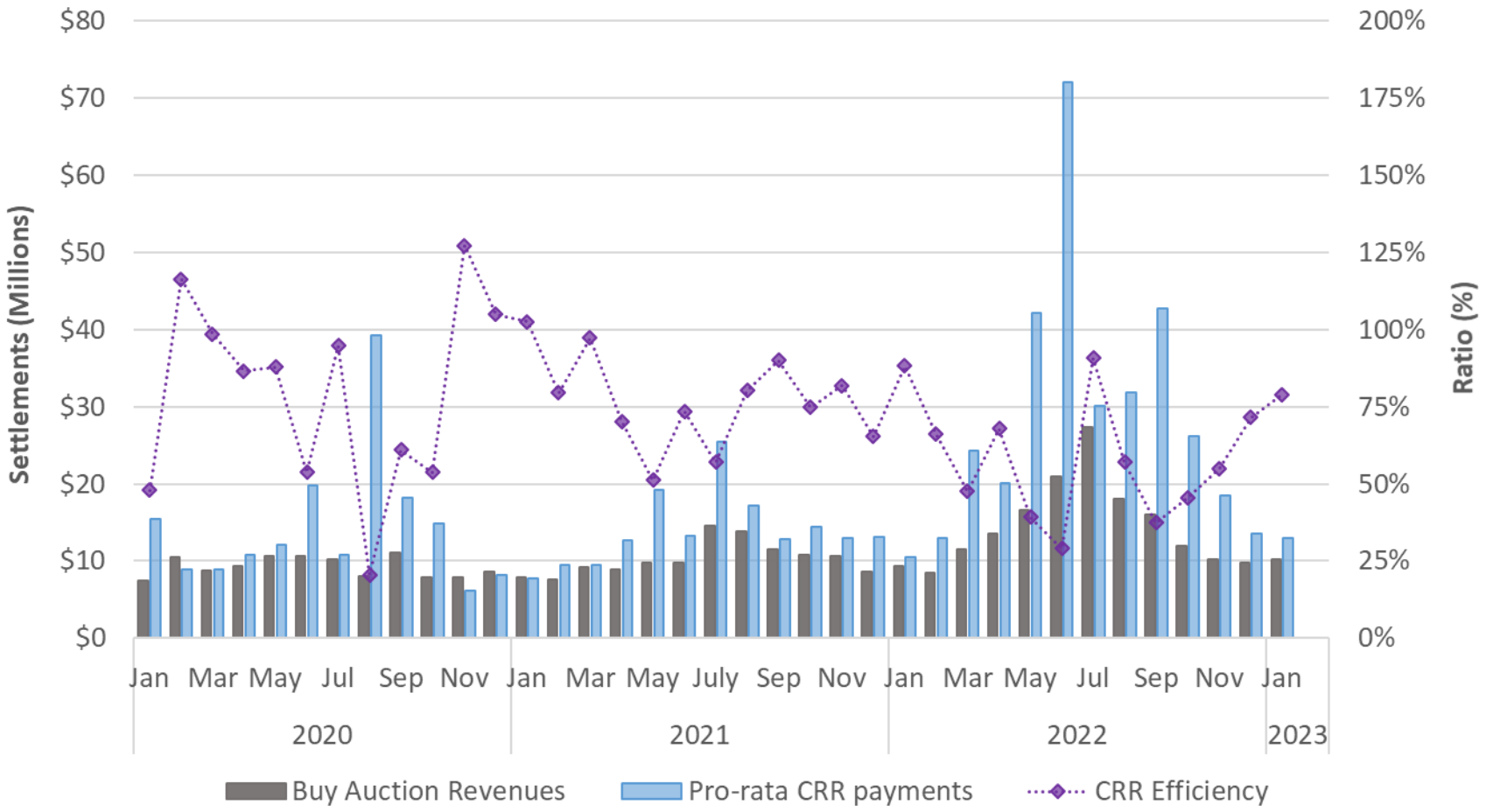
The magnitude of the overall CRR settlements has decreased after summer



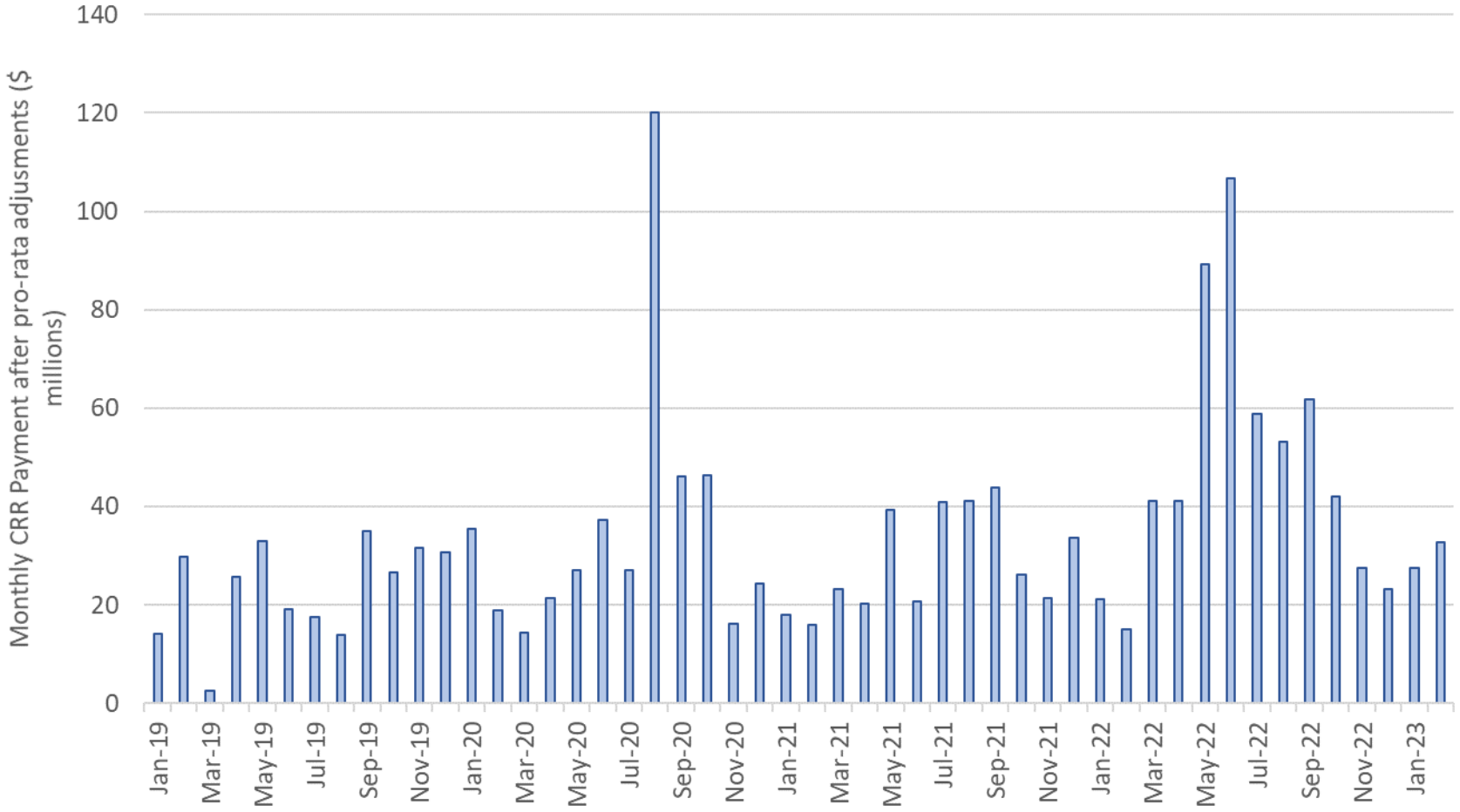
Implementation of pro-rata funding continues to improve revenue adequacy in 2022



Auction efficiency remain low as congestion levels remained high in October due to scheduled outages



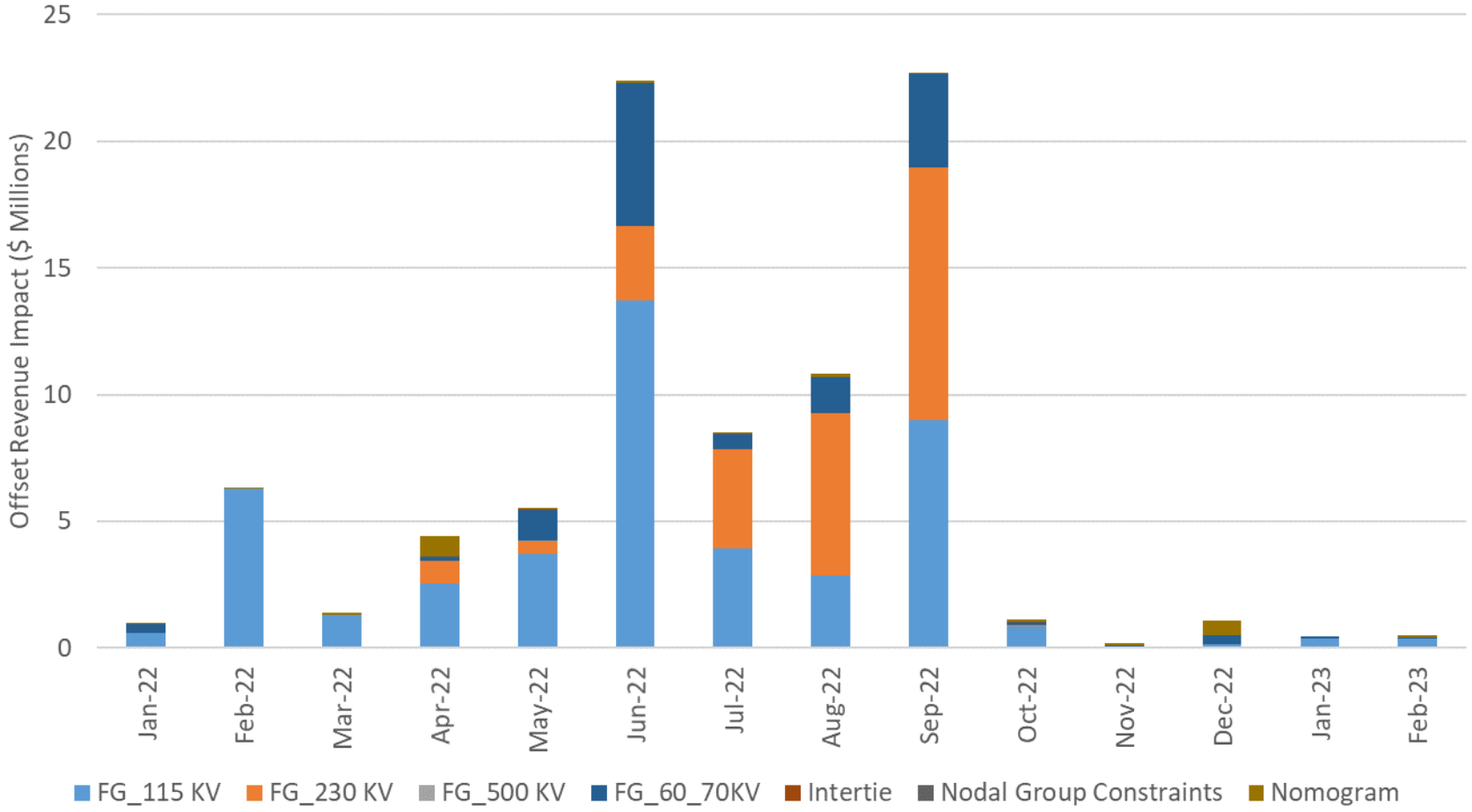
Monthly CRR payment after pro-rata adjustment tend to be higher during summer months



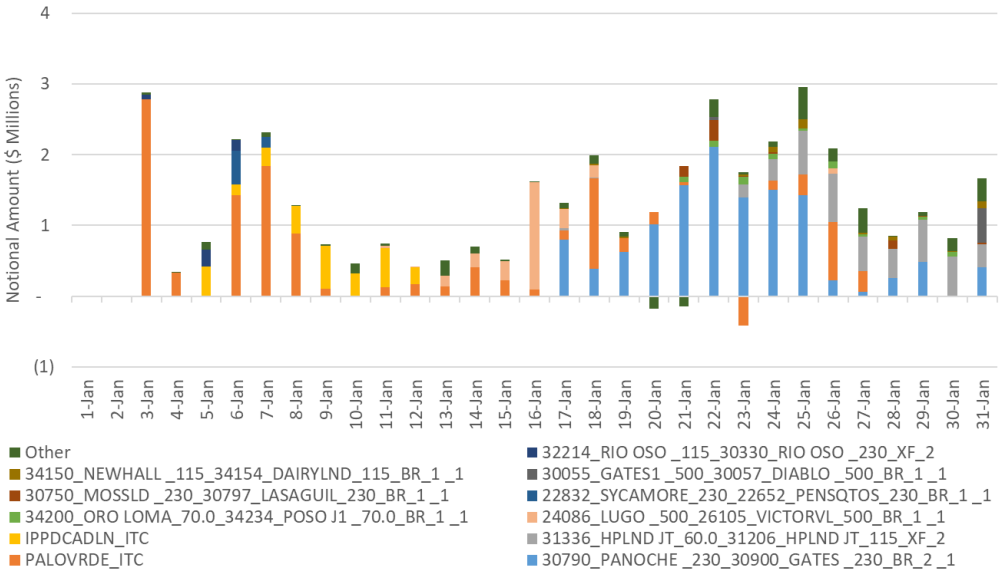
Offset Revenue Impact

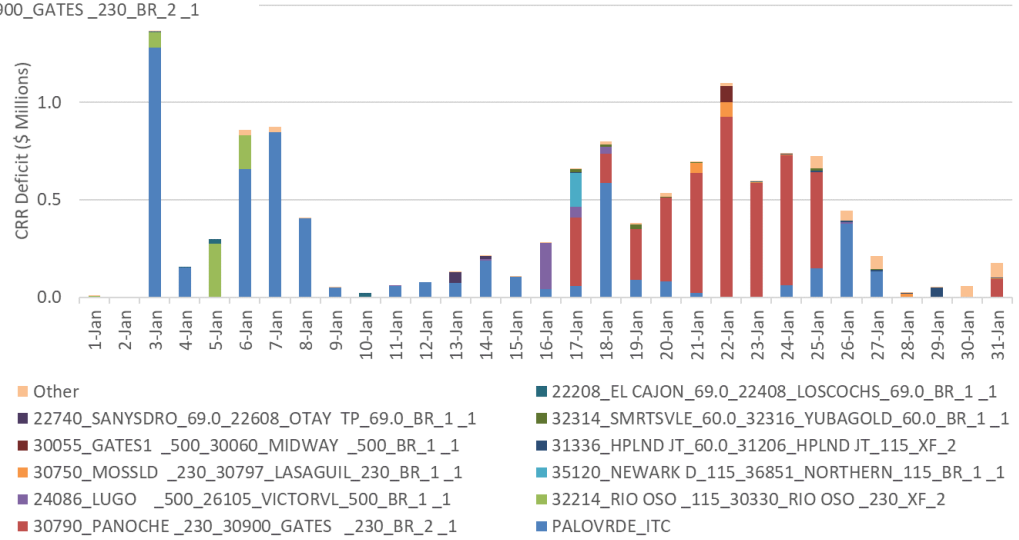
- Offset Revenue Impact - Amount of offset revenues that exceeded the notional revenues based on the historical percentages of offsets for those same constraints
- Apply average percentages of offset revenues for the constraint - when offset revenues was greater than notional revenues
- Example - constraint A to be binding for one hour –
  - notional revenues = $1,000
  - Offset revenues = -$1,600
  - Offset revenues based on the historical percentage of offset for this constraint = -$400
  - Offset Revenue Impact = -$1,200 (amount of offset being applied in excess based on the historical percentages of offset for the same constraint)

Offset revenue impact for all the constraints from January 2022 – February 2023

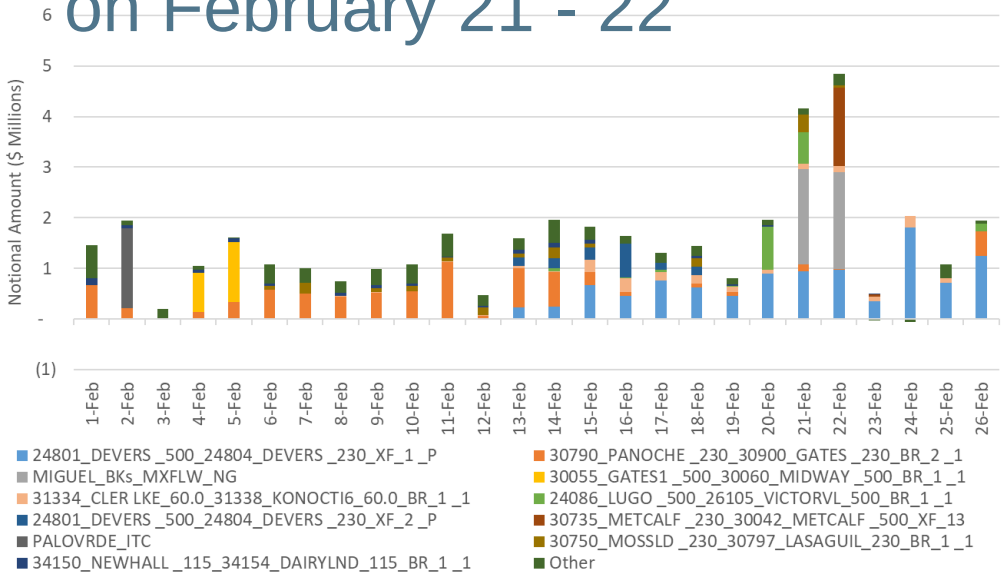


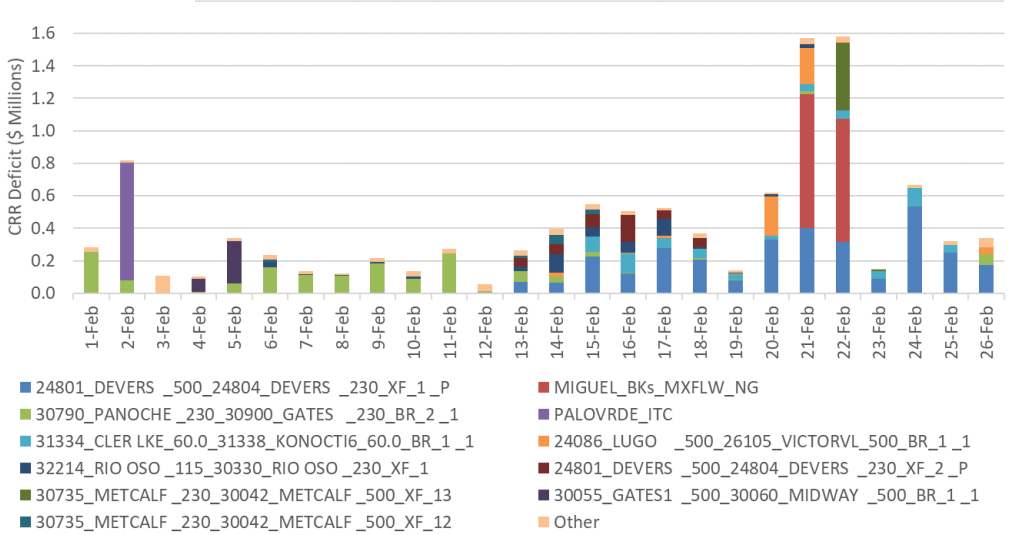
Notional and offset revenues for January 2023





February 2023 shows the several constraints binding on February 21 - 22



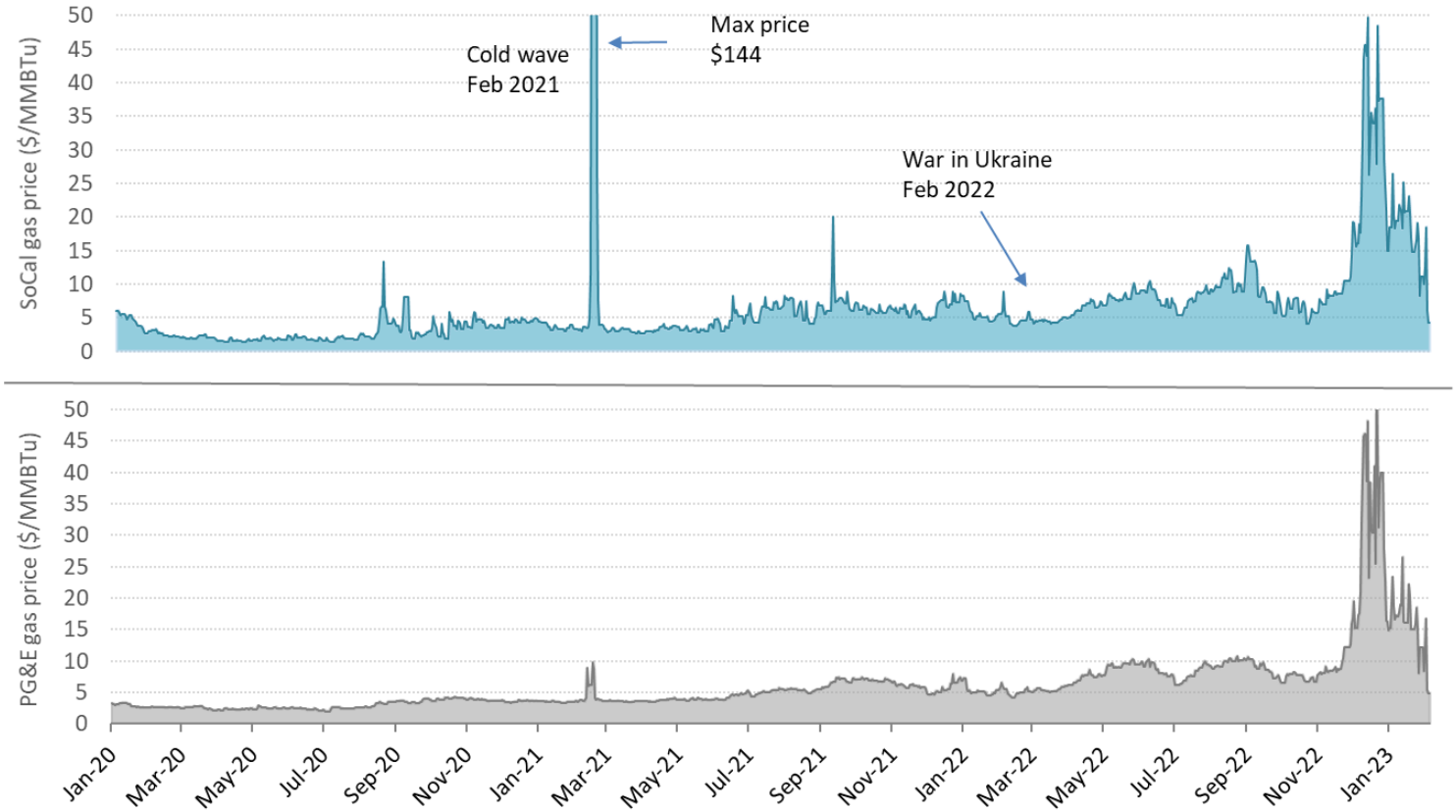


Ongoing effort for Congestion Revenue Right

- CAISO completed the stakeholder proposal to address the issue of the shift factor threshold applied to aggregated locations.
- The ISO will bring this proposal for approval on the March session of the Board of Governors
- CAISO will pursue further assessment on applying reduced shift factors to specific interties.
- The next stage of CAISO's analysis will focus on drivers for
  - CRR settlement reversal on constraints
  - CRR shortfalls by constraint
- CAISO will present finding in the upcoming MPPF

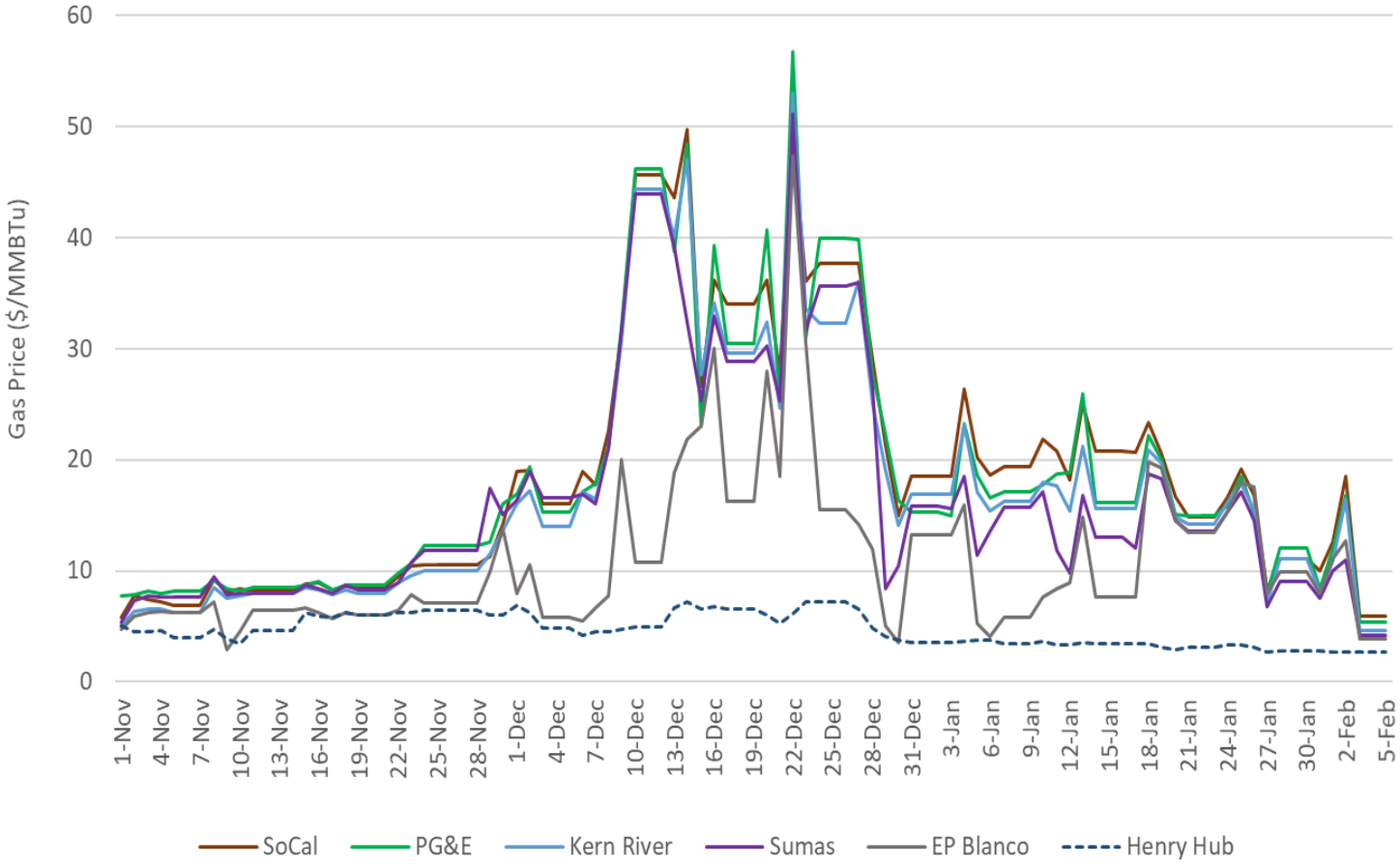
Gas Conditions and CAISO's markets in December 2022

Gas Prices observed sustained high levels in December 22 due to a confluence of factors

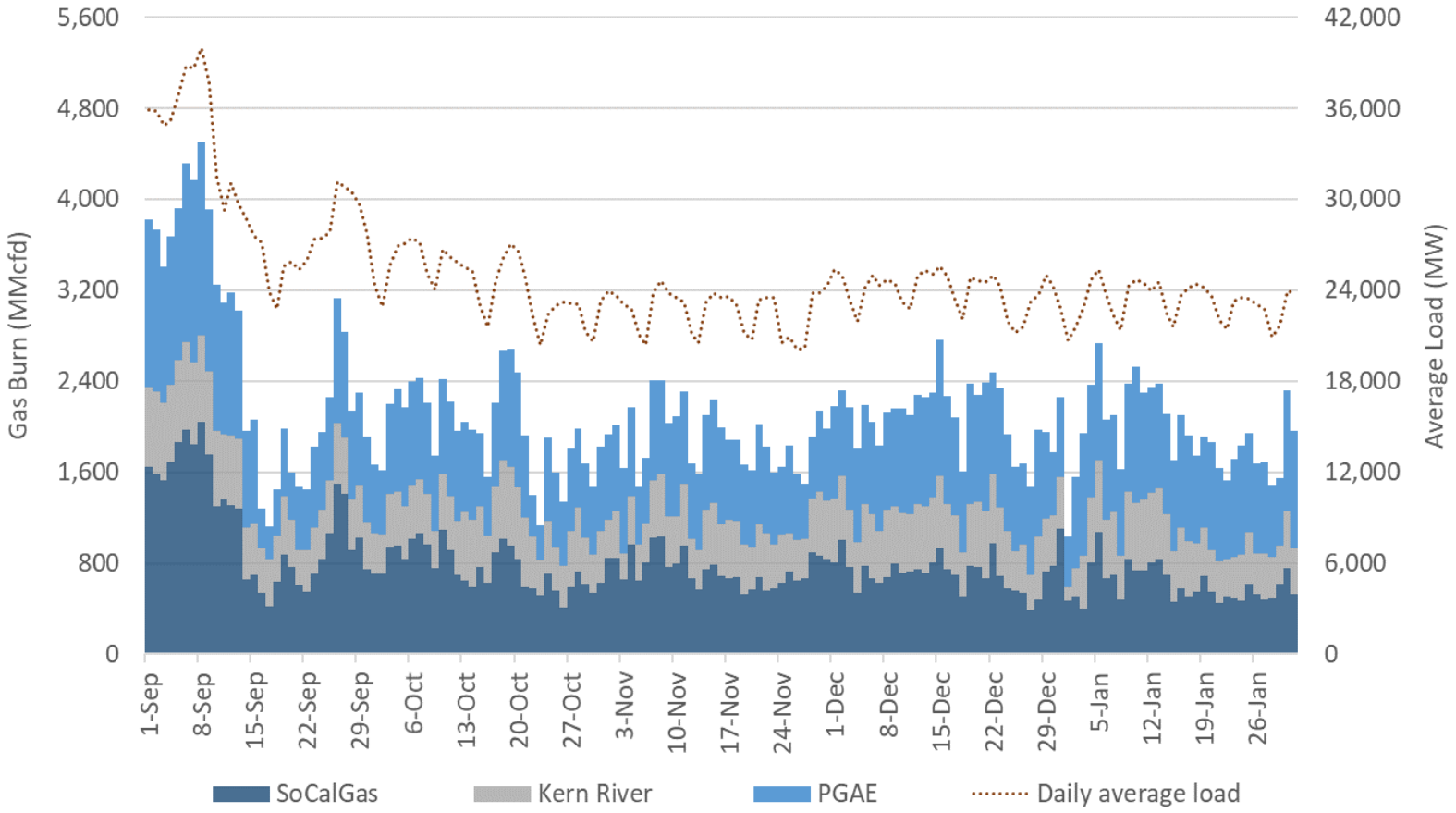


Extreme cold weather with higher demand
Pipeline work
Gas Storage levels

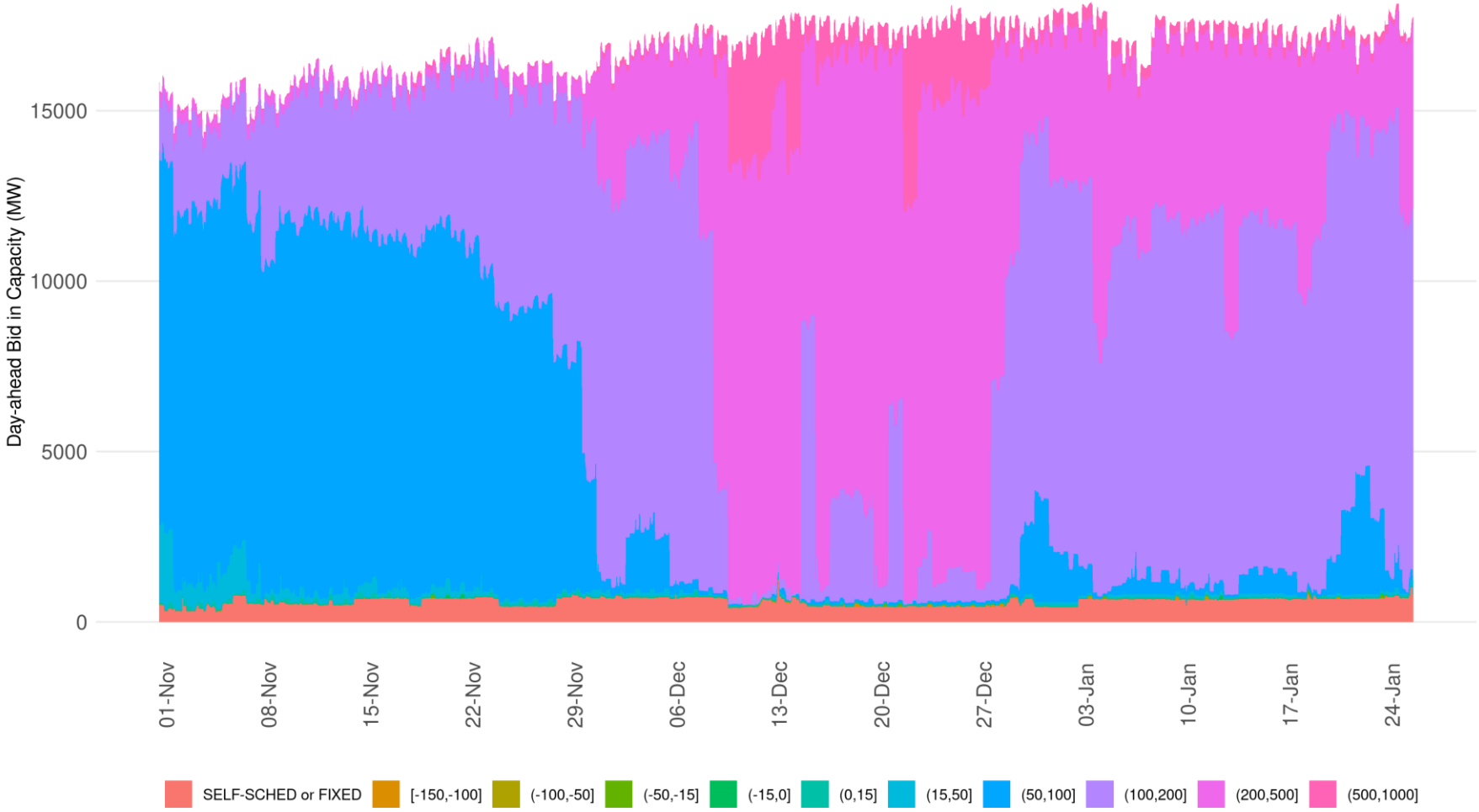
Higher gas prices were observed across the West hubs



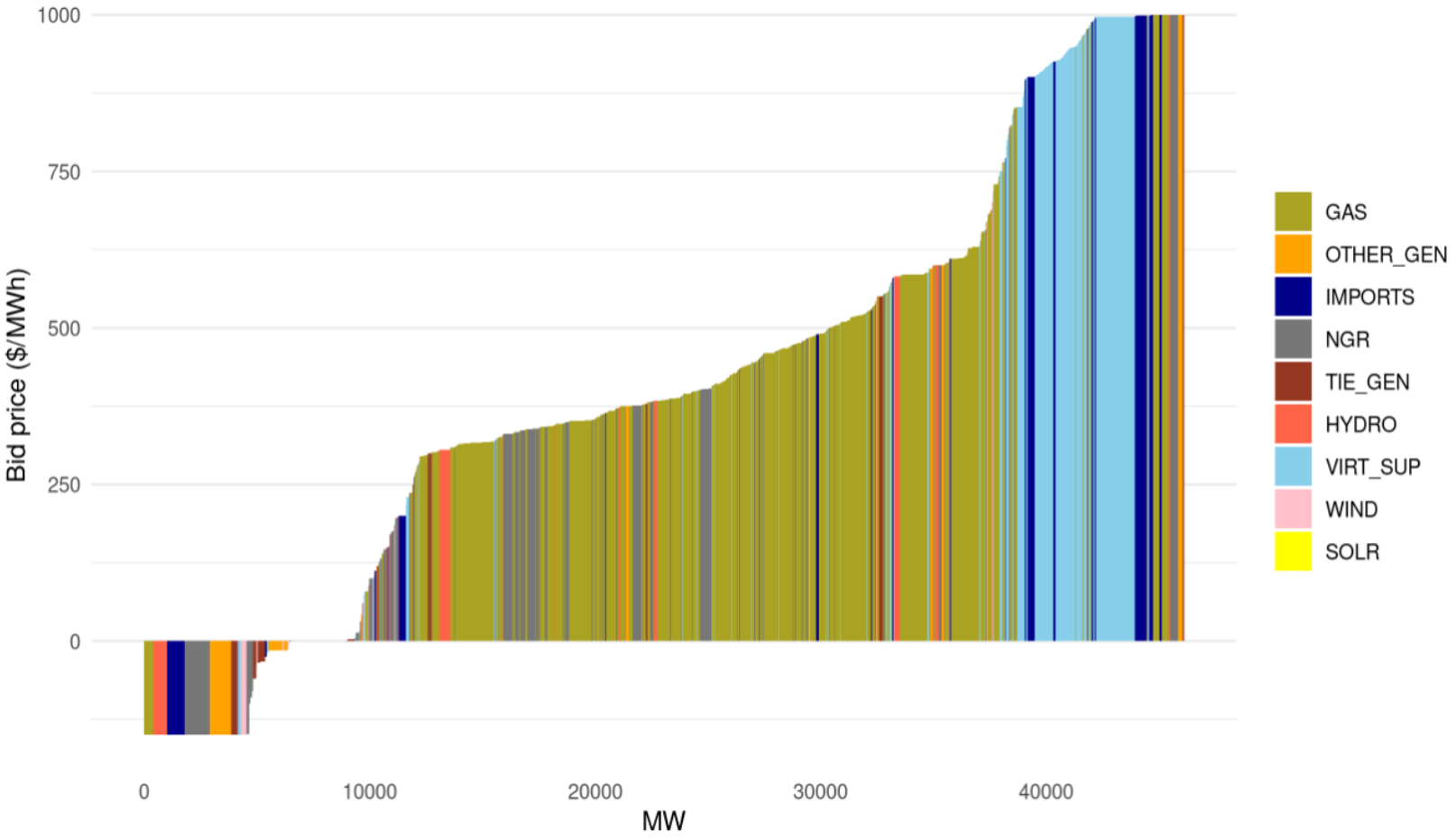
Gas burn levels in December 2022 were within typical ranges but higher than in December 2021



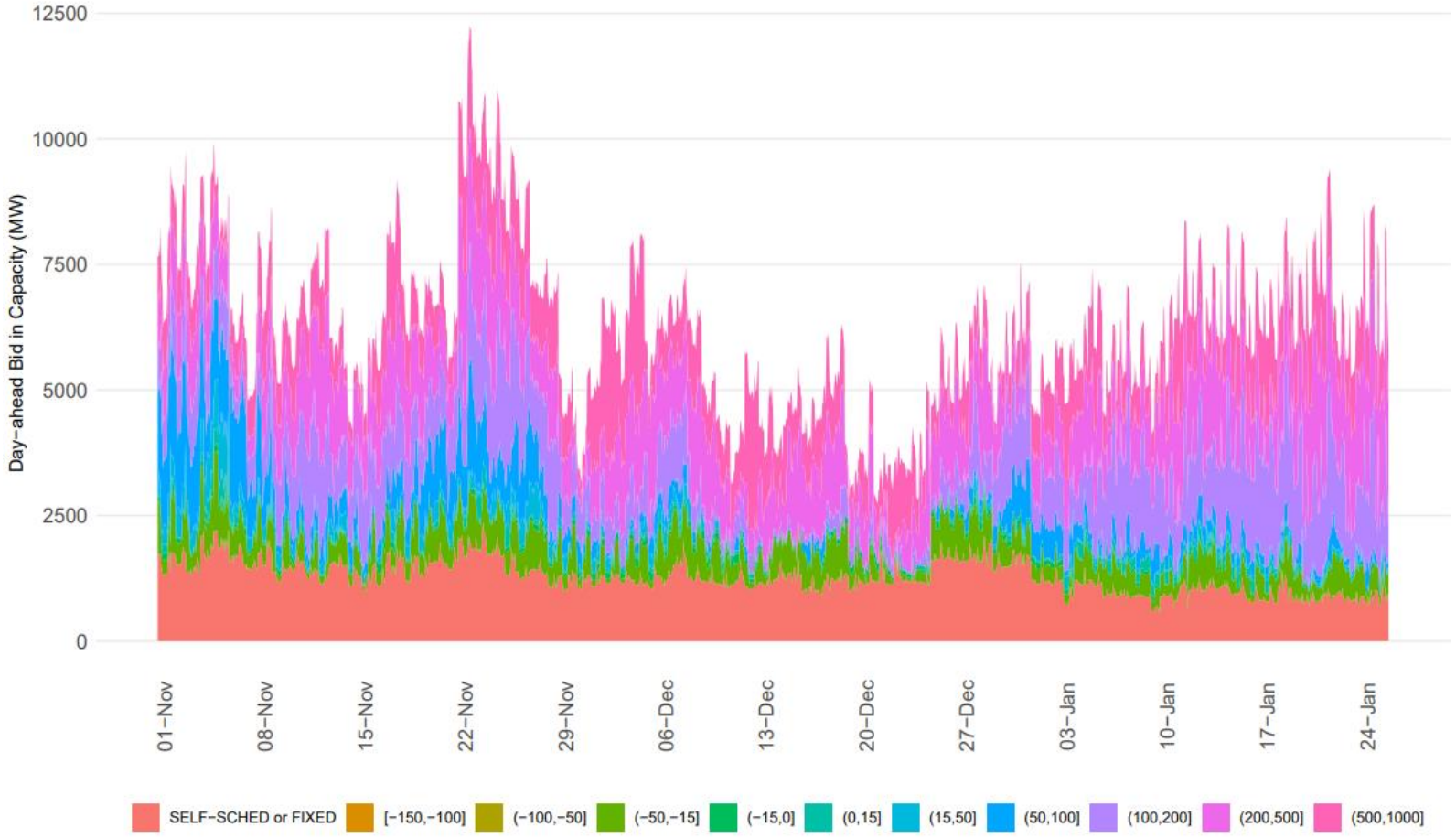
Gas prices are reflected accordingly in more expensive energy bids



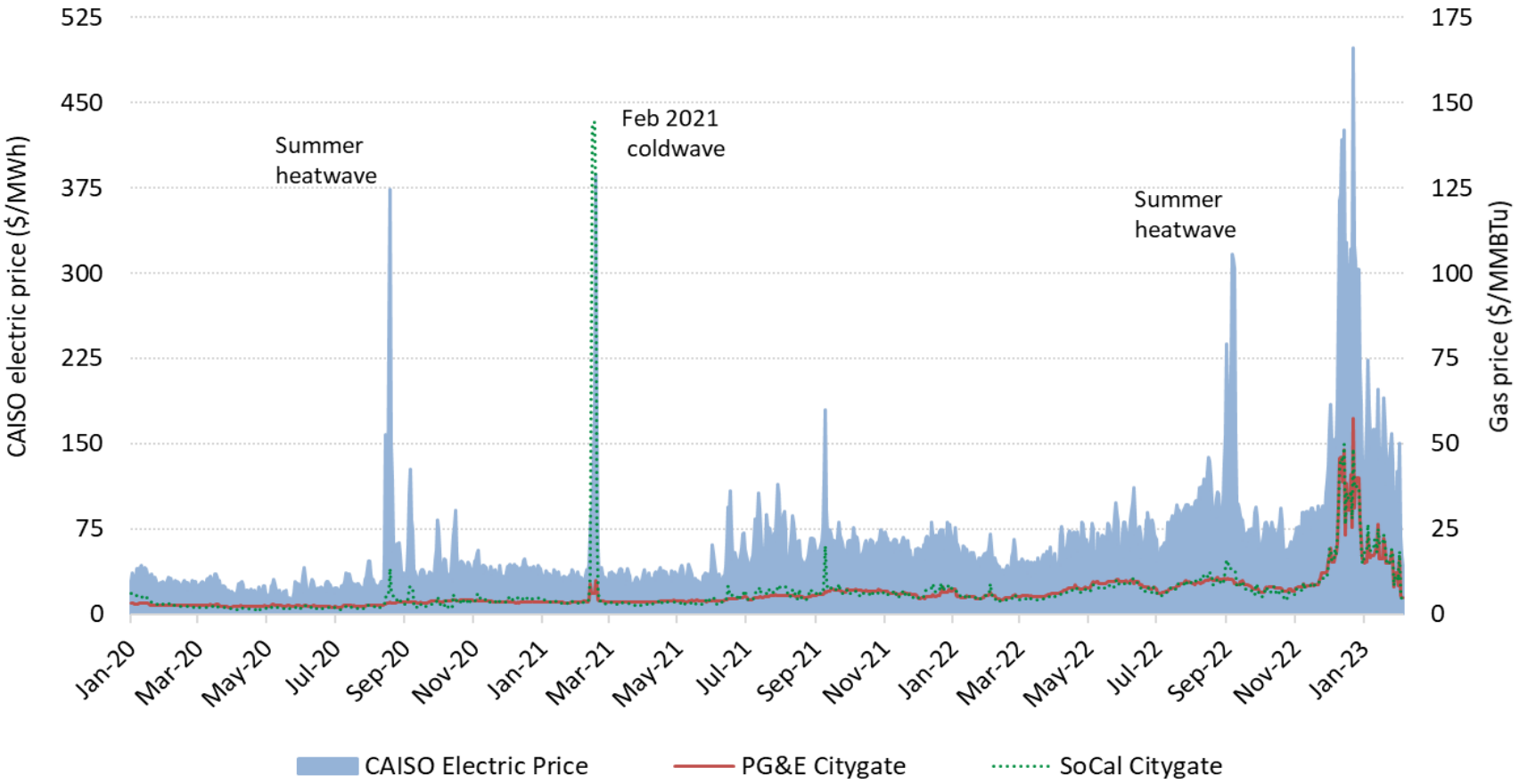
The impact of gas prices on gas resources were directly reflected in higher energy bids



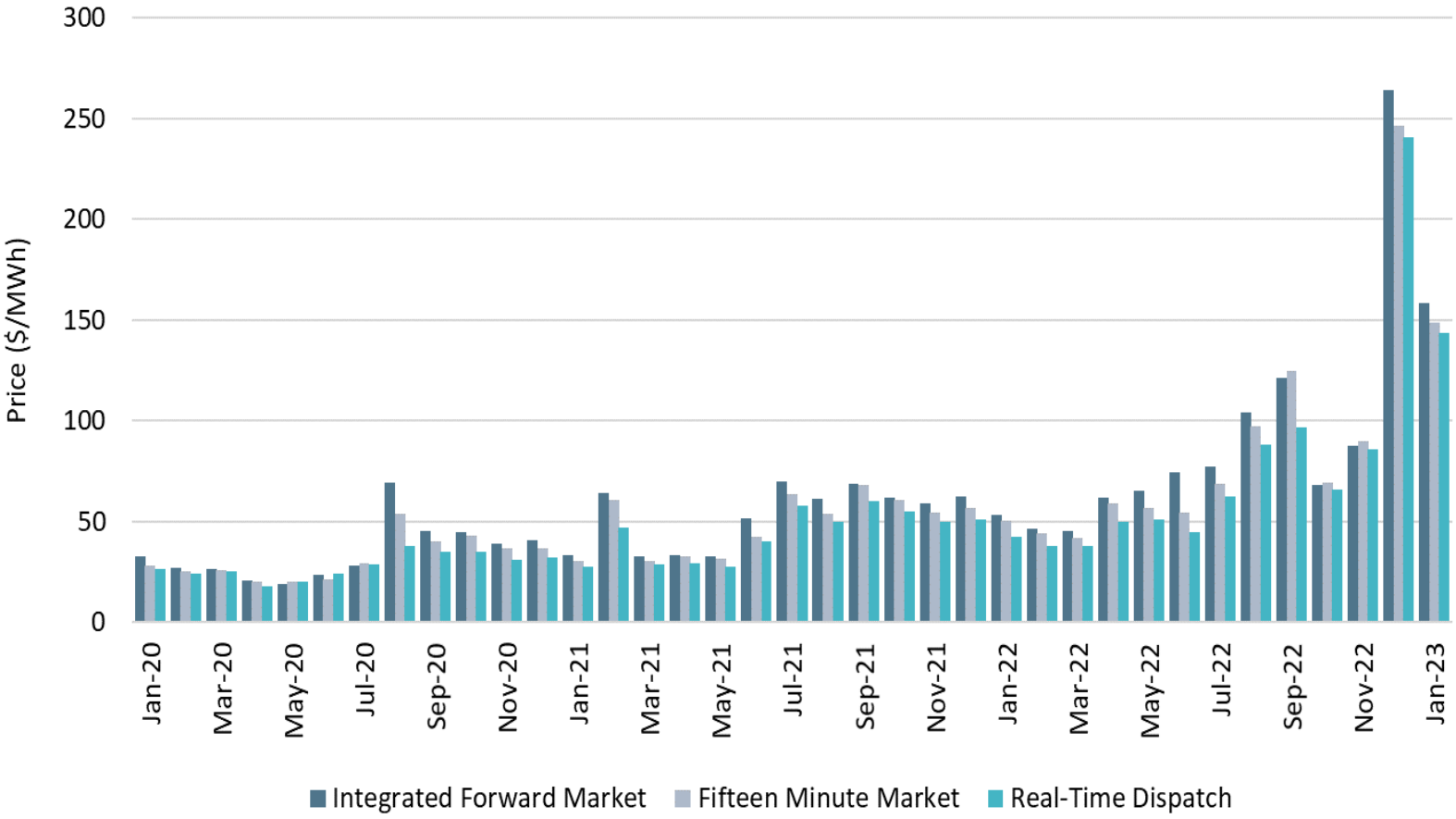
Imports participating in the CAISO market reflect gas dynamics, with lower volumes at higher prices



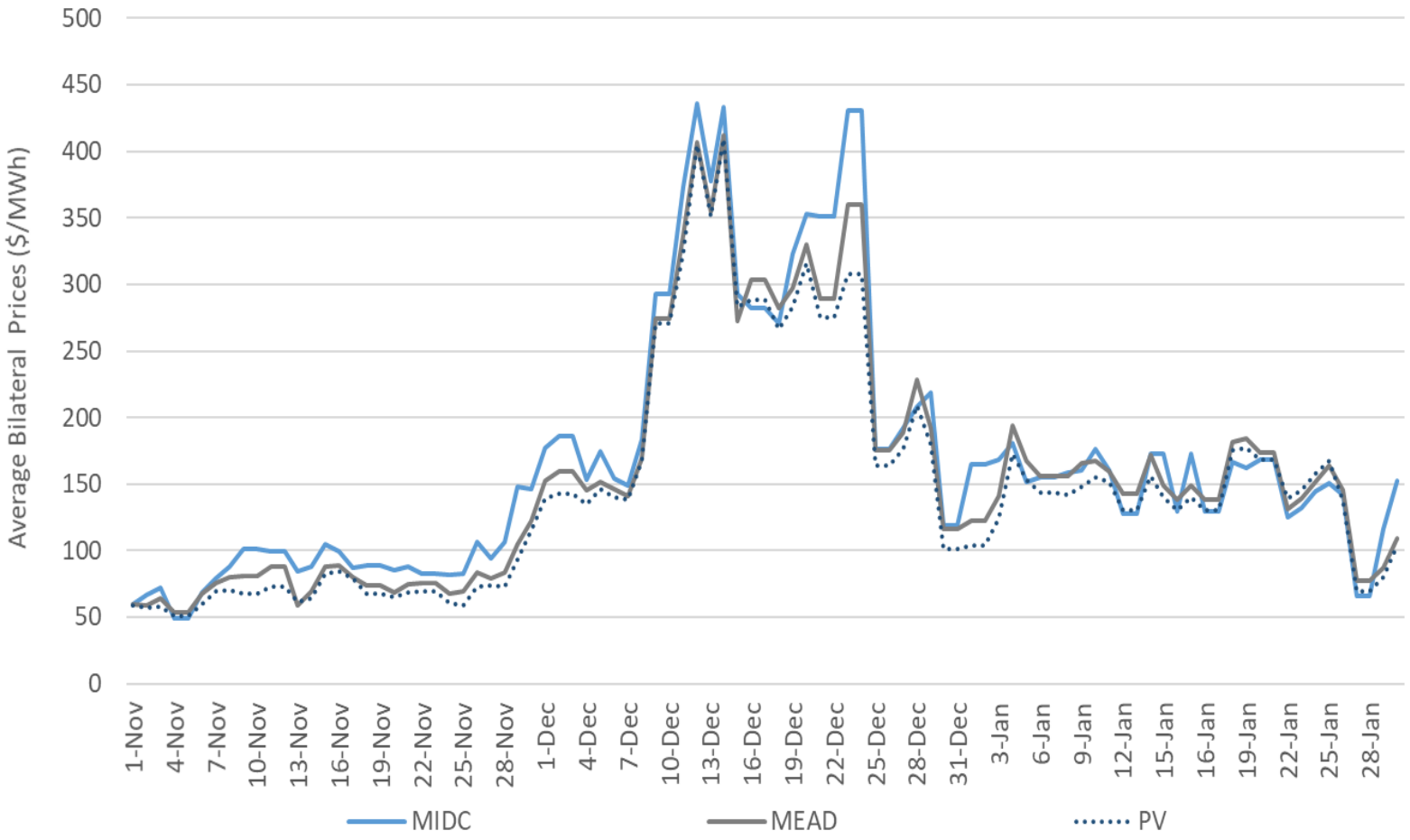
CAISO's electric prices tracked close to gas prices



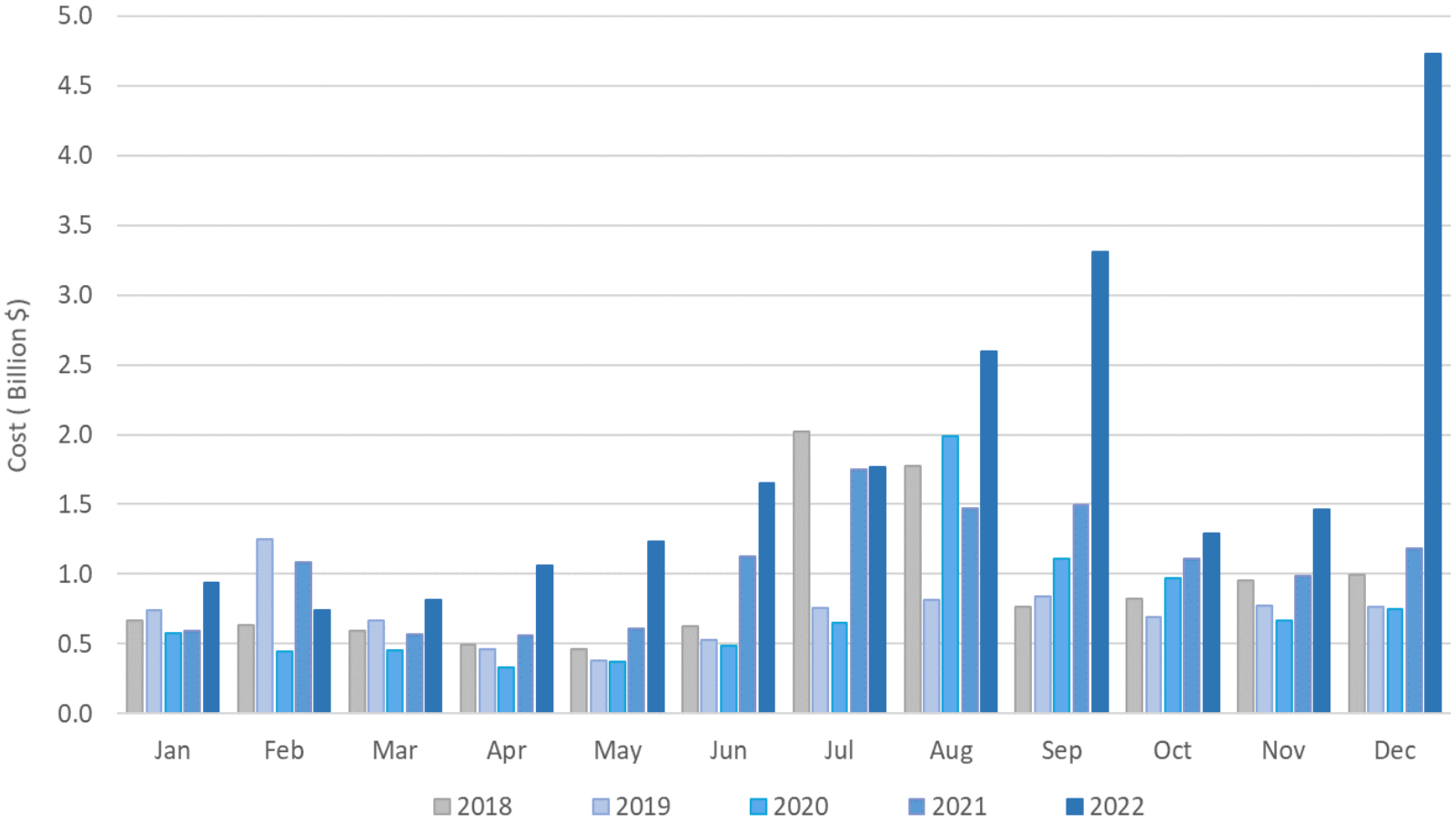
CAISO's electric markets saw a fivefold increase with respect to December 2021 prices



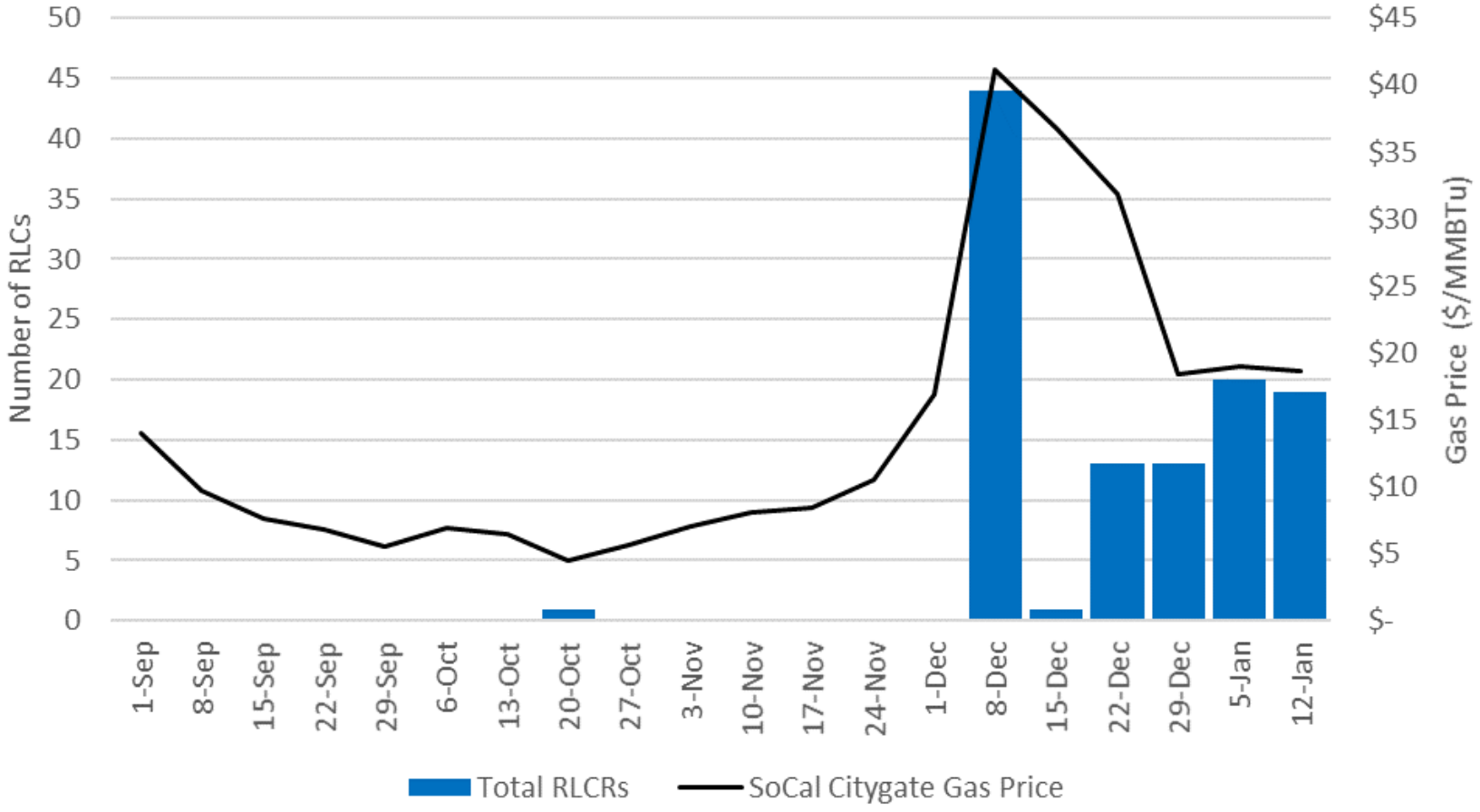
External bilateral prices also saw higher levels



Wholesale costs in the CAISO's energy market saw additional costs of $3 billion in December and about $0.9 billion in January



A total of 110 requests were submitted by participants for reference level changes to reflect gas dynamics

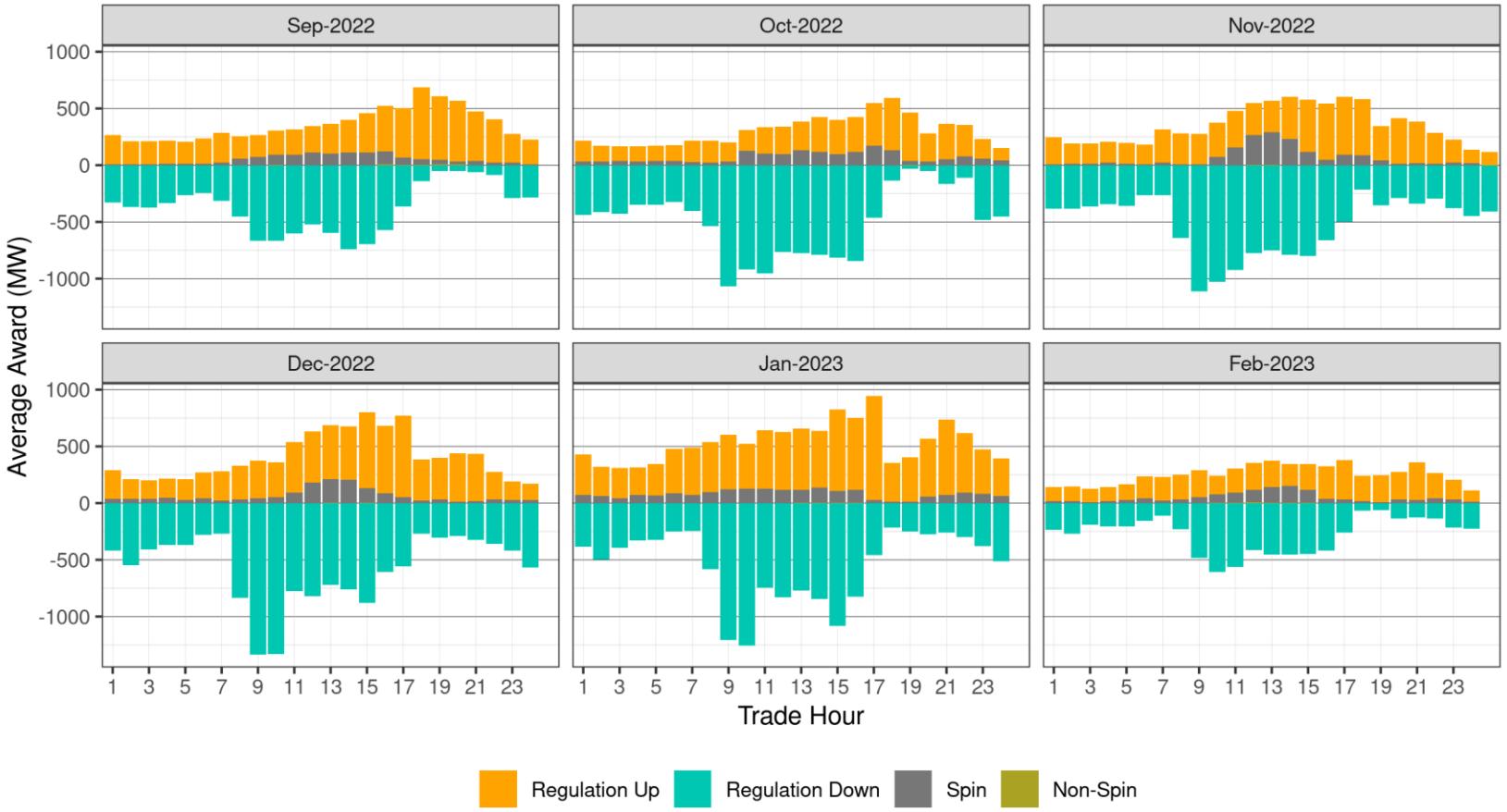


Procurement of Regulation

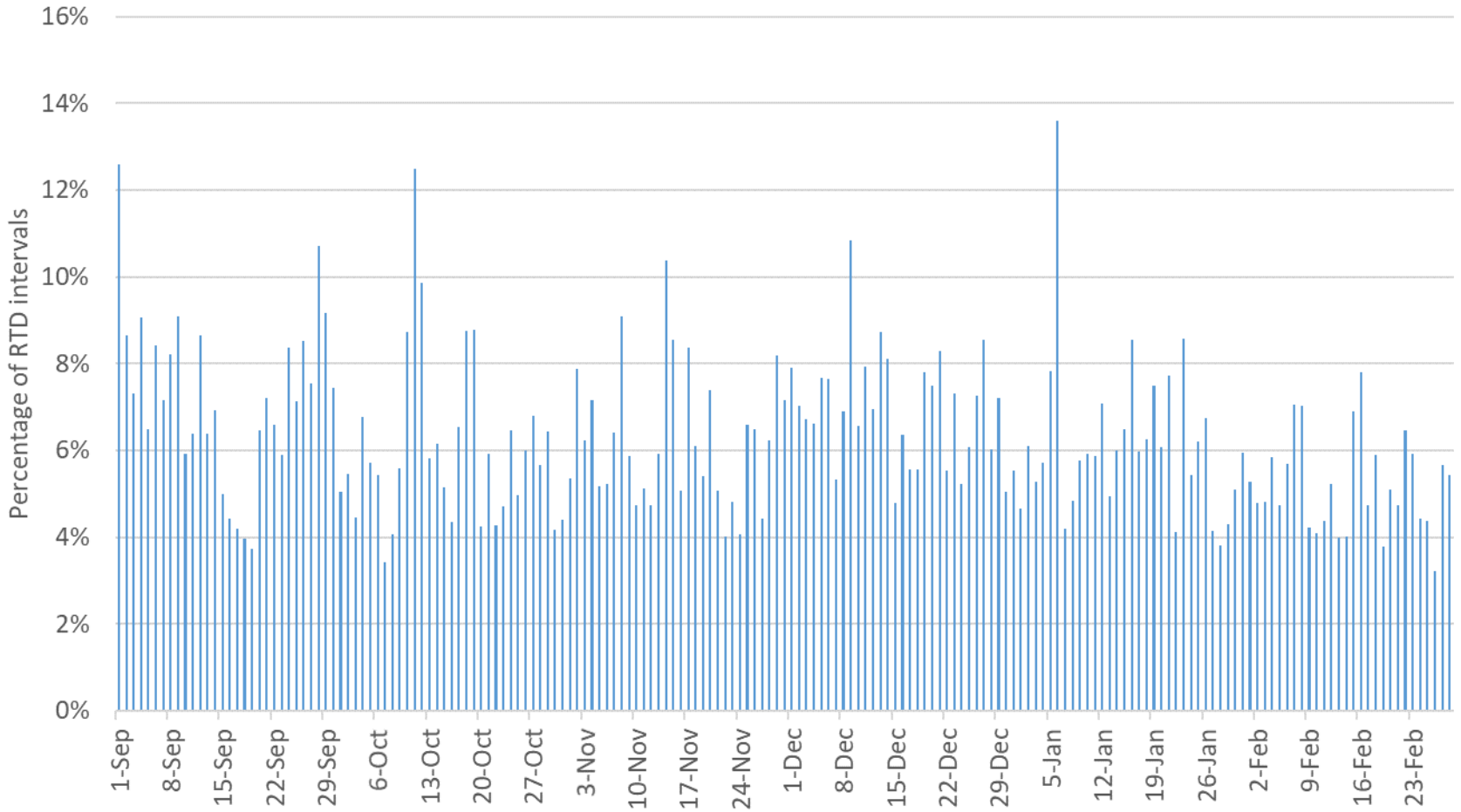
Regulation is a reliability service critical to control system frequency and maintain grid stability

- When a large volume of awarded regulation is not accessible to the system, it can impact the system reliability
- The ISO has observed instances where some resources carrying regulation
  - Do not get on AGC control
  - Do not follow signals
- Resources awarded regulation are expected to make the capacity available and follow signals

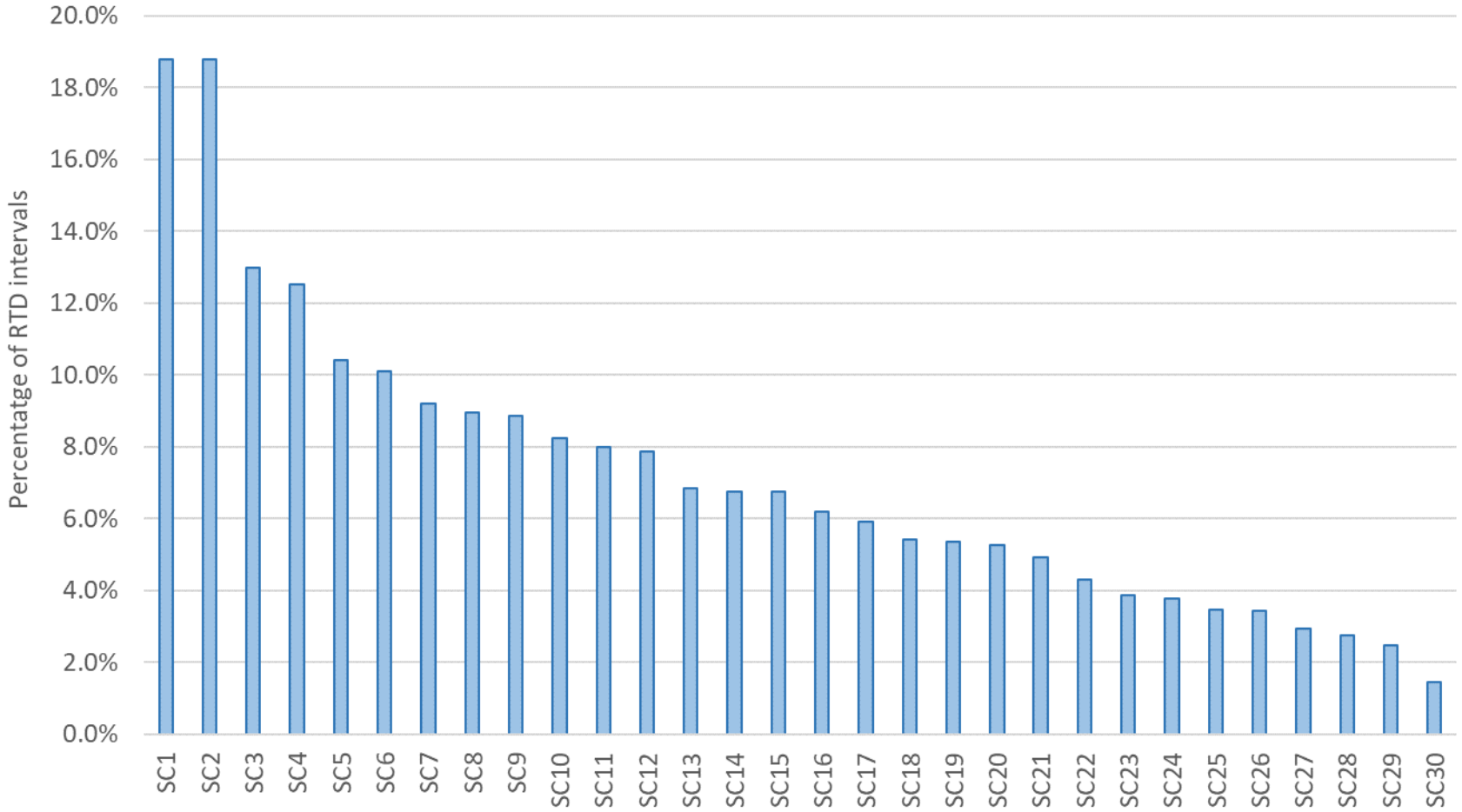
Batteries continue to provide a significant share of both Regulation up and Regulation down



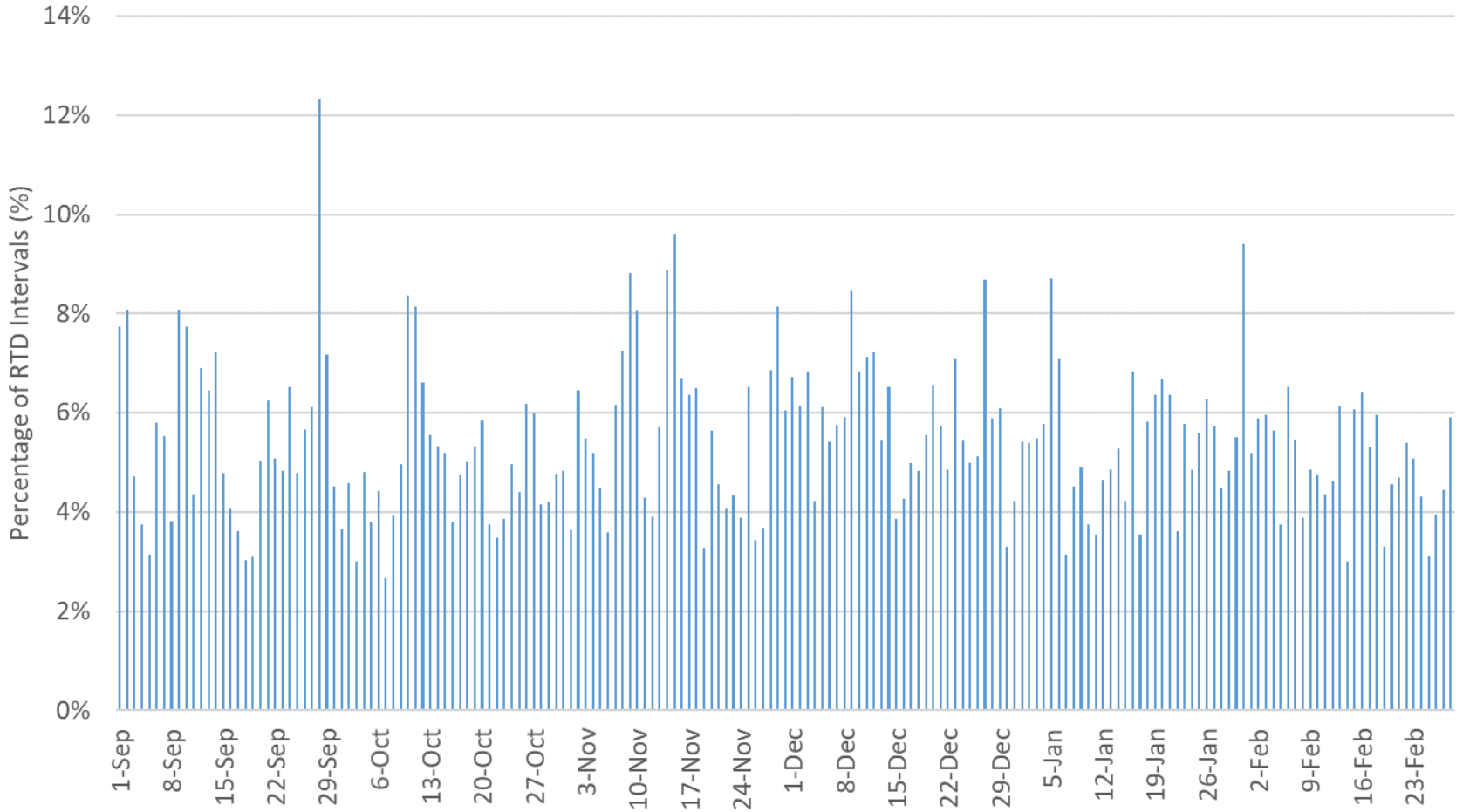
Percentage of five-minute intervals when resources do not get on AGC control and are awarded upward regulation



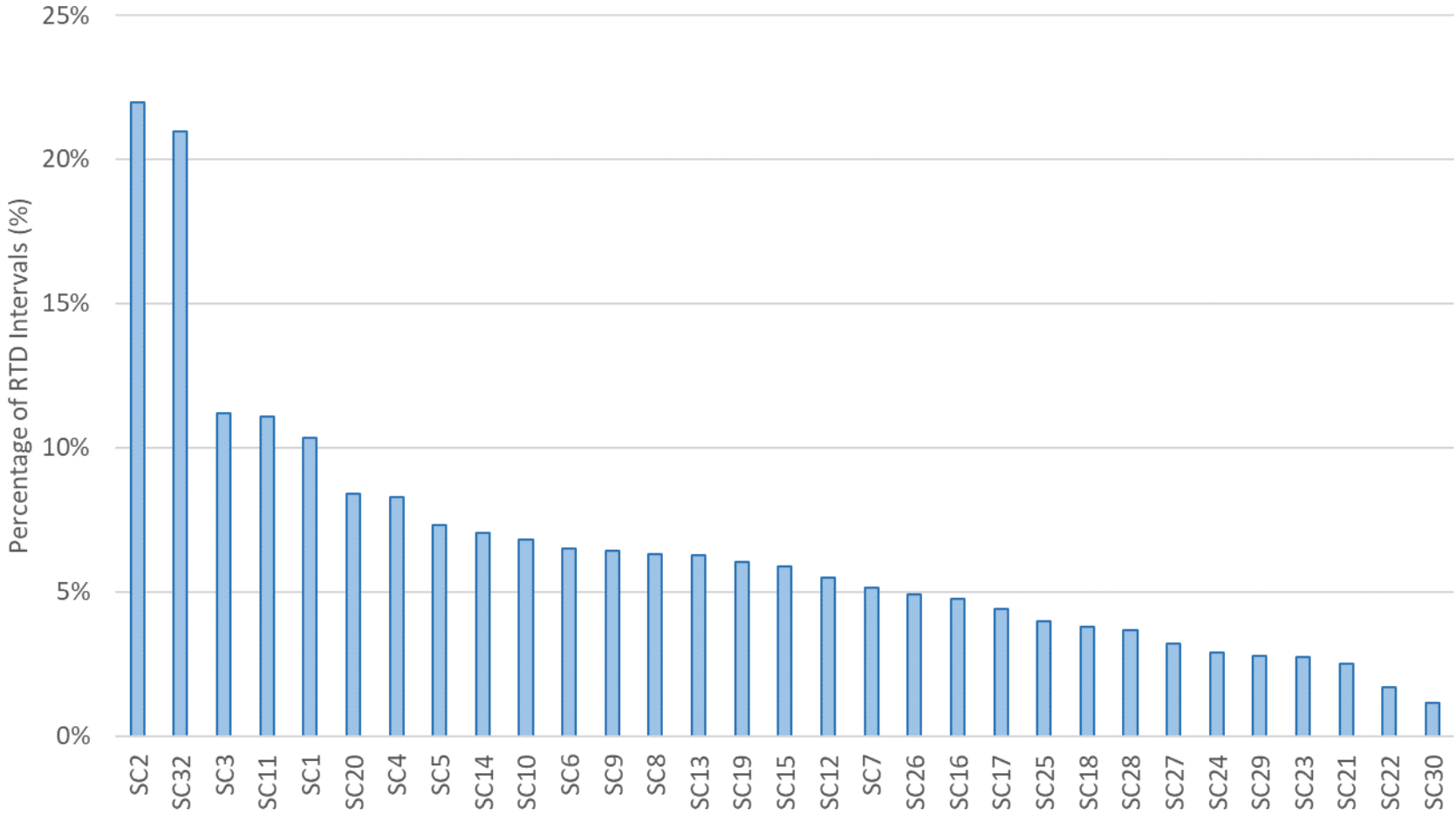
Percentage of five-minute intervals when resources do not get on AGC control for Sep 22– Feb 23



Percentage of five-minute intervals when the storage resources do not get on AGC control during regulation down awards



Percentage of five-minute intervals when the storage resources do not get on AGC control by SC for September – February 2023 for regulation down



Flexible Ramp Product Enhancement

Background

- Mosaic model incorporates weather information into estimation of uncertainty requirement
- Histogram was the methodology used to estimate the same requirement

Relevant Links	Website Location
FRP Uncertainty Calculation Simulations Study	http://www.caiso.com/InitiativeDocuments/Analysis-FlexibleRampingUncertaintyCalculationintheWesternEnergyImbalanceMarket.pdf
FRP Uncertainty Calculation Simulation Presentation	http://www.caiso.com/InitiativeDocuments/Presentation-FlexibleRampingUncertaintyCalculationWesternEnergyImbalanceMarket-WEIM%E2%80%93Apr1-2022.pdf
External BRS for Requirements	http://www.caiso.com/Documents/BusinessRequirementsSpecifications12-FlexibleRampProduct-RequirementsEnhancements.pdf
External BRS for FRP Enhancements	http://www.caiso.com/Documents/BusinessRequirementsSpecifications12-FlexibleRampingProduct-Deliverability.pdf

FRP Requirements Performance Measurements:

1. Coverage:
   - The percentage of observed uncertainty covered by the proposed requirement.
   - This is used to check the validity of a model, and is the coverage of observed uncertainty against the requirement.
2. Requirement:
   - The average of estimated requirements over a period of time.
3. Exceeding:
   - The average MW differences when the observed uncertainty exceeds the proposed requirement.
4. Closeness:
   - The average distances between the observed uncertainty and the proposed requirement

- These measurements are designed to display the performance from four different perspectives: Coverage, requirement, exceeding, and closeness can be used to reflect operational reliability, cost, risk, and margin, respectively.

Mosaic offers less but comparable FRP **Coverage** when comparing against the Histogram

BAA	FRU_H	FRU_M	FRD_H	FRD_M
SCL	95.00%	95.00%	90.00%	91.00%
PNM	92.00%	92.00%	93.00%	92.00%
IPCO	93.00%	91.00%	91.00%	91.00%
PSEI	94.00%	92.00%	93.00%	89.00%
BCHA	92.00%	92.00%	94.00%	94.00%
PGE	91.00%	91.00%	92.00%	88.00%
PACW	94.00%	94.00%	91.00%	87.00%
PACE	93.00%	93.00%	96.00%	96.00%
CISO	97.00%	96.00%	89.00%	88.00%
AVA	95.00%	95.00%	92.00%	91.00%
BANC	93.00%	91.00%	93.00%	88.00%
BPAT	94.00%	93.00%	92.00%	90.00%
NWMT	95.00%	94.00%	93.00%	91.00%
NEVP	94.00%	92.00%	93.00%	90.00%
TIDC	94.00%	93.00%	94.00%	91.00%
SRP	94.00%	91.00%	92.00%	88.00%
TEPC	92.00%	93.00%	92.00%	83.00%
AZPS	93.00%	93.00%	94.00%	91.00%
LADWP	94.00%	93.00%	93.00%	89.00%
TPWR	93.00%	93.00%	93.00%	94.00%

**MAPE = abs(Forecast – Actual)/Actual

Mosaic generally has less FRP **Requirement** than the histogram methodology

BAA	FRU_H	FRU_M	FRD_H	FRD_M
SCL	21.93	23.04	-18.96	-21.04
PNM	96.39	97.78	-98.37	-89.77
IPCO	97.4	98.91	-117.6	-117.47
PSEI	133.53	146.06	-135.39	-127.76
BCHA	155.94	160.08	-162.82	-172.8
PGE	110.88	103.68	-110.85	-97.14
PACW	93.79	91.62	-98.62	-86.82
PACE	274.6	268.61	-336.44	-323.47
CISO	1095.76	985.49	-736.28	-725.33
AVA	48.03	47.95	-50.58	-47
BANC	42.83	36.93	-44.71	-35.42
BPAT	199.15	187.11	-328.63	-267.57
NWMT	75.33	72.02	-76.26	-60.7
NEVP	179.8	143.25	-159.45	-123.66
TIDC	8.11	7.8	-8.02	-6.93
SRP	105.32	95.65	-98.7	-77.33
TEPC	110.22	108.88	-81.23	-70.6
AZPS	143.32	137.81	-117.51	-100.38
LADWP	160.21	143.29	-150.52	-134.3
TPWR	11.58	12.23	-12.35	-12.97

**MAPE = abs(Forecast – Actual)/Actual

Mosaic generally has less FRP **Exceeding** than the histogram method

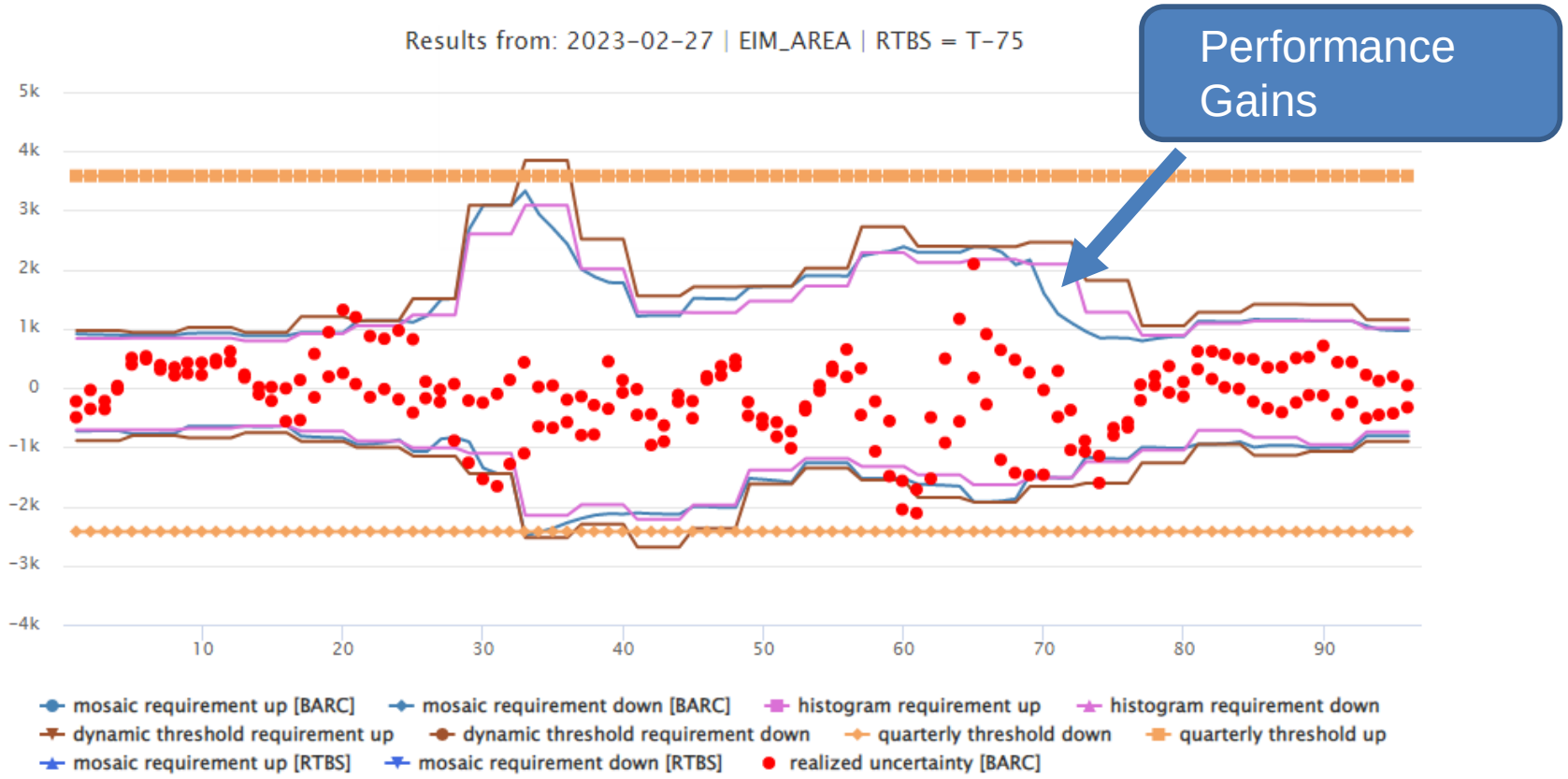
BAA	FRU_H	FRU_M	FRD_H	FRD_M
SCL	5.88	5.93	7.99	7.36
PNM	33.67	30.44	29.03	23.9
IPCO	38.78	34.15	30.46	31.03
PSEI	55.81	46.49	35.36	33.2
BCHA	63.58	66.64	67.61	68.8
PGE	41.22	31.17	47.59	35.29
PACW	26.44	22.57	34.82	24.43
PACE	117.43	111.23	72.74	64.7
CISO	196.42	185.05	238.45	224.93
AVA	14.59	10.81	18.46	13.85
BANC	26.99	26.48	29.4	21.9
BPAT	61.94	46.57	97.19	68.37
NWMT	15.64	15.53	19.35	15.69
NEVP	108.53	100.32	87.73	68.58
TIDC	2.92	2.46	4.04	3.11
SRP	41.34	36.59	35.12	31.47
TEPC	38.48	33.79	32.77	22.65
AZPS	46.31	48.21	26.41	25.84
LADWP	66.53	52.43	74.91	54.2
TPWR	3.21	3.23	3.87	3.84

**MAPE = abs(Forecast – Actual)/Actual

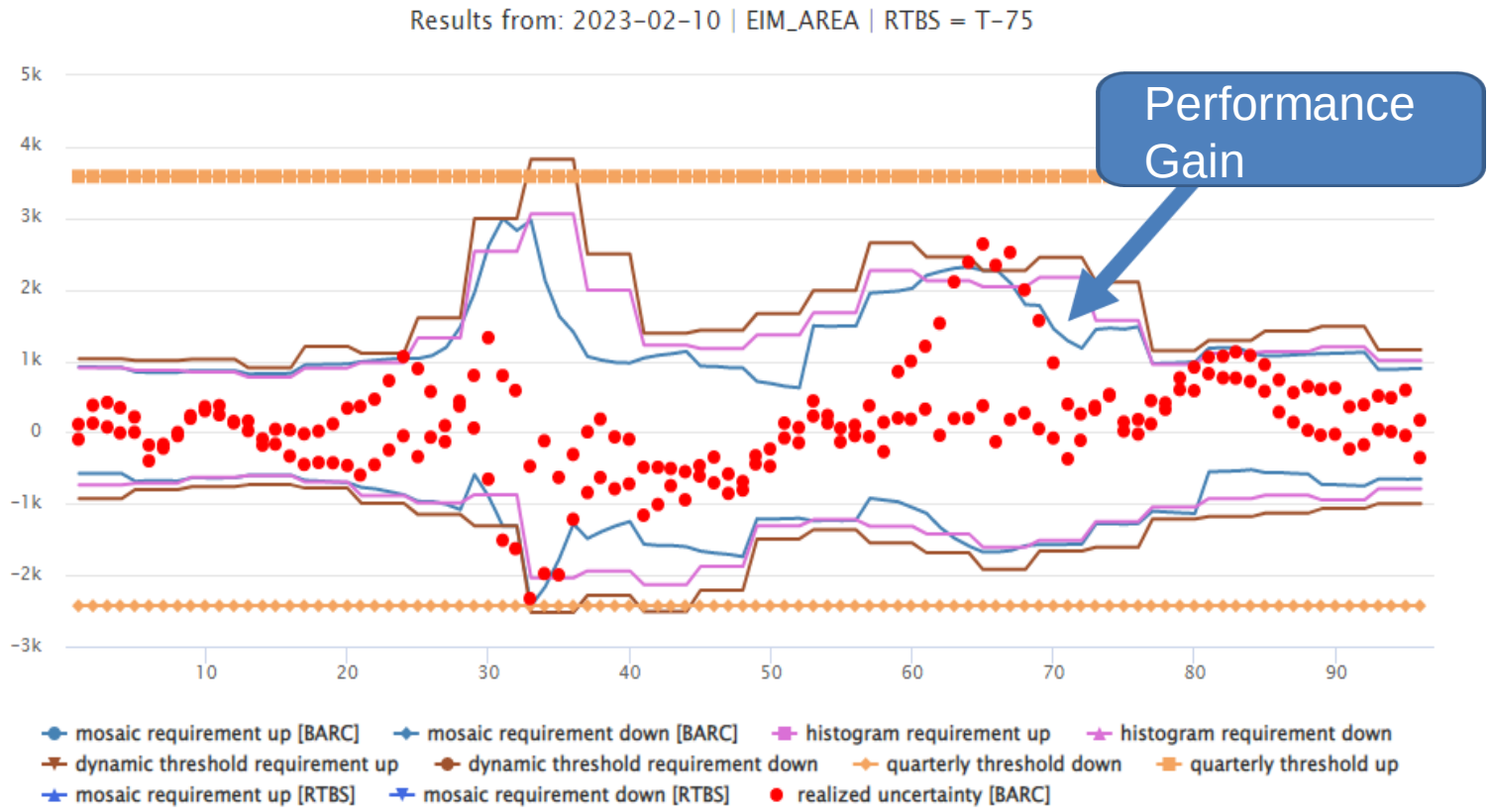
Mosaic provides better FRP **Closeness** than histogram

BAA	FRU_H	FRU_M	FRD_H	FRD_M
SCL	13.54	14.71	11.71	13.62
PNM	62.01	61.52	62.13	55.32
IPCO	64.47	64.5	71.64	74.52
PSEI	87.54	99.91	91.48	87.82
BCHA	98.93	102.89	103.87	114.72
PGE	72.74	64.11	75.97	66.59
PACW	62.34	56.21	65.07	55.41
PACE	185.78	177.51	221.8	212.05
CISO	711.76	610.87	485.11	474.99
AVA	34.68	33.54	34.49	30.92
BANC	28.8	24.71	31	22.3
BPAT	138.41	115.09	220.3	170.26
NWMT	51.11	47.17	51.67	39.52
NEVP	120.86	89.12	116.08	79.65
TIDC	5.25	5.04	5.28	4.43
SRP	68.09	59.97	65.02	45.29
TEPC	69.64	69.39	54.61	42.58
AZPS	95.58	91.62	83.49	68.17
LADWP	115.06	96.71	100.54	86.75
TPWR	7.47	8.01	8.15	8.79

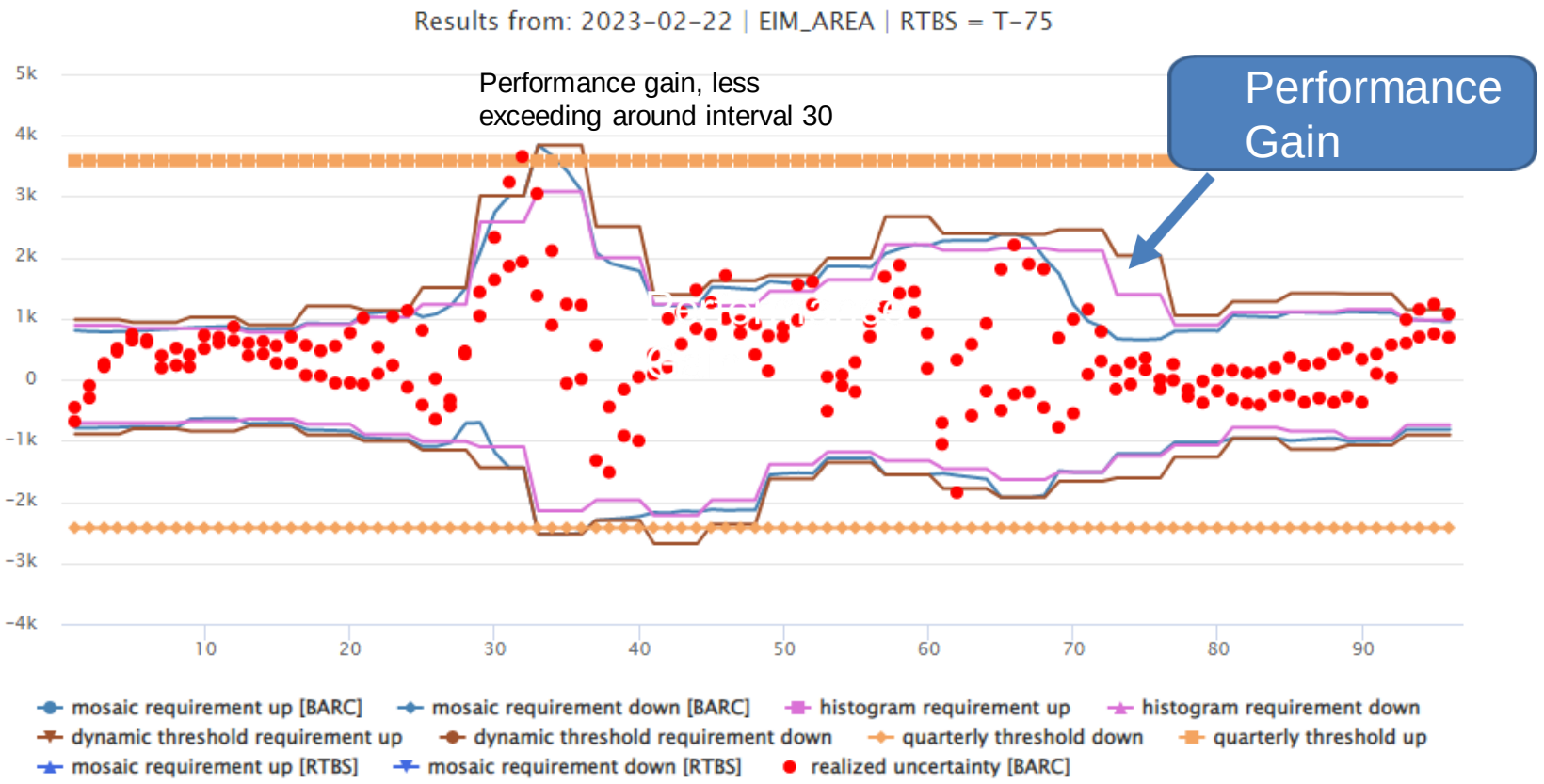
Example: Daily Requirements Comparison



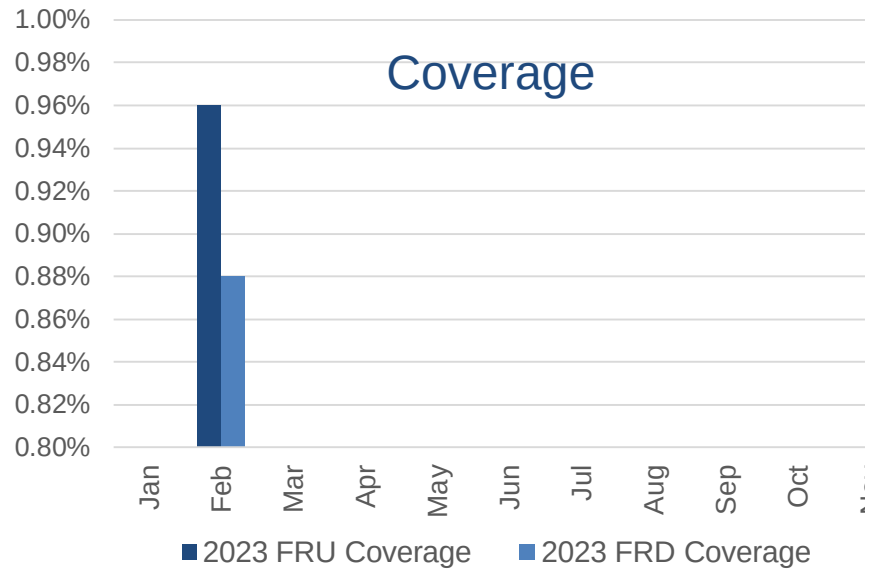
Example: Daily Requirements Comparison

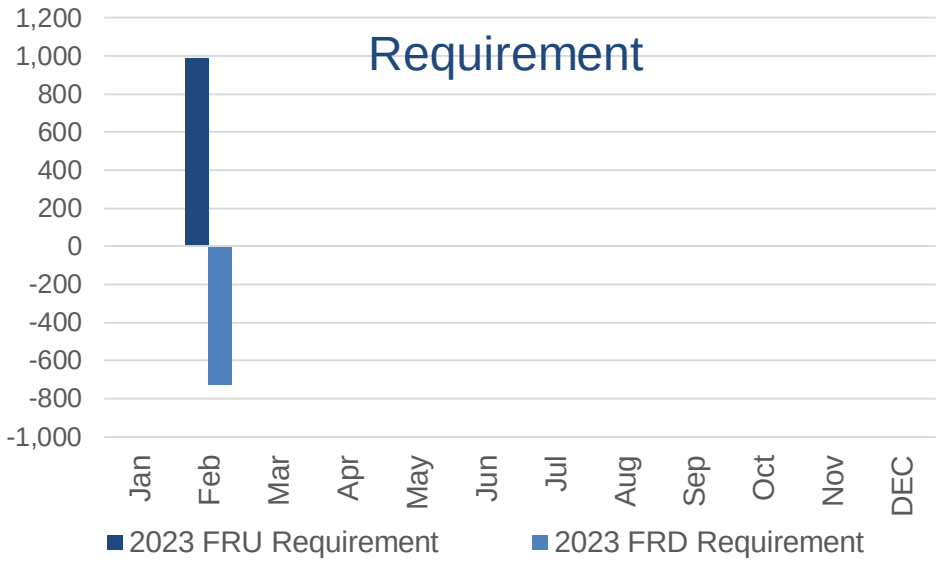


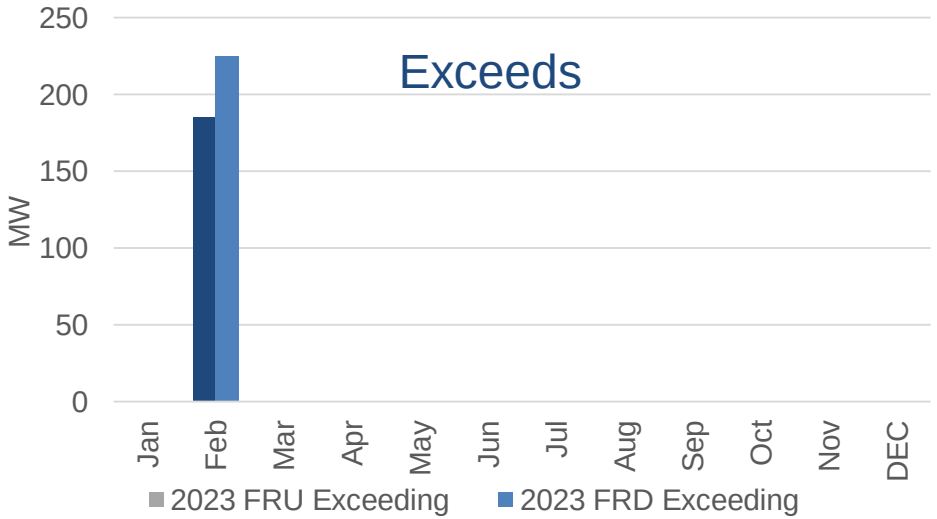
Example: Daily Requirements Comparison

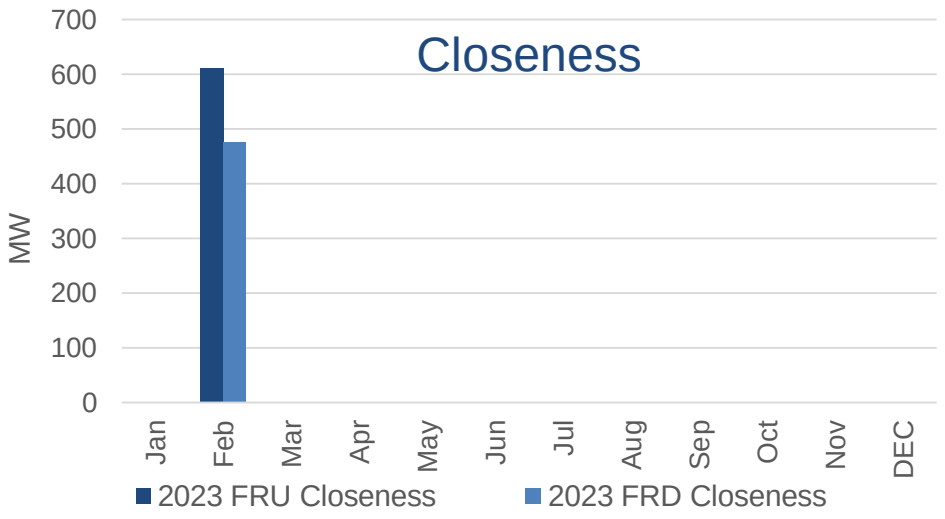


FRP Requirement Performance Evaluation: CAISO

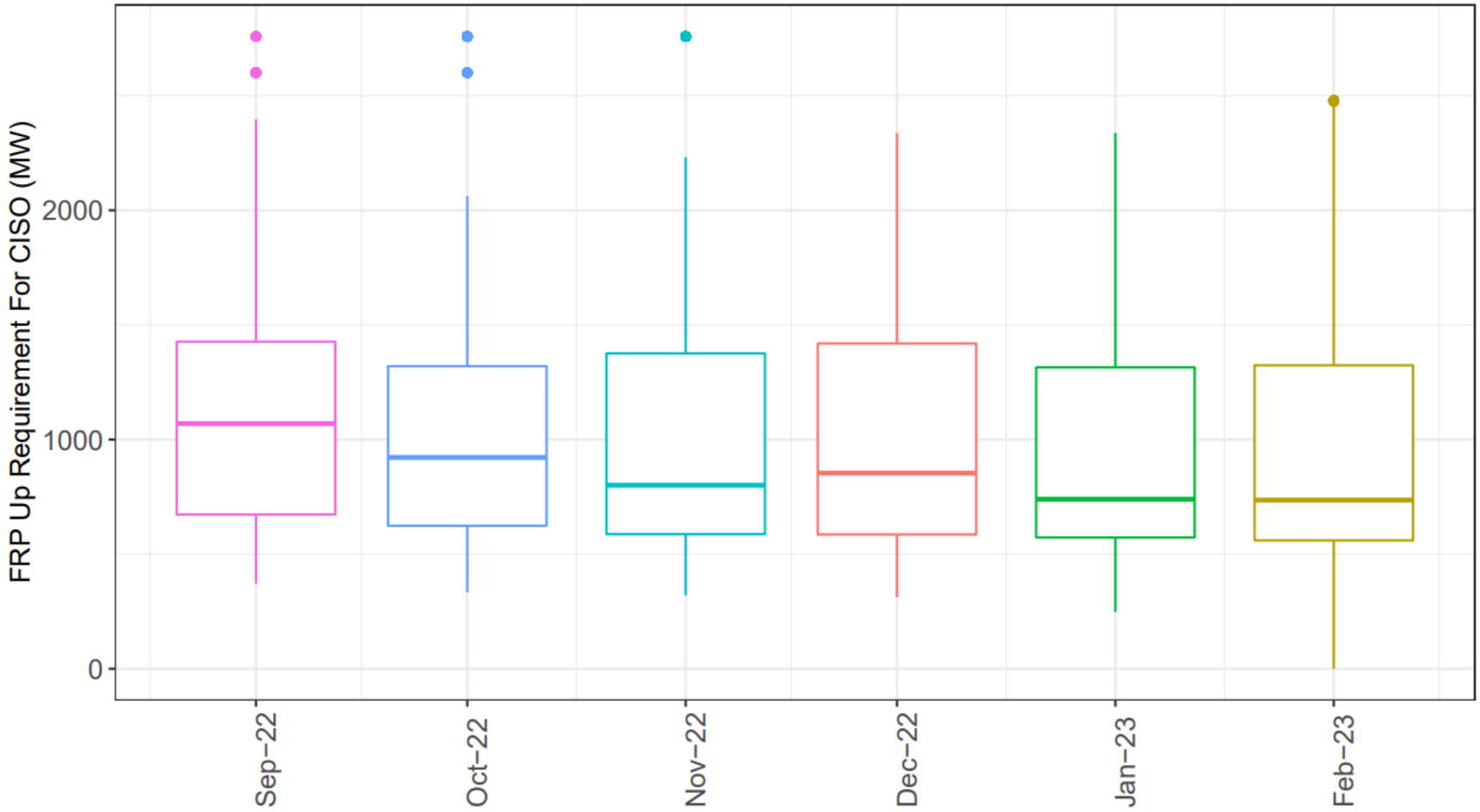




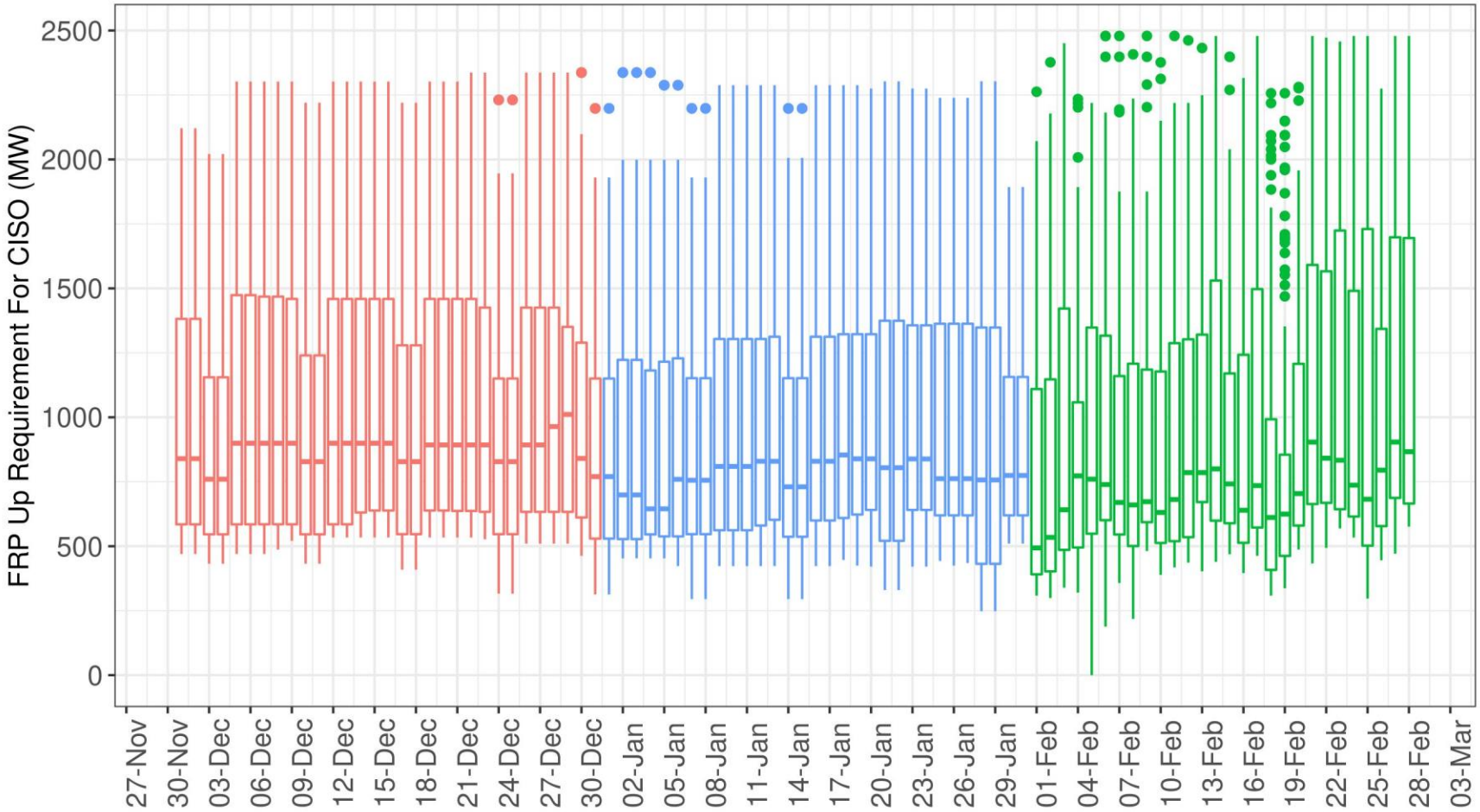




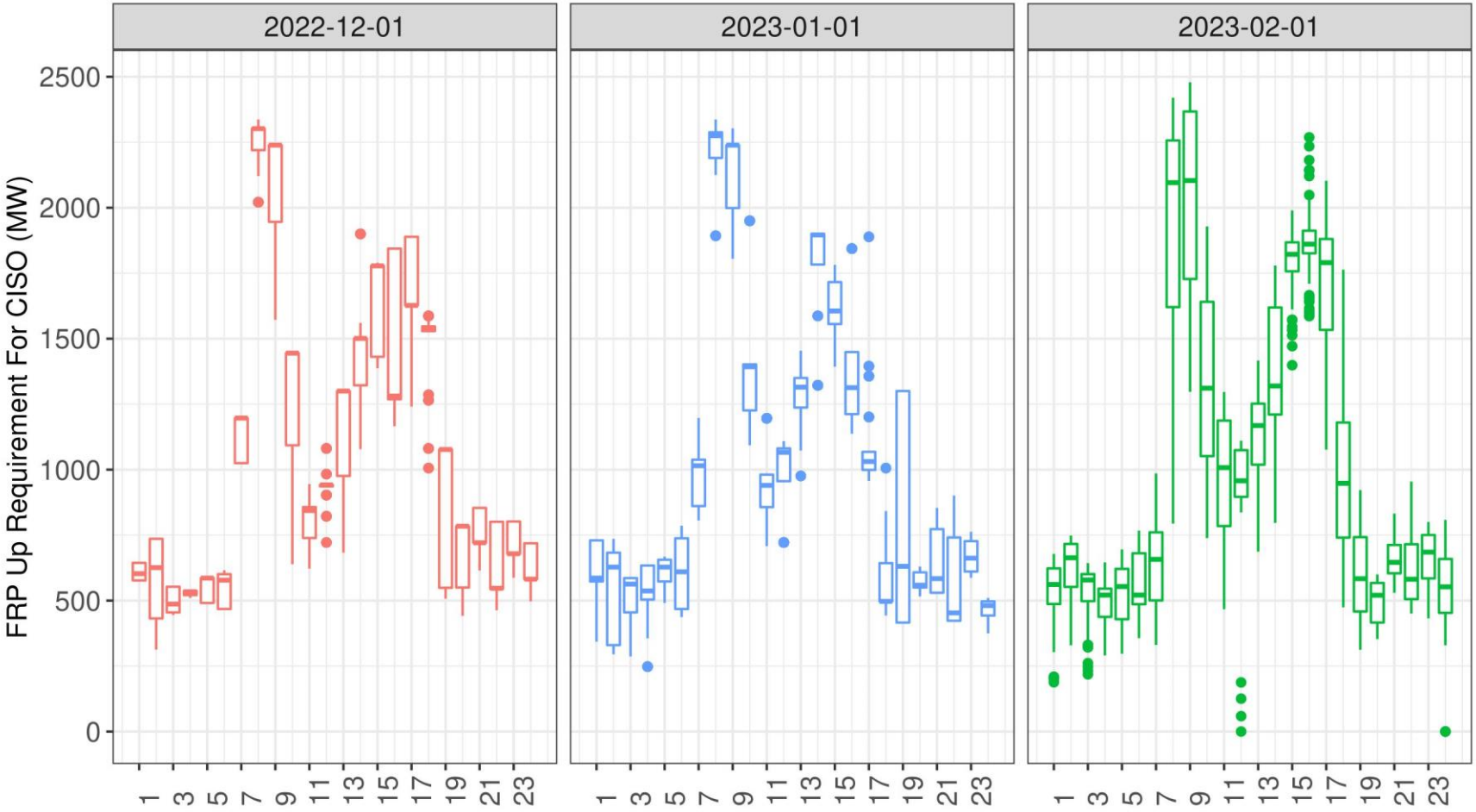
Uncertainty Requirement in the up direction trends within typical ranges



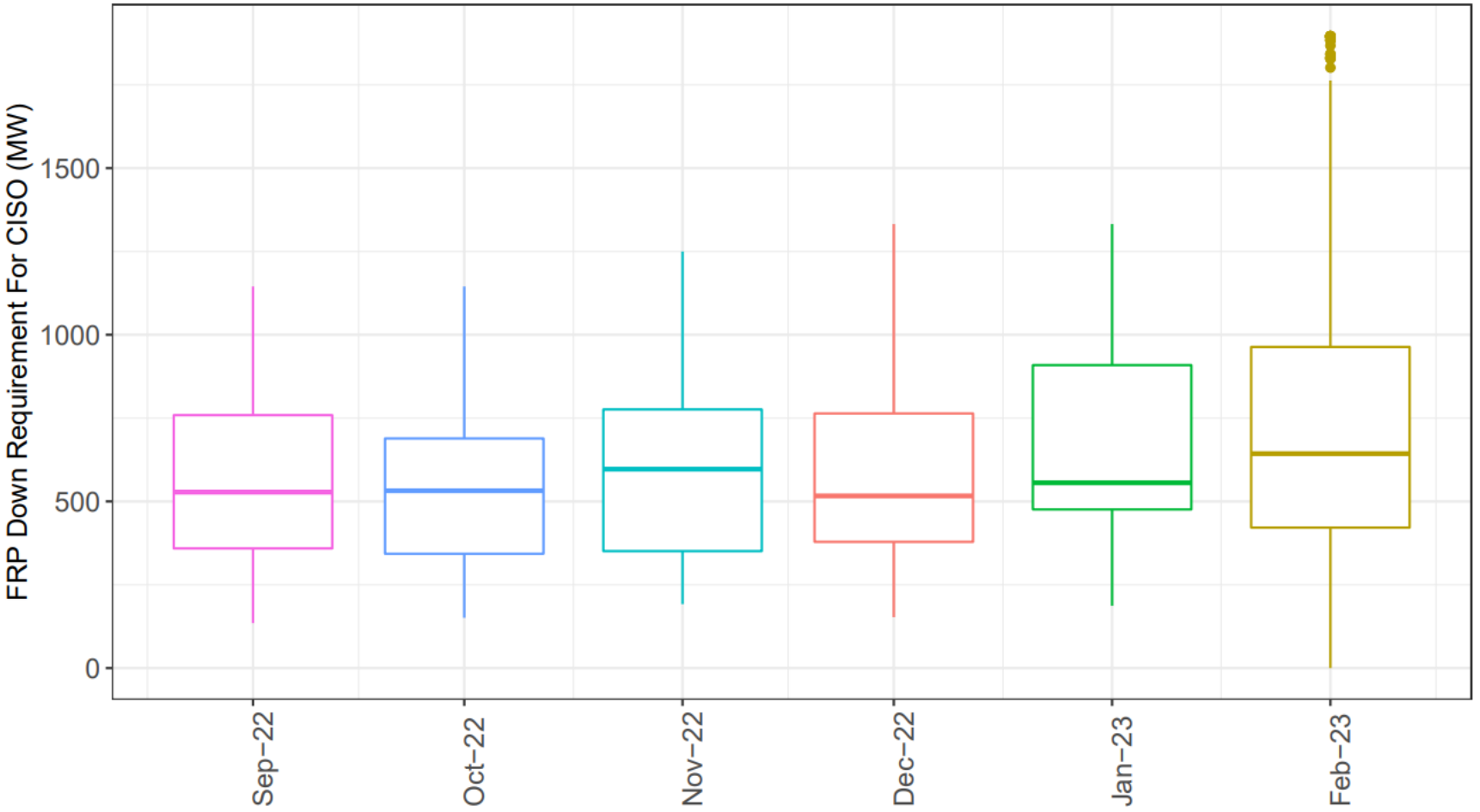
Uncertainty Requirement in the up direction remain within typical ranges



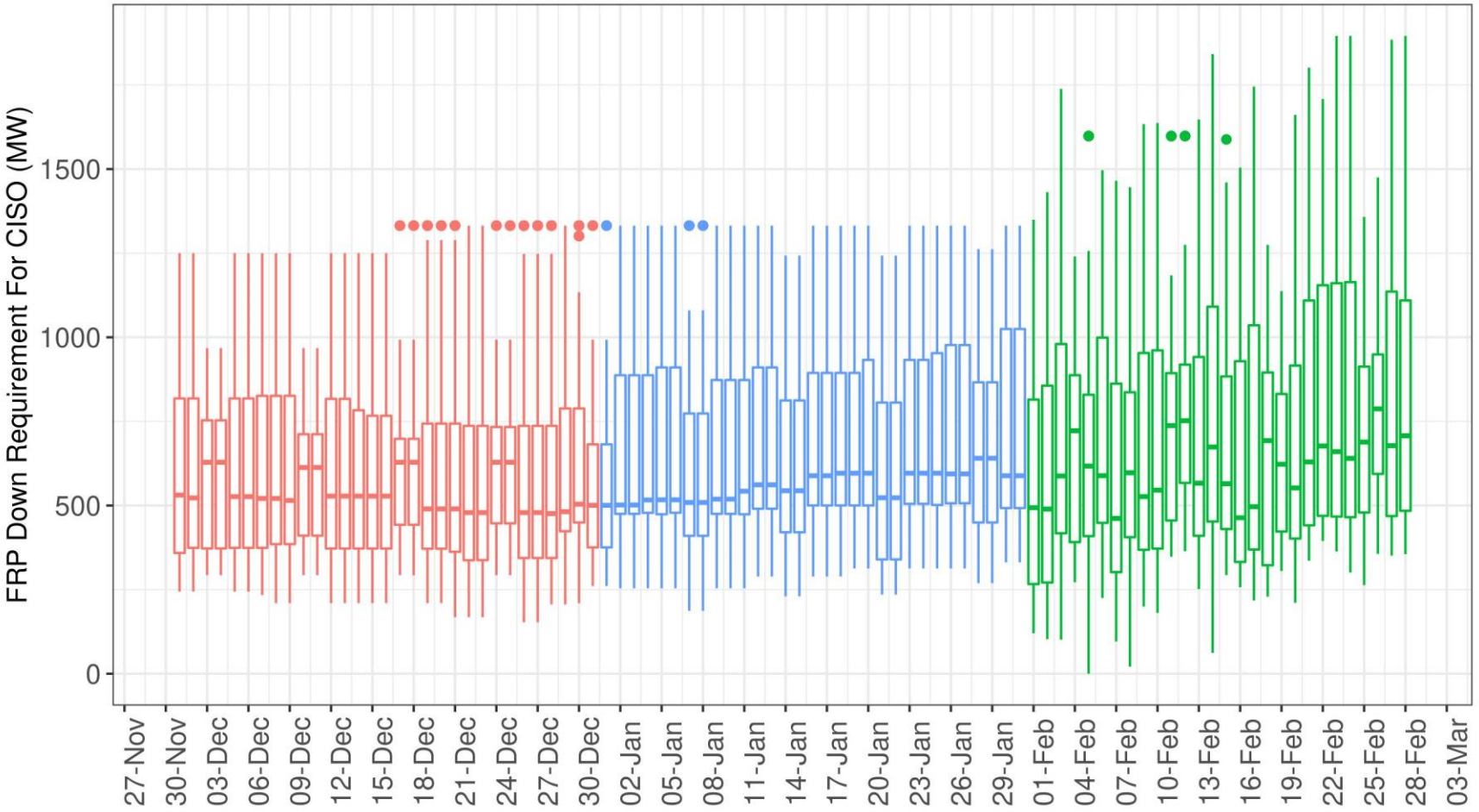
Hourly profile of uncertainty Requirement in the up direction showed a more defined pattern in February



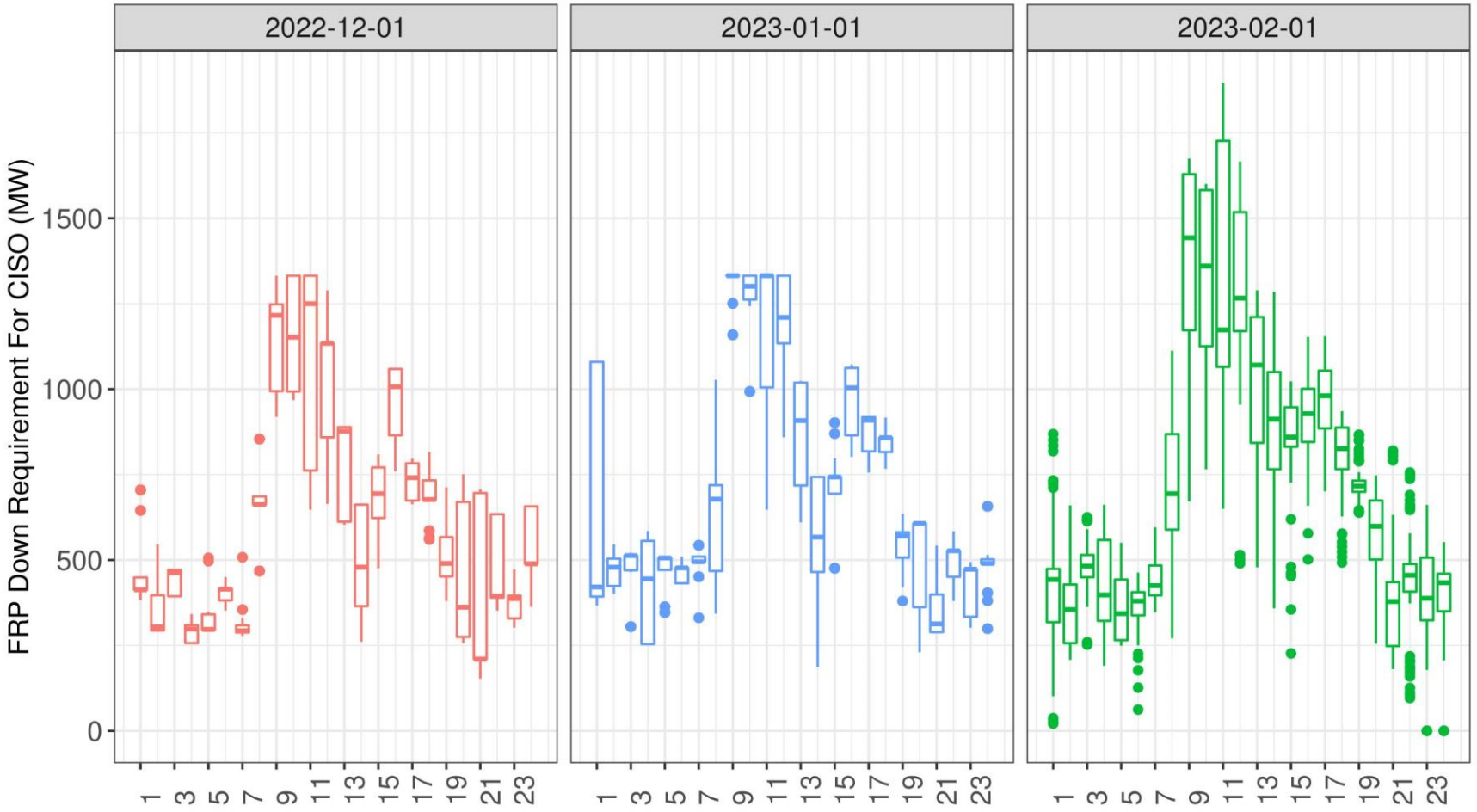
Uncertainty Requirement in the down direction increased fairly in February



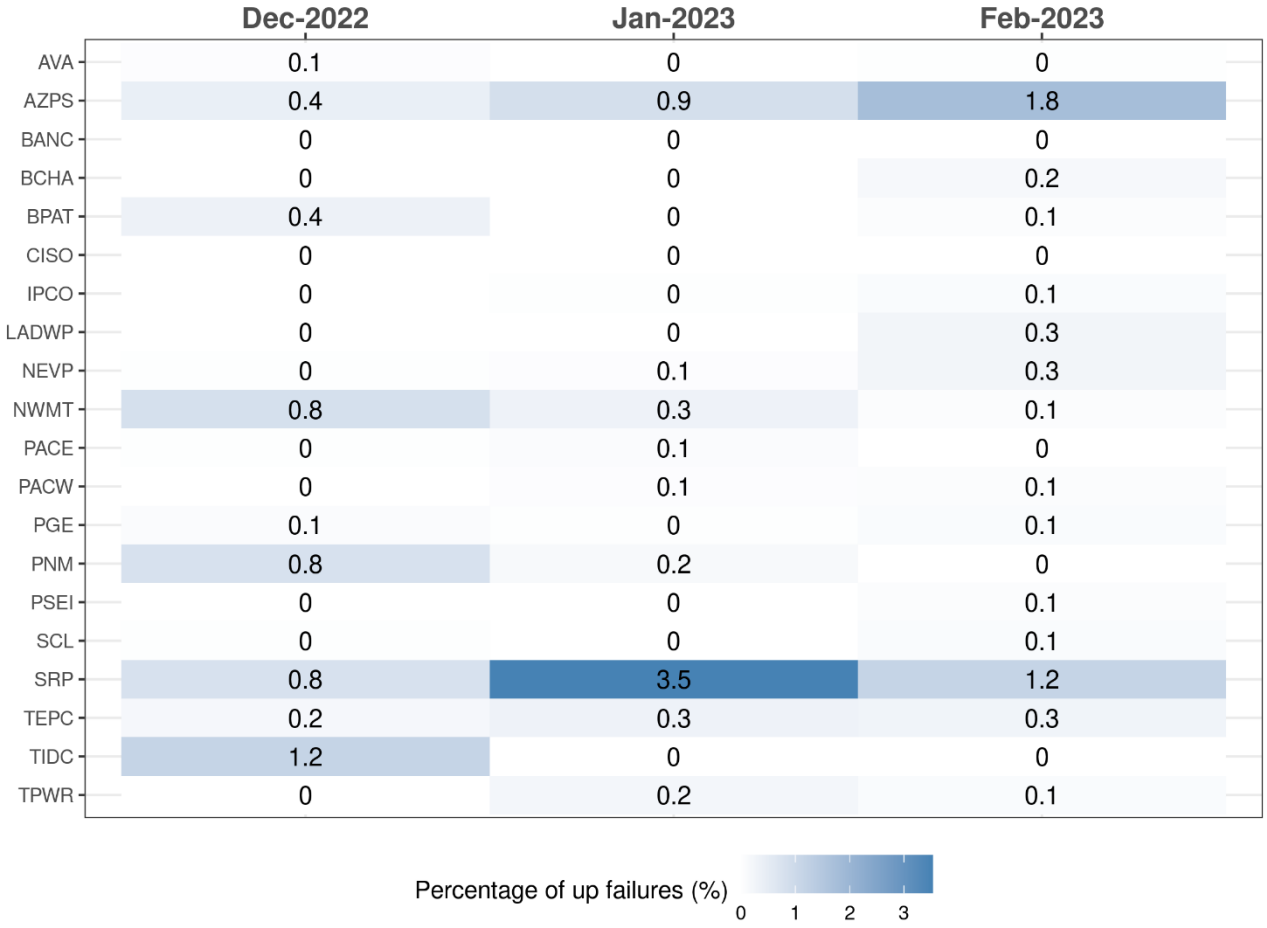
Uncertainty Requirement in the down direction increased fairly in February 2023



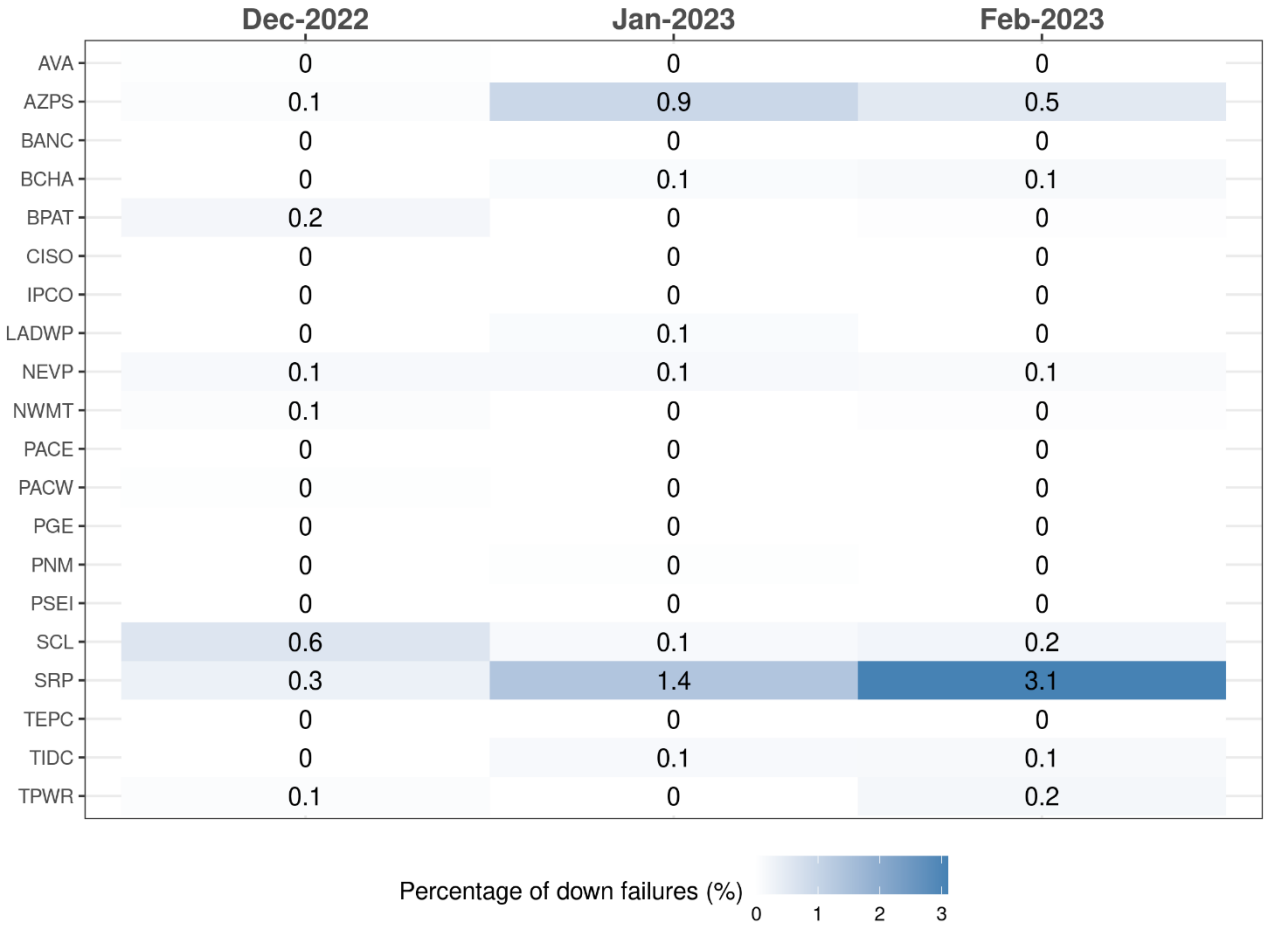
Uncertainty Requirement in the down direction increased more markedly in the early hours of the day



Flexible Ramping Test – Number of intervals in February 2023 failing in the up direction does not highlight major changes

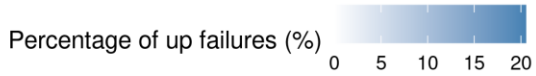


Flexible Ramping Test – number of intervals failed in the down direction does not exhibit a defined trend



Flexible Ramping Test – number of intervals failed by hour for February 2023 in the up direction is mainly concentrated in the early hours

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
AZPS	0	0	0	0	1	1	0	12	21	4	0	0	0	1	0	1	0	2	0	0	0	2	0	0
BANC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCHA	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BPAT	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CISO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IPCO	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LADWP	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	0	1	2
NEVP	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1	0	3	0	0	0	0	0
NWMT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
PACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACW	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PGE	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
PNM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PSEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
SCL	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SRP	0	0	0	0	4	8	10	3	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
TEPC	0	0	0	0	0	2	0	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
TIDC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPWR	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Flexible Ramping Test – number of intervals failed by hour for February 2023 in the down direction

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
AVA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AZPS	0	0	0	0	0	1	0	2	0	4	1	0	0	2	0	0	4	0	0	0	0	0	0	0
BANC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BCHA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0
BPAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
CISO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IPCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LADWP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NEVP	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
NWMT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
PACE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PGE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PNM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PSEI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0
SRP	0	0	0	2	0	0	0	0	2	3	3	0	8	7	17	22	8	2	0	0	0	1	1	0
TEPC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TIDC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
TPWR	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Percentage of down failures (%)

0 5 10 15 20

The passing group consists of generally most of the WEIM areas

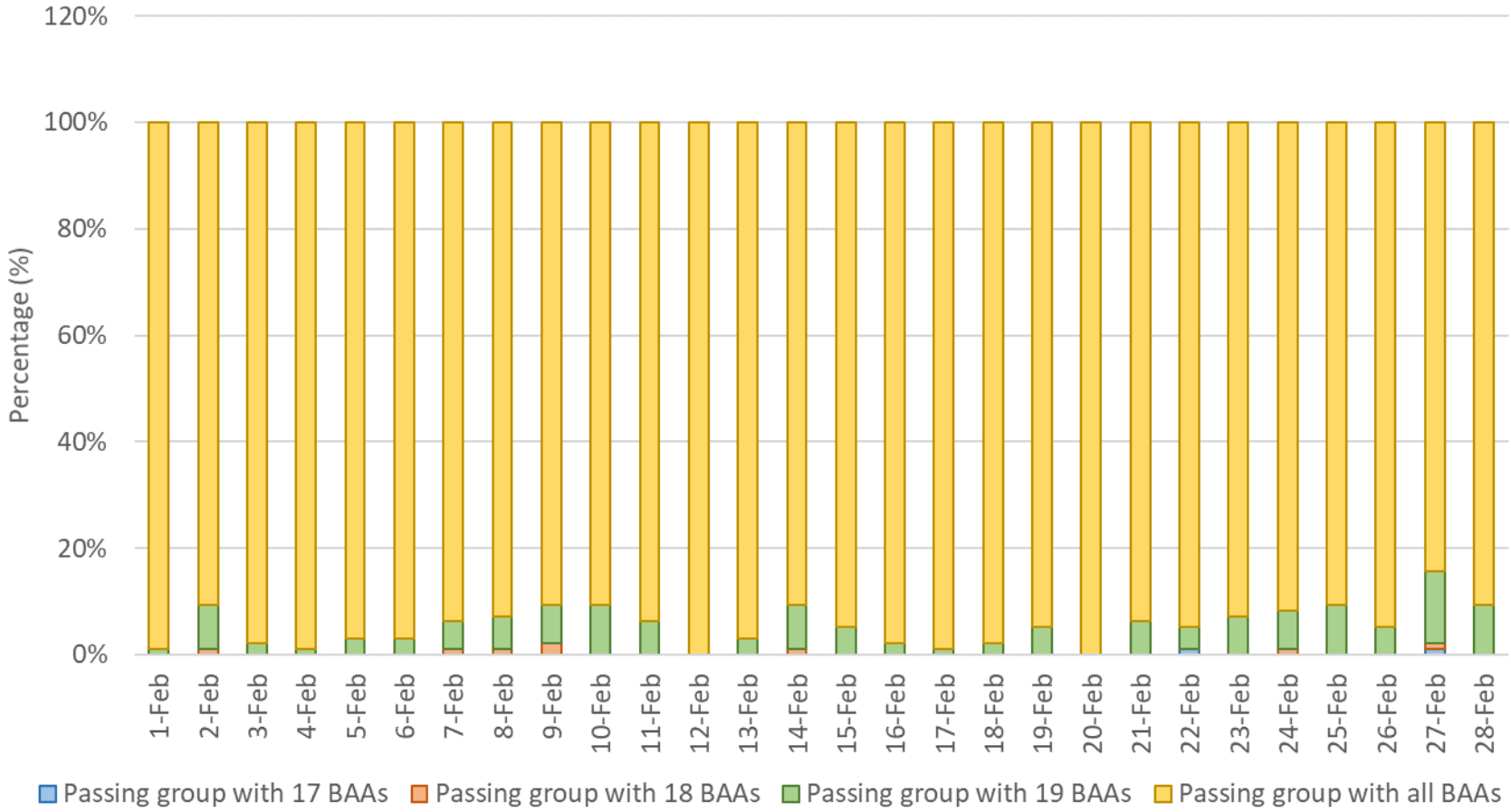
FRD

BAAs	Passing group with 18 BAAs	Passing Group with 19 BAAs
AZPS		X
BCHA		X
BPAT		X
NEVP		X
SCL		X
SRP		X
TIDC		X
TPWR		X
AZPS, NEVP	X	
AZPS, SRP	X	
BCHA, SRP	X	
BPAT, NWMT	X	
BPAT, SRP	X	
SRP, TIDC	X	

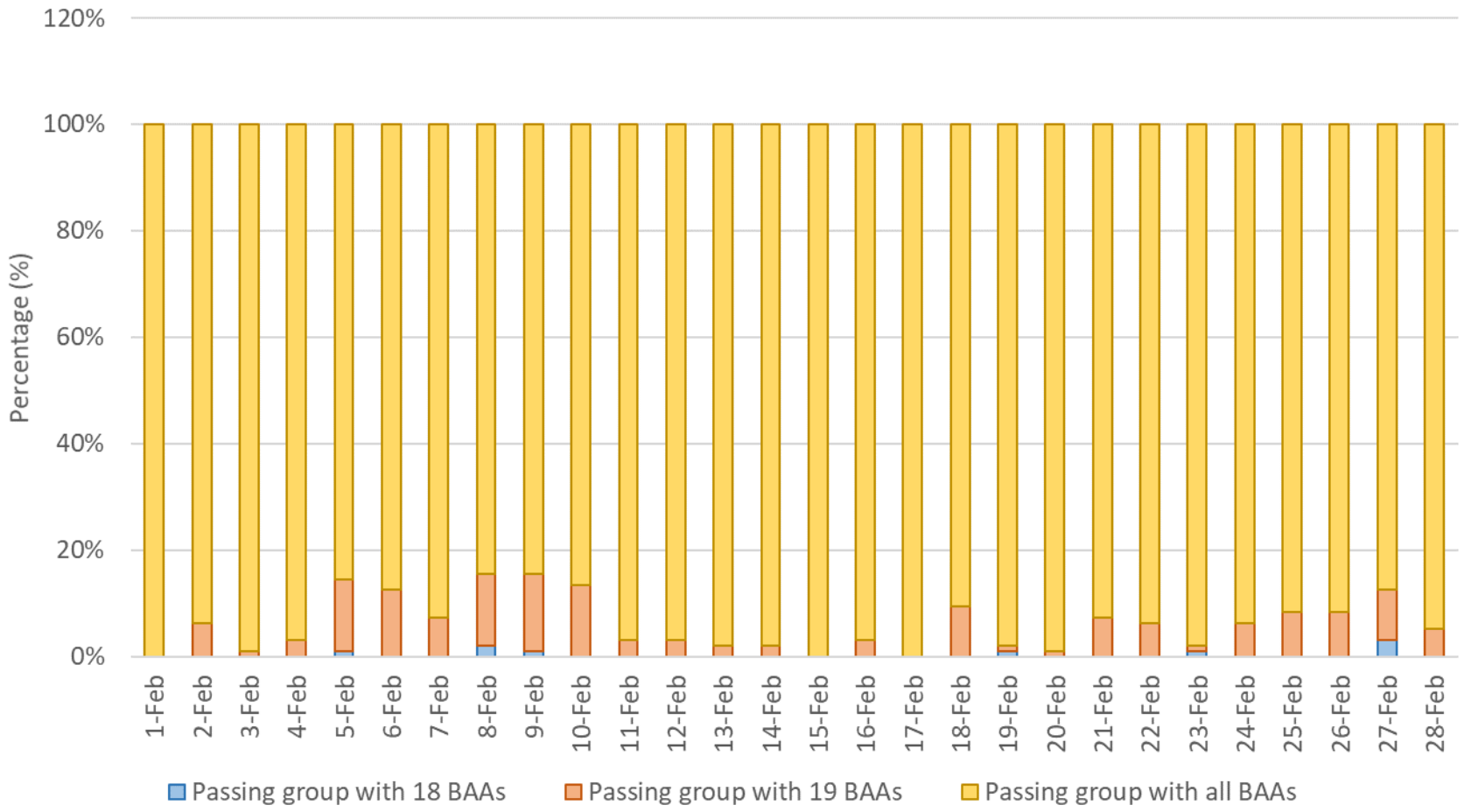
FRU

BAAs	Passing Group with 17 BAAs	Passing group with 18 BAAs	Passing group with 19 BAAs
AVA			X
AZPS			X
BCHA			X
BPAT			X
IPCO			X
LADWP			X
NEVP			X
NWMT			X
PACW			X
PGE			X
PSEI			X
SCL			X
SRP			X
TEPC			X
TPWR			X
AZPS, SRP		X	
SRP, TEPC		X	
BCHA, IPCO		X	
LADWP, NEVP		X	
PACW, SRP		X	
NWMT, PACW, PGE	X		
AZPS, SRP, TEPC	X		

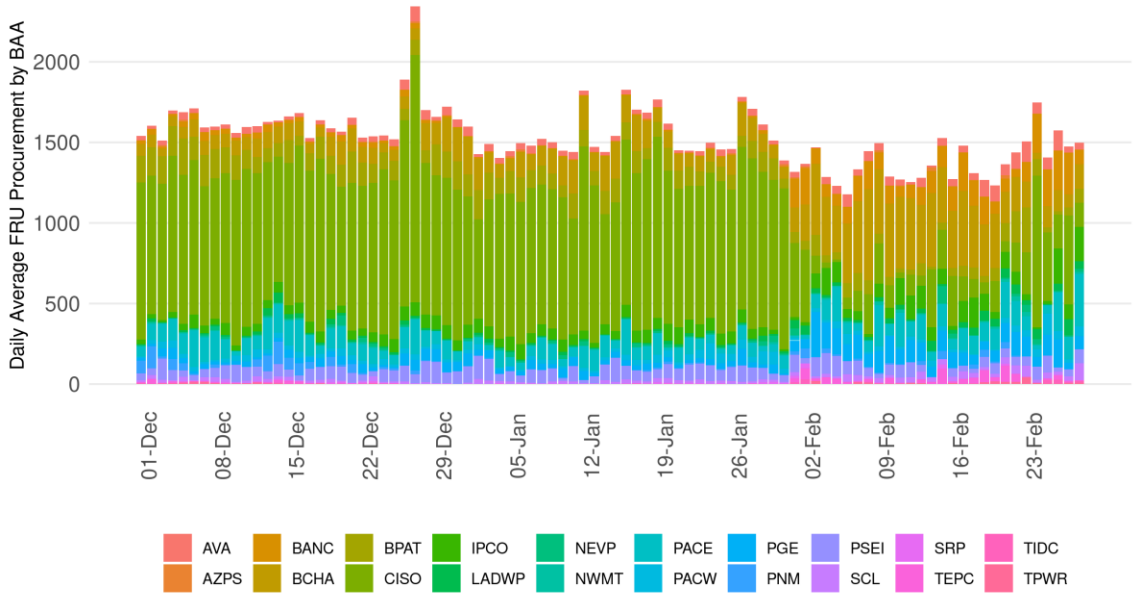
Over 80 percent of the time, the passing group consists of all WEIM areas



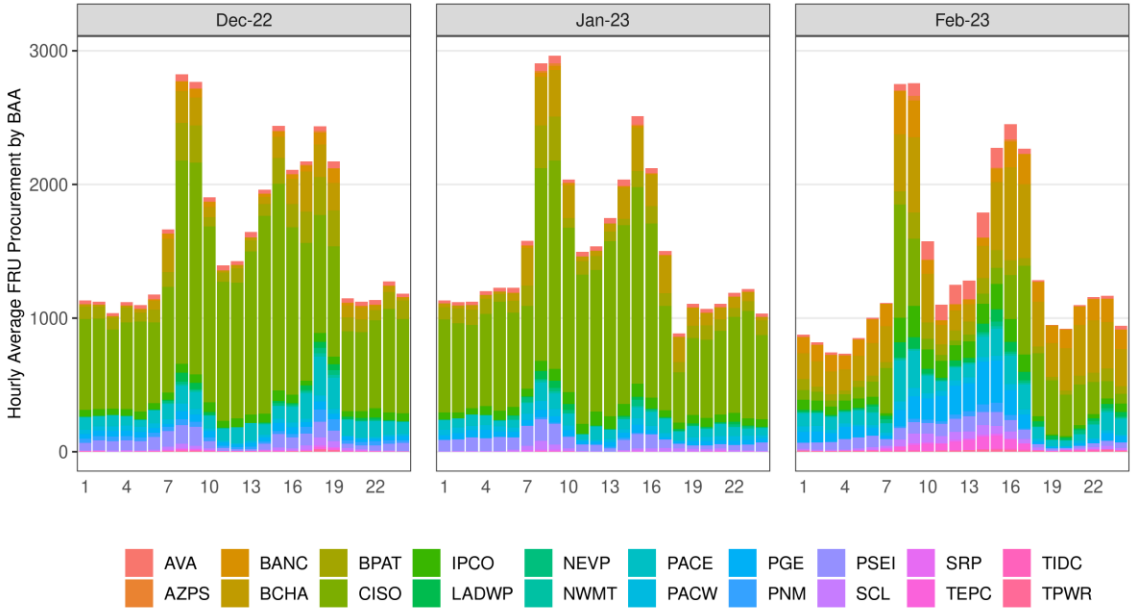
Over 80 percent of the time, the passing group consists of all WEIM areas



Composition of FRP procurement –All WEIM areas

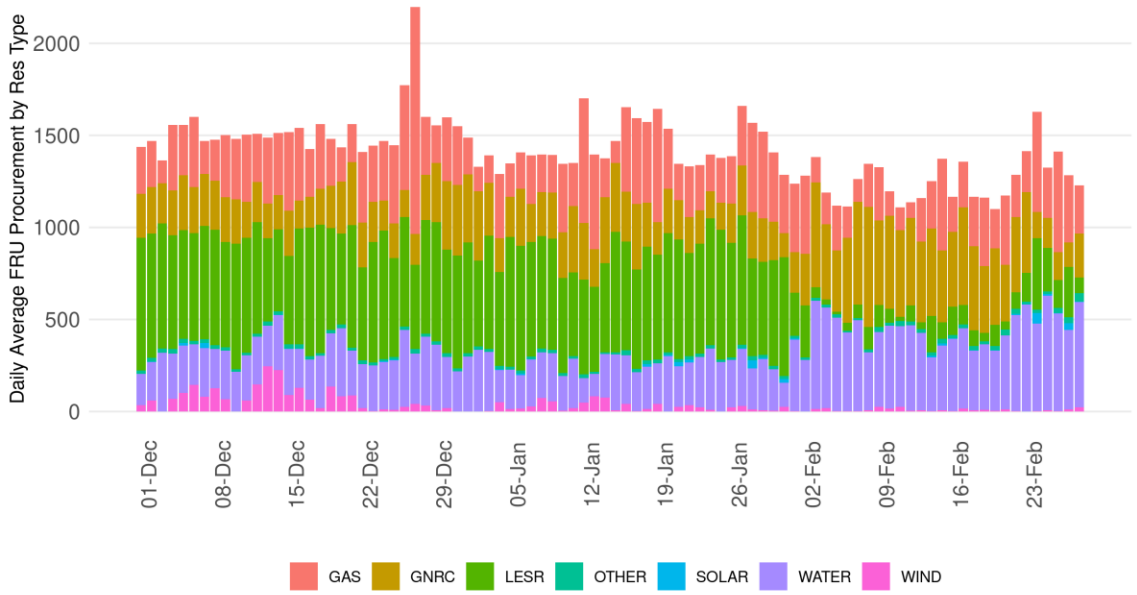


There is a noticeable change in the source of FRP procurement with the introduction of nodal logic

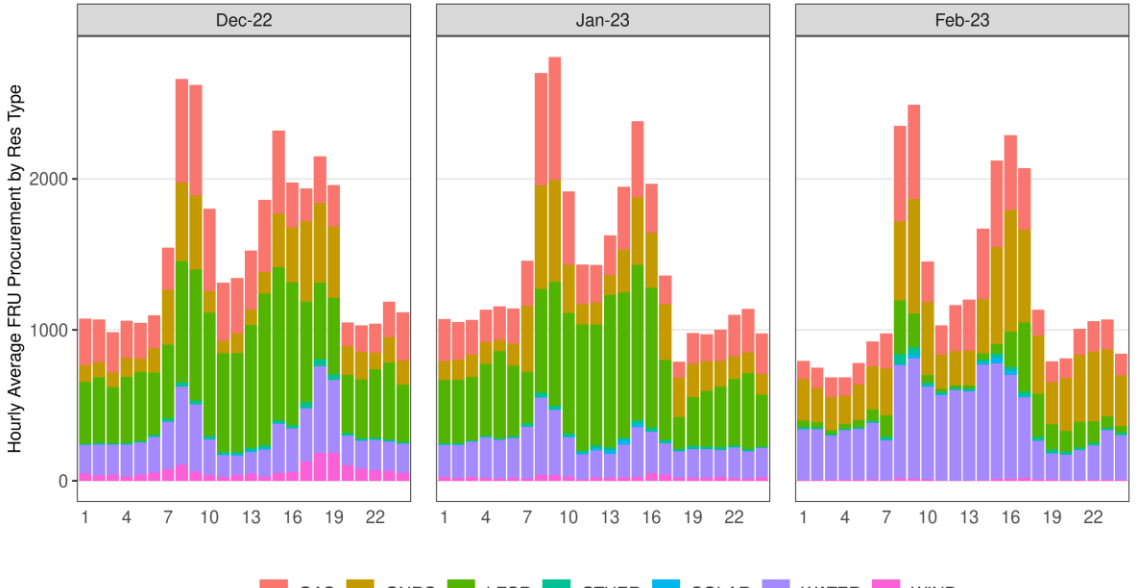


California ISO

FRU Procurement by Resource Type

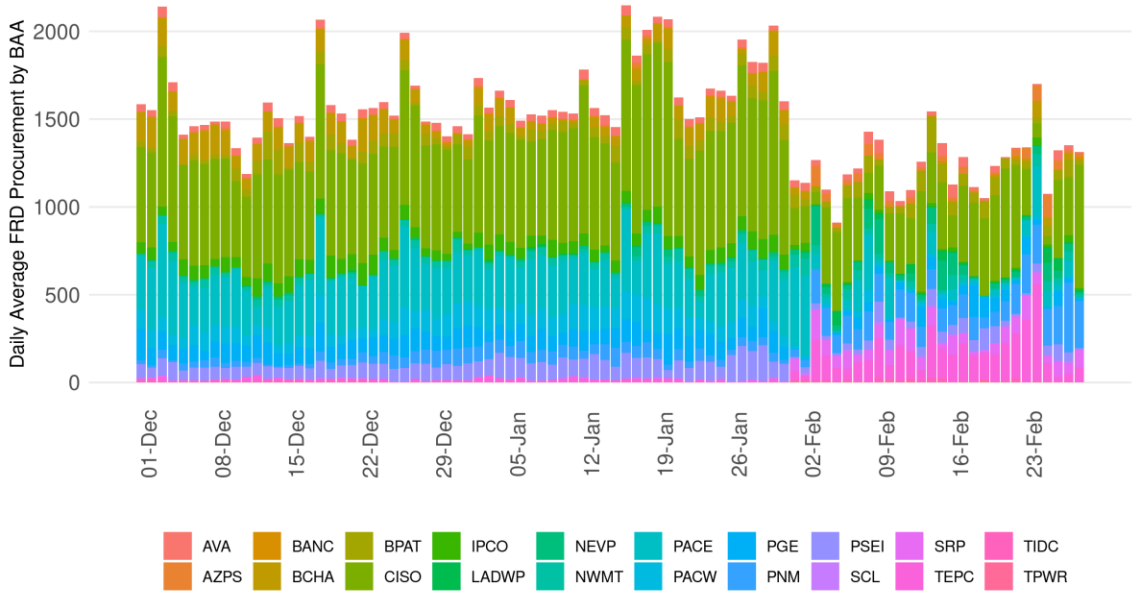


There is a noticeable change in the Type of resource procuring FRP after the introduction of nodal logic

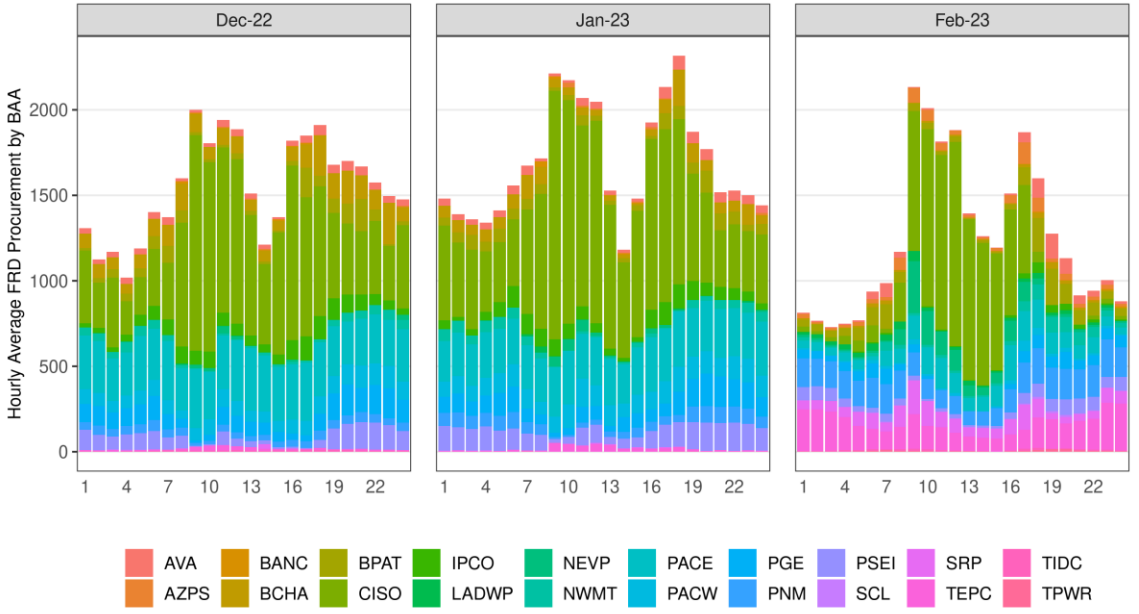


California ISO

FRD Procurement by BAA

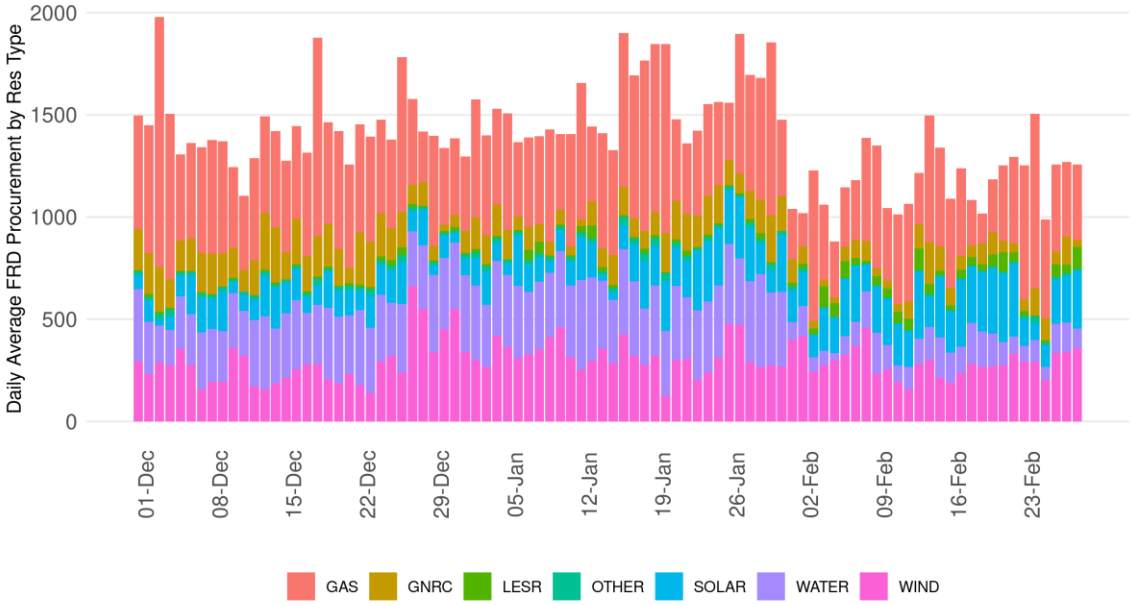


There is a noticeable change in the source of FRP procurement with the introduction of nodal logic

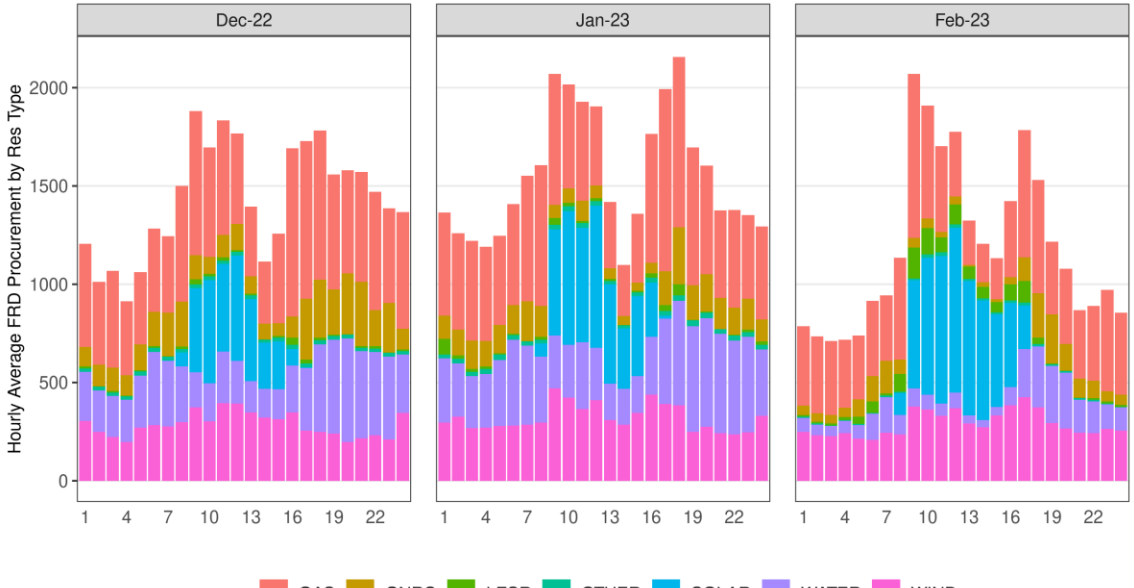


California ISO

FRD Procurement by Resource Type

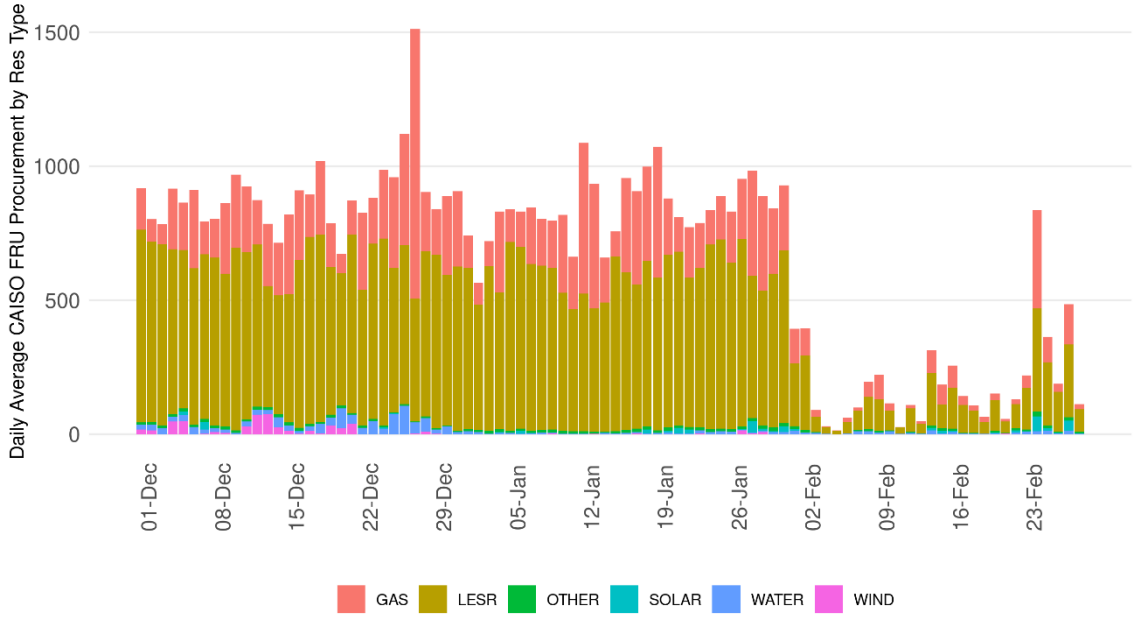


There is a noticeable change in the Type of resource procuring FRP after the introduction of nodal logic



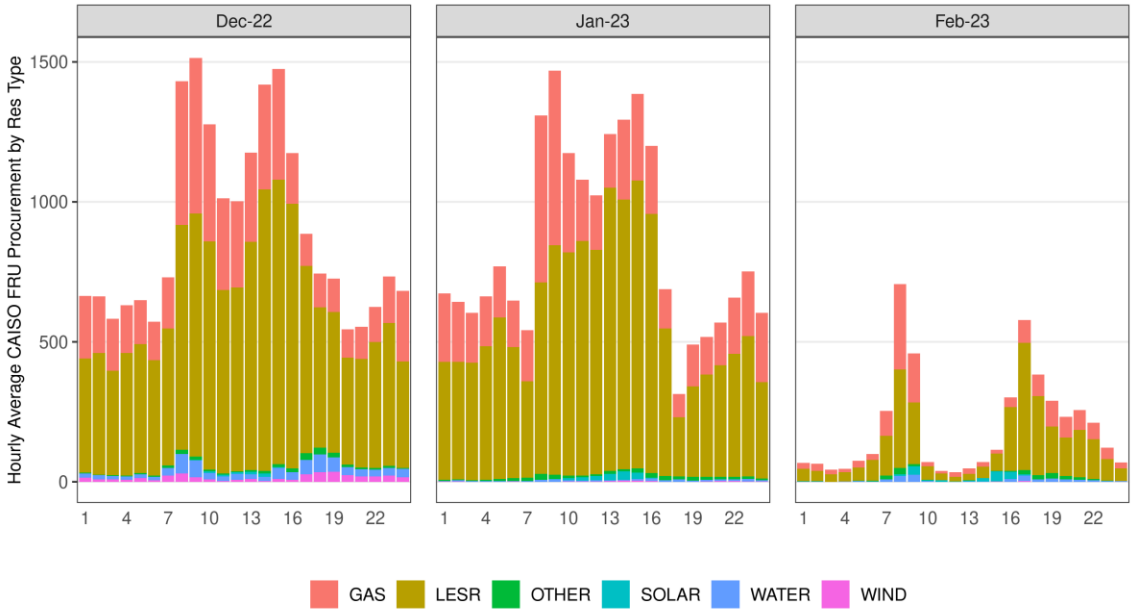
California ISO

CAISO FRU procurement by resource type



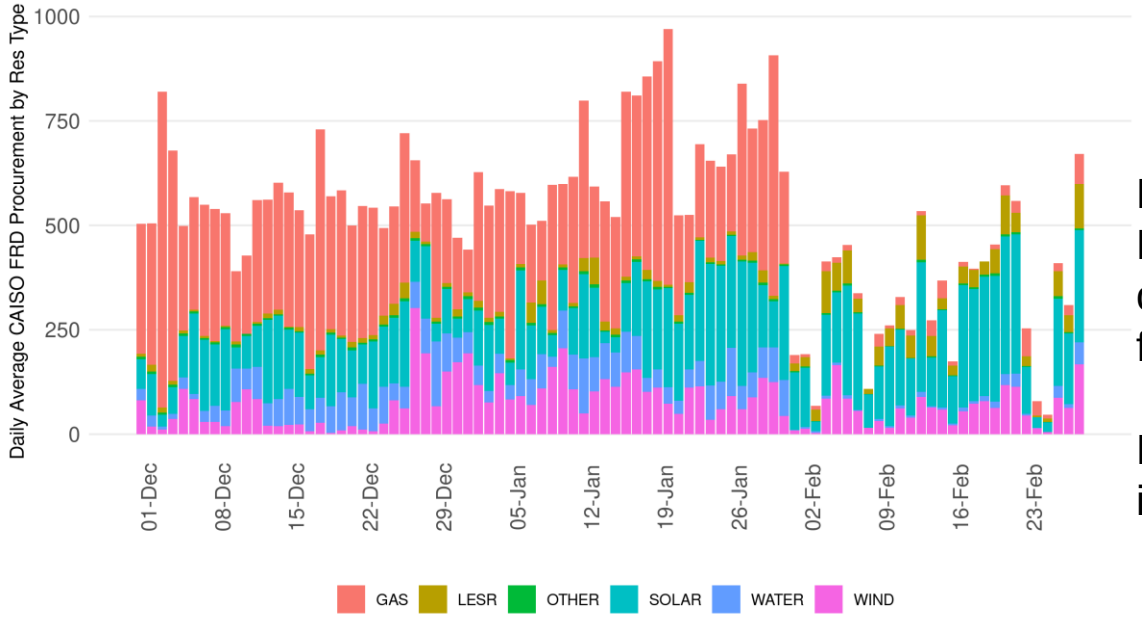
Procurement from CAISO area Dropped significantly with introduction of nodal procurement

No minimum requirement imposed for CAISO area



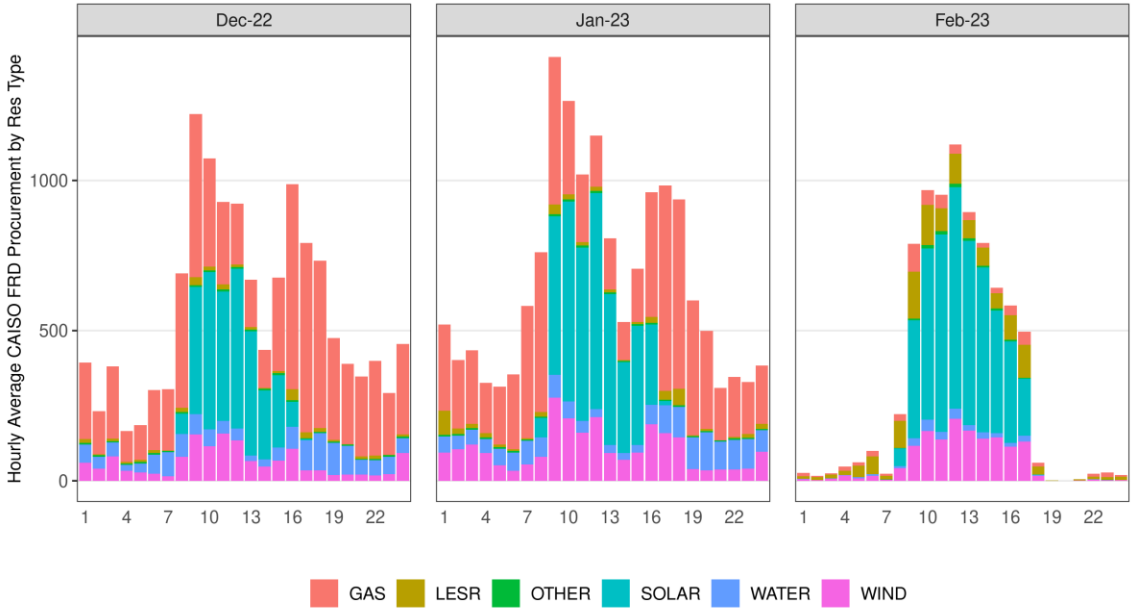
California ISO

CAISO FRD procurement by resource type



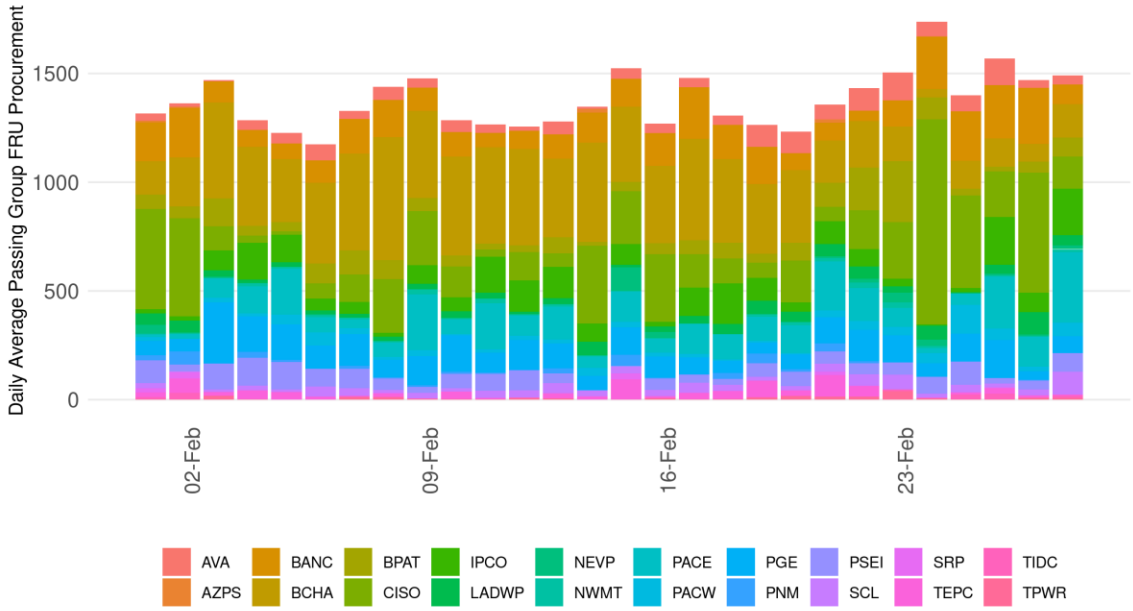
Procurement from CAISO area Dropped fairly with introduction of nodal procurement, mainly from gas resources

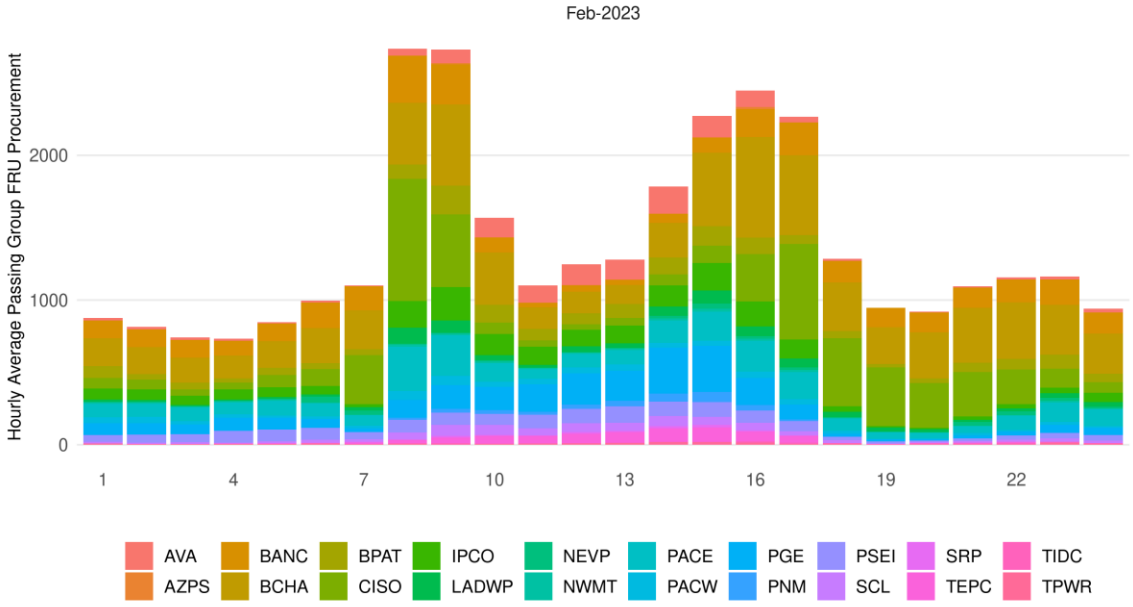
No minimum requirement imposed for CAISO area



California ISO

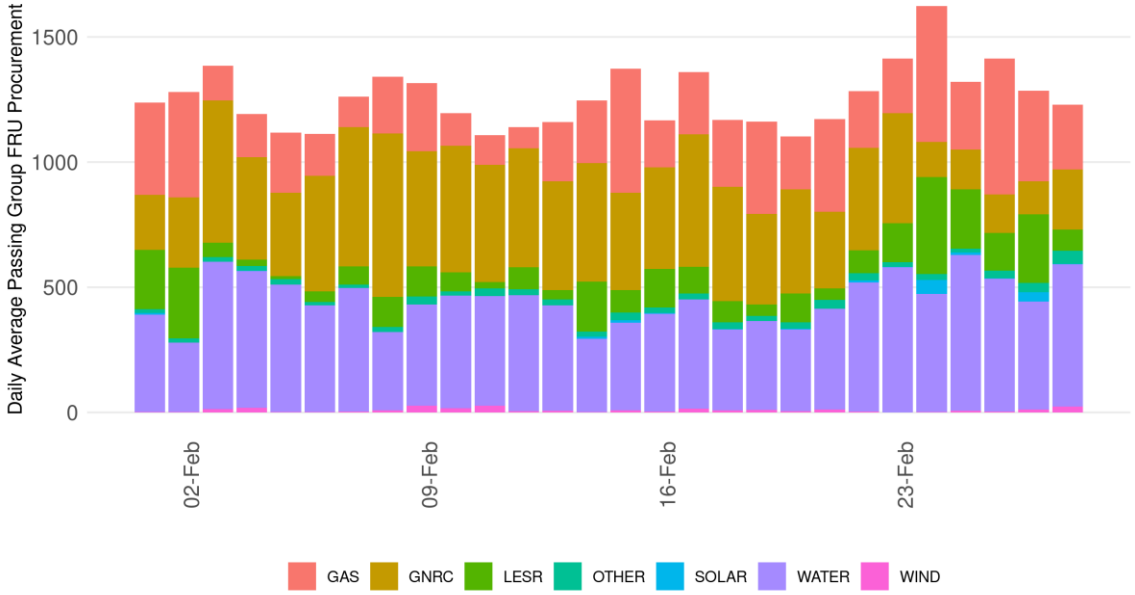
Passing Group FRU Procurement by BAA

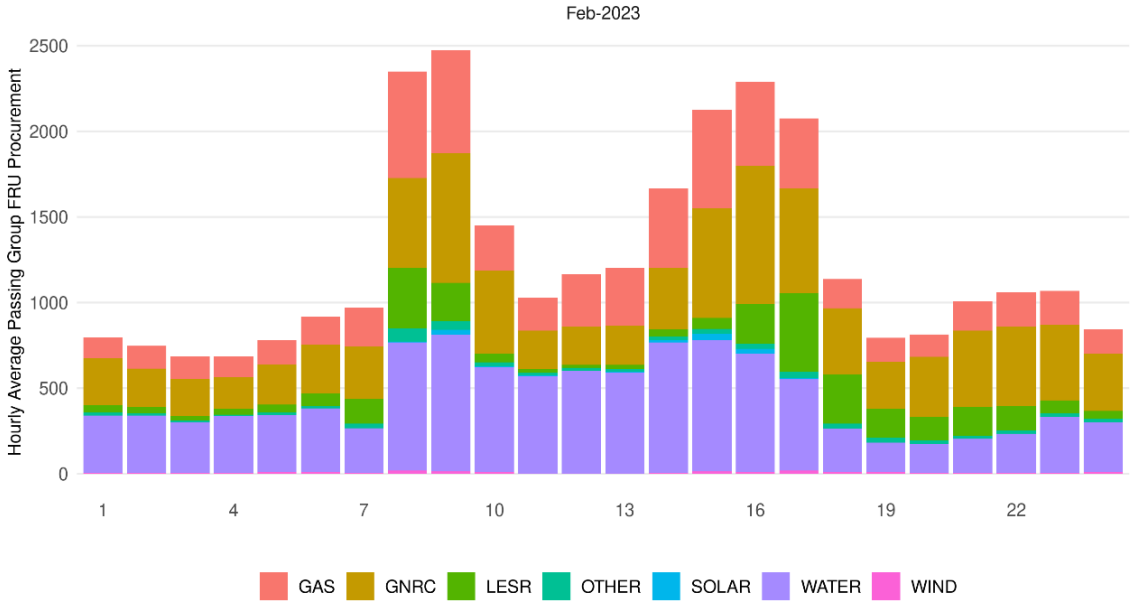




California ISO

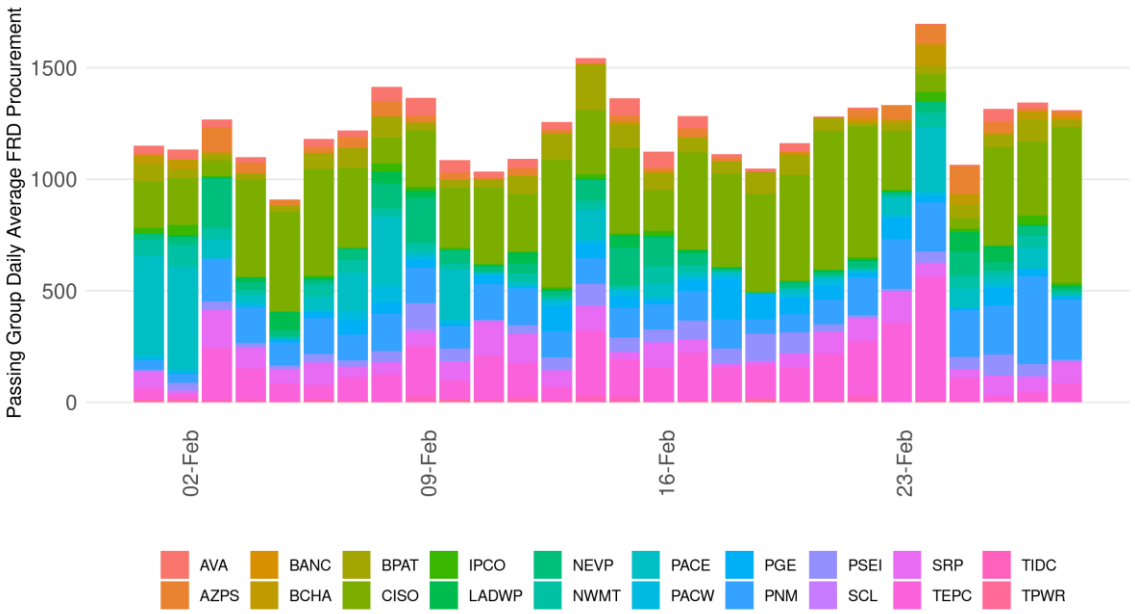
Passing Group FRU Procurement by Resource Type

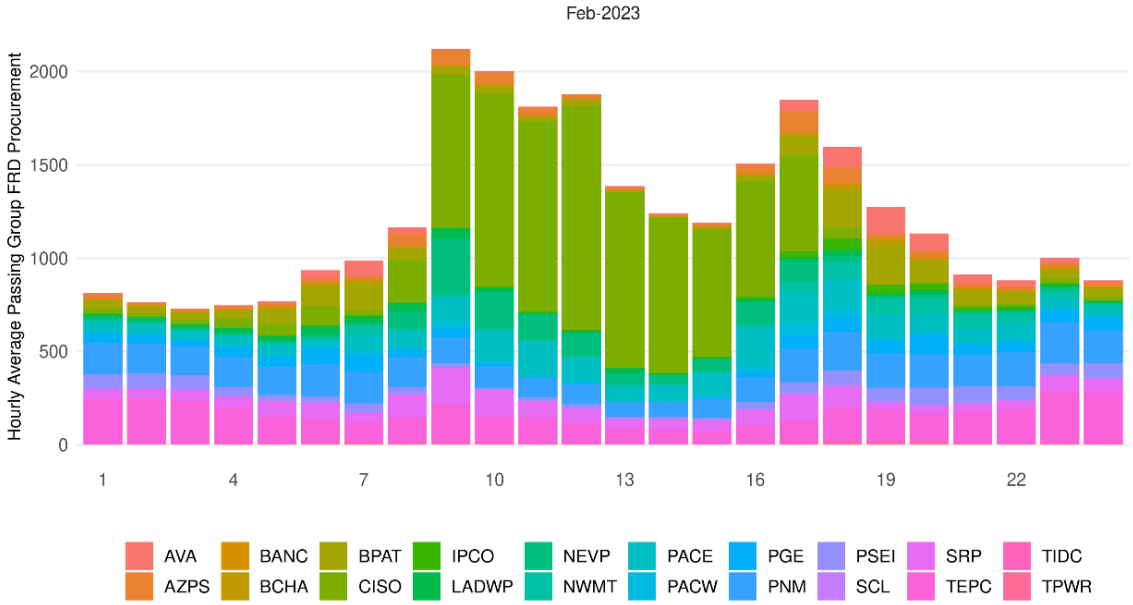




California ISO

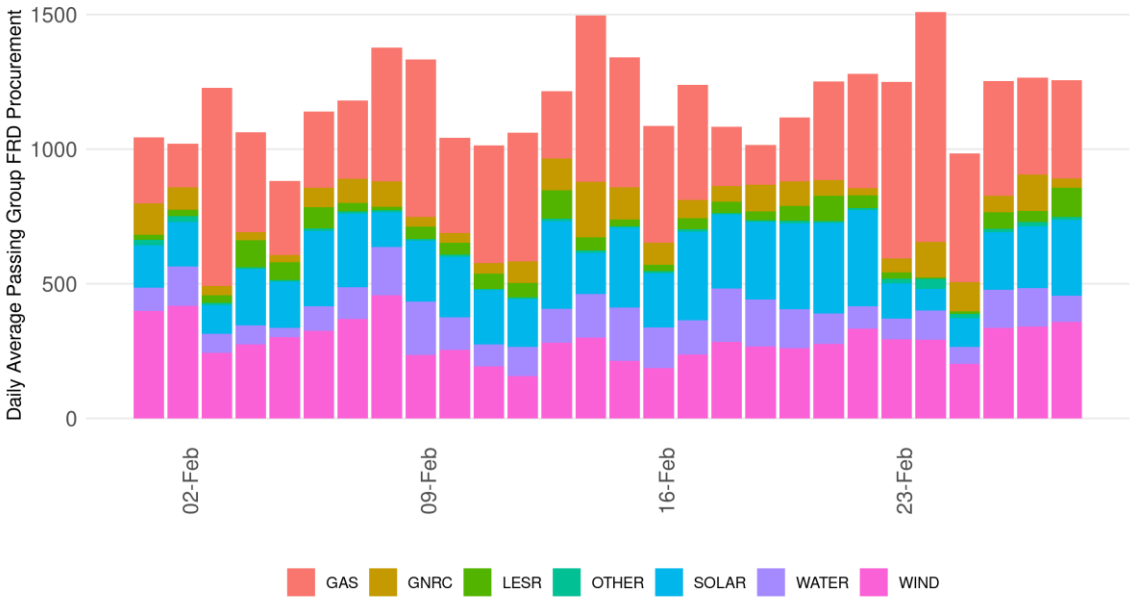
Passing Group FRD Procurement by BAA

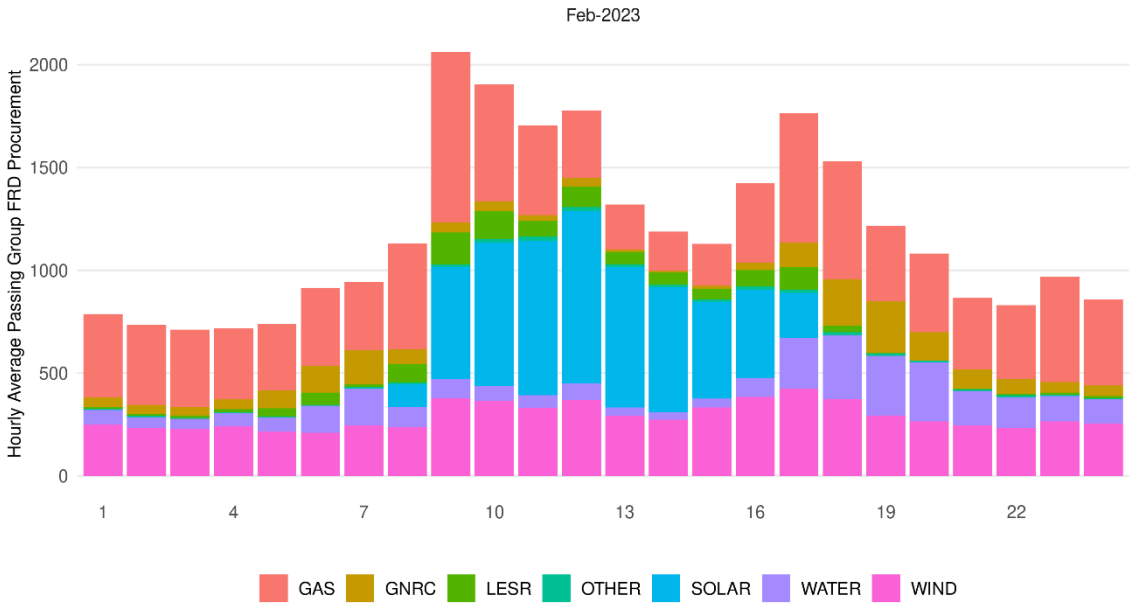




California ISO

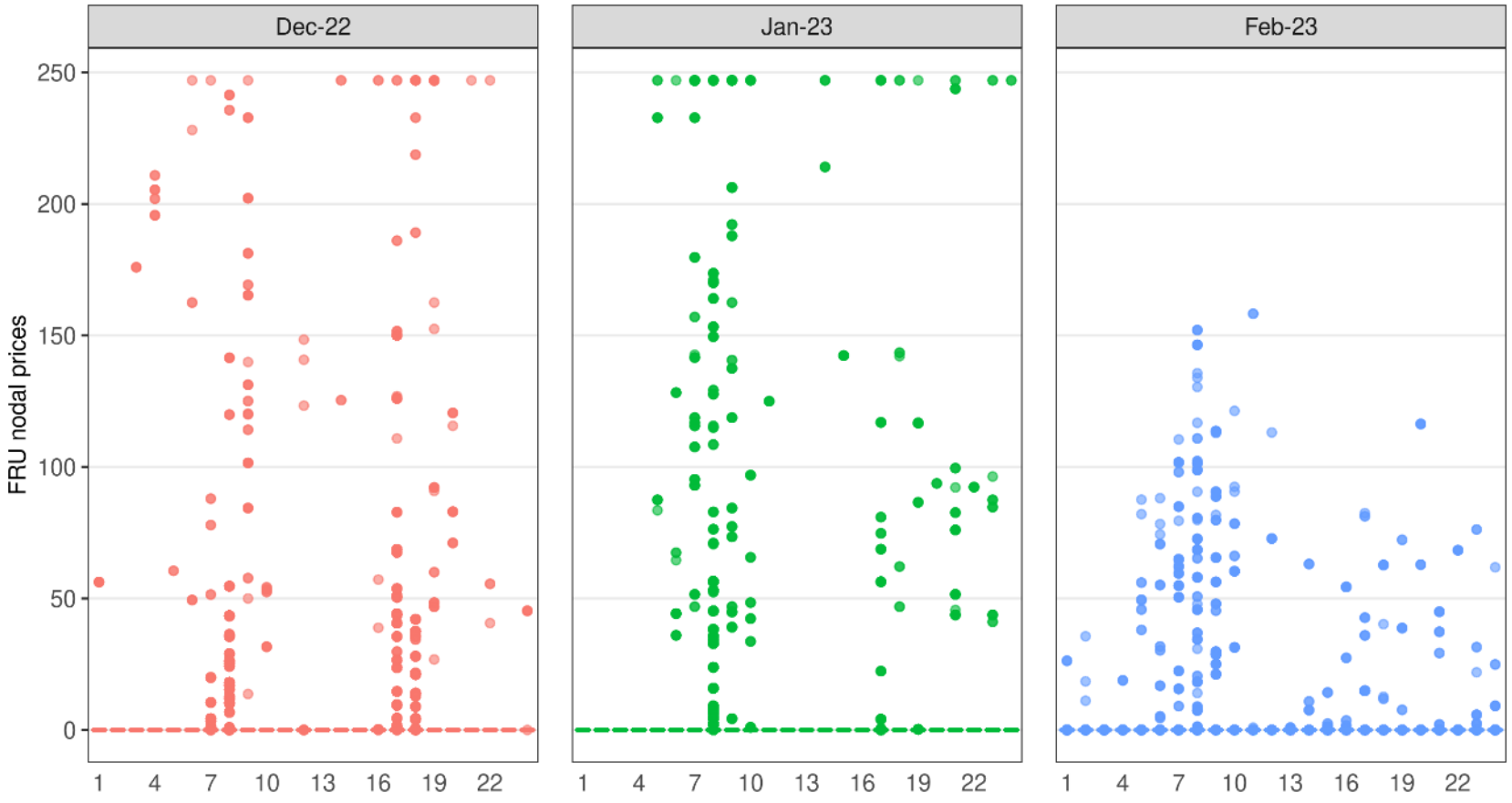
Passing Group FRD Procurement by Resource Type



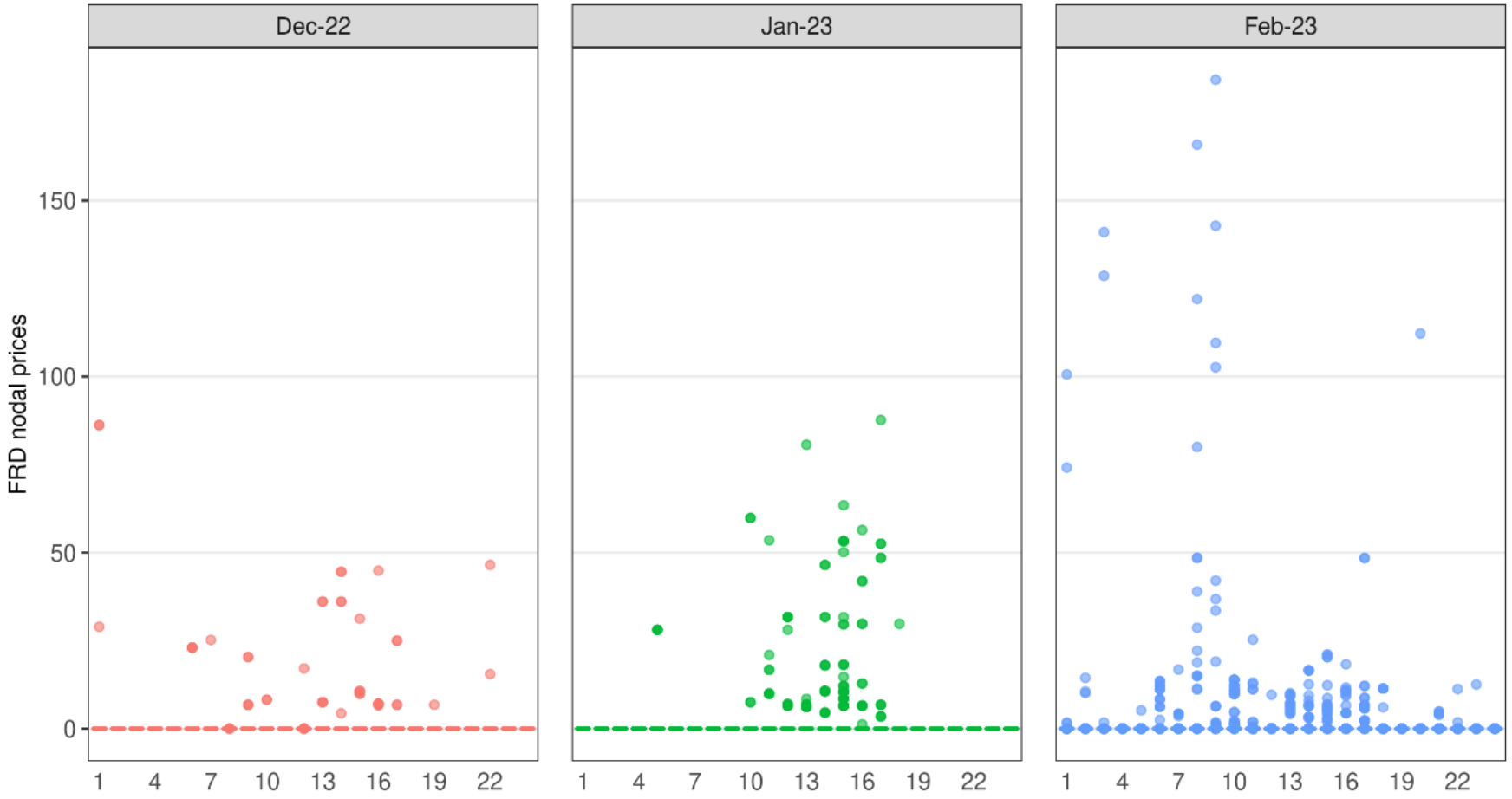


California ISO

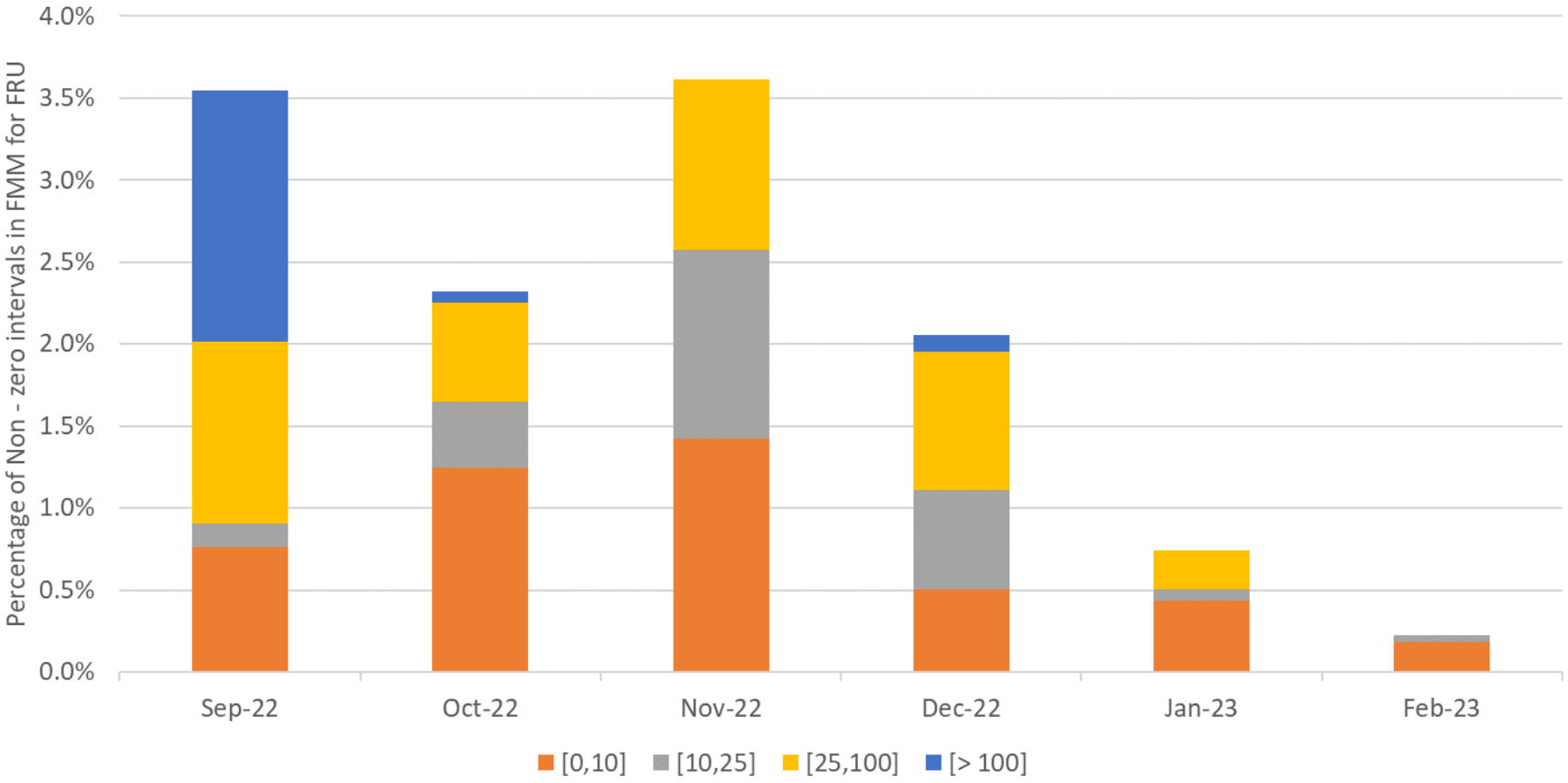
FRU Nodal prices in the FMM market have moderate spreads and remain low



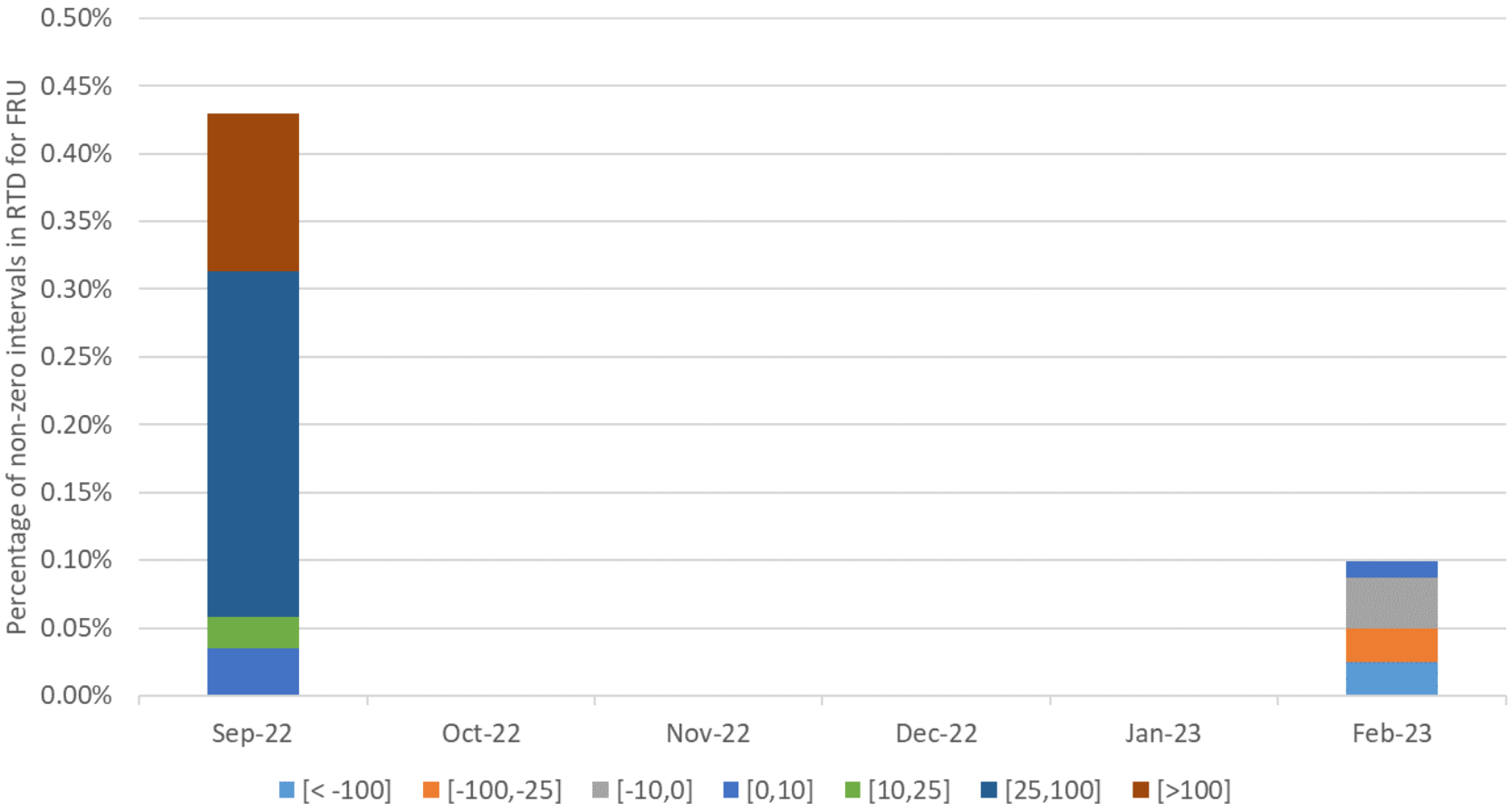
FRD Nodal Prices remain low but with wider spreads



Frequency of intervals with non-zero shadow prices in FMM market in the up direction for ISO continue to be low



Frequency of intervals with non-zero shadow prices in RTD market in the up direction for ISO continue to be low



Why FRP clears at $0?

- FRP procurement is from a larger area (passing area), in which there is plenty of capacity available from a diverse generation mix
- A subset of transmission constraints have been enforced for deployment scenarios as the ISO gains experience with the new model
- This time of the year tends to have less congestion, with low demand levels and relatively low prices
- As system transitions to Spring and shoulder months conditions are bounded to change
- FRP (nodal, zonal or system wide) is based on opportunity costs instead of bids.

Further considerations of FRP new functionality

- FRP enhancement implemented on Feb 1, 2023 introduce nodal procurement
- Similar to energy-based constraints, transmission constraints can be congested due to deployed FRP
- FRP prices are now nodal and have a reference-price component as well as a congestion component
- Nodal formulation ensure FRP is feasible for transmission constraints if deployed

Further considerations of FRP nodal functionality

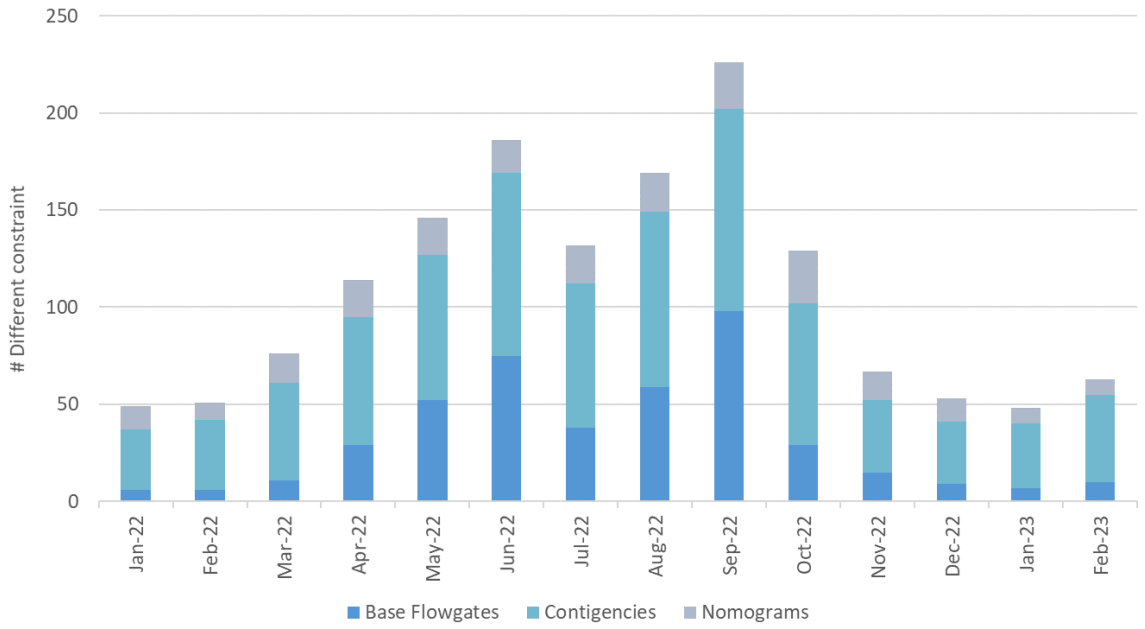
- Flow-based transmission constraints in CAISO's markets can be
    - Base flowgates
    - Contingency flowgates
    - Nomograms
- There are also Scheduling limits and transfers
- Since go-live on Feb 2023, for flow-based constraints only base flowgates are enforced for FRP nodal procurement
- FRP nodal model introduced with a limited set of constraints while gaining operational experience and settling systems

Further considerations of FRP nodal functionality

- Functionality is currently being expanded for nomograms
- CAISO will further assess elements for enforcement of contingencies

Given seasonal patterns, February observed moderate number of real-time constraints

Few constraints for base flowgates applicable to FRP were binding



For most of WEIM balancing areas, only a handful of different flow-based (internal) constraints tend to bind

Number of different flow-based constraints binding per BAA

	AZPS	CISO	NEVP	NWMT	PACE	LADWP	IPCO	TIDC	BANC	BPAT	PACW	SRP
Jan-22	2	47	2	1	4							
Feb-22	1	49	2		3							
Mar-22	1	72			3	1						
Apr-22	2	104	4		4	5	1	1				
May-22	5	125	2		3	2	2					
Jun-22	6	152	4		6	1	1		3	1	4	
Jul-22	6	121	4		6	2	4				1	
Aug-22	6	141	6		3	3	2		4			
Sep-22	3	183	3		5	5	6		5			
Oct-22	1	117	2		6	7	1					
Nov-22	4	61	3		4			1	3			
Dec-22	6	49			5	1	3	1	1			
Jan-23	4	46			3	1		1				1
Feb-23	2	58	2		4	1			1	1		

Example of $0 FRP prices

- February 24, HE18. FMM market
- Passing group: all WEIM areas except BPA
- Uncertainty requirement: 1019.8 MW
- Total resource awards matches the requirement. Procurement was met from 18 units from 5 out of the 19 balancing areas in the group
- Therefore, there is no relaxation (surplus variable) to trigger the demand curve.
- No resource experienced an opportunity cost to procure FRP

BAA	CC	CT	GNG	Hy	HYB	LES	ST	Total
BANC				121.0				121.0
BCHA			50.2					50.2
CISO	30.0	23.4			86.0	142.7	20.1	302.2
PGE				308.3				308.3
PSEI				238.1				238.1
								1019.8

With nodal approach, the nodal FRP prices have more than the FRP procurement shadow prices defining the price

02/24/2023 6:35 FRP RTD binding

Passing group FRP req shadow price: -$100.4

Passing group total FRU award: 305.5 MW

All FRP requirement is met with 7 resources

There are nodal prices!

Resource	Fuel Type	FRU MW	FRU Nodal $
1	WATER	3.3	7.7
2	GAS	26	3.8
3	LESR	26.8	19.3
4	LESR	0.08	0
5	LESR	32.3	19.3
6	LESR	178.3	19.3
7	LESR	38.6	0

FRP nodal price is composed of both FRP req shadow price and congestion component

Resource 5 FRU award: 32.3MW

FRU nodal price: $19.3

Nodal pricing components:

- Shadow price for Passing group FRU: $-\$100.4$
- Binding constraint $3861.6

  99254_J.HINDS2_230_24806_MIRAGE _230_BR_1 _1
- Shift factor: -0.031
- Congestion component FRU deployment:

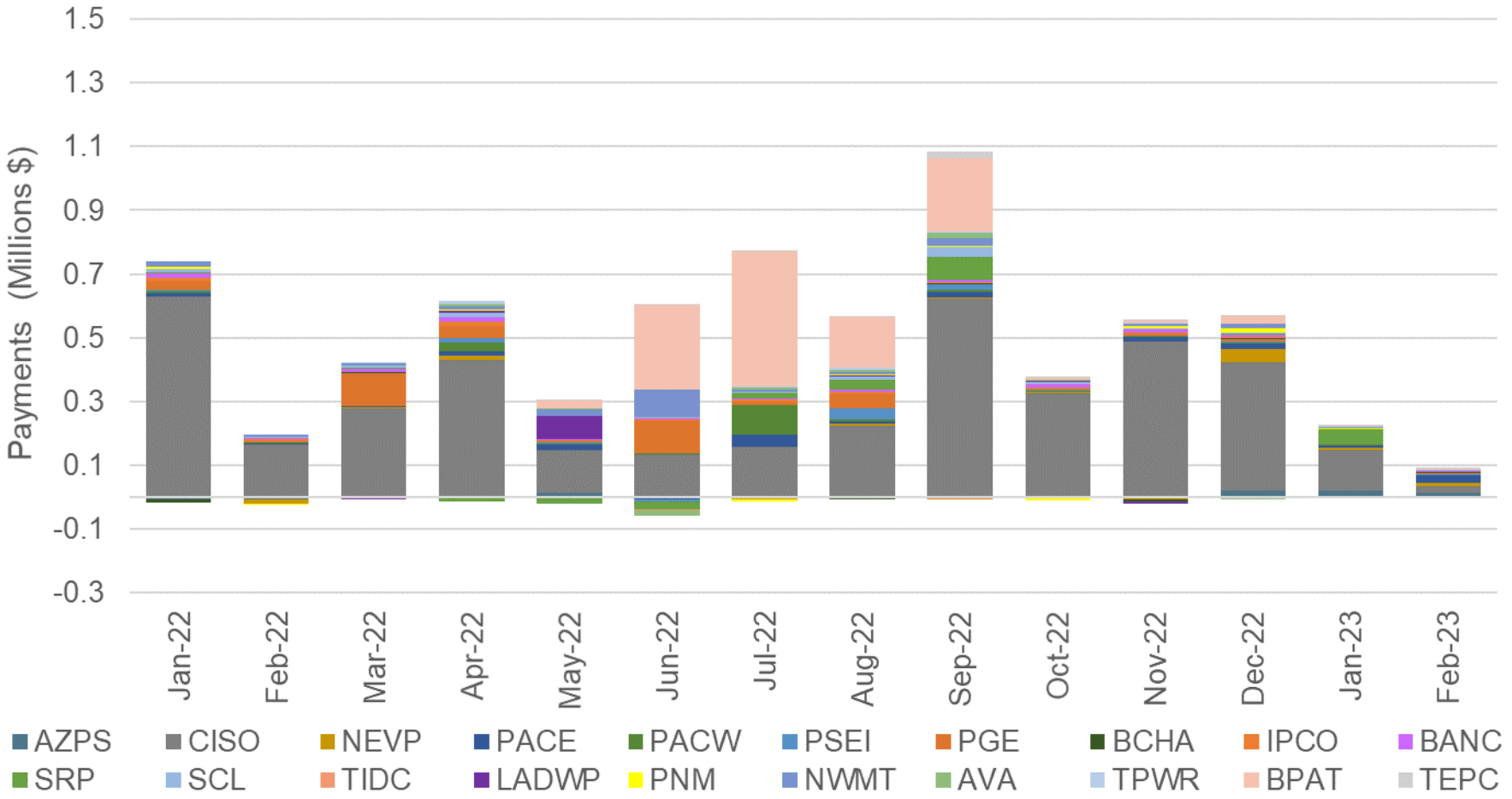
  $$-\$119.7 = \$3861.6 * (-0.031)$$

- FRU LMP= -$100.4+$119.7=$19.3

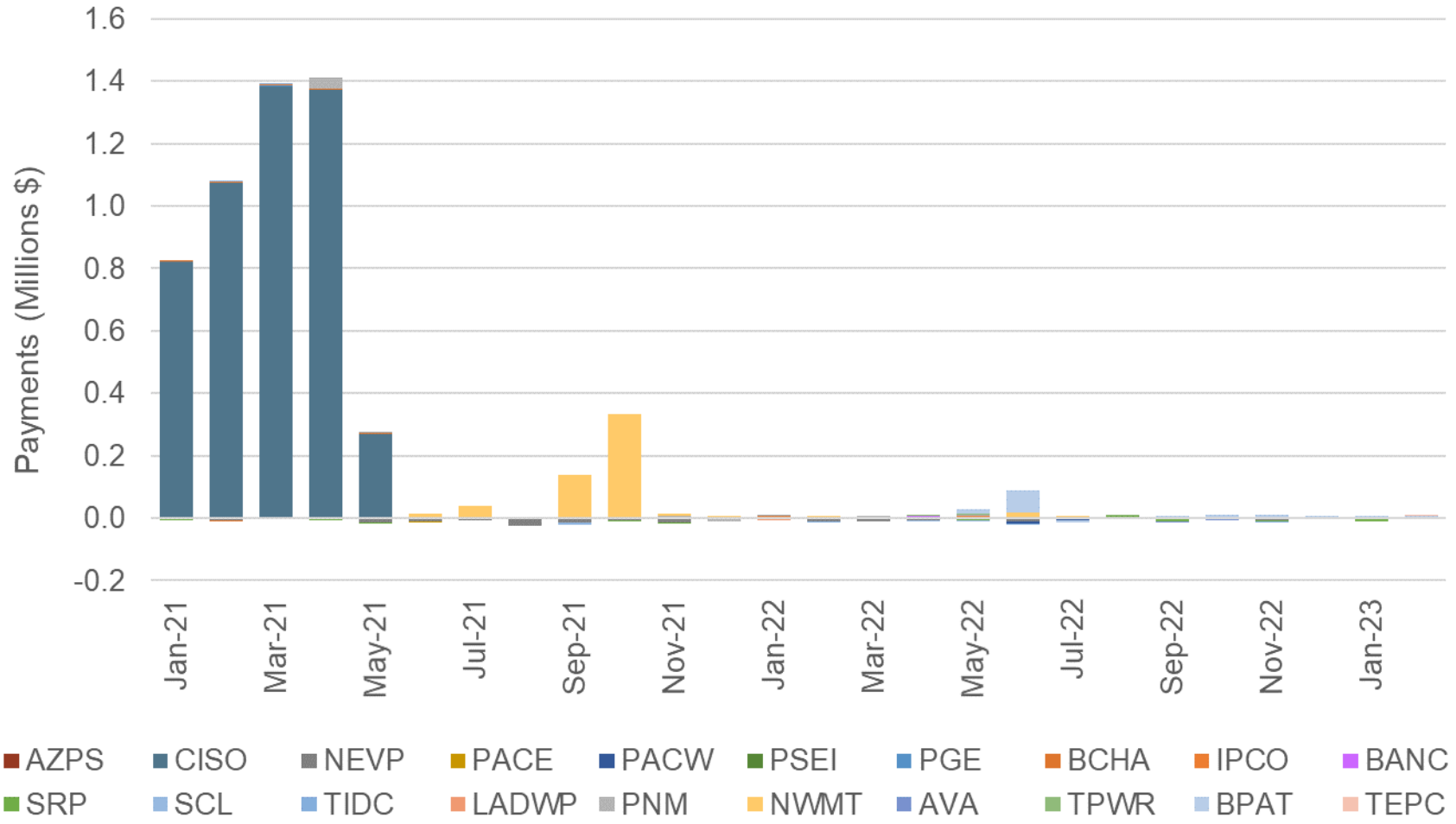
Further consideration of FRP implementation

- CAISO continues to assess the performance of FRP enhancement, and has identified areas for more transparency or enhanced logic, including
  - The results of the T-55 test are now used to determine if an entity pass or not the test for consideration in the run of the first interval of the hour in the real-time market
  - Treatment of negative but negligible FRP requirement shadow prices
  - Consideration of energy limits in the FRP procurement for certain energy-limited resources

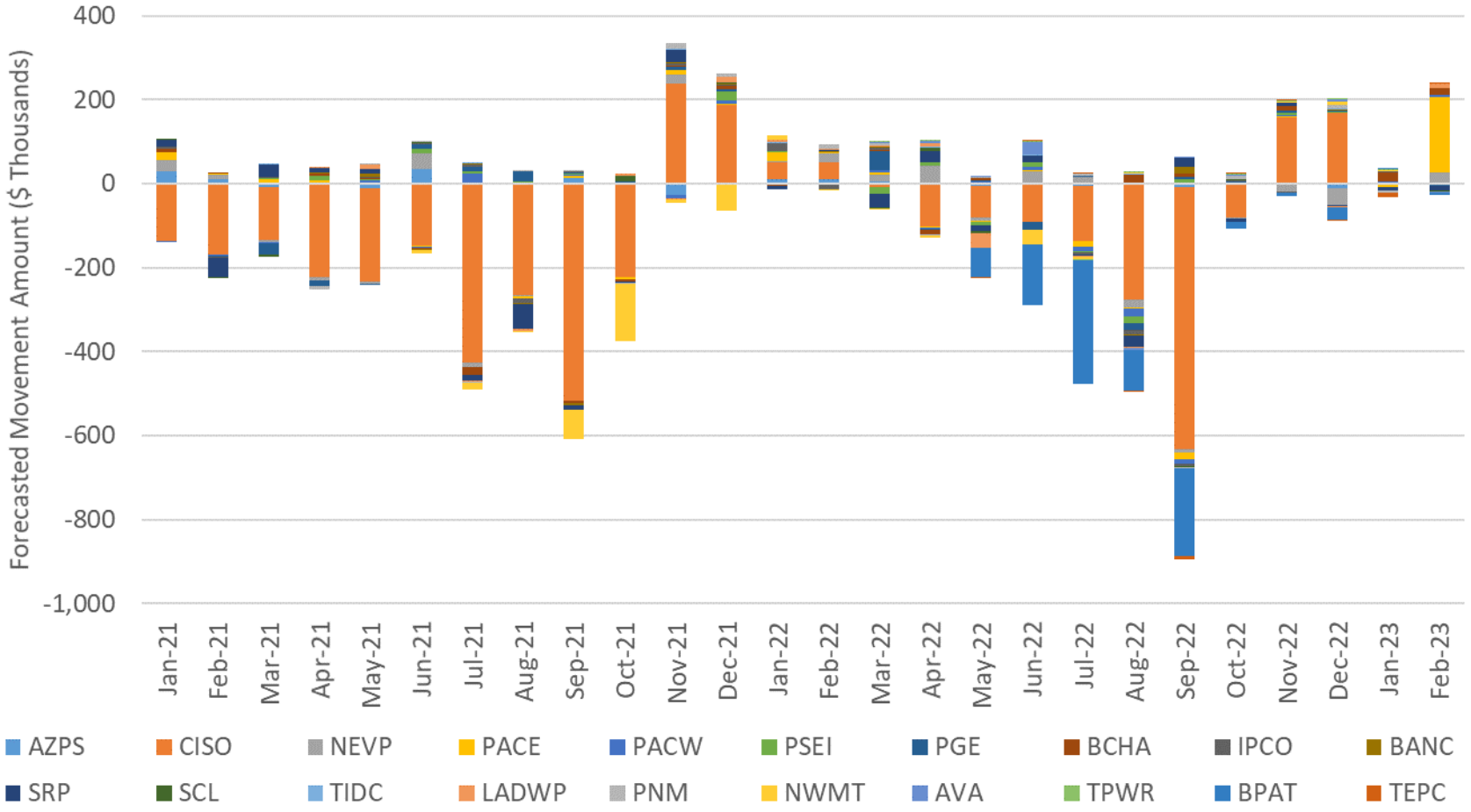
FRP Uncertainty Up Settlement Amount



FRP Uncertainty down settlement amount

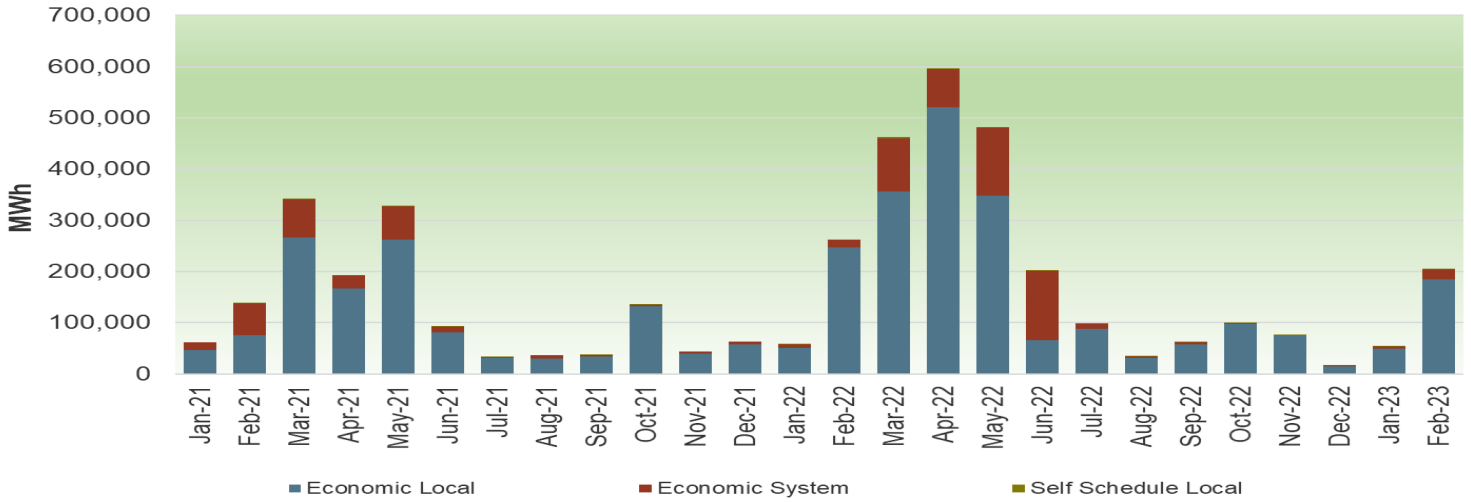


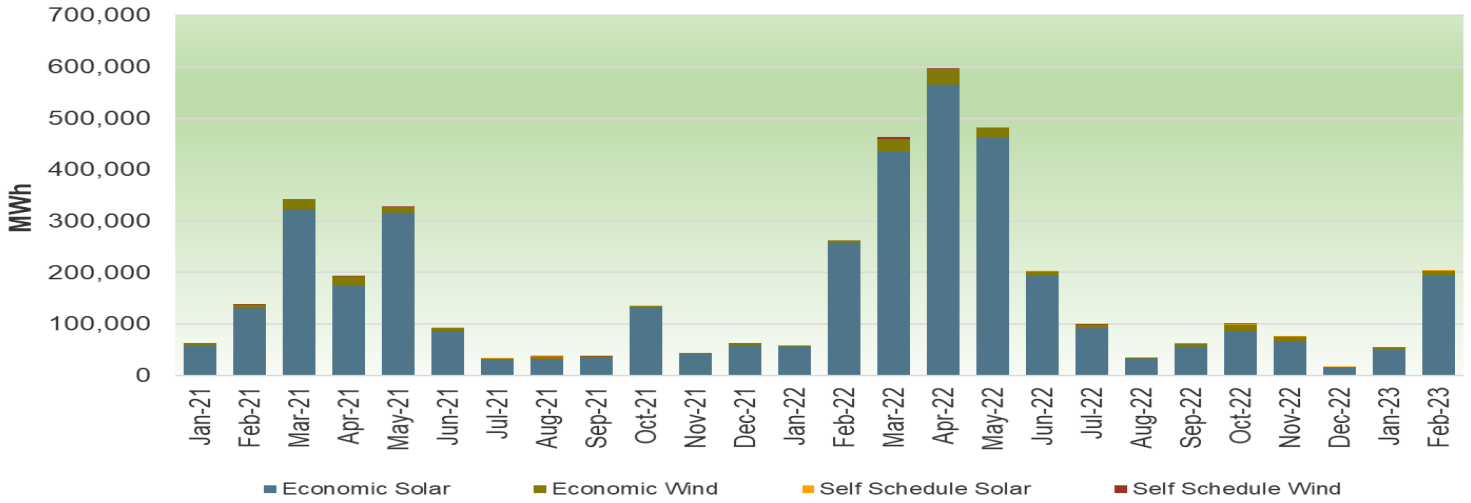
Forecasted Movement by BAAs



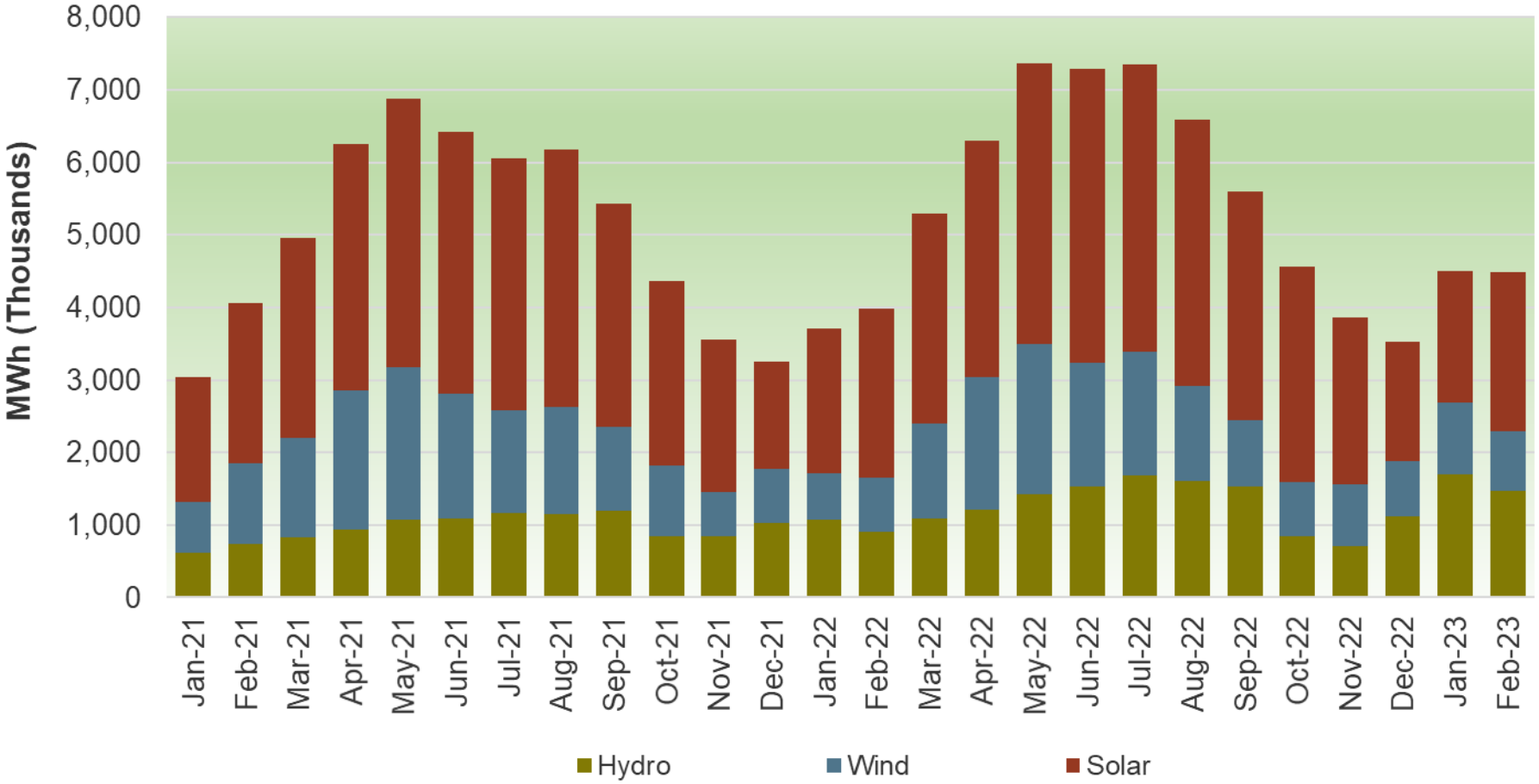
Market Performance Metrics

RTD renewable (VERs) curtailment increased in February following seasonal patterns

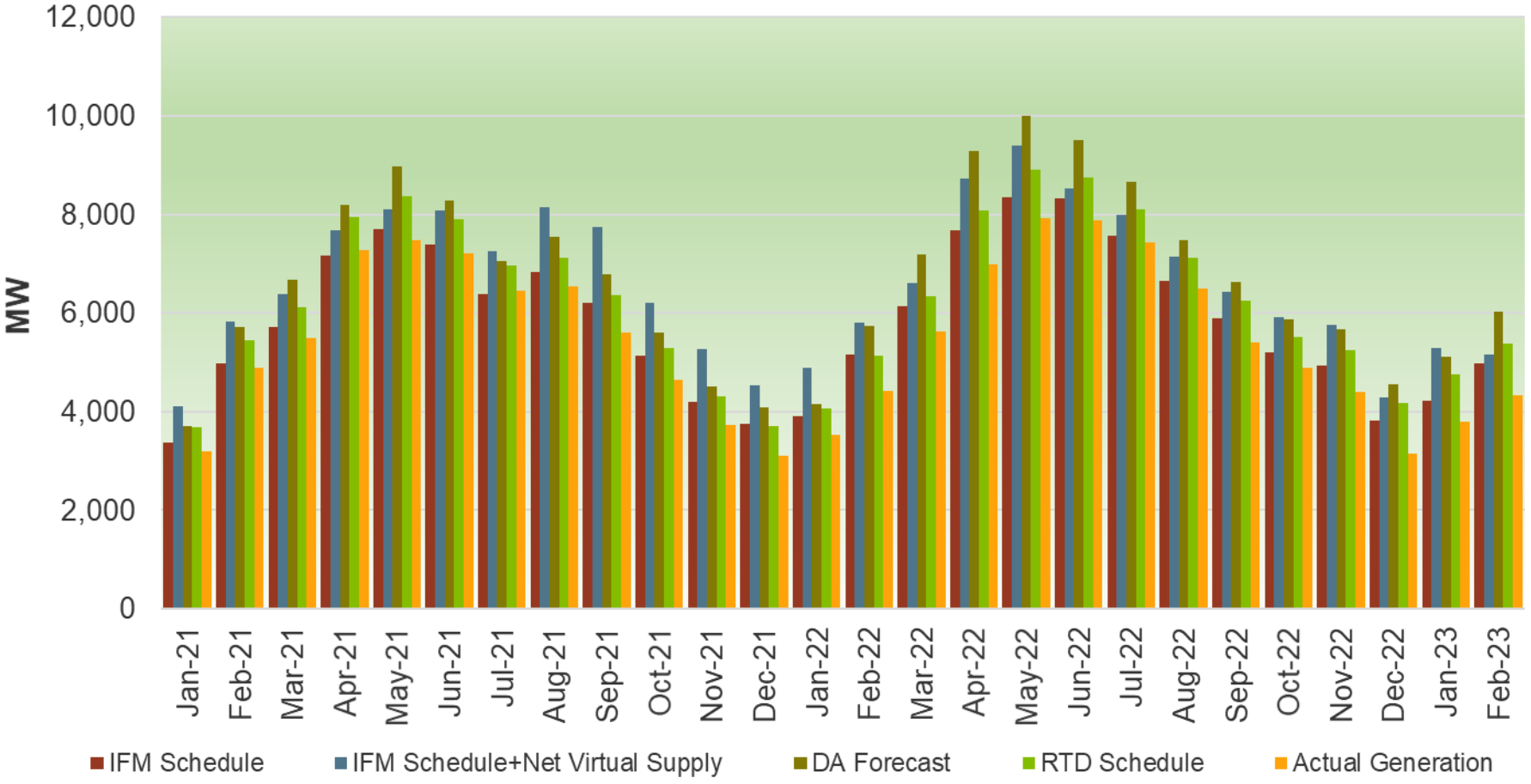




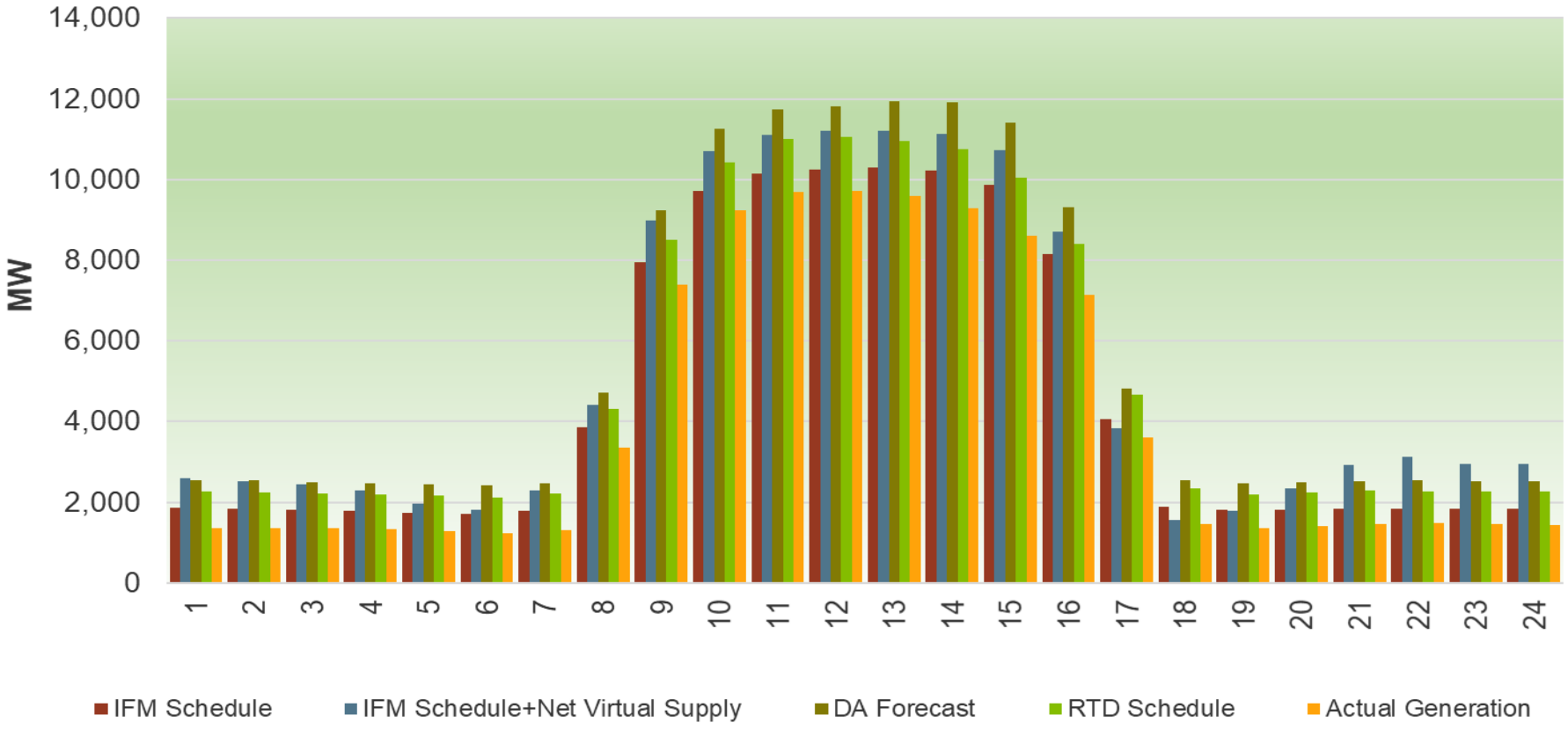
Hydro production relatively higher compared to previous years



ISO total monthly VERS schedules and forecasts compared to actuals

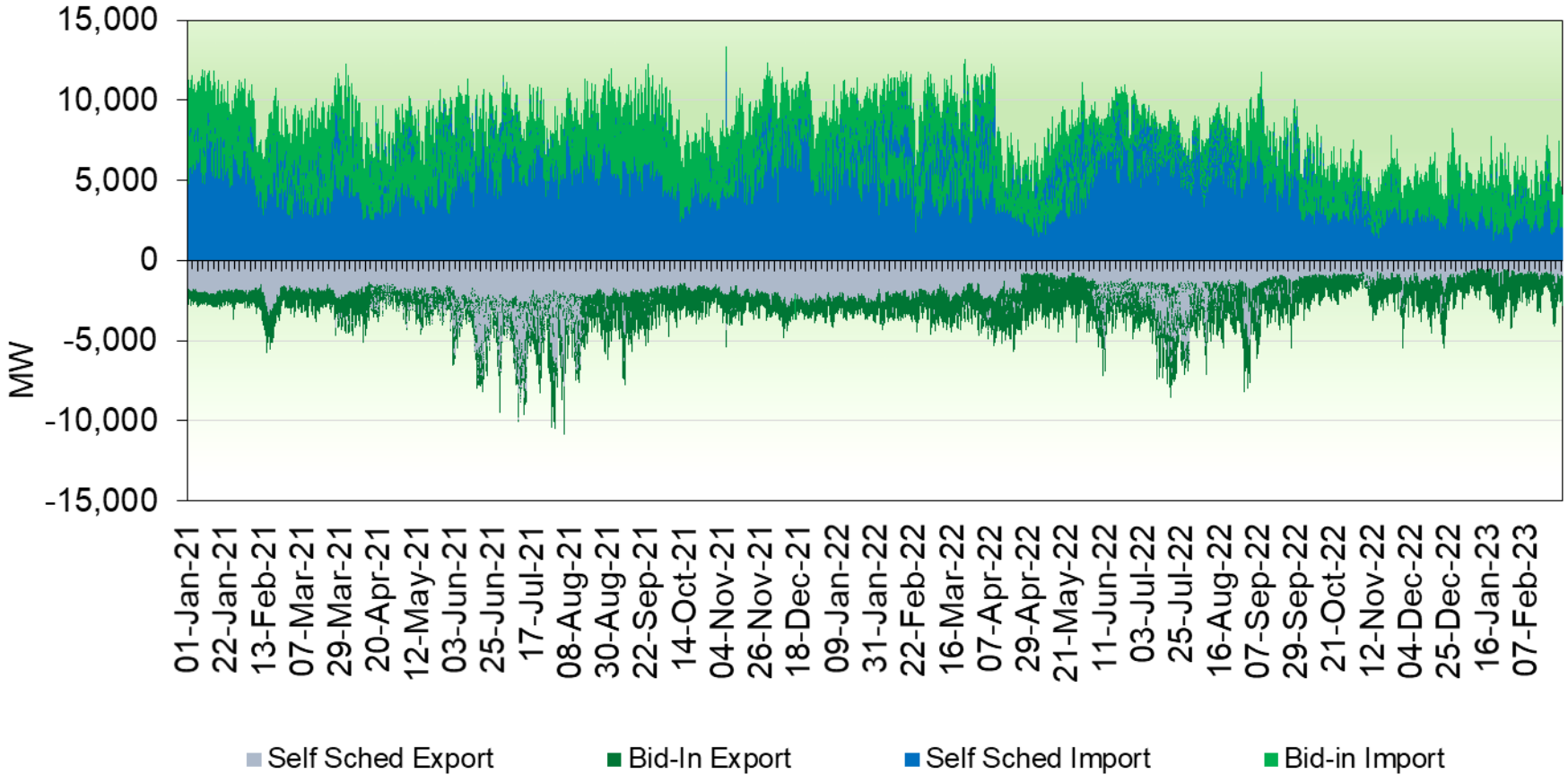


Renewable (VERS) schedules including net virtual supply aligns with VER forecast in January and February

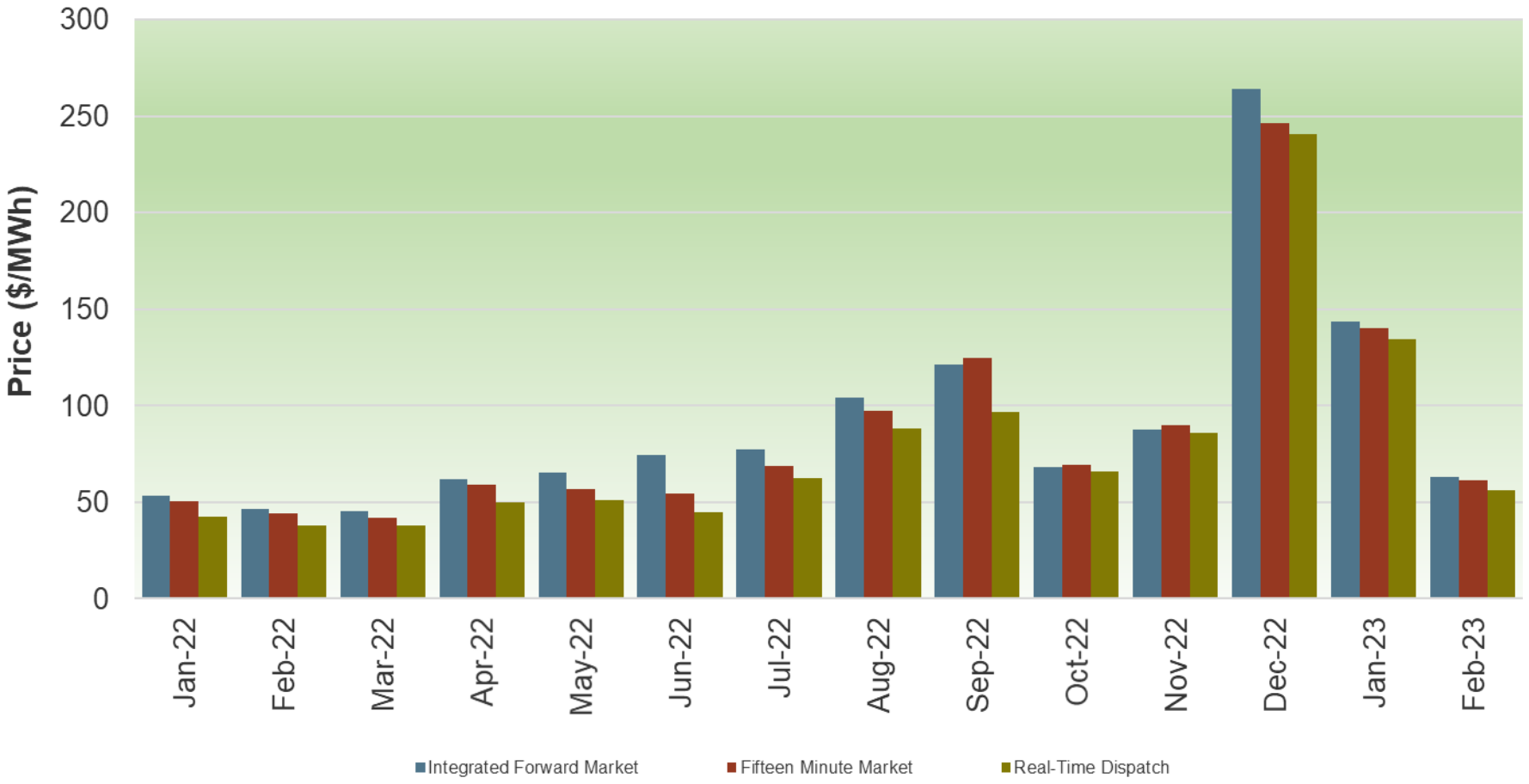


http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=EFF75C2E-F28E-4087-B88B-8DFFAED828F8

Self scheduled exports trended downward since last September

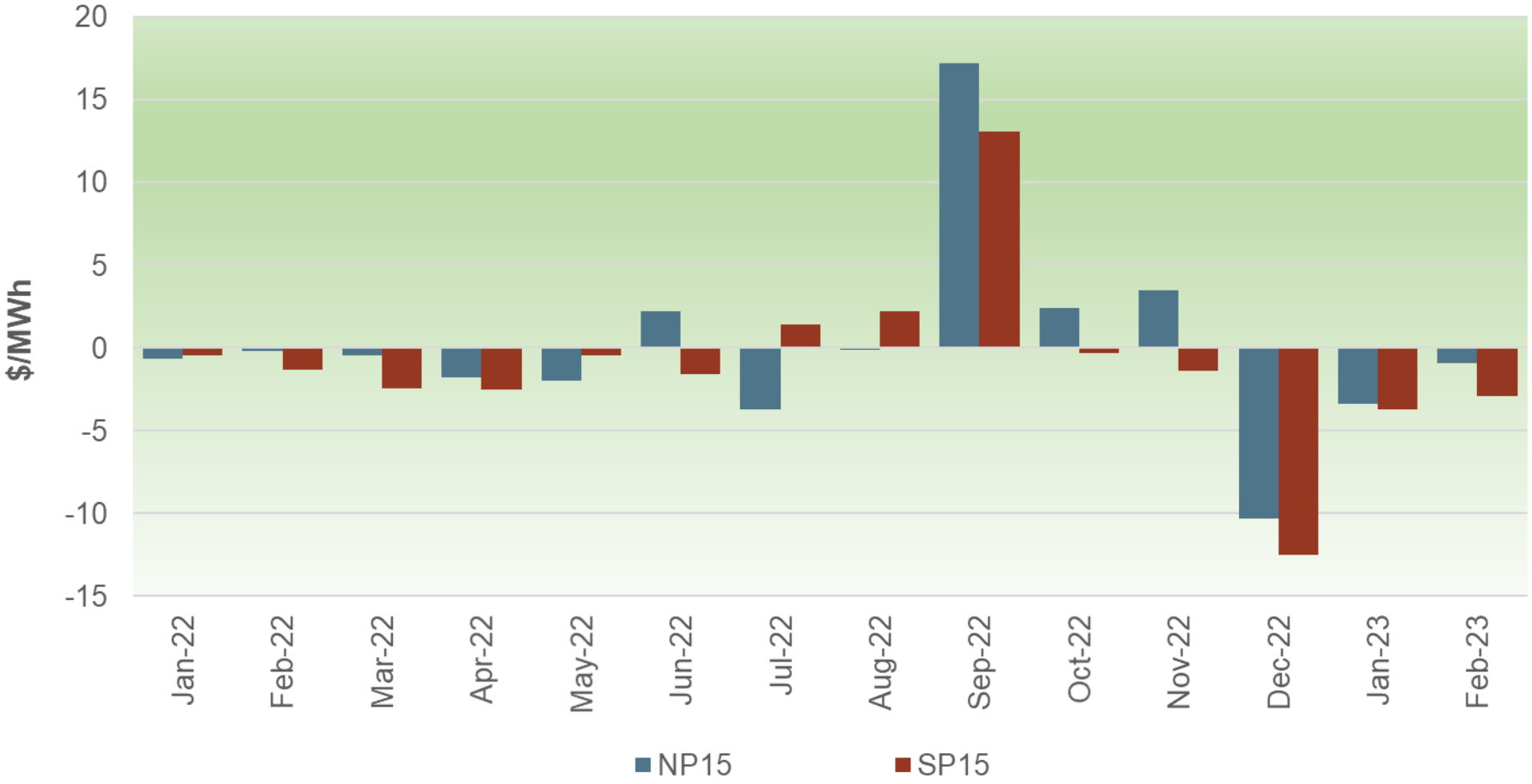


High prices in December and January due to high gas prices

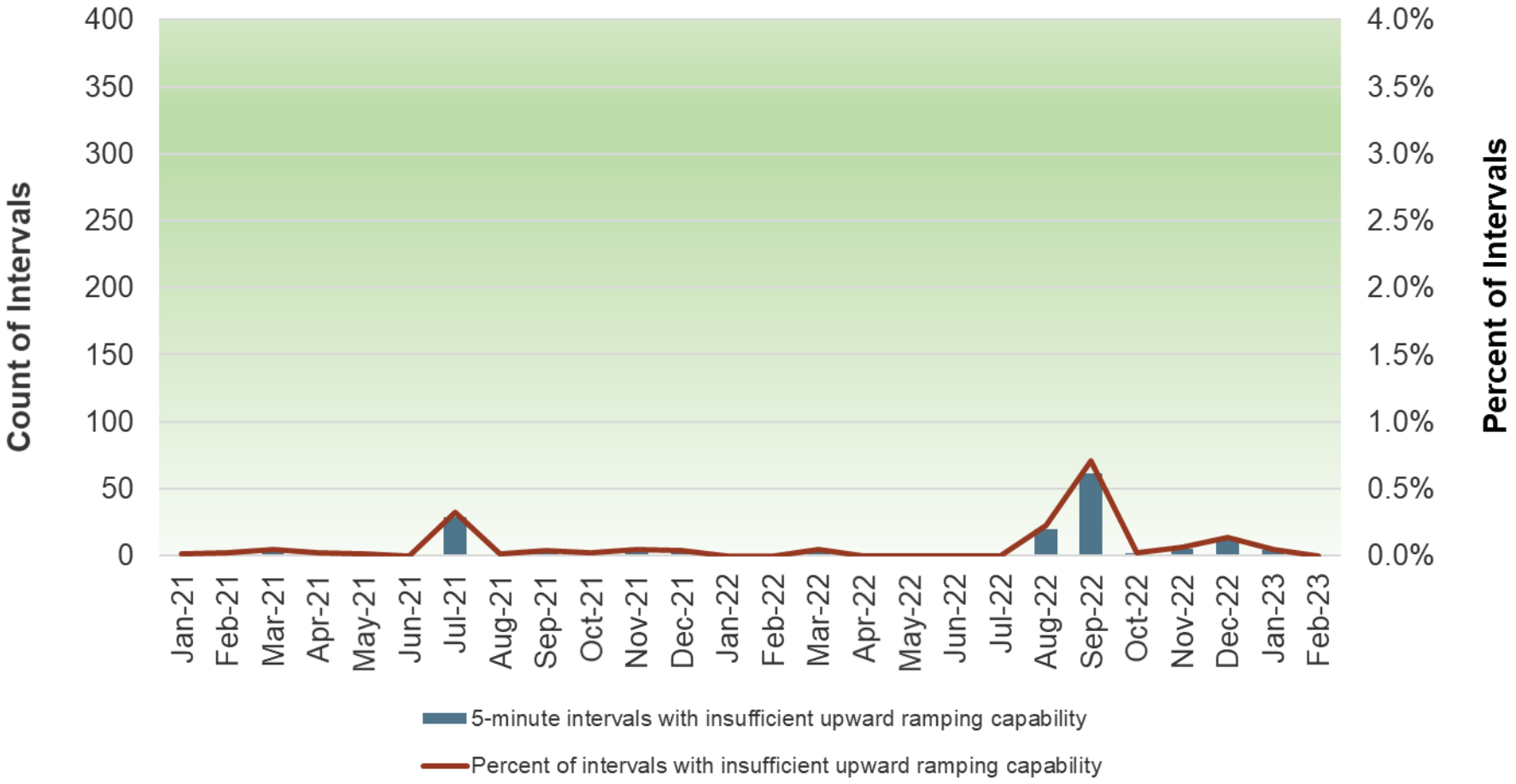


Note: Metric Based on System Marginal Energy Component (SMEC)

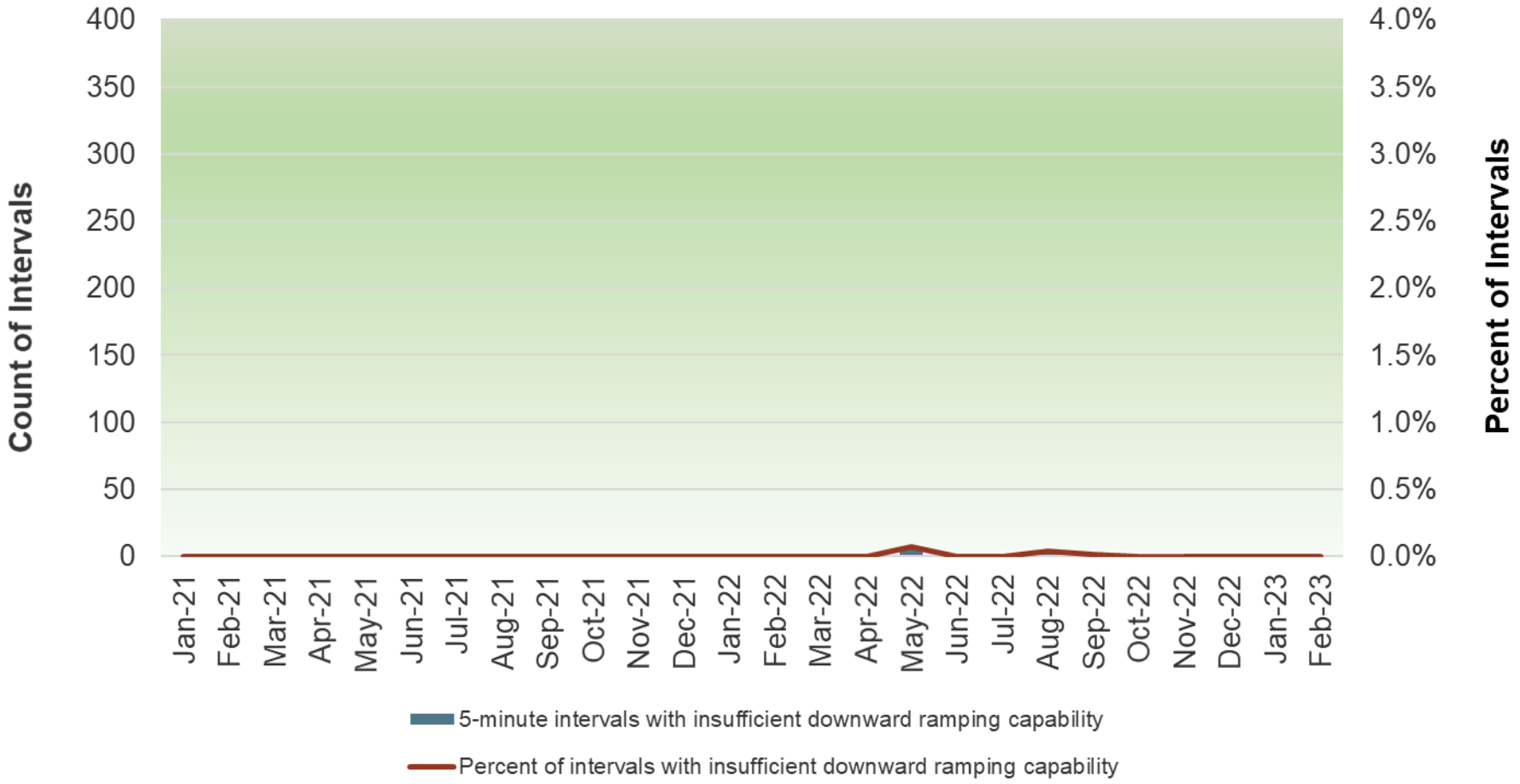
Real-time prices lower than day-ahead prices for both NP15 and SP15 in the past three months



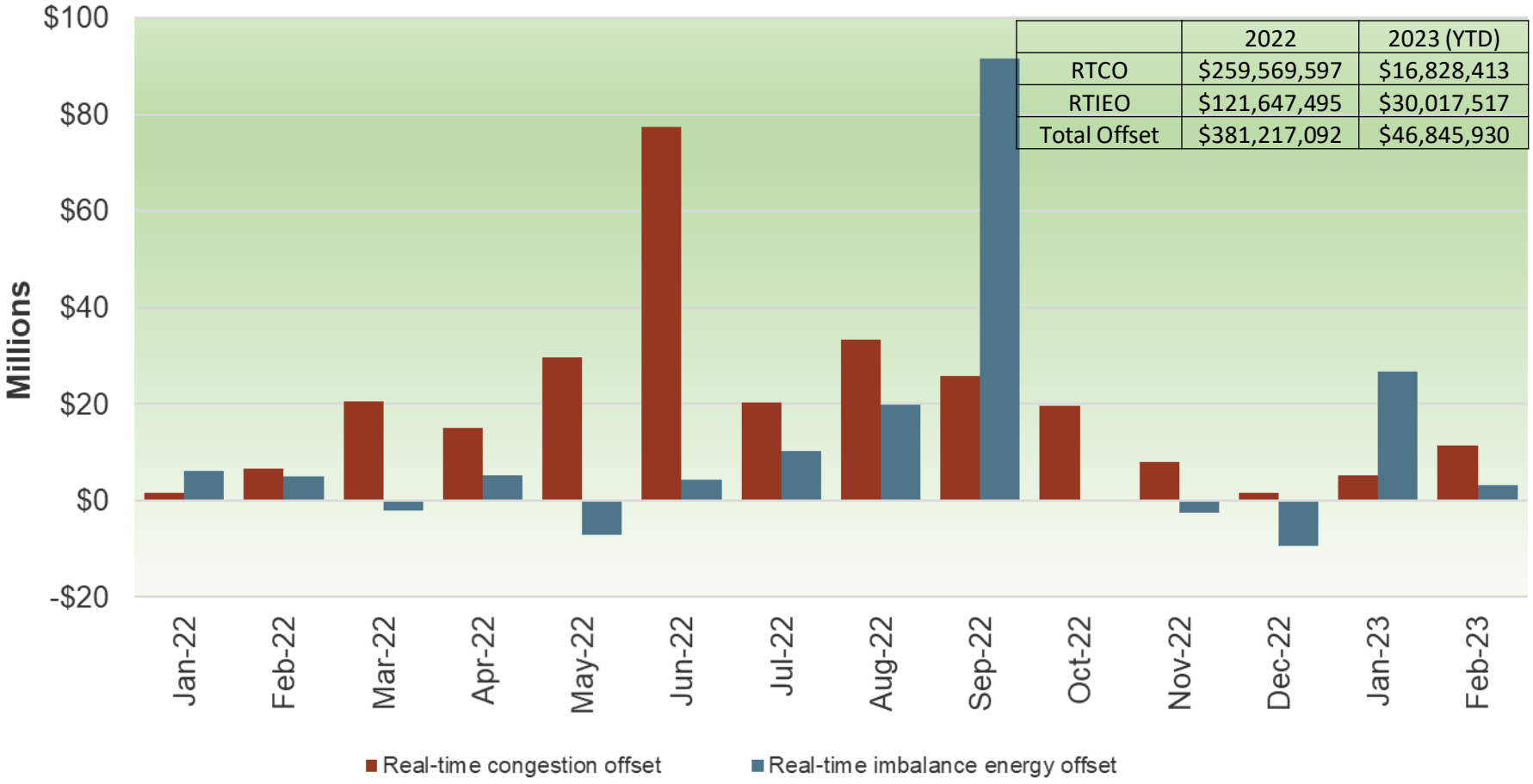
Insufficient upward ramping capacity in ISO real-time increased continued to be low



Insufficient downward ramping capacity in real-time stayed low

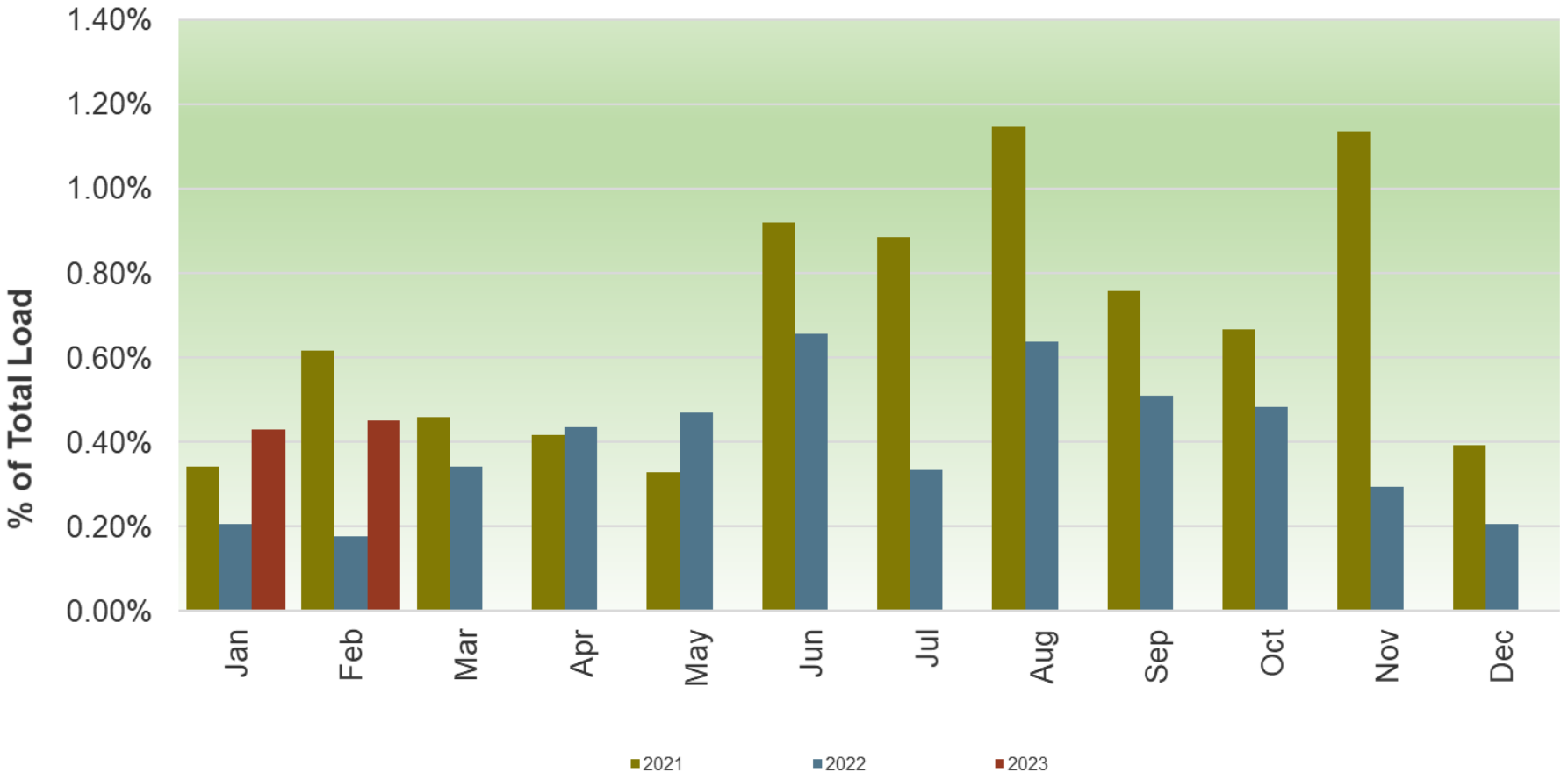


ISO area real-time imbalance offset was low in February

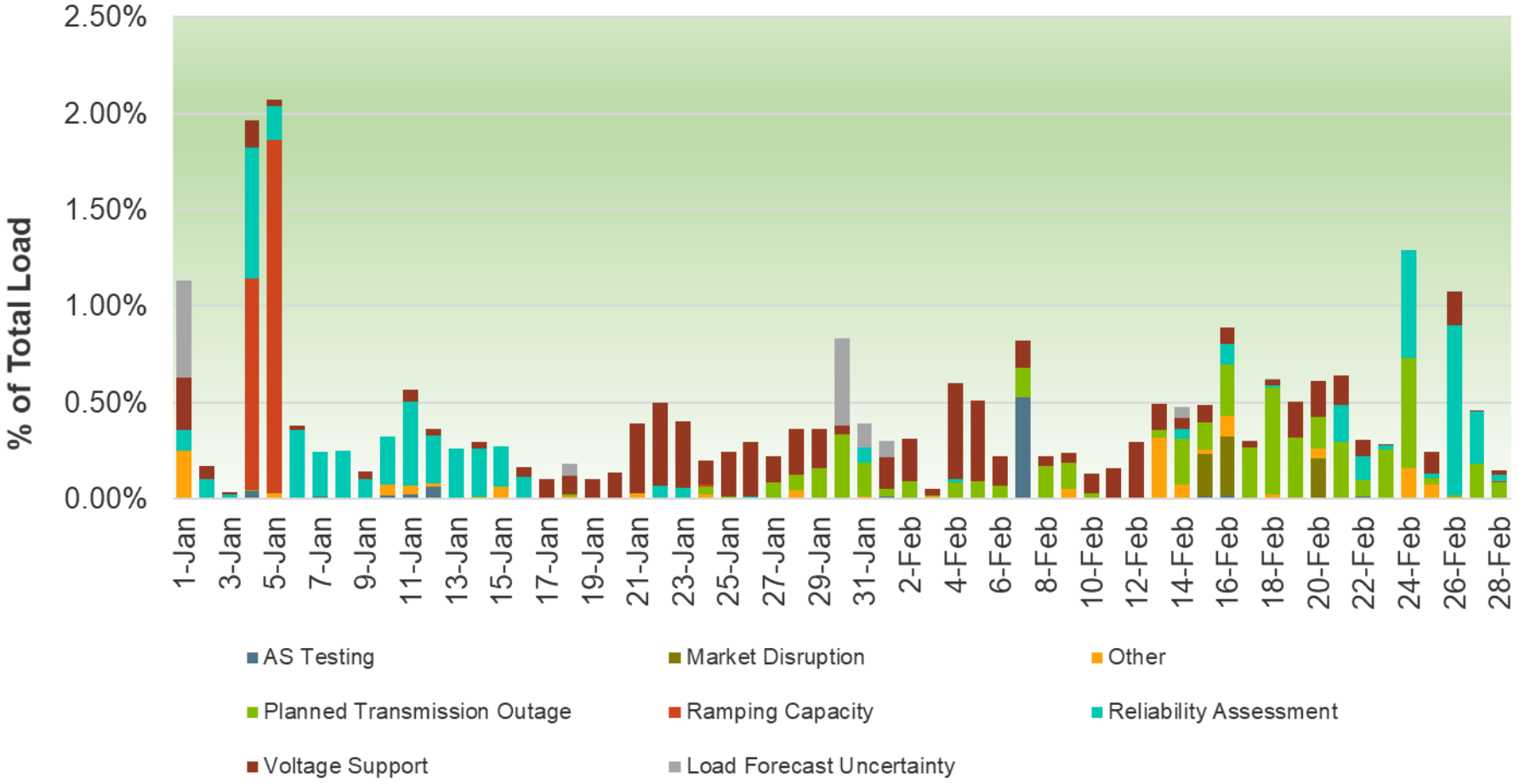


	2022	2023 (YTD)
RTCO	$259,569,597	$16,828,413
RTIEO	$121,647,495	$30,017,517
Total Offset	$381,217,092	$46,845,930

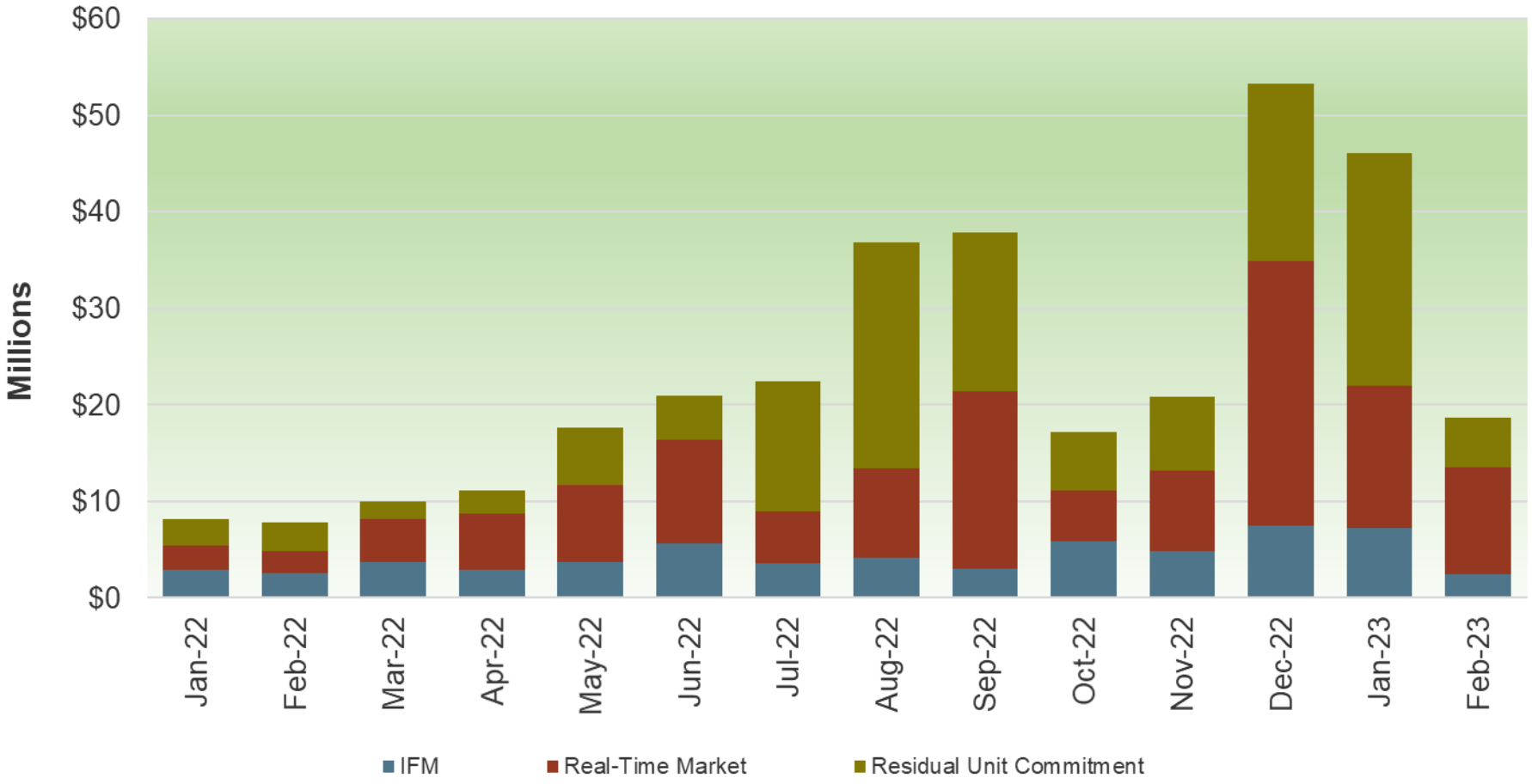
Exceptional dispatch volume in the ISO area are at low levels



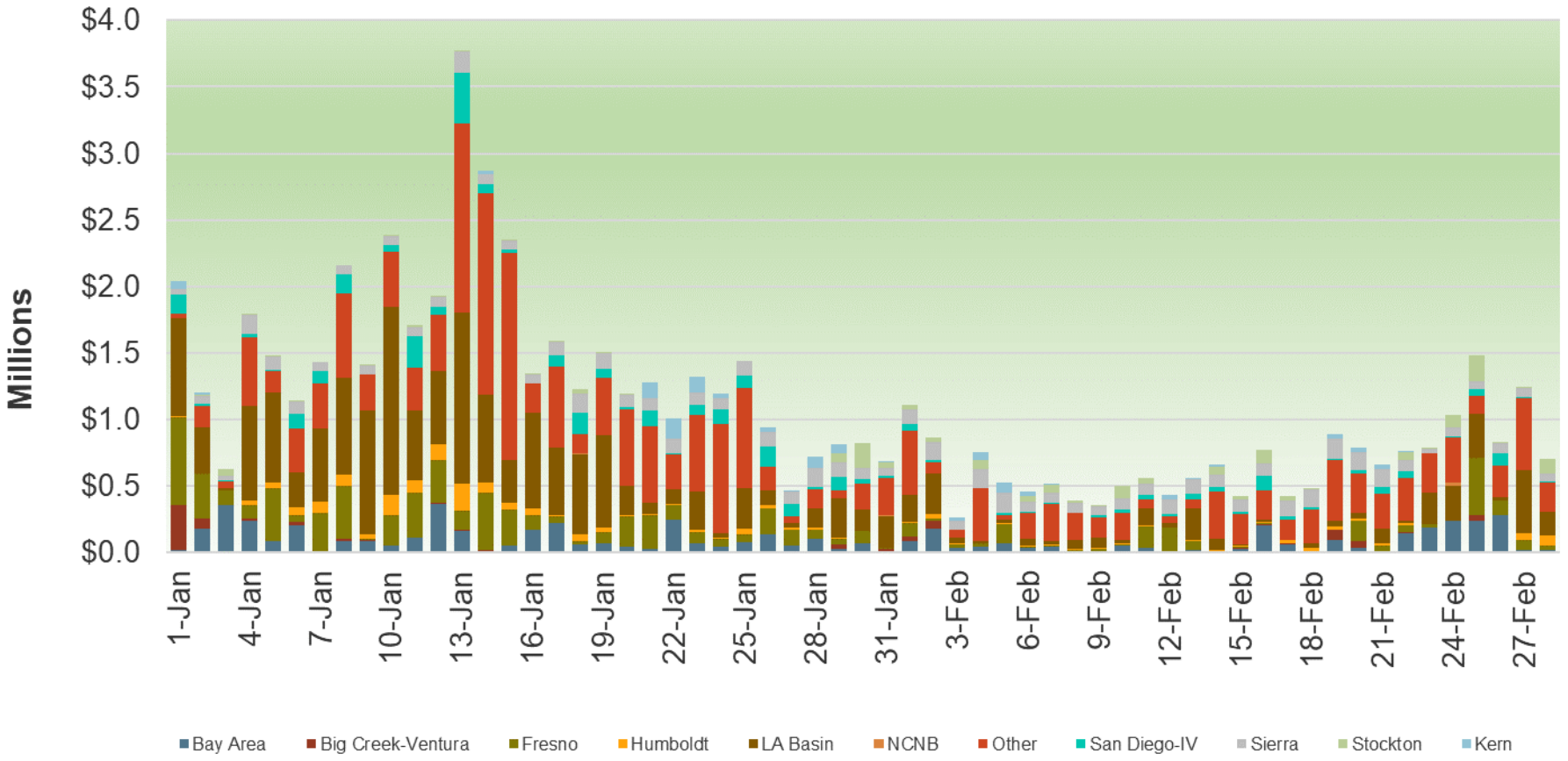
Exceptional dispatches volume driven by a variety of reasons in January and February



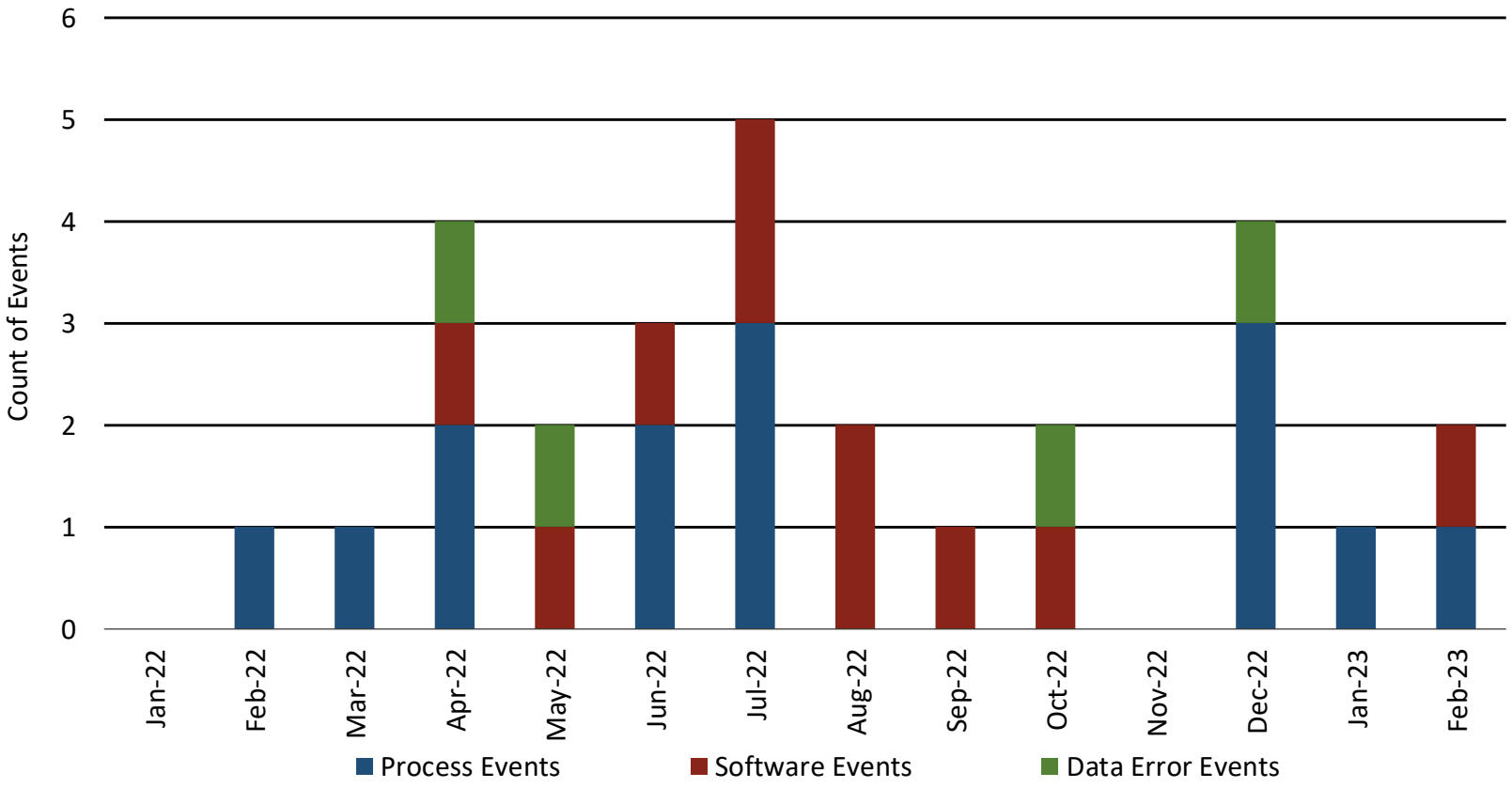
Bid cost recovery was high in December and January driven by high gas prices



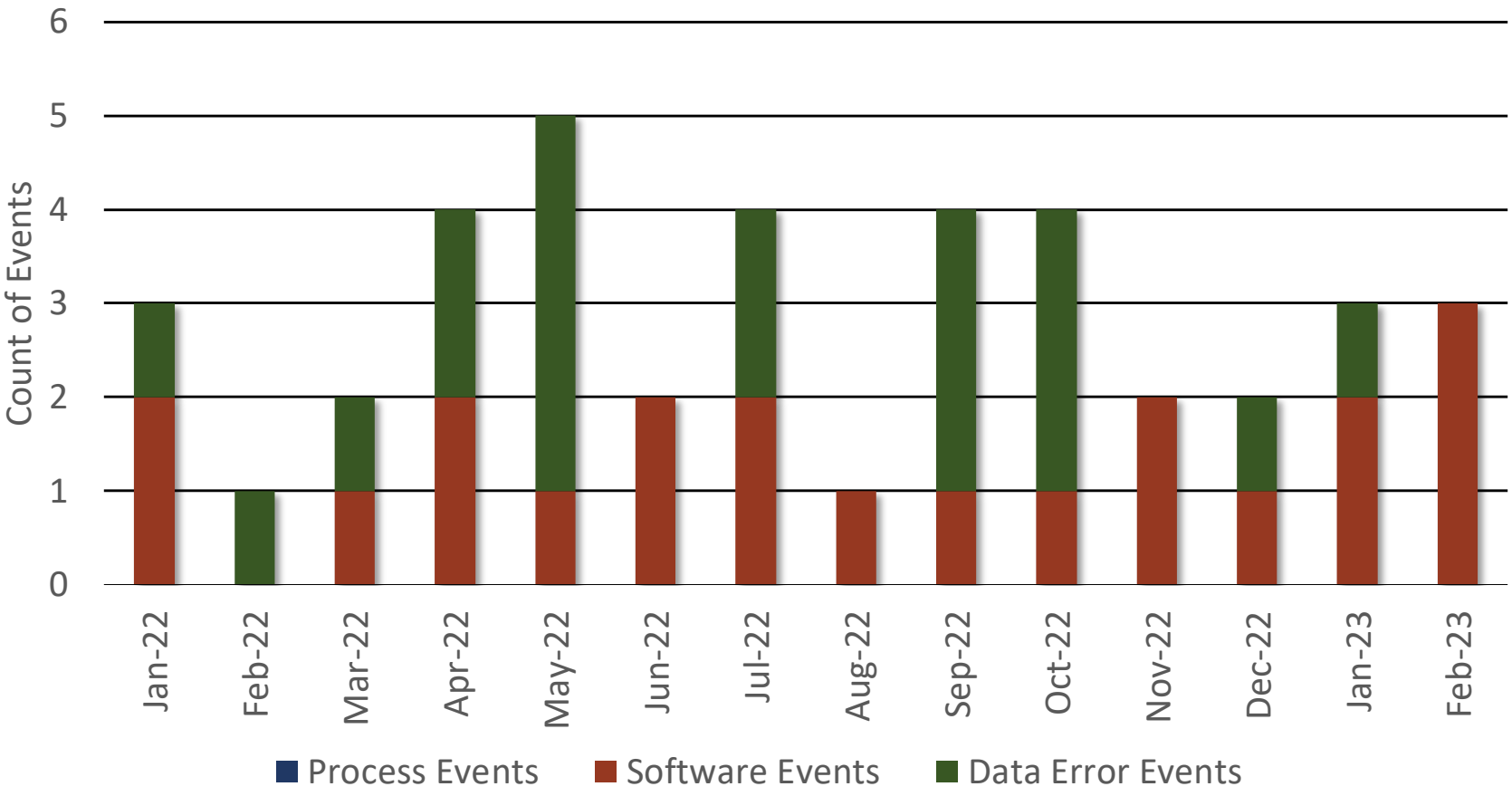
Bid cost recovery (BCR) by Local Capacity Requirement area



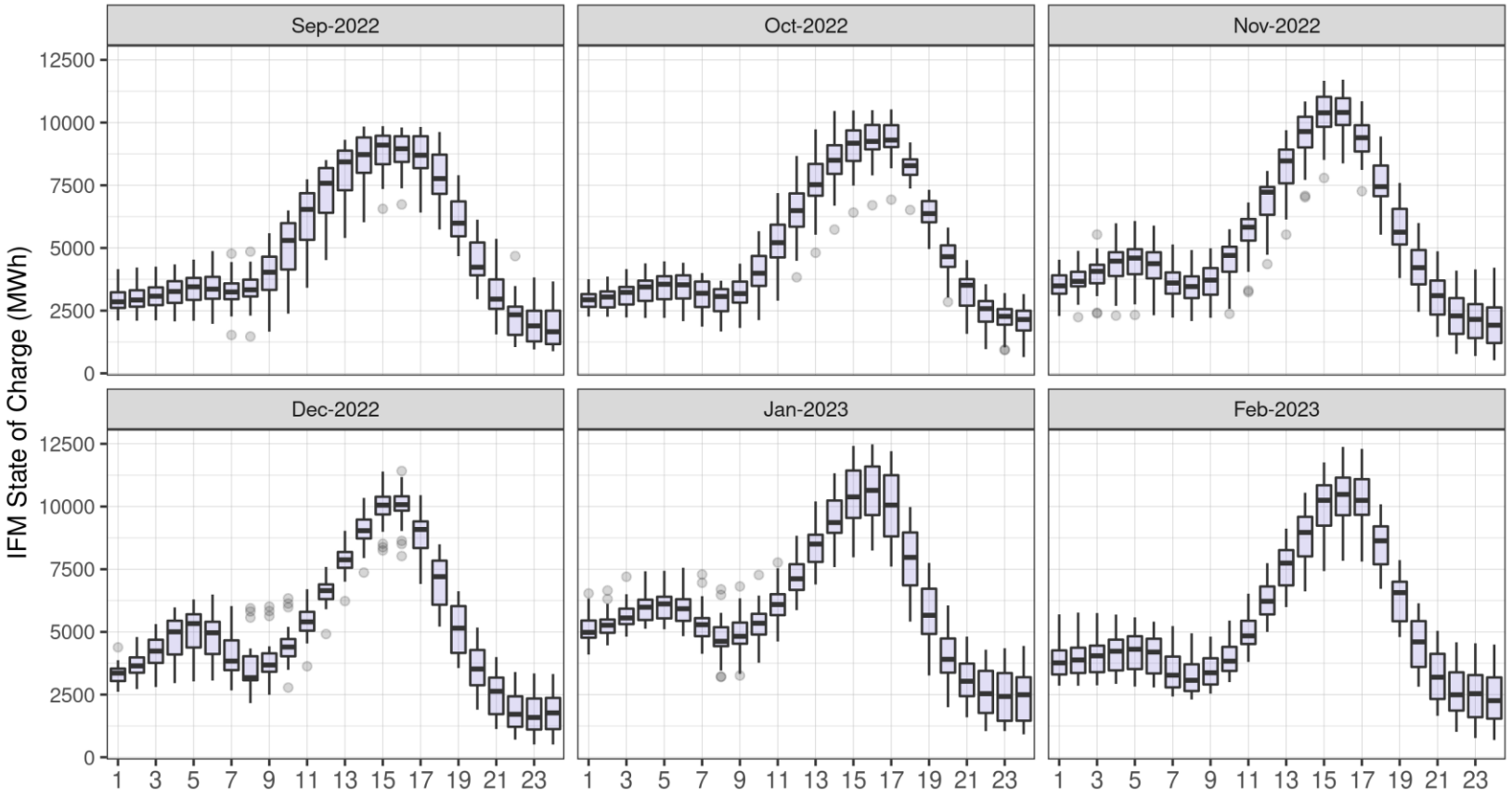
CAISO price correction events remain low



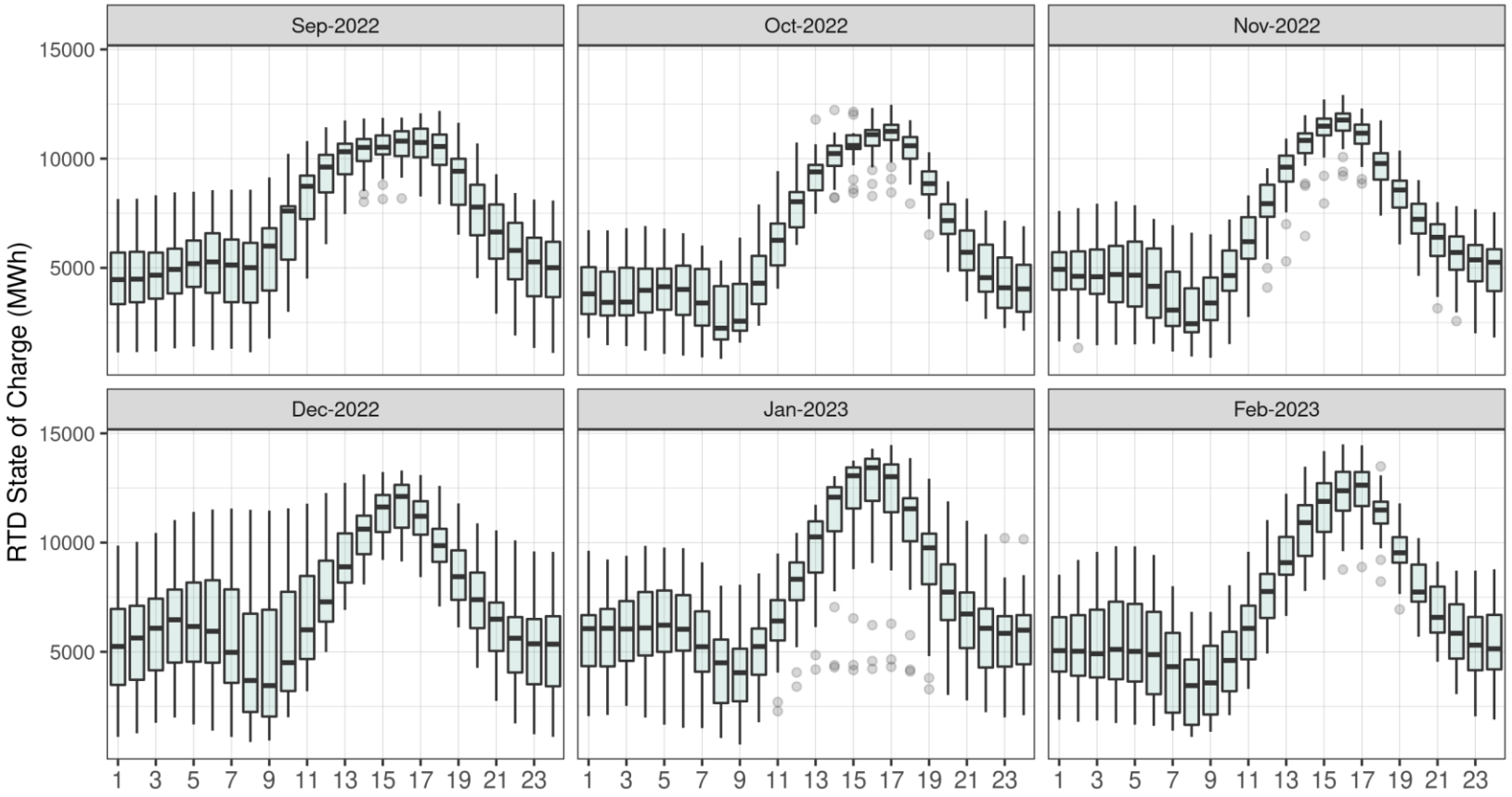
EIM-related price corrections increased in January and February



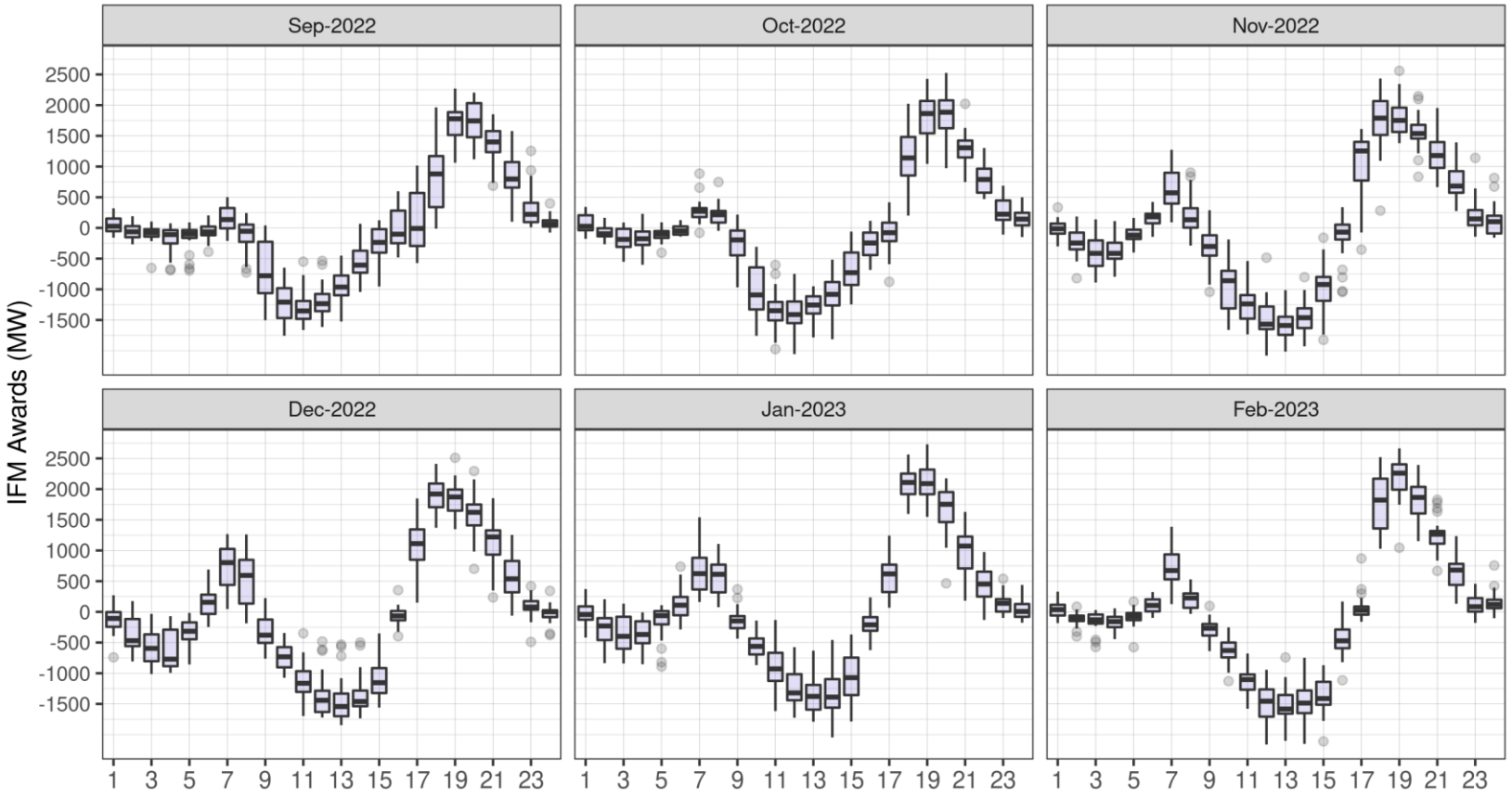
Day-Ahead state of charge for storage resources was the highest in hour ending 14 through 17



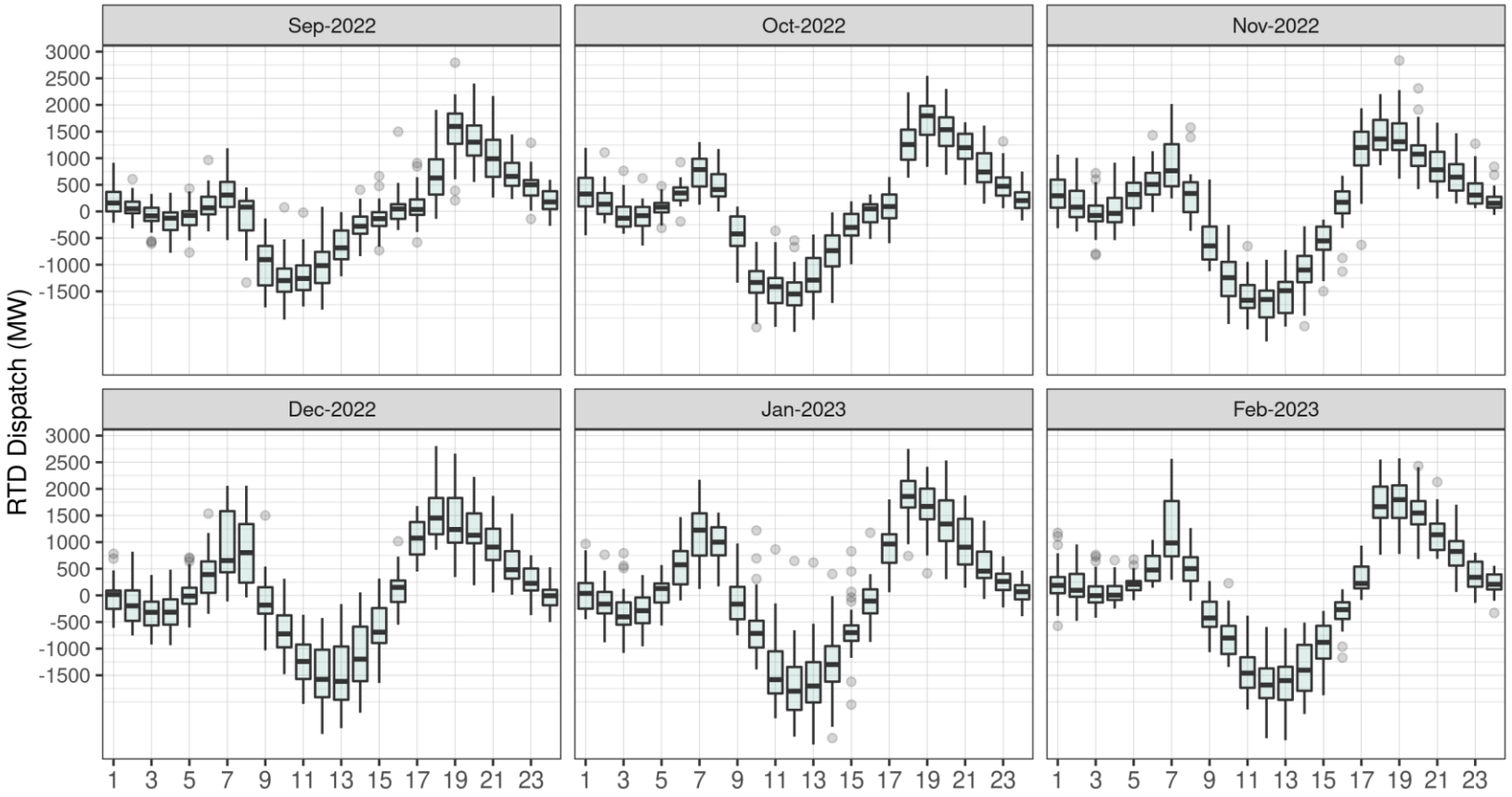
Real-Time State of charge for storage resources was in line with the day-ahead state of charge



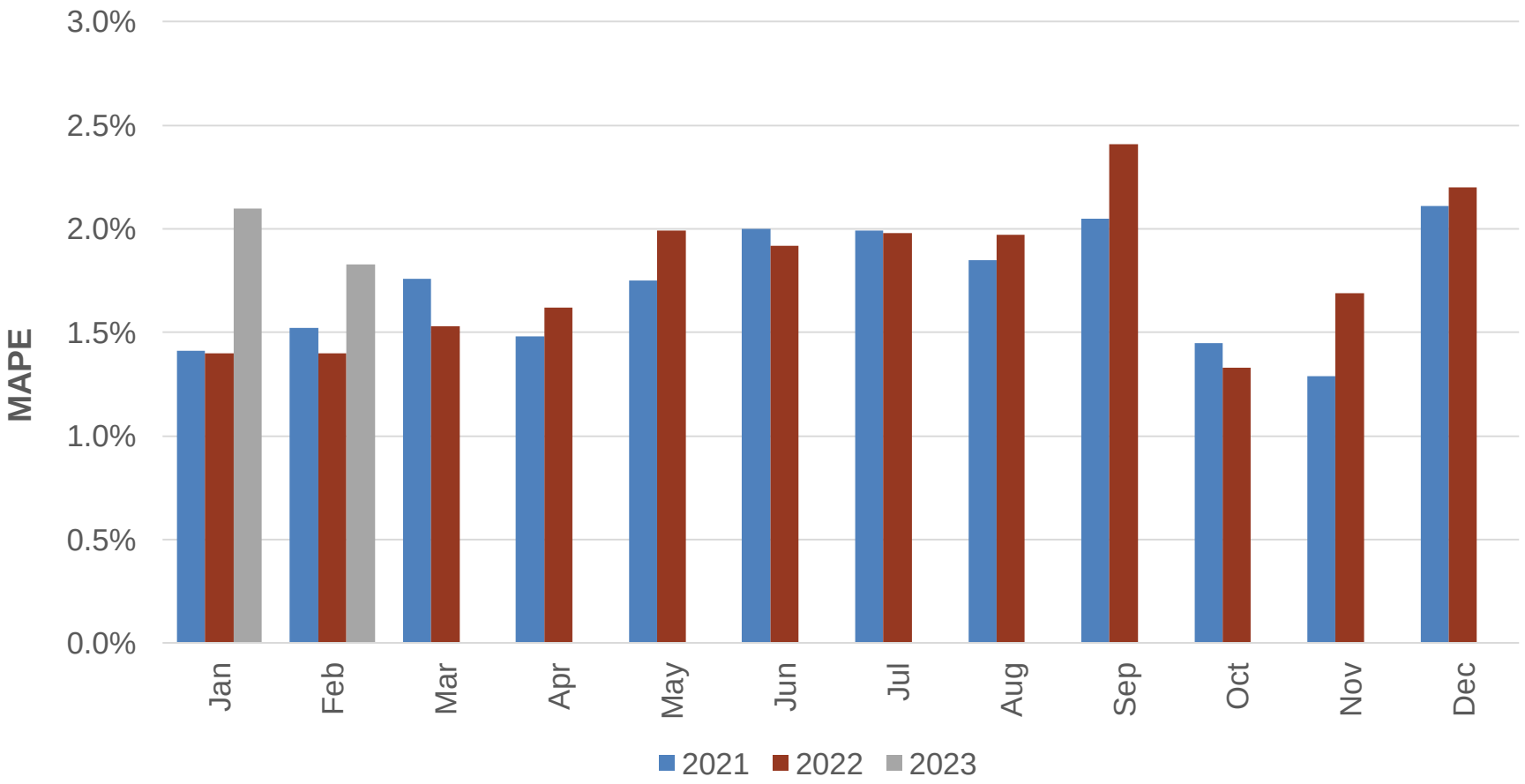
Storage resources were consistently charging during solar hours and discharging during net load peaks



Storage resources were consistently charging during solar hours and discharging during net load peaks

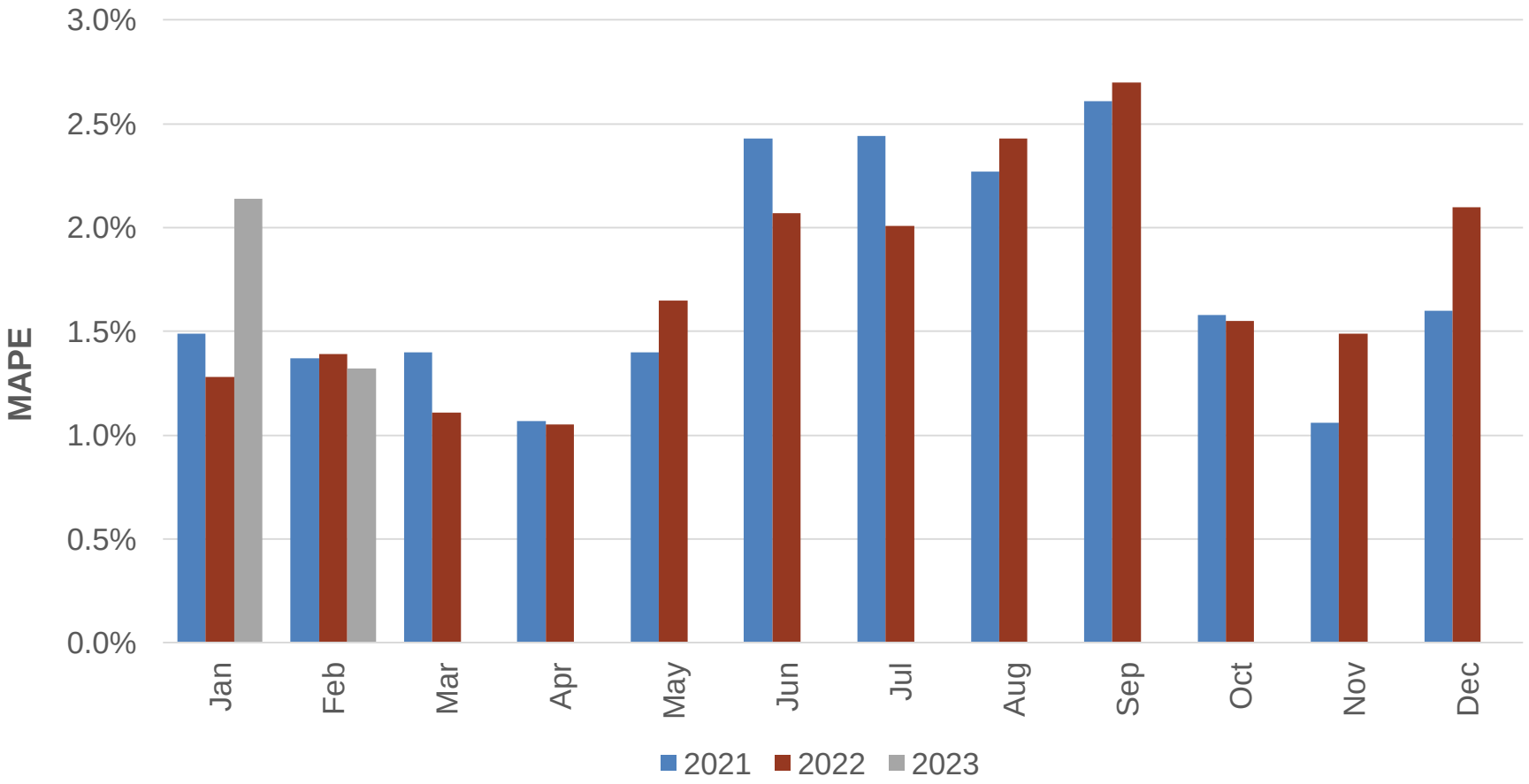


Day-ahead load forecast



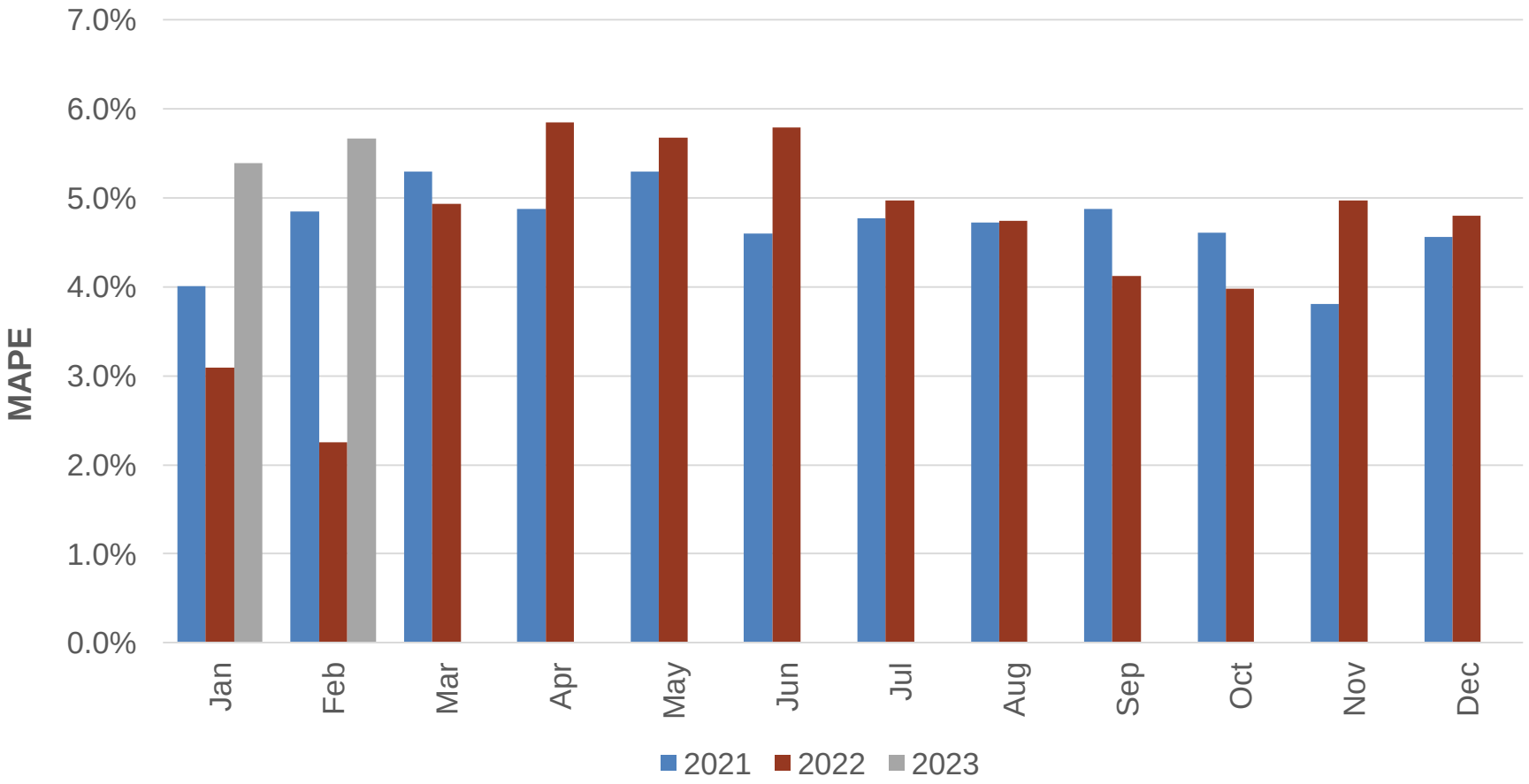
**MAPE = abs(Forecast – Actual)/Actual

Day-ahead peak forecast



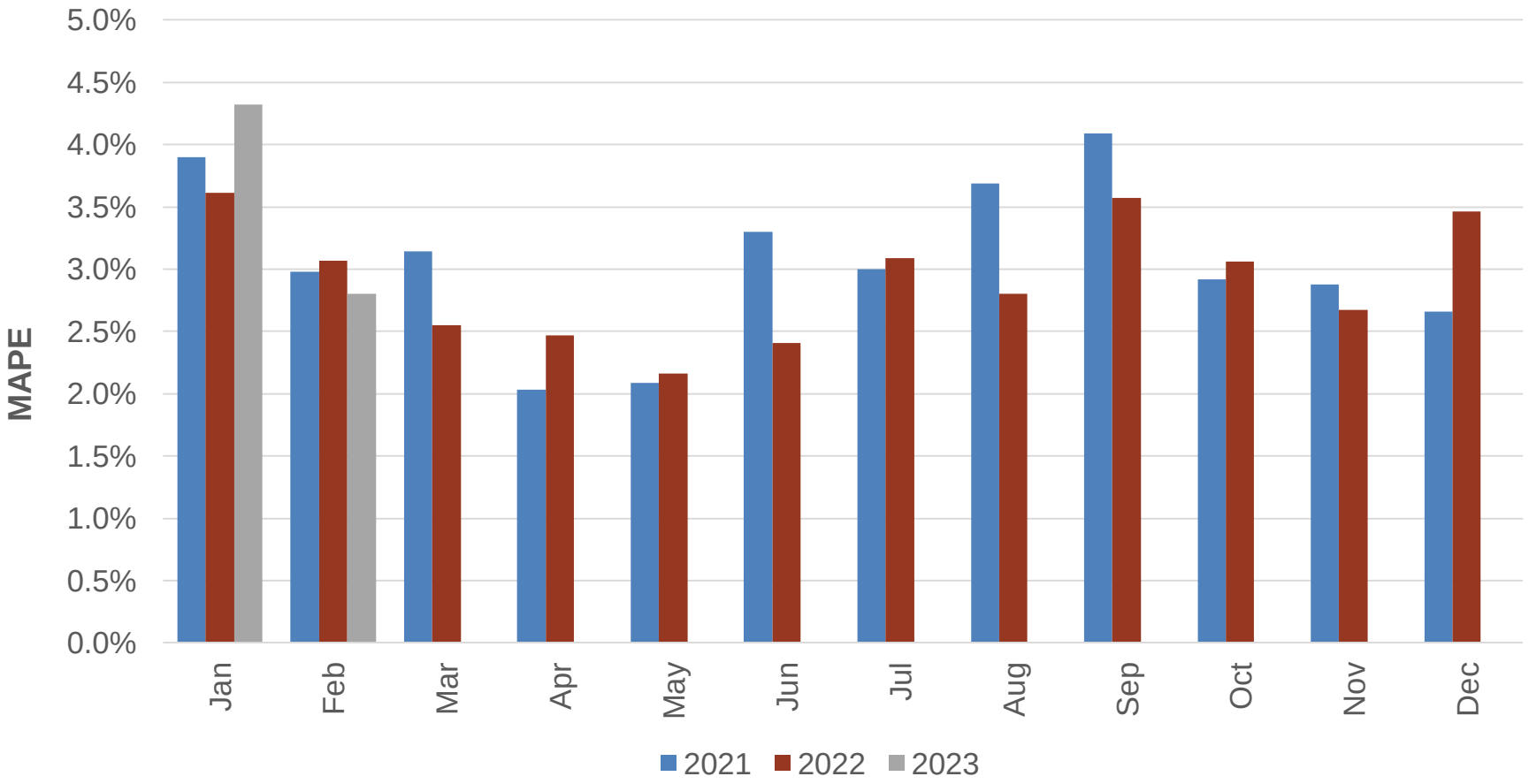
**MAPE = abs(Forecast – Actual)/Actual

Day-ahead wind forecast



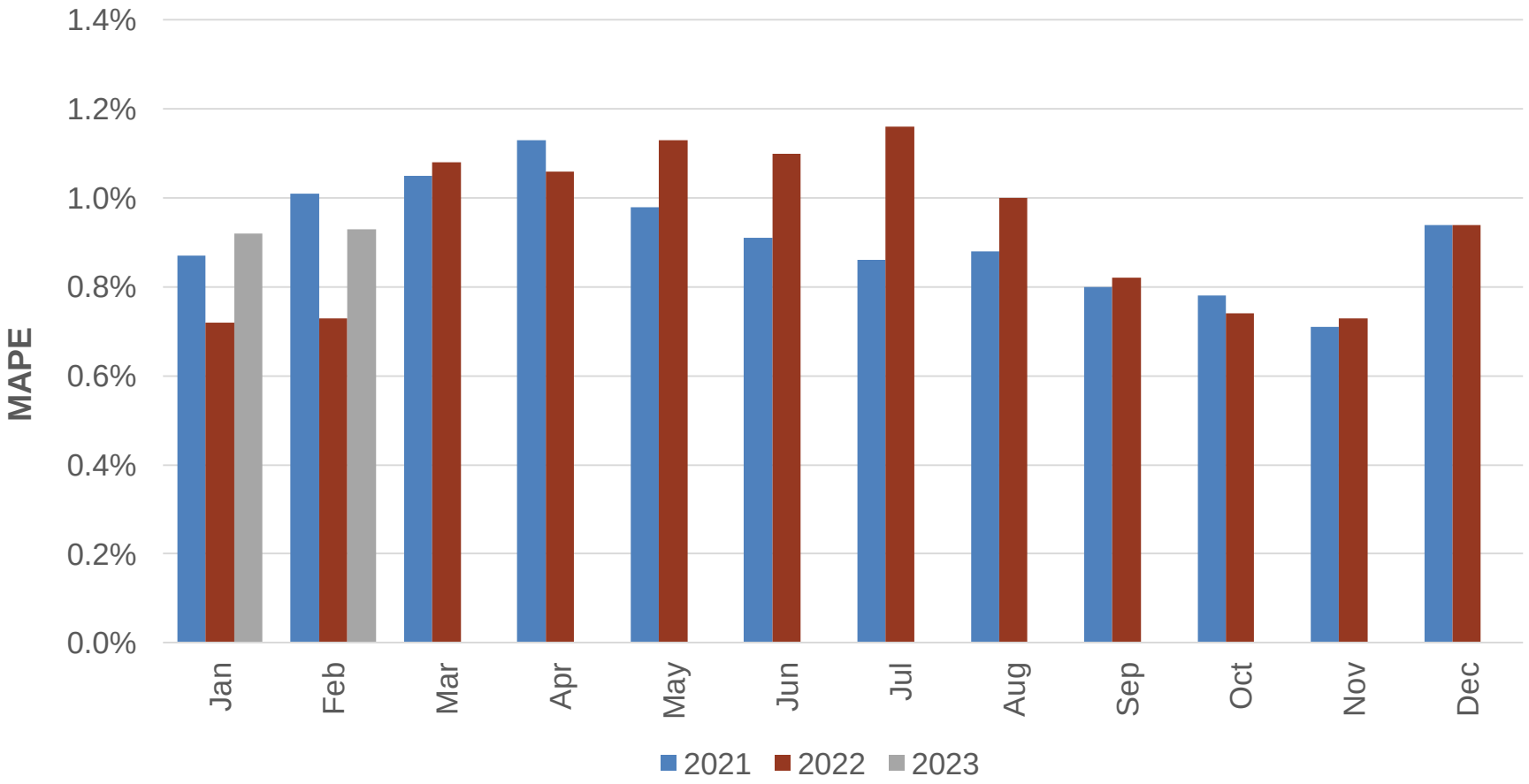
**MAPE = abs(Forecast – Actual)/Capacity

Day-ahead solar forecast



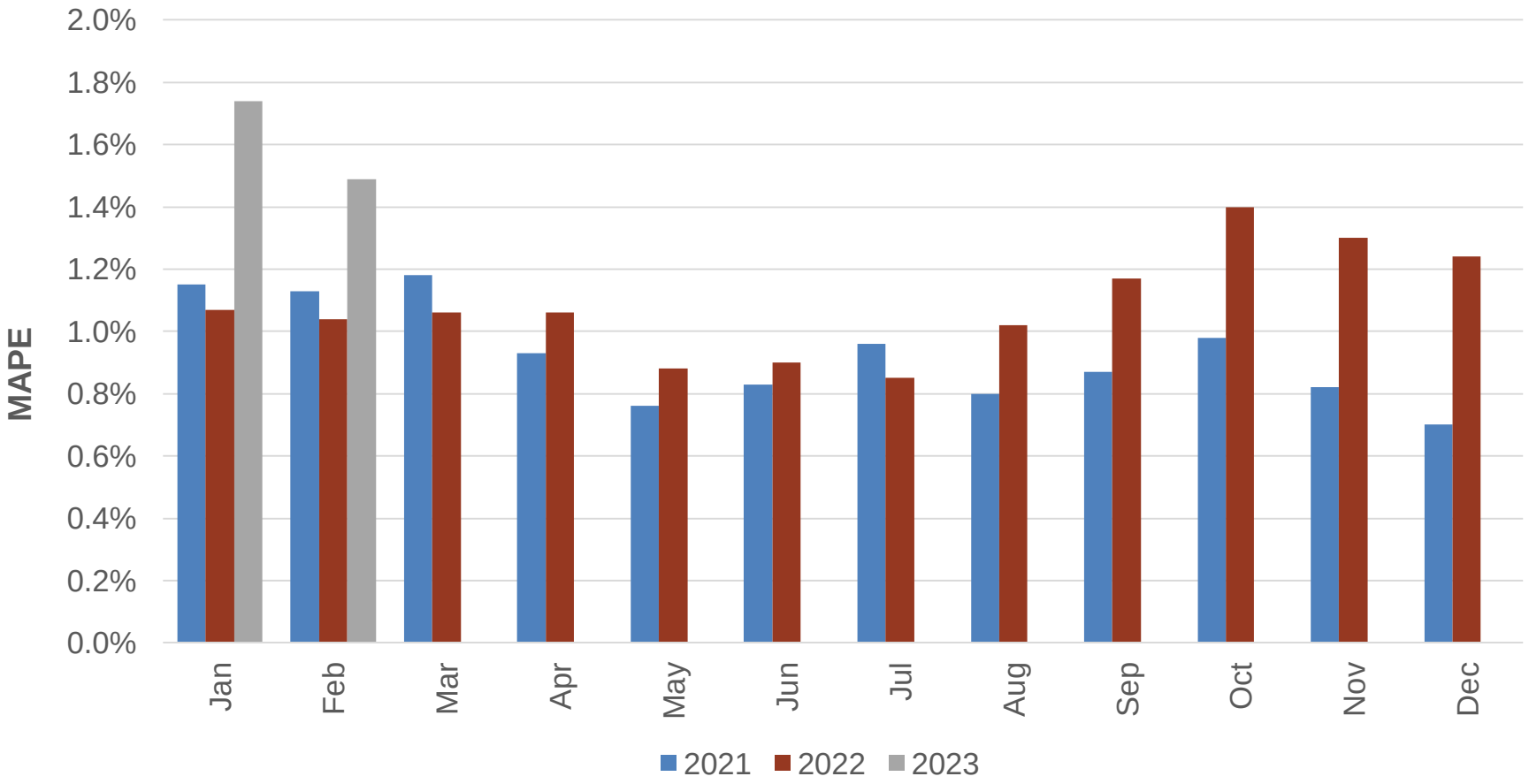
**MAPE = abs(Forecast – Actual)/Capacity

Real-time wind forecast



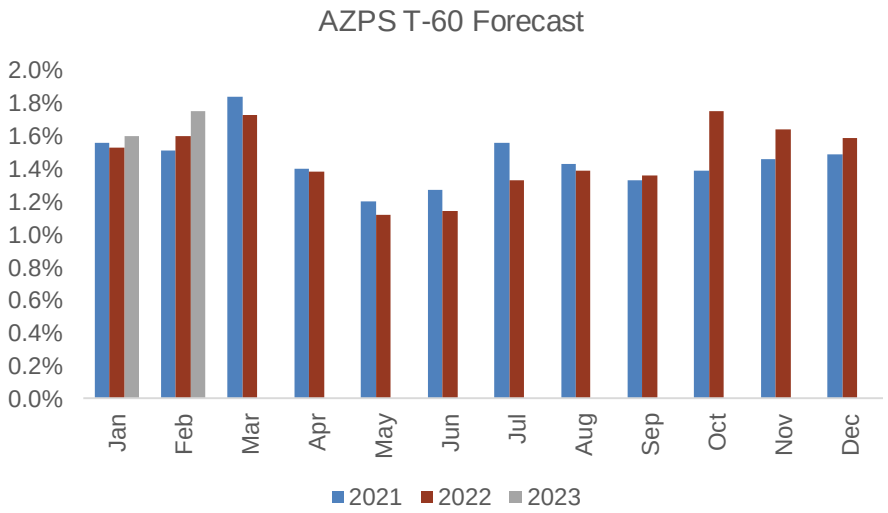
**MAPE = abs(Forecast – Actual)/Capacity

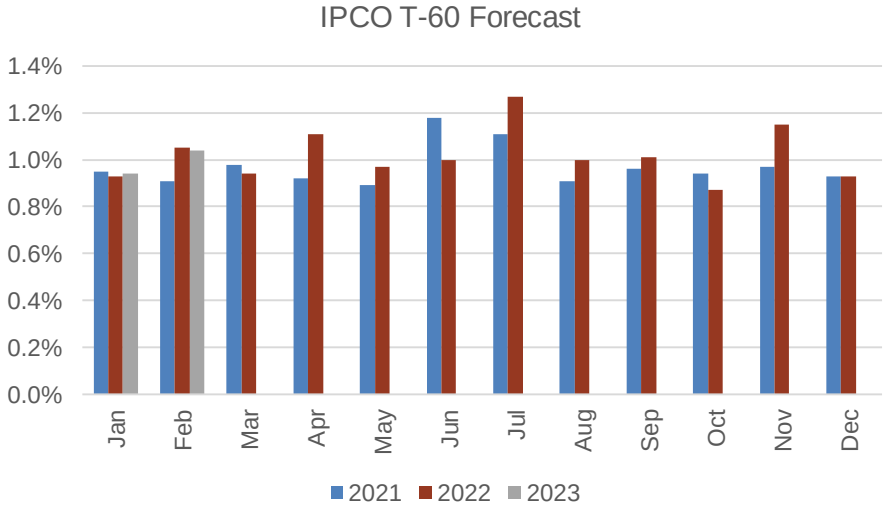
Real-time solar forecast

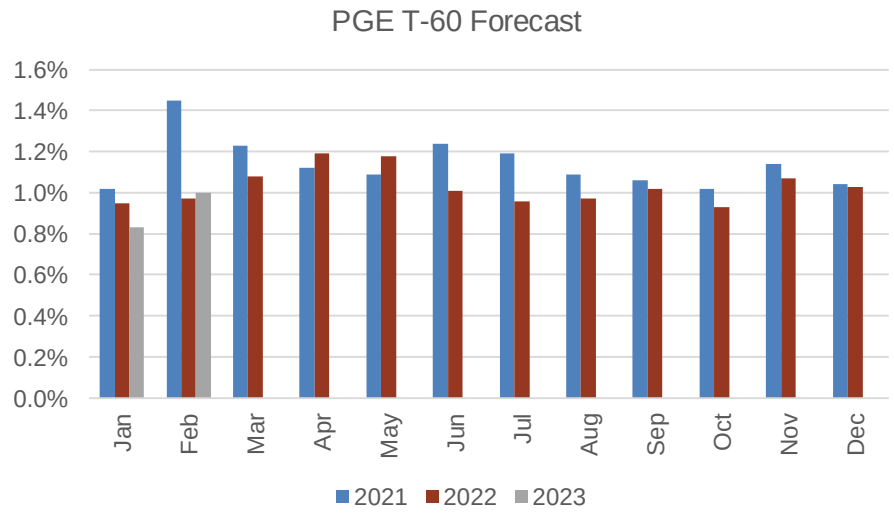


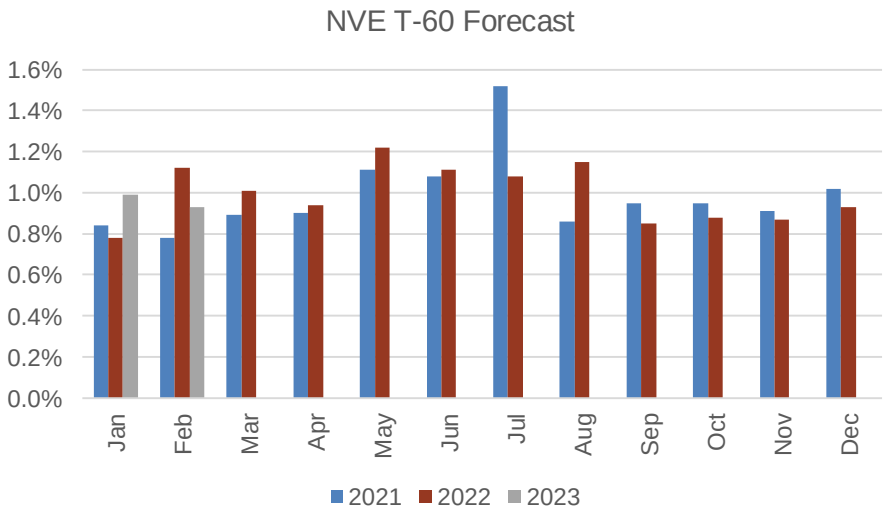
**MAPE = abs(Forecast – Actual)/Capacity

EIM T-60 forecast

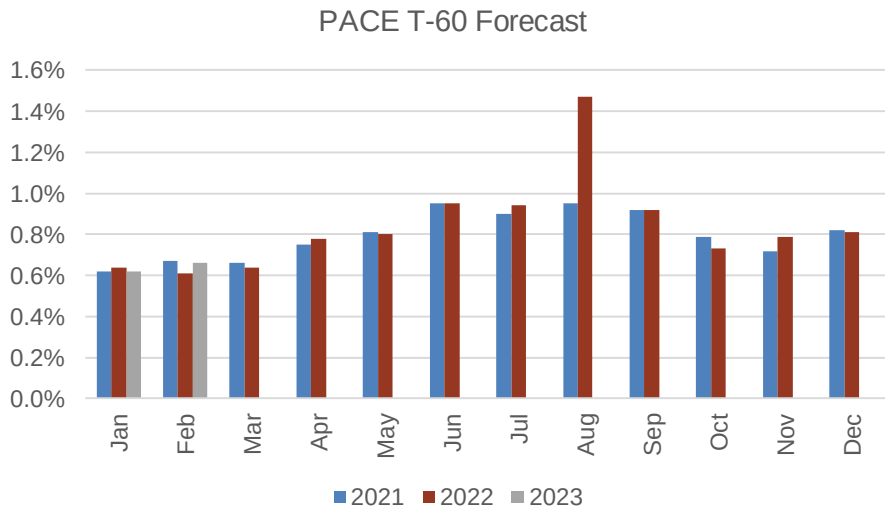


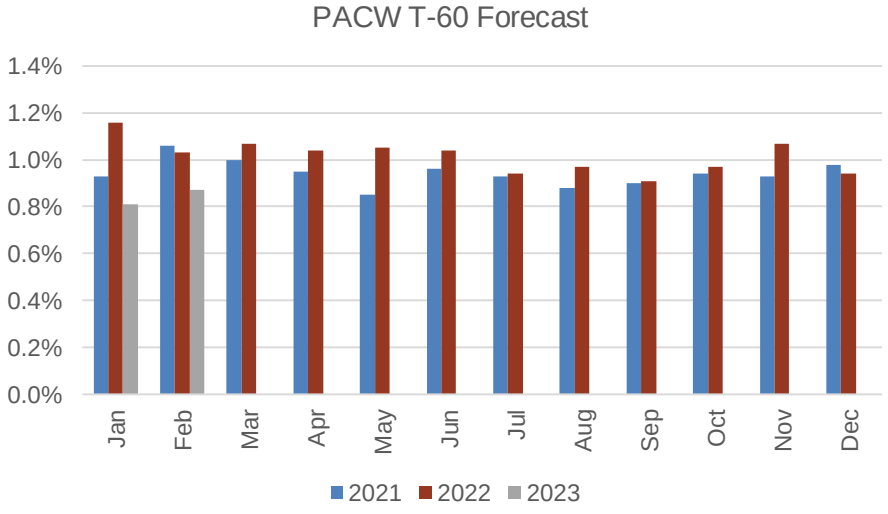


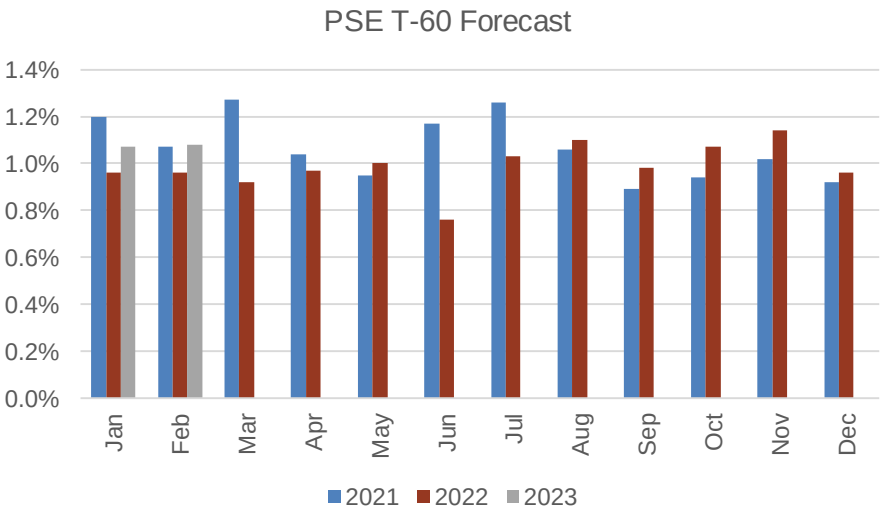


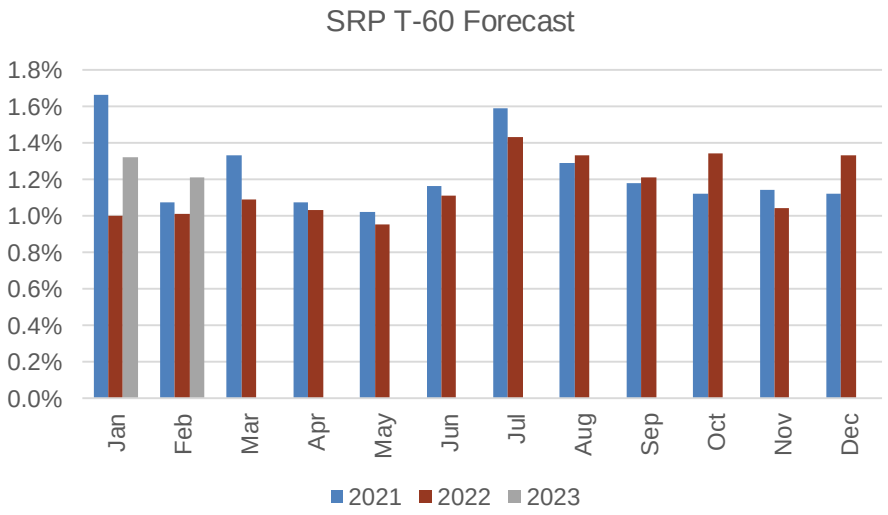


EIM T-60 forecast

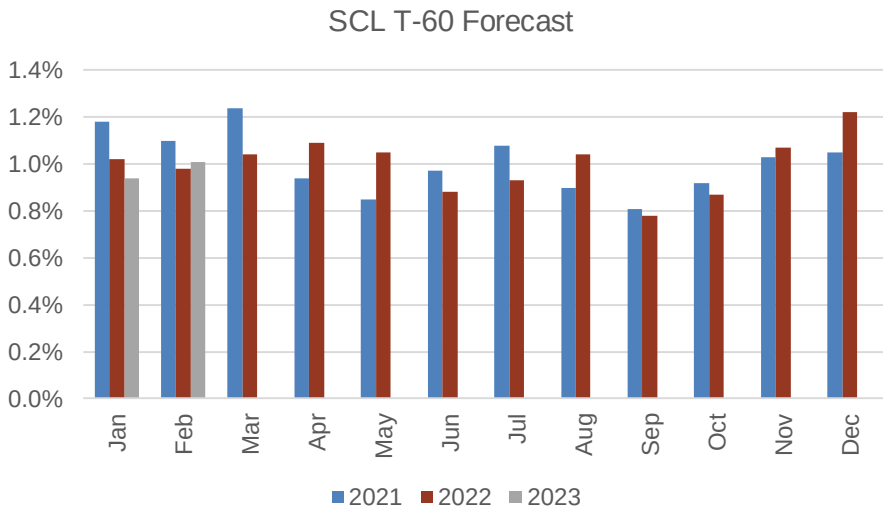


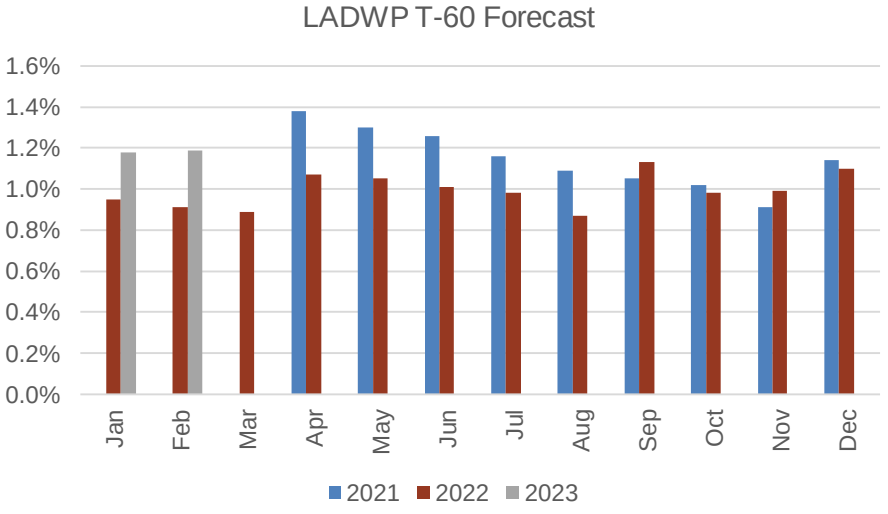


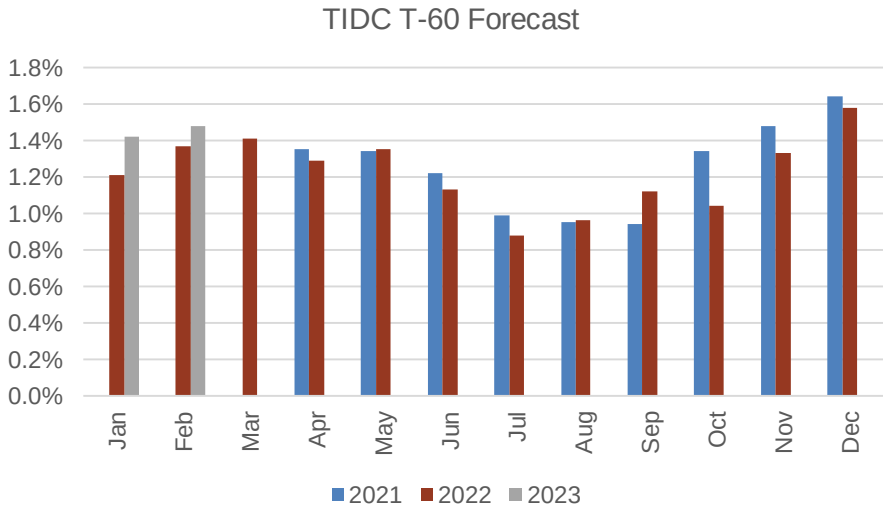


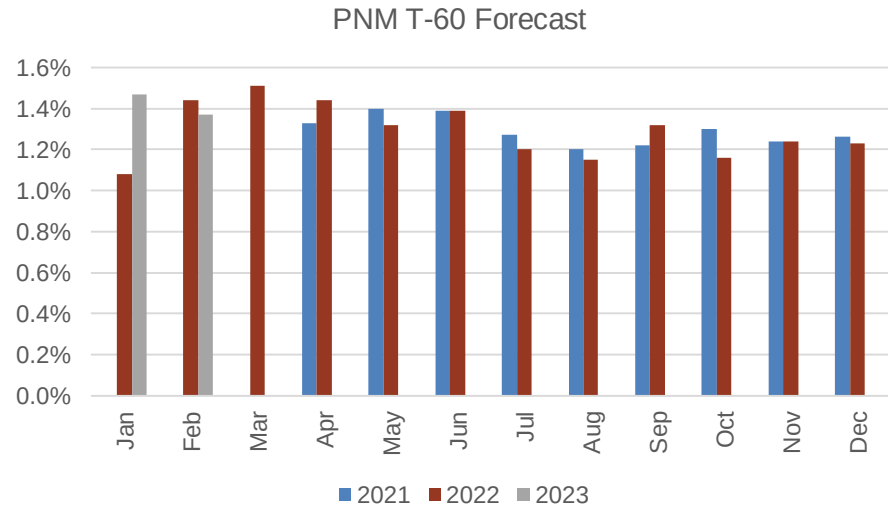


EIM T-60 forecast

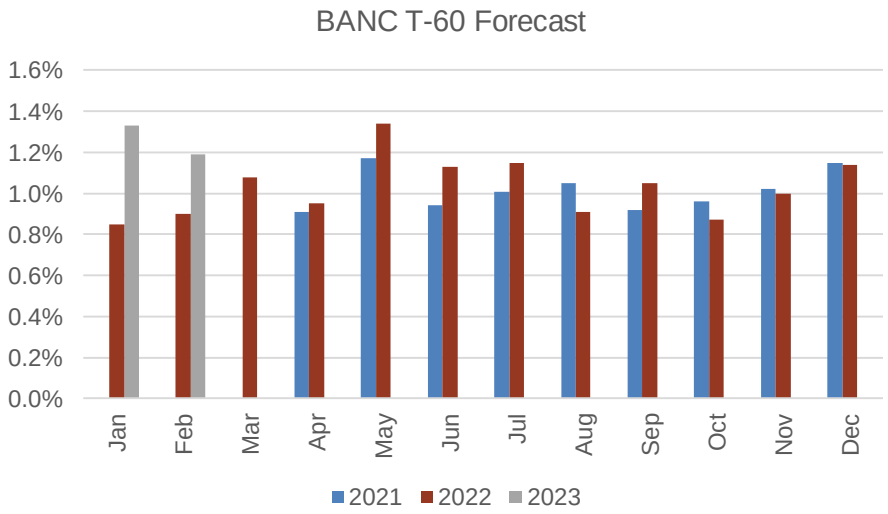


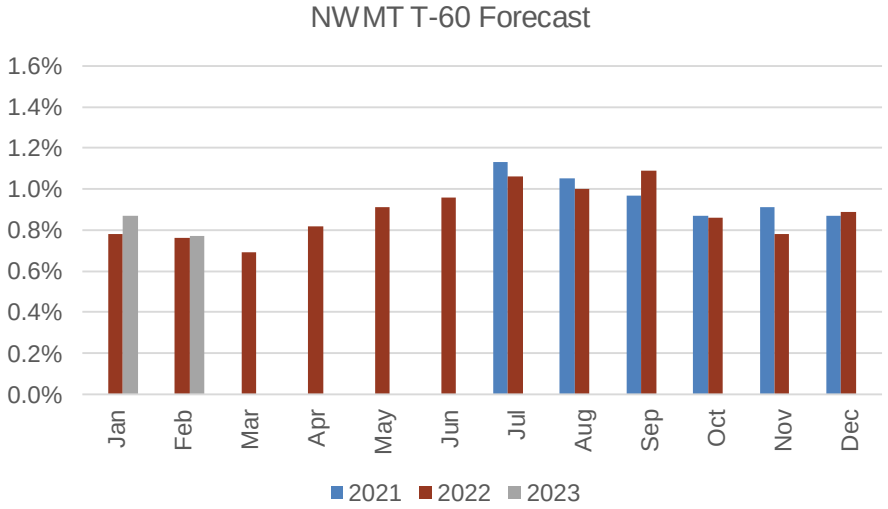


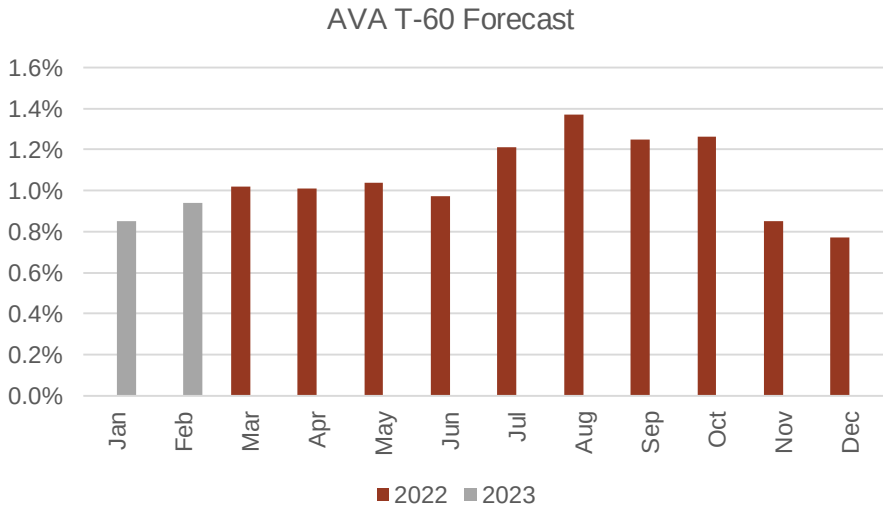


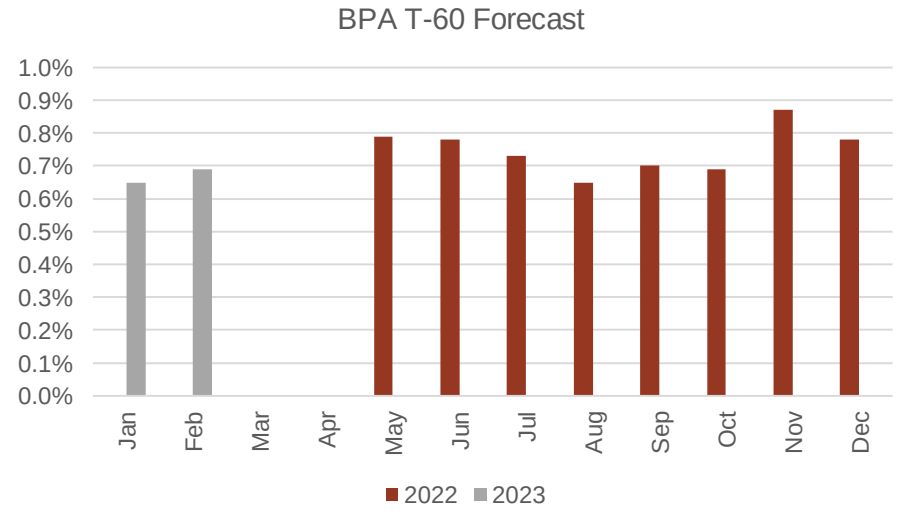


EIM T-60 forecast

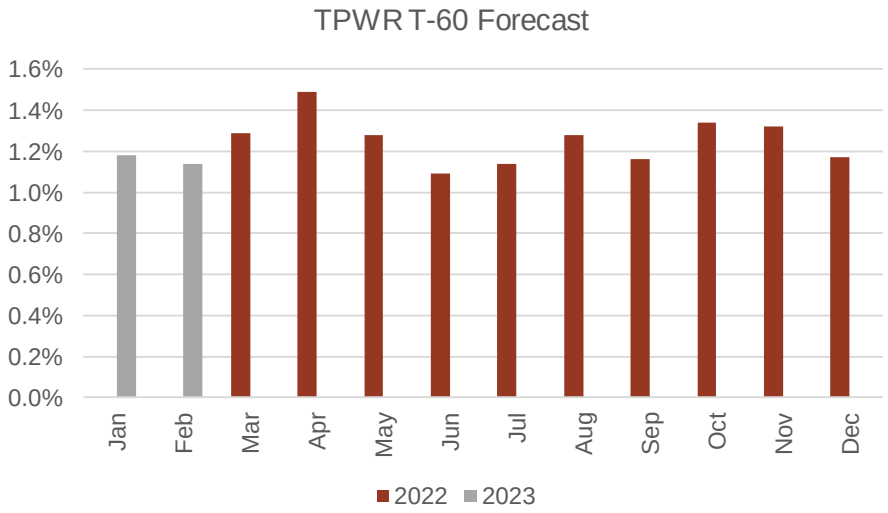


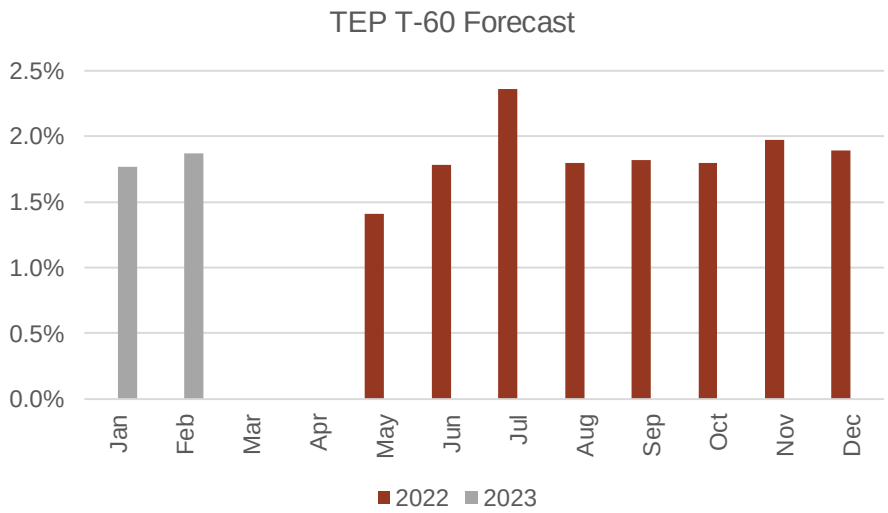






EIM T-60 forecast





Policy Update

Gillian Biedler

Policy Integration and Governance Manager

Interconnection Process Enhancements

- Scope: Enhancing the CAISO's generator interconnection and deliverability allocation procedures
  - Enhancements to address queue overload
  - Broader process reform considerations focusing on aligning the interconnection process with LSE procurement processes
- Decisional Classification: CAISO Board only
- Status:
  - Phase 1 – Approved at May 2022 CAISO Board meeting
  - Phase 2 – Approved at Oct 2022 CAISO Board meeting
    - FERC filing planned for Q1 2023
  - IPE 2023 – targeting May 2023 CAISO Board meeting

Greenhouse Gas (GHG) Technical Workshops

- The ISO will launch a series of technical workshops to continue to discuss evolution of the GHG accounting framework in EDAM and WEIM.
- The workshops will focus on establishing working knowledge on current GHG accounting policy, problem statement, and evaluating further enhancements.

May – September 2023, Phase 1 Workshops:

- Establishing a common understanding of:
  - the CAISO market and GHG design elements, and
  - current GHG regulation and integration across the West.
- Development of problem statement(s)

September 2023 & Beyond, Phase 2 Workshops:

- Stakeholder and ISO opportunity to present and consider enhancements
- Inform the scope of GHG initiatives

WEIM Resource Sufficiency Evaluation Enhancements – Phase 2

- Scope:
  - WEIM emergency energy assistance
  - Adjusting RSE obligations to account for low-priority exports
  - Requiring CAISO low-priority exports to be e-tagged as firm provisional

- Decisional Classification: Joint WEIM Governing Body/CAISO Board, WEIM Governing Body advisory
- Status:
  - MSC opinion adopted Dec 6
  - Second revised final proposal posted Dec 7
  - Dec 2022 CAISO Board and WEIM Governing Body meeting

Capacity Procurement Mechanism – Track 1

- Scope: Addresses various Capacity Procurement Mechanism operational and process enhancements
- Decisional Classification: CAISO Board only
- Status:
  - Revised draft final proposal posted on Nov 29
  - Final proposal posted Jan 11
  - Tariff language posted Jan 11
  - Mar 2023 CAISO Board meeting

Energy Storage Enhancements

- Scope: Market enhancements to efficiently dispatch storage resources in alignment with operational needs.
  - Ancillary services enhancements
  - Enhancements to the co-located resource model
- Decisional Classification: Joint WEIM Governing Body/CAISO Board
- Status:
  - Final proposal posted Oct 27
  - MSC opinion adopted Dec 6
  - Dec 2022 CAISO Board and WEIM Governing Body meetings
  - Revised Draft Tariff Language posted Mar 15

Minimum State of Charge Constraint Extension

- Scope: Extension of the minimum state of charge constraint currently in place for storage resources to ensure capacity to meet day-ahead discharge awards
  - Proposed extension through September 30, 2023
- Decisional Classification: CAISO Board decisional with WEIM Governing Body advisory role
- Status:
  - Final proposal posted March 6
  - March 2023 CAISO Board and WEIM Governing Body meetings

Ancillary Service State of Charge Constraint

- Scope:
  - Follow-up to CAISO's September 19 tariff amendment regarding the ancillary service storage state of charge requirement and related uplift payments
  - Initiative will consider potential additional revisions
- Decisional Classification: Joint WEIM Governing Body/CAISO Board
- Status:
  - Straw proposal anticipated in Q2 2023

Day-Ahead Market Enhancements

- Scope:
  - Co-optimizing supply in IFM based on both cleared demand and imbalance reserve product needs
  - Residual unit commitment process improvements
- Decisional Classification: recommending Joint WEIM Governing Body/CAISO Board
- Status:
  - MSC meeting Dec 12
  - Dec 2022 CAISO Board and WEIM Governing Body meeting briefing
  - Final proposal posted Jan 11
  - Workshops Feb 27, Mar 7-8
  - MSC meeting Mar 10
  - May 2023 CAISO Board and WEIM Governing Body meeting decision

Extended Day-Ahead Market

- Scope: Extending day-ahead market to WEIM entities. Scope includes:
  - Day-ahead resource sufficiency evaluation
  - Transmission availability
  - Greenhouse gas accounting and costs
- Decisional Classification:
  - Proposed that the EDAM initiative fall under CAISO Board/WEIM Governing Body joint authority
- Status:
  - Final proposal posted Dec 7
  - Dec 2022 CAISO Board and WEIM Governing Body meeting briefing
  - Feb 2022 CAISO Board and WEIM Governing Body meeting decision
  - Targeting July tariff filing to FERC

Transmission Services and Market Scheduling Priorities

- Scope:
  - Process for wheeling transactions through the CAISO BAA to obtain high-priority scheduling rights
  - Enhancements to processes for exporting from non-resource adequacy resources
- Decisional Classification: CAISO Board, with WEIM Governing Body advisory role
- Status:
  - Draft final proposal posted Dec 9
  - Dec 2022 CAISO Board and WEIM Governing Body briefing
  - Final proposal in Jan 2023
  - Feb 2023 CAISO Board and WEIM Governing Body decision

Price Formation Enhancements

- Scope:
  - Phase 1
    - Scarcity pricing enhancements that better reflect tight supply
    - Consideration of fast-start pricing in the CAISO markets
    - Improvements to local market power mitigation to more accurately assess transmission constraints between BAAs
  - Phase 2
    - Enhancements to real-time market use of advisory prices
    - Bid cost recovery changes focused on storage resource interaction with the real-time market's multi-interval optimization
- Decisional Classification: WEIM Governing Body advisory
- Status:
  - Stakeholder workshop held Nov 16, upcoming Dec 16
  - Stakeholder workshop Mar 20
  - Straw proposal Q2 2023

Market Parameter Change Enhancements

- Scope:
  - Minimum shift factor used in the CAISO market
  - Procedure for change penalty prices used in the CAISO market
- Decisional Classification: Joint WEIM Governing Body/CAISO Board
- Status:
  - Straw proposal posted in April
  - Draft final proposal posting in Jan 2023
  - Mar 2023 joint CAISO Board and WEIM Governing Body and meeting

EDAM ISO BAA Participation Rules

- Scope: Forthcoming initiative to address ISO BAA-specific elements required for EDAM participation
- Decisional Classification: TBD
- Status:
  - Market notice Mar 20 to announce initiative, and to provide initiative scope and schedule
  - Stakeholder workshop Apr 5

Generation Deliverability Methodology Review

- Scope: New initiative to respond to industry concerns with access to deliverability for resources seeking to compete in load serving entity procurement processes
- Decisional Classification: TBD
- Status:
  - Update paper posted Dec 12, 2022
  - Issue paper Mar 2023
  - Stakeholder meeting Apr 2023

Release Plan Update

Trang Vo
Senior Project Manager,
Strategic Initiative Management

ISO Training Schedule

Training Course	Date and time
ISO Workshop: ISO Settlements (session is full - waitlist only)	March 21 and 22 9am – 12pm PPT
ISO Workshop: Introduction to ISO Markets	August 8 and 9 9am – 12pm PPT
ISO Workshop: Market Transactions	August 15 and 16 9am – 12pm PPT
ISO Workshop: ISO Settlements	August 22 and 23 9am – 12pm PPT

Are you looking for more training?

The ISO Learning Center has computer based training available for lots of topics. Check out the Learning Center: http://www.caiso.com/participate/Pages/LearningCenter/default.aspx

Release Plan Summary

WEIM Spring 2023 Release

- WEIM 2023 – Avangrid
- WEIM 2023 – El Paso Electric
- WEIM 2023 – WAPA Desert Southwest Region

2023 Independent

- WEIM Enhancements: ETSR UI; April 2023
- WEIM Enhancements: Shared Ramping Constraint
- Washington WEIM Greenhouse Gas Enhancements
- Congestion Revenue Rights System Replacement (2023-2024)

2023 Summer – Tentative, under further assessment

- Ancillary Service State of Charge Constraint
- Energy Storage Enhancements Phase 1 Track 1 – Ancillary Services & Exceptional Dispatch
- WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1
- Hybrid Resources Phase 2C - Settlements

Future Release – Tentative, under further assessment

- Transmission Service & Market Scheduling Priorities Phase 2
- Day-Ahead Market Enhancements
- Extended Day-Ahead Market
- Congestion Revenue Rights System Replacement (2023-2024)

WEIM Spring 2023 Release

WEIM Spring 2023 – WEIM integrations for Avangrid, El Paso Electric, and WAPA Desert Southwest Region

Project Info	Details/Date
Application Software Changes	System modifications as needed to accommodate any unique Avangrid, El Paso Electric, and WAPA Desert Southwest Region needs to support their WEIM onboarding.
BPM Changes	WEIM BPM will be updated if needed to reflect changes identified during the onboarding and as required to reflect the unique processes of Avangrid, El Paso Electric, and WAPA Desert Southwest Region.
Market Simulation	December 2022 thru January 2023
Parallel Operations	February 2023 thru March 2023

Milestone Type	Milestone Name	Dates		
		Avangrid	El Paso Electric	WAPA Desert Southwest Region
Market Sim	Market Sim Window	✓ Dec 2022 thru Jan 2023		
Parallel Operations	Parallel Operations	Feb 2023 thru Mar 2023		
Tariff	File Readiness Certification	✓ Mar 3, 2023		
Production	Activation	Apr 5, 2023		

Independent 2023 Releases

WEIM Enhancements

Project Information	Details/Date
High Level Business Problem or Need	To collectively address important issues identified by WEIM market participants through Customer Inquiry, Dispute and Information system (CIDI) requests to improve the visibility, functions and features in Energy Imbalance Market (WEIM).
High Level Project Scope	• BAAOP: ETSR detail screen will be available to BOTH RTMO and WEIMs. (First drop for testing will only be available to RTMO). • BAAOP: WEIM shared ramping constraint IS NOT editable through UI.
BPM Changes	WEIM, Market Instruments
Tariff Change	Section 29.4
Impacted Systems	RTM/BAAOP, RTM/Integration

System	High Level Changes
Real-Time Market (RTM)	BAAOP: WEIM shared ramping constraint IS NOT editable through UI. ***2023*** • Shared ramping capability constraint • UI for WEIM entity input parameters for ramp sharing • Use in the optimization for each resource based on BAA ramp share parameters
Real-Time Market (RTM)	BAAOP: ETSR detail screen ***April 2023*** • ETSR detail screen will be available to BOTH RTMO and WEIMs. (First drop for testing will only be available to RTMO). • New ETSR detail screens • Currently in “Coming Soon”

2023 Summer, and Future Releases

Tentative, under further assessment

Overview - Tentative

Release	Project	BOG	Tariff	BRS	Settlements CG	Settlements Effective Date	Production Activation
2023	Washington WEIM Greenhouse Gas Enhancements	Oct 2022 - Approved	Filed 11/21/22 Accepted 02/10/23 Filed Amendment 03/13/23	02/06/23	N/A	N/A	2023
2023 Summer	Ancillary Service State of Charge Constraint		Filed 09/19/22 Accepted 11/18/22	02/09/23	Tech Doc 2/13 **1st Draft CG 3/15** 2nd DCG week of 4/3 or 4/10	Retroactive to 09/20/22	2023
	Energy Storage Enhancements Phase 1 Track 1 – Ancillary Services & Exceptional Dispatch	Dec 2022 - Approved	Draft 02/10/23 **Revised DTL 03/15/23**	02/08/23	Tech Doc 2/17 **1st Draft CG 3/15** 2nd DCG week of 4/3 or 4/10	1st of the month; new CCs	2023
	WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1	Dec 2022 - Approved	Revised 12/12/22 **Final Revised DTL 03/07/23**	02/10/23	Tech Doc 2/17 **1st Draft CG 3/15** 2nd DCG week of 4/3 or 4/10	1st of the month; new CCs	2023
	Hybrid Resources Phase 2C			01/31/23	Tech Doc 2/13 **1st Draft CG 3/15** 2nd DCG week of 4/3 or 4/10	1st of the month	2023
Future Release	Transmission Service & Market Scheduling Priorities Phase 2	Feb 2023 - Approved					Summer 2024
	Day-Ahead Market Enhancements	Feb 2023 – Briefing **May 17, 2023 – Decision**					Fall 2024
	Extended Day-Ahead Market On-Boarding	Feb 2023 – Approved	File Jul 2023				Fall 2024 Spring 2025

Overview – System Impacts

Project	ADS	CMRI	Master File	MF RDT	OASIS	RIMS	Settlements	Market	SIBR
WA WEIM GHG Enhancements		X	X	X*	X*		X	X	X
Ancillary Service State of Charge Constraint		X*					X	X	
Energy Storage Enhancements Phase 1 Track 1 AS & ED	X	X*			X	X	X	X	X
WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1			X		X*		X	X	
Hybrid Resources2C						X (Independent 2023)	X (Summer 2023)		

X* = Technical Specifications

Overview – System Interface Changes

System	Project	UI	API	Data
ADS	ESE1T1	Existing	Existing	New ED Reason Codes: “SOC Hold” and “SOC Charge”
CMRI	**ESE1T1**	**New** report to display Exceptional Dispatch Hold State of Charge	**New**: Retrieve Exceptional Dispatch Hold State of Charge v1 **New**: Retrieve Exceptional Dispatch Hold State of Charge v1 DocAttach	
CMRI	**ASSOCC**	**New** report to display ASSOC binding constraints	**New**: RetrieveStateOfChargeConstraint_CMRIv1 RetrieveStateOfChargeConstraint_CMRIv1_DocAttach	Data retroactive to 9/20/22
CMRI	WA WEIM GHGE	Existing	Existing	New Attributes/Records to indicate state/include GHG index price for each state
OASIS	ESE1T1	Existing: Energy > System > Operator-Initiated Commitment report	Existing: System > Operator-Initiated Commitment report	New ED type Reason Code: “SOC Hold” and “SOC Charge”
OASIS	**RSEE2T1**	**New**: Public Bids > Market Bid Caps	**New**: Public Bids > Market Bid Caps	
OASIS	RSEE2T1	Existing: Energy > EIM > WEIM RSE Capacity Tests	Existing: Energy > EIM > WEIM RSE Capacity Tests	> Original data publishing is existing system functionality. > Corrected data publishing is new system functionality that will be published on same existing report as original data. >BAA RSE Capacity Test Failure Upward/Downward Capacity (15-min granularity)
OASIS	RSEE2T1	Existing: Energy > Flexible Ramping > Flexible Ramp Requirements Inputs and Outputs (WEIM RSE Flexible Ramping Tests)	Existing: Energy > Flexible Ramping > Flexible Ramp Requirements Inputs and Outputs (WEIM RSE Flexible Ramping Tests)	> Original data publishing is existing system functionality. > Corrected data publishing is new system functionality that will be published on same existing report as original data. >BAA RSE Flexible Ramp Test Failure Upward/Downward Capacity (15-min granularity)
OASIS	**WA WEIM GHGE**	Existing: Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Existing – Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Add WA GHG index prices, display average of daily WA GHG price indices

Overview – System Interface Changes

System	Project	UI	API	Data
MF	**RSEE2T1**	Existing	Existing	BAA Assistance Energy Transfer Opt In/Out Flag
MF RDT	**RSEE2**	Add a new Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag	Add a new Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag	Track 2 for Fall 2023
MF RDT	**WA WEIM GHGE**	Add a new BAA level attribute to identify BAAs associated with Washington State	SubmitGeneratorRDT_MFRDv5 SubmitGeneratorRDT_MFRDv5_DocAttach RetrieveGeneratorRDT_MFRDv5 RetrieveGeneratorRDT_MFRDv5_DocAttach	Add a new BAA level attribute to identify BAAs associated with Washington State
SIBR	ESE1T1	Existing	Existing	Rules Only
SIBR	WA WEIM GHGE	Existing	Existing	Consume WA GHG adders
RIMS	ESE1T1	Existing: Existing > App & Study > Equipment Configuration tab > Generation as Modeled and Implemented grid	NA	> Pull storage resource MWh from MF > Add new field for calculated MWh > Add new field for storage resource duration in hours
ITS	RSEE2T1	Existing	NA	Exports e-Tagging Submission Requirement > SCs shall be required to e-tag the following as “Firm Provisional Energy (G-FP)”, via utilizing Misc. field: o RT economic (RTECON) exports that clear HASP o DA economic (DAECON) exports that clear both RUC and HASP o RTLPT exports that clear HASP o DALPT exports that clear both RUC and HASP > SCs shall be required to e-tag the following as “Firm Energy (G-F)”: o RTPT exports that clear HASP o DAPT exports that clear both RUC and HASP

Independent 2023 – WA WEIM GHG Enhancements - Overview

Project Information	Details/Date
High Level Business Problem or Need	Pursuant to State of Washington's recently revised Clean Air Act and beginning in 2023, Washington (WA) will require reporting of emissions associated with Western Energy Imbalance Market (WEIM) transactions. Emissions reporting is a key element of Washington's new cap-and-invest program that sets a limit on overall carbon emissions in Washington and requires emitters to obtain allowances equal to their covered GHG emissions. This initiative comprises the first phase of enhancements to support reporting WEIM transactions for emissions year 2022. As reporting rules continue to develop, additional enhancements outside of the scope of this initiative will likely be necessary.
High Level Project Scope	• Identify resources within WA State boundary • Update WA State associated resources' greenhouse gas (GHG) reference levels with dynamic pricing using vendor-provided indices • Note: while Tariff stipulates use of static pricing as an interim measure prior to the first Washington allowance auction, due to implementation timing, this is not anticipated to be necessary. This first auction is scheduled for February 28, 2023. • Calculate and publish monthly projected GHG prices for Washington State • Develop reports to support WEIM Entity annual reporting to Washington State
BPM Changes	Energy Imbalance Market (EIM), Market Instruments
Tariff Changes	Sections 30.4.4.5, 30.4.5.2, 39.6.1.6.2, 39.7.1.1.1.1, 39.7.1.1.1.2, 39.7.1.1.1.4
Impacted Systems	MF, Internal System, SIBR, OASIS

Independent 2023 – WA WEIM GHG Enhancements - Overview

System	High Level Changes
MF	• New rule to verify that relevant resources within WA State must provide resource specified GHG emission rate • New attribute at the BAA level to identify BAAs associated with Washington State • New attribute to associate resources within WA State with the State of WA to identify resources with GHG obligation • Exception: BPA—not subject to WA reporting rule

Internal System	• Reference level (commitment costs/DEBs) changes to reflect GHG costs
	  • DEBs to include GHG components for generators inside WA State
	  • Update GHG startup cost curve for resources inside WA State
	  • Update Greenhouse Gas Minimum Load Cost Allowance
	• Differentiate between CA and WA resources
	• Capture WA GHG price in the resource-specific minimum load and startup GHG adders for the purposes of commitment cost calculations

SIBR	• Receive startup GHG adders for the purposes of commitment cost calculations for WA State resources • Confirm GHG curves generated for WEIM resources within WA State are successfully received and processed
OASIS	• Add WA GHG index prices to existing GHG Index Price OASIS report • Only applicable for dynamic GHG pricing

Independent 2023 – WA WEIM GHG Enhancements

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Oct 26, 2022	✓
	WEIM Governing Board Approval	Oct 26, 2022	✓
External BRS	Publish External BRS	Feb 06, 2023	✓
Settlements Config Guides	Settlements Config Guides	N/A	
Tech Spec	MFRDT OASIS	Apr 2023	
Tariff	File Tariff ER23-474 Tariff Accepted Filed Amendment	Nov 21, 2022 Feb 10, 2023 Mar 13, 2023	✓ ✓ ✓
BPMs	Publish Draft Business Practice Manuals – WEIM Publish Draft Business Practice Manuals – Market Instruments		
Market Sim	Market Sim Window	N/A	
Production Activation	WA WEIM GHG Enhancements	2023	

Summer 2023 – Ancillary Services State of Charge Constraint

Project Information	Details/Date
High Level Business Problem or Need	In spring of 2022, the Department of Market Monitoring (DMM) discovered undue market outcomes resulting from regulation down awards to or self-provisions by storage resources for long periods when paired with high energy bids from those resources. Both DMM and the CAISO have concluded that these excess bid cost recovery payments under these conditions cannot be justified by the principles underlying bid cost recovery.
High Level Project Scope	Make storage resources ineligible for Bid Cost Recovery (BCR) uplift for certain market intervals in real time: • When the market state of charge (SOC) constraint is binding due to AS Awards causing the market to dispatch resource energy uneconomically. • Retroactively settle relevant intervals (beginning with effective date of 09/20/2022)
BPM Changes	Market Instruments, Market Operations, Settlements and Billing
Tariff Changes	Sections 8.4.3, 8.4.1.1(g), 11.6.6 Note: Tariff filing completed on 09/19/2022
Impacted Systems	RTM, Settlements, CMRI

System	High Level Changes
Real Time Markets (RTM)	Capture RTD/RTPD AS SOC binding constraint shadow price data
Settlements	Design new bill determinants and configurations using the RTD/RTPD AS SOC binding constraint shadow price data for calculation of BCR ineligibility
CAISO Market Results Interface (CMRI)	Develop new external report to inform on AS SOC binding constraint for settlement purposes (resource specific—private report)

Summer 2023 – Ancillary Services State of Charge Constraint

Milestone Type	Milestone Name	Dates	Status
External BRS	Publish External BRS	Feb 09, 2023	✓
Settlements Config Guides	First Draft Technical Documents First Draft Configuration Output File + Draft Release Artifacts Second Draft Configuration Output File	Feb 13, 2023 Mar 15, 2023 Week of Apr 3, 2023	✓ ✓
Tech Spec	Create and Publish ISO Interface Spec (Tech Specs) – CMRI	Apr 2023	
Tariff	File Tariff ER22-2881 Tariff Accepted	Sep 19, 2022 Nov 18, 2022	✓ ✓
BPMs	Publish Draft Business Practice Manual – Market Instruments Publish Draft Business Practice Manual – Market Operations Publish Draft Business Practice Manual – Settlements & Billing		
Market Sim	Market Sim Window		
Production	Ancillary Service State of Charge Constraint – Deployment Ancillary Service State of Charge Constraint – Effective Date Retroactive	Summer 2023 Sep 20, 2022	

Summer 2023 – Energy Storage Enhancements Phase 1 Track 1 AS & ED

Project Information	Details
High Level Business Problem or Need	This initiative includes enhancements to reliability processes and tools to better manage energy storage resource state of charge. The initiative also includes day-ahead storage resource DEB updates to better capture storage resource opportunity costs.

High Level Project Scope	Scope 1: Reliability Enhancements
	• Include expected impacts from regulation in State of Charge (SOC)
	• Require storage to bid energy in the opposite direction of Ancillary Service (AS) awards
	  • A resource providing regulation up/regulation down must have energy bids to charge/discharge (respectively)
	  • Energy bids must be 50% of AS awards
	• Allow for Exceptional Dispatches (EDs) to be issued for storage resources to hold SOC
	  • Storage may receive a traditional ED or an SOC ED, but not both
	  • Include lost opportunity from not generating due to hold SOC ED in storage compensation
	  • Calculate counterfactual energy revenues with and without the hold SOC ED
	  • If prices are below bids counterfactuals will not include discharges
	  • Use actual LMPs (the ISO will not generate counterfactual LMPs)
	  • Include hold SOC ED period through the end of the day in time horizon
	  • Different Settlement process than traditional ED
	Scope 2: Reference Level Enhancements
	• Update DA storage resource default energy bid (DEB) to include storage specific opportunity cost

BPM Changes	Market Instruments, Market Operations, Settlements and Billing
Impacted Systems	RIMS, SIBR, Market, ADS, Settlements, CMRI, OASIS

Summer 2023 – Energy Storage Enhancements Phase 1 Track 1 AS & ED

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval WEIM Governing Board Approval	Dec 14, 2022	✓
External BRS	Post External BRS	Feb 08, 2023	✓
Settlements Config Guides	First Draft Technical Documents First Draft Configuration Output File + Draft Release Artifacts Second Draft Configuration Output File	Feb 17, 2023 Mar 15, 2023 Week of Apr 3, 2023	✓ ✓
Tech Spec	Create ISO Interface Spec (Tech spec) – CMRI	Apr 2023	
Tariff	Draft Tariff Language Revised Draft Tariff Language File Tariff Tariff Accepted	Feb 10, 2023 Mar 15, 2023	✓ ✓
BPMs	Draft BPM changes – Market Instruments Draft BPM changes – Market Operations Draft BPM changes – Settlements & Billing		
Market Sim	Market Sim Window		
Production Activation	Energy Storage Enhancements Phase 1 Track 1 AS & ED	Summer 2023	

Summer 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1

Project Information	Details

High Level Project Scope	• Exclude RTLPT exports and RT economic (RTECON) exports that that are associated with latest RTPD run from the following RSE tests for CAISO BAA
	  • Capacity Test (Upward and Downward)
	  • Flexible Ramping Sufficiency Upward Test
	• Facilitate assistance energy transfer between WEIM BAAs into the WEIM BAAs that failed RSE upward test:
	  • Added as ex-post surcharge through Settlements.
	  • Market broadcasts needed data to Settlements.
	• Clarification of Post-HASP Block Hour Low-Priority Export
	  • Require DALPT and DA economic (DAECON) export that clears both RUC and HASP, RTLPT and RT economic (RTECON) export that clears HASP be e-tagged as “Firm Provisional Energy (G-FP)”

BPM Changes	Western Energy Imbalance Market, Market Operations, Settlements and Billing
Tariff Changes	Sections 29.11, 29.34
Impacted Systems	MF, Market, Settlements, OASIS

Summer 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval WEIM Governing Board Approval	Dec 14, 2022	✓
External BRS	Post External BRS	Mar 10, 2023	✓
Settlements Config Guides	First Draft Technical Documents First Draft Configuration Output File + Draft Release Artifacts Second Draft Configuration Output File	Feb 17, 2023 Mar 15, 2023 Week of Apr 3, 2023	✓ ✓
Tech Spec	Create ISO Interface Spec (Tech spec) – OASIS	Apr 2023	
Tariff	Revised Tariff Final Revised Draft Tariff Language	Dec 12, 2022 Mar 07, 2023	✓ ✓
BPMs	Draft BPM changes – WEIM Draft BPM changes – Market Operations Draft BPM changes – Settlements & Billing		
Market Sim	Market Sim Window		
Production Activation	Resource Sufficiency Evaluation Enhancements Phase 2 Track 1	Summer 2023	

Summer 2023 – Hybrid Resources 2C

Project Information	Details/Date
High Level Business Problem or Need	The ISO launched this stakeholder initiative to identify new or enhanced market rules and business processes needed to accommodate hybrid resources, resources that consist of two sets of market rule changes that will facilitate mixed-fuel type (hybrid and co-located resources) project participation in the ISO markets. Prior to this initiative, Phase 1 identified a first set of modifications generally concerned with setting up and operating co-located resources. Building on phase 1, Phase 2 focuses on modifications that will explore how hybrid generation resources can be registered and configured to operate within the ISO market. The initiative will further develop solutions allowing developers to maximize the benefits of their resource's configuration. Additionally, hybrid resource configurations also raise new operational and forecasting challenges that the ISO plans to address during this initiative.
High Level Project Scope	With this initiative, there's an opportunity to increase storage and the number of hybrid resources that can connect to the ISO grid. Currently the interconnection queue includes more than 24,000 MW of mixed fuel projects and nearly 20,000 MW of storage which represents roughly half of all generation in the current interconnection queue.
BPM Changes	Direct Telemetry, Market Instruments, Metering, Settlements & Billing
Impacted Systems	RIMS, Settlements, Today's Outlook, ISO Today Mobile Application, Reports
Requirements	http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf

Summer 2023 – Hybrid Resources 2C

Milestone Type	Milestone Name	Dates	Status
External BRS	Publish External BRS	Jan 31, 2023	
Settlements Config Guides	First Draft Technical Documents First Draft Configuration Output File + Draft Release Artifacts Second Draft Configuration Output File	Feb 17, 2023 Mar 15, 2023 Week of Apr 3, 2023	✓ ✓
Tech Spec	Create and Publish ISO Interface Spec (Tech Specs)	N/A	
Market Sim	Market Sim Window		
Production Activation	Hybrid Resources 2C – Settlements Hybrid Resources 2C – RIMS	Summer 2023 Independent 2023	

2023-2024 CRR System Upgrade

2023 – 2024 Congestion Revenue Rights (CRR) Upgrade

Project Information	Details/Date
High Level Project Scope	The Congestion Revenue Rights (CRR) system was implemented by CAISO in 2008 as part of the Market Redesign and Technology Upgrade (MRTU) implementation. The current CRR system is at its end of life, does not have the flexibility to accommodate future policy changes and requires the ISO to calculate data and run processes manually outside the current system to produce a successful CRR Auction. The CAISO has decided on a significant upgrade of the existing CRR system and adopt the latest technology stack aligned with CAISO's technology standards, consolidate all CRR related functions, minimize human errors, reduce processing time, eliminate manual workarounds, and positions the system to accommodate policy changes down the road.
BPM Changes	Congestion Revenue Rights • Enhancements made to the new CRR product. • Automatic publishing of CRR market results. • Automatic CRR notification. • New CRR schedule calendar. • New CRR FNM access. • New CRR data submission and download interface UI/API. • New CRR market results interface. • Load Migration
Tariff Change	No
Impacted Systems	CRR, AIM, CMRI, OASIS, CTS, Market Clearing, EMMS, IFM/RTN, MQS, Master File, MPP, Settlements, WebOMS, ETCC.

2023 – 2024 Congestion Revenue Rights (CRR) Upgrade

System	High Level Changes
CRR	Significant system upgrade including: • Enhancements made to the new CRR application. • Automatic publishing of CRR market results. • Automatic CRR notification. • New CRR schedule calendar. • New CRR FNM access. • New CRR data submission and download interface UI/API. • Other TBDs identified through BRS development.
AIM	• New users and roles to support new CRR functionality
CMRI	• Full and incremental Payload publishing • Publish CRR Awards payload on event-driven, ad-hoc or scheduled basis • Publish CRR Awards payload on event-driven, ad-hoc or scheduled basis
OASIS	• Publish CRR Calendar, and all available CRR market names, and credit margin information, 3 year historical expected value.. • Allow authorized users to publish CRR inventory payloads • Broadcast the following: set aside values, the results of all CRR markets, retired pnode/anode mapping, binding constraints, initial and updated CRR source and sink list for each CRR market,
CTS	• Broadcast
EMMS	• CRR will consume data from EMMS
IFM/RTN	• CRR will consume data from IFM/RTN
MQS	• MQS will consume and process SCID in a new format • MQS will consume ownership payload in bulk
Master File	• Master File will be modified as needed to support the new CRR functionality
MPP	• CRR will provide pre-configured external reports
Settlement	• Settlements will be modified as needed to support the new CRR functionality
WebOMS	• CRR will consume data from WebOMS
ETCC	• CRR will consume data from ETCC

2023 – 2024 Congestion Revenue Rights (CRR) Upgrade

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	N/A	
External BRS	Publish External BRS BRS Revision	Nov 16, 2022 Mar 17, 2023	✓
Config Guides	Post Draft Config Guides	Yes	
Tech Spec	Publish Technical Specification	Feb 24, 2023	✓
Deployment Plan	Draft Deployment Plan	Mar 17, 2023	
Training	Training	May – Jun, 2023	
Market Sim	Market Sim	Sep 2023	
Parallel Operations	Parallel Operations	October 2023	
Production	Phase 1 Go-Live	Nov 1, 2023	
Production	Effective Trade Date	Jan 1, 2024	
Production	Phase 2 Go-Live	Apr 3, 2024	
Customer Partnership Group	**Next CPG**	**Mar 22, 2023**	

2023 - 2024 CRR System Upgrade – Get Connected

- CRR External meetings:

  - **Bi-weekly Technical User Group (TUG)** Tue 10 AM, alternates with RUG.
    - Meetings available on the CAISO calendar on www.caiso.com
    - Meeting details and presentation materials are available on the CAISO Developer site at www.developer.caiso.com , which requires an account to be setup for access

  - **CRR Customer Partnership Group**
    - **Next CPG meeting is Wed, 3/22 @ 10 AM**
    - Monthly
    - Meetings available on the CAISO calendar on www.caiso.com
    - Meeting details and presentation materials are available on www.caiso.com > Stay Informed > Meetings & Events > Customer Partnership Groups

Stay Informed

Ways to participate in releases

- Visit the Release Planning page
  - http://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx

- Attend meetings
  - Release Users Group (RUG) bi-weekly meetings
    - Initiative status updates
    - System change updates on independent releases
  - Market Simulation calls
    - Visit the ISO calendar at www.caiso.com for meeting dates and times and add events to your calendar
    - Typically held on Mondays and Thursdays
  - Market Performance and Planning Forum
    - Bi-monthly review of market performance issues
    - High level discussion of release planning, implementation and new market enhancements

What to look for on the calendar…

Market Sim

Release Users Group (RUG)

Market Sim

Calendar of Meetings, Training and Events

Month: February Year: 2018 Calendar View | List View | Print View

today **February 2018** month | day

Sun	Mon	Tue	Wed	Thu	Fri	Sat
4	5 WebCONF: Market Simulation 2:00pm - 3:00pm	6 Training: Get to Know the ISO - Day 1 9:00am - 4:00pm WebCONF: Imbalance Conformance Enhancements 10:00am - 12:00pm WebCONF: Technical User Group 10:00am - 11:00am	7 Deadline: Comments - Interconnection Process Enhancements 2018 - Issue Paper and Meeting Discussion Training: Get to Know the ISO - Day 2 9:00am - 4:00pm Meeting: Flexible Resource Adequacy Criteria Must Offer Obligation Phase 2 - Revised Draft Flexible Capacity Framework 10:00am - 4:00pm WebCONF: Market Settlement User Group 10:00am - 11:00am	8 Meeting: Audit Committee Teleconference (Executive) 8:30am - 9:30am Training: Settlements 101 9:00am - 4:00pm Meeting: 2017-2018 Transmission Planning Process 10:00am - 4:00pm WebCONF: Market Simulation 2:00pm - 3:00pm	9 Training: Settlements 201 9:00am - 4:00pm	10
11	12 WebCONF: Participating Transmission Owner Per Unit Cost Guides 10:00am - 12:00pm WebCONF: Market Simulation 2:00pm - 3:00pm	13 Meeting: Congestion Revenue Rights Auction Efficiency 10:00am - 4:00pm WebCONF: Release User Group 10:00am - 11:00am Call: Energy Imbalance Market Governing Body Teleconference (Executive) 11:30am - 12:30pm	14 Deadline: Submissions - April 2018 Monthly Resource Adequacy and Supply Plans Call: Congestion Revenue Rights 11:00am - 11:30am WebCONF: Outage Management System Customer Partnership Group 2:00pm - 3:00pm	15 Deadline: Comments - Review Transmission Access Charge Structure Straw Proposal and Meeting Discussion Call: Board of Governors Teleconference (General) 8:15am - 9:00am Call: Board of Governors Teleconference (Executive) 9:00am - 10:00am Call: Market Update 10:15am - 11:00am WebCONF: Market Simulation	16	17

User Group Calendar - 2023

California ISO

2023

Release User Group Meetings

Note: dates subject to change; for the latest information please visit the Calendar on www.caiso.com

January						
Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February						
Su	Mo	Tu	We	Th	Fr	Sa
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

March						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

California ISO

2023

Technical User Group Meetings

Note: dates subject to change; for the latest information please visit the Calendar on www.caiso.com

January						
Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February						
Su	Mo	Tu	We	Th	Fr	Sa
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

March						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

California ISO

2023

Settlement User Group Meetings

Note: dates subject to change; for the latest information please visit the Calendar on www.caiso.com

January						
Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

February						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

March						
Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Agenda Topic suggestions

MPPF related materials are available on the ISO website here.

Agenda topic suggestions:

- Submit through CIDI
  - Select the *Market Performance and Planning Forum* category
- Send email to isostakeholderaffairs@caiso.com.
  Subject MPPF

Upcoming meetings

The next MPPF is scheduled in person on June 15, 2023.

User groups and recurring meetings > Market performance and planning forum > 2023

California ISO

2023

Market Performance and Planning Forum Meetings

Note: dates subject to change; for the latest information please visit the Calendar on www.caiso.com

March

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

June

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

September

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Meeting

Follow us on Twitter @California_ISO or @ISONotices for our latest updates