



California ISO

Market Performance and Planning Forum

June 29, 2023


CAISO PUBLIC

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.
- Please keep comments brief and refrain from repeating any comments previously made.

Instructions to ask a question

Virtual Participation:

- Select the raise hand icon  located in the lower tool bar. You will hear a beep tone when you are un-muted; at that time please state your name, and question.
- Phone only 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.
- Do not mute yourself until you have completed your question or comment. WebEx platform will LOCK and mute you if you mute yourself once you have finished your question.

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
 - Reminder: Policy discussions should occur in the initiative stakeholder process

Market Performance and Planning Forum

Agenda – June 29, 2023

9 a.m. – 12 p.m.

| Time: | Topic: | Presenter: |
|---------------|---|---|
| 9:00 – 9:05 | Introduction, Agenda | Brenda Corona |
| 9:05 – 11:00* | Market Performance Updates <ul style="list-style-type: none">• Operating Procedure 4420 System Emergency – update to add Strategic Reliability Reserve Program (SRRP)• AS Scarcity• Flexible Ramping Product (FRP) performance• Load Conformance• Assistance Energy Transfer• Storage resources, CRRs, market and forecasting metrics | CA Regulatory Affairs Operations Planning Market Analysis Short-Term Forecasting |
| 11:00 – 11:30 | Policy Update | Gillian Biedler, Market Strategy and Governance |
| 11:30 – 12:00 | Release Update | Trang Vo, Project Management |

*Time per topic is approximate

Operating Procedure 4420 System Emergency Update to add Strategic Reliability Reserve Program (SRRP)

Operating Procedure 4420 Updates: Overview

- The CAISO posted an updated Operating Procedure 4420 on 6/22
 - Updates detail how the CAISO will operationalize generators that are part of the state's Electricity Supply Strategic Reliability Reserve Program (SRRP) and the State Power Augmentation Project (SPAP), overseen by the Department of Water Resources
 - Updates includes details on the operation of both long and short start Strategic Reserve assets in the CAISO markets
 - Operating Procedure 4420 is limited to the CAISO's operational processes

Operating Procedure 4420 Updates

- Long Start SRRs - 1 – 7 days before Operating Day – depending on start up time requirements
 - CAISO issues ED instructions stay online at Pmin for the range of dates and times forecasted for the emergency event
 - Scheduling Coordinator(s) end Environmental Restrictions outages
 - CAISO may initiate a resource test
 - Scheduling Coordinator(s) submit bids
 - CAISO issue ED shut down instructions at end of event
- Fast Start SRRs
 - Scheduling Coordinator(s) submit bids
 - Based on EEA notification dates and times, Scheduling Coordinators adjust availability through Environmental Restrictions outages to make bids available to the market for periods declared in any EEA notification

Operating Procedure 4420 Updates

- If a sudden onset event occurs
 - For the time period specified in the EEA notice, SCs for SRRP fast start resources adjust any Environmental Restriction outages to make the resources available to the market and for Exceptional Dispatch
- If a Transmission Emergency occurs
 - If one or more SRRP generators can be utilized, CAISO will issue Exceptional Dispatch instructions to the SCs for each applicable generator

Market Update

Market Analysis Short-Term Forecasting

2020-2022 Ancillary Service Scarcity Event Report

2020 to 2022 Ancillary Service Scarcity Event Report

- When the market cannot procure the target requirement for Ancillary Services (A/S), prices are automatically set to administrative A/S scarcity prices.
- There is a Tariff requirement to review A/S Scarcity Administrative pricing every three years to determine if changes are needed to the pricing mechanism.
- Past and current reports located:
<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=0DB07C0D-A0F9-4B81-BD66-4903D05798D0>

2020 to 2022 Ancillary Service Scarcity Event Report

- In 2020, the amount of scarcity events was relatively high with 27 percent of the total annual events occurring during the heat wave events of August and September 2020 when energy supplies were insufficient to meet demand.
- The number of scarcity events decreased 61 percent in 2021 from 2020 and there were only six scarcity events in 2022.

| | 2020 | 2021 | 2022 |
|------------------------------------|--------|--------|--------|
| IFM Intervals with A/S Scarcity | 0% | 0% | 0% |
| IFM Intervals without A/S Scarcity | 100% | 100% | 100% |
| RTM Intervals with A/S Scarcity | 0.40% | 0.16% | 0.02% |
| RTM Intervals without A/S Scarcity | 99.60% | 99.84% | 99.98% |

2020 to 2022 Ancillary Service Scarcity Event Report

Frequency of Scarcity Events by Cause

| Issue impacting A/S procurement | Year | | |
|--|------|------|------|
| | 2020 | 2021 | 2022 |
| Resource outage or PMin re-rate | 29 | 19 | 1 |
| System conditions where energy is needed over A/S capacity | 40 | 7 | |
| Increase in A/S requirements in RTM | 28 | 14 | 3 |
| Telemetered limits reduce resource capacity | 30 | 10 | |
| Transmission issues block A/S delivery | 7 | 3 | |
| Multi-Stage Generator (MSG) transition issue | 3 | 2 | 2 |
| State of Charge Issues | 5 | | |
| Totals | 142 | 55 | 6 |

2020 to 2022 Ancillary Service Scarcity Event Report

- The low frequency of A/S scarcity events reflects that there is sufficient resources available and bidding A/S in the ISO markets.
- The ISO updated the Scarcity Reserve Demand Curves when it adjusted the energy bid cap to comply with FERC Order No. 831 in June 2021.
 - When conditions are appropriate to increase the energy bid cap from \$1000 to \$2000, the current Scarcity Reserve Demand Curves also double in magnitude.
- The ISO does not see a need to change the Scarcity Reserve Demand Curves at this time.

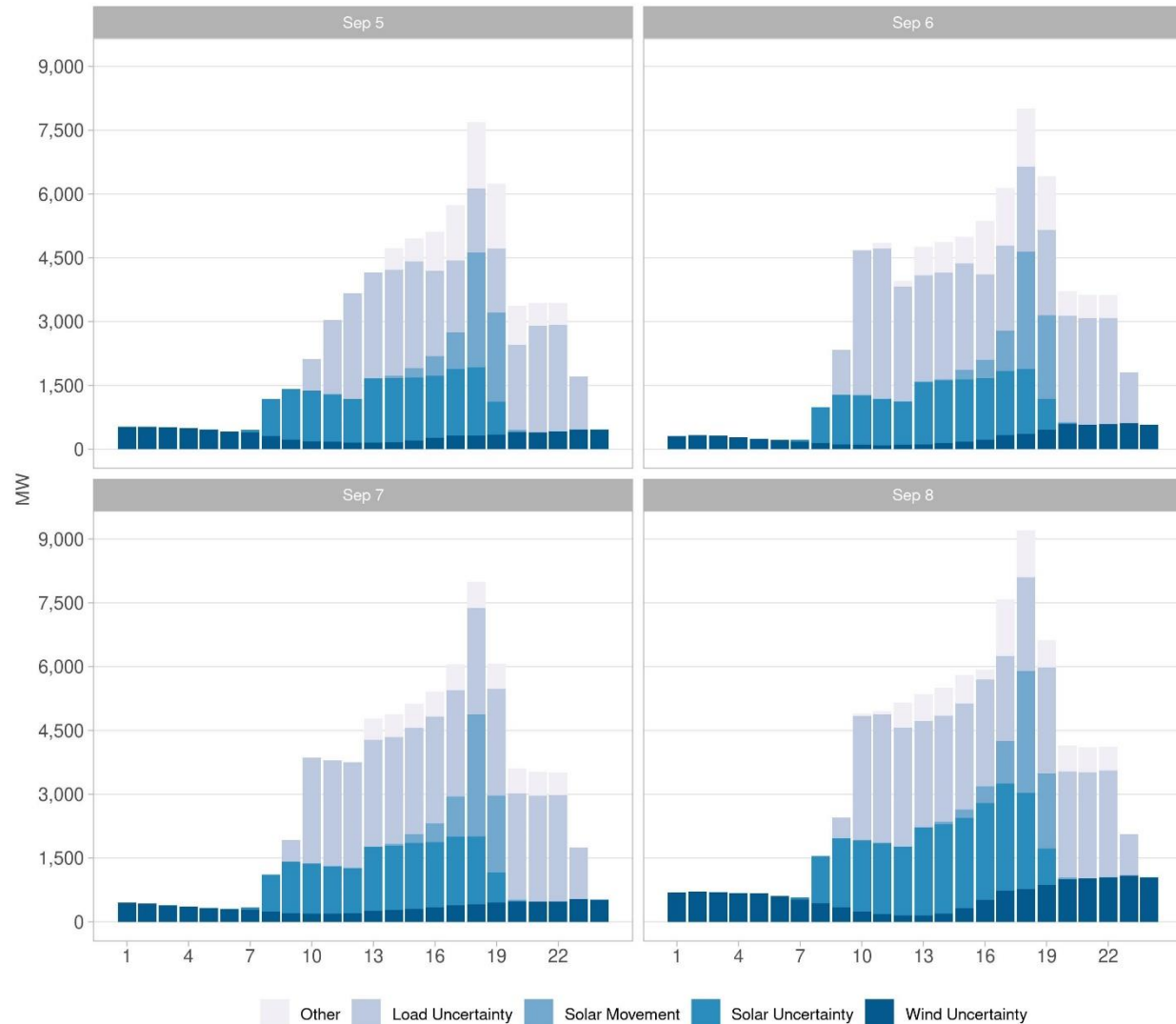
Load Conformance in CAISO's markets

From the Summer 2022 performance, CAISO planned to further assess the need and use of load conformance

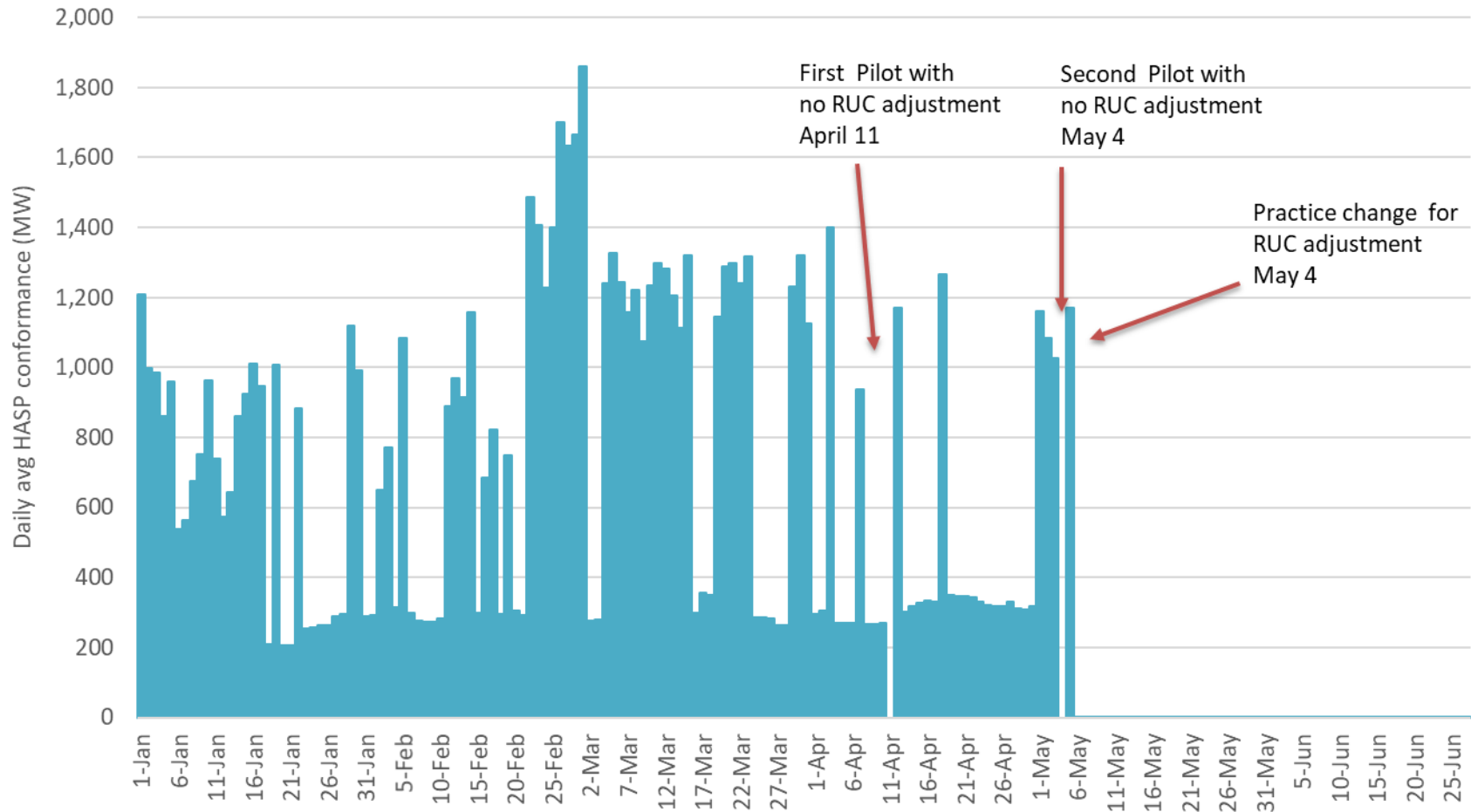
In September 2022, RUC conformance reached up to 10,000MW

The different uncertainty components have been added together to derive the RUC adjustment

CAISO has been assessing the utilization and the results of load conformance across markets

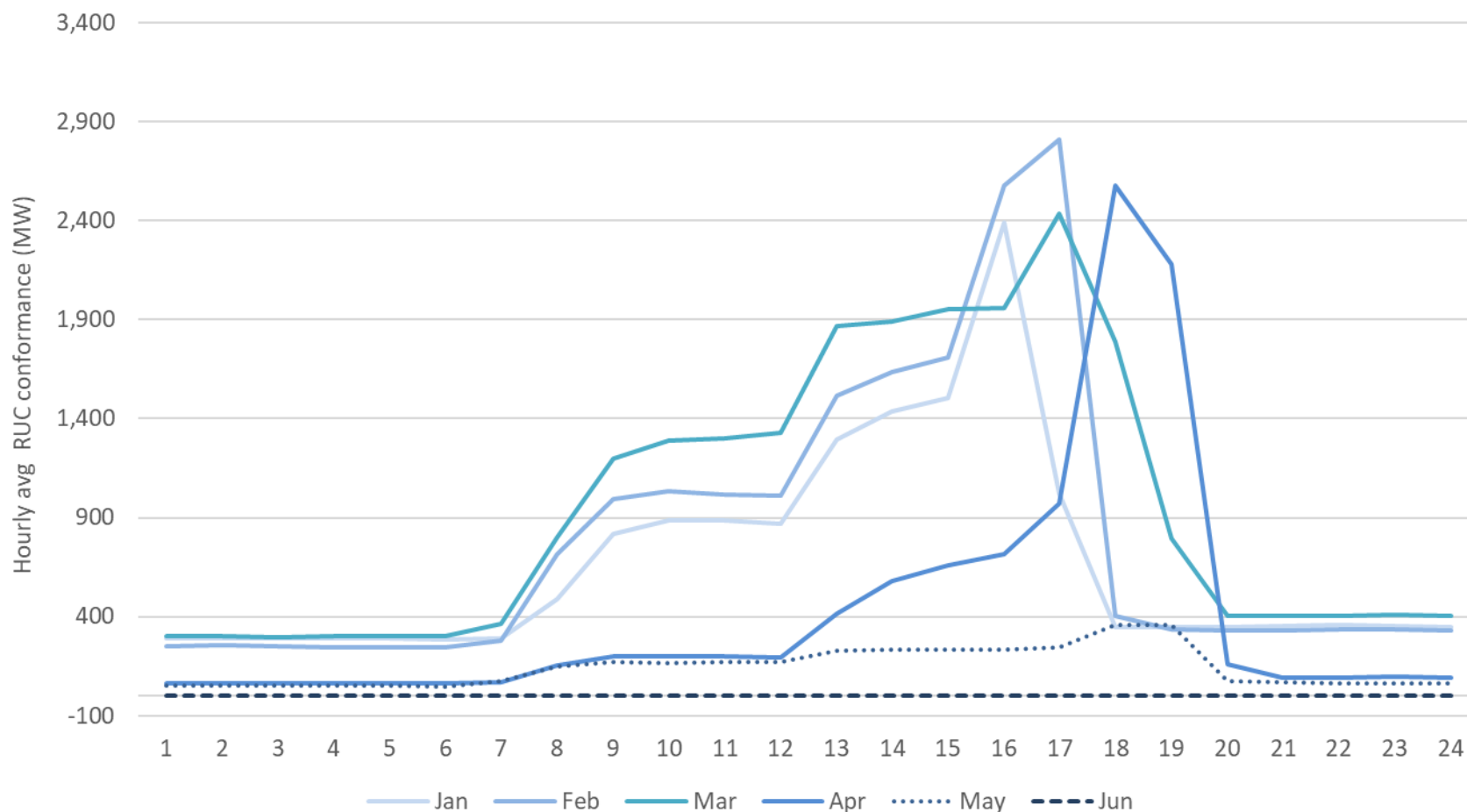


CAISO changed practice effective May 6, 2023. If load forecast < 35,000MW then RUC adjustment=0

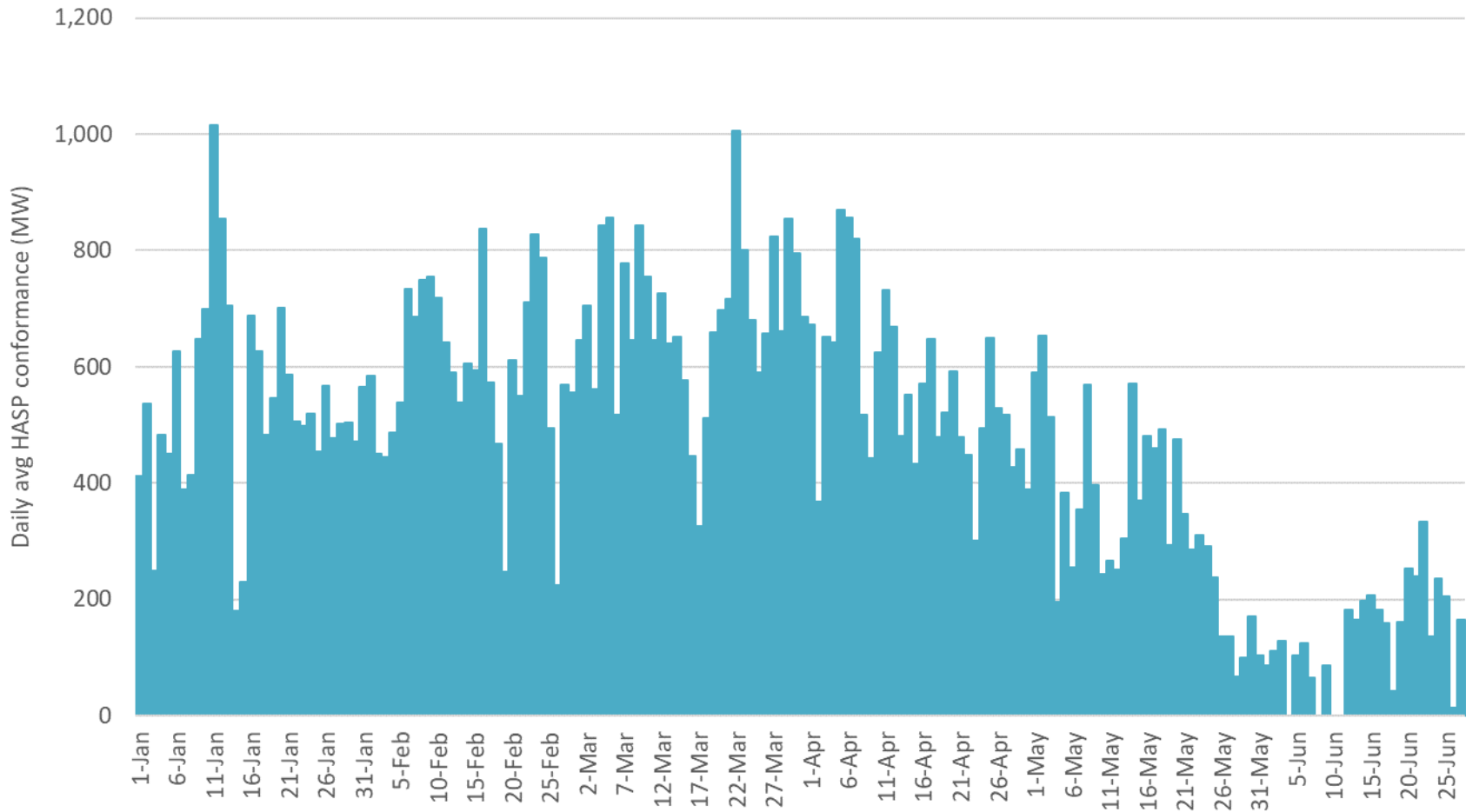


Results of pilot case study provided insights on the merits of RUC adjustments

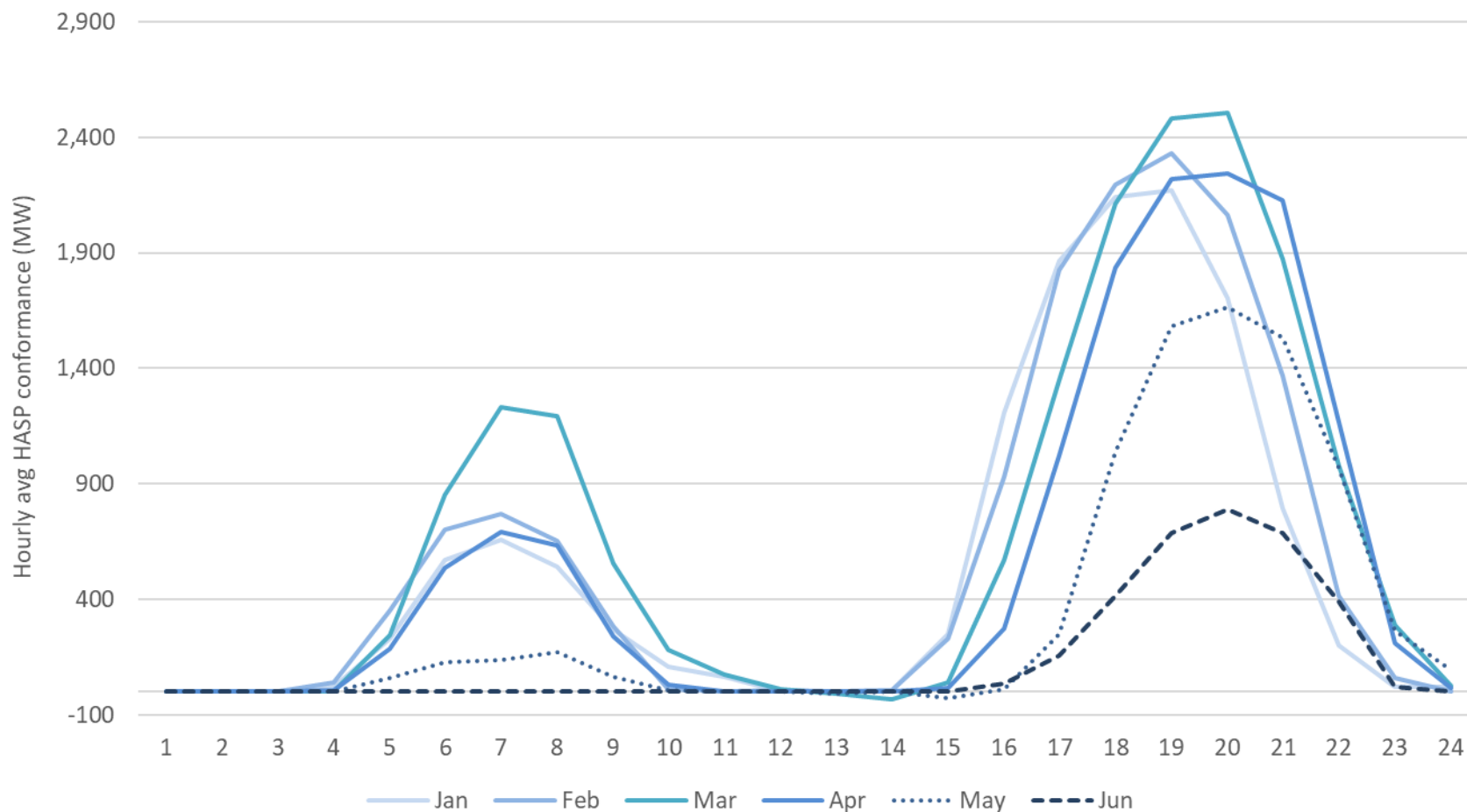
Hourly profile of RUC adjustments saw a reduction after the change of practice on May 6



CAISO's explicit effort to reduce load conformance is reflected in the downward trend in the first half of 2023

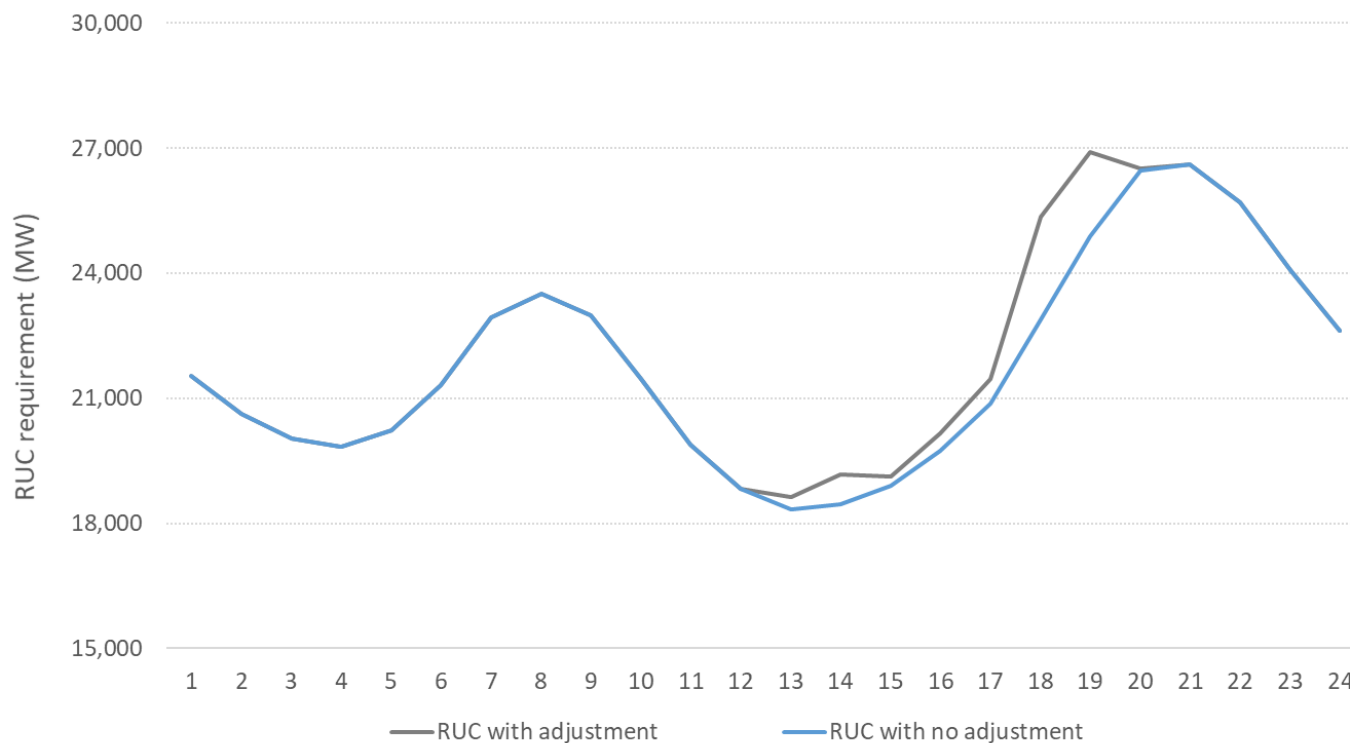


Reduction of HASP conformance has been throughout the hourly profile



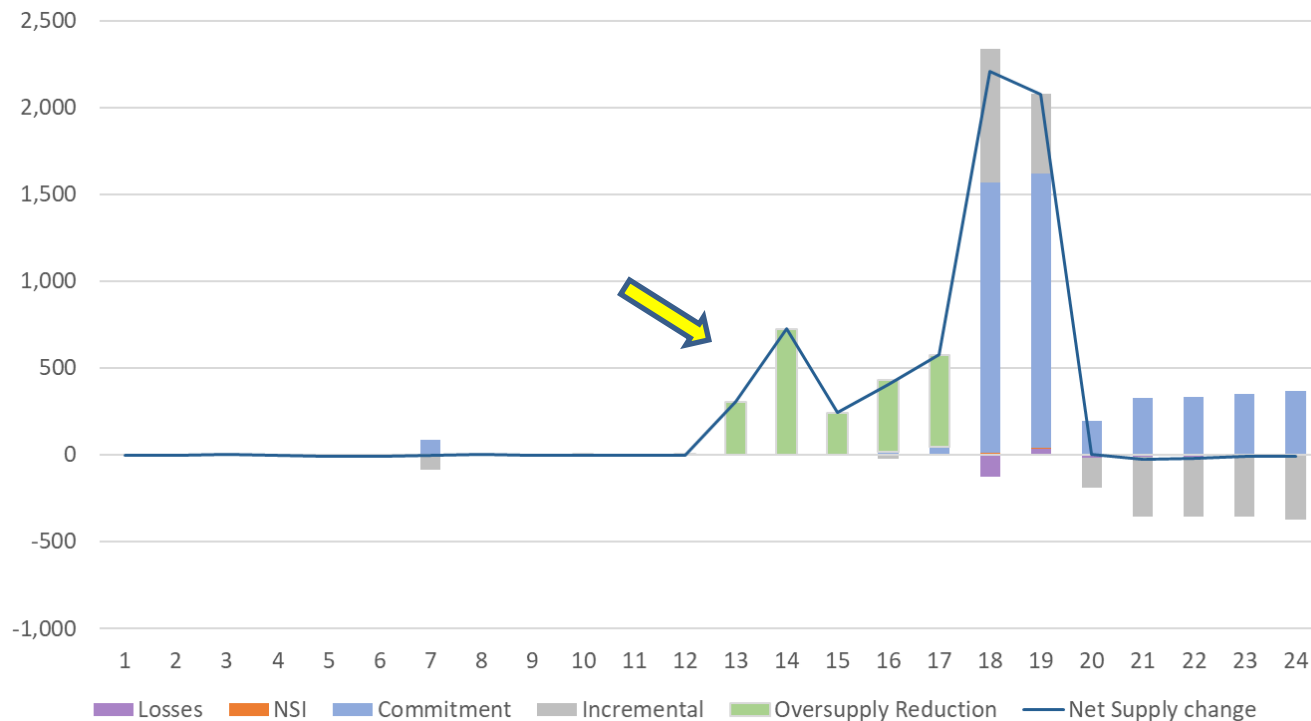
CAISO has been running a Pilot program to assess the impact of load conformance.

Case Study: April 11, no RUC adjustment was used in the market.



The maximum RUC adjustment avoided was up to 2,400MW

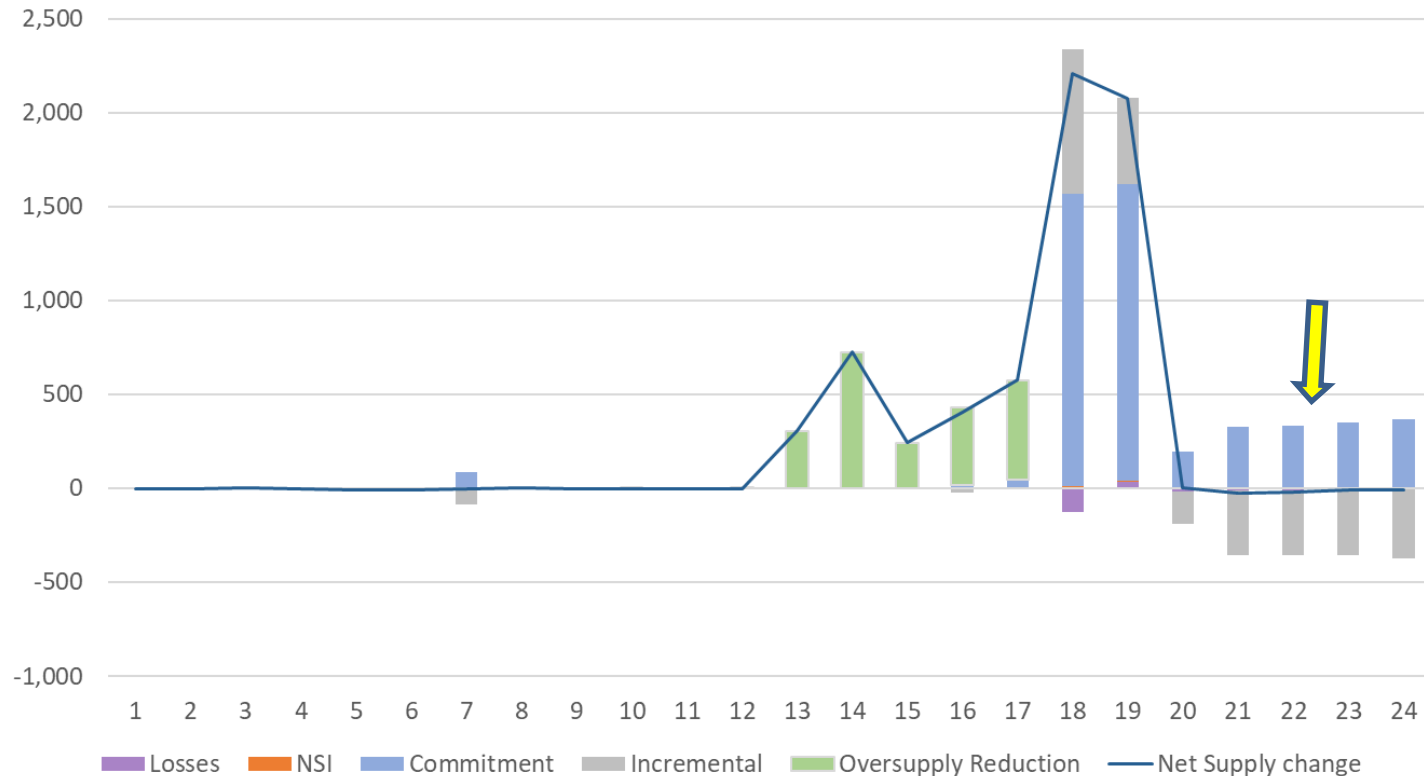
The RUC adjustment would have resulted in net supply increases



HE13-HE17 observed oversupply, the RUC adjustment could have masked it

The RUC adjustment did not provide any significant additional supply or relief to oversupply

The RUC adjustment would have resulted in net supply increases

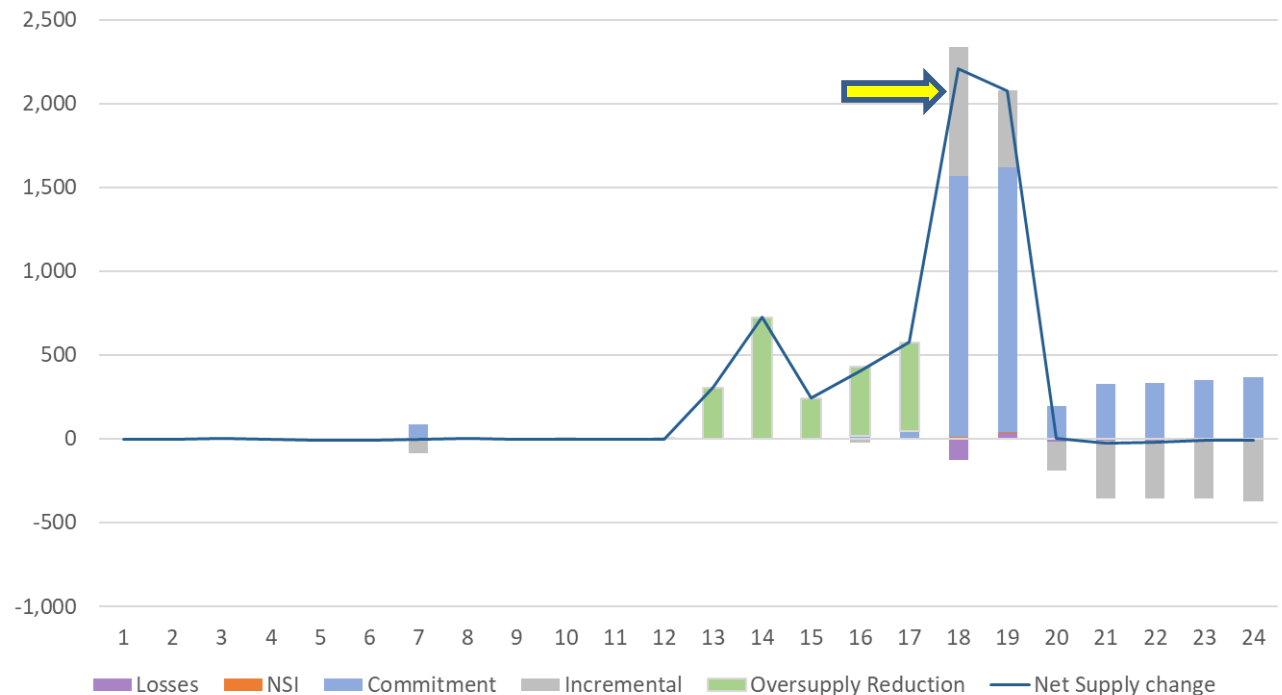


HE20-HE24 committed supply would have been offset by same amount of already committed supply being dec'd

The RUC adjustment would have resulted in only a fraction of additional capacity committed

HE18-HE19 would have seen over 2,000MW of RUC adjustment

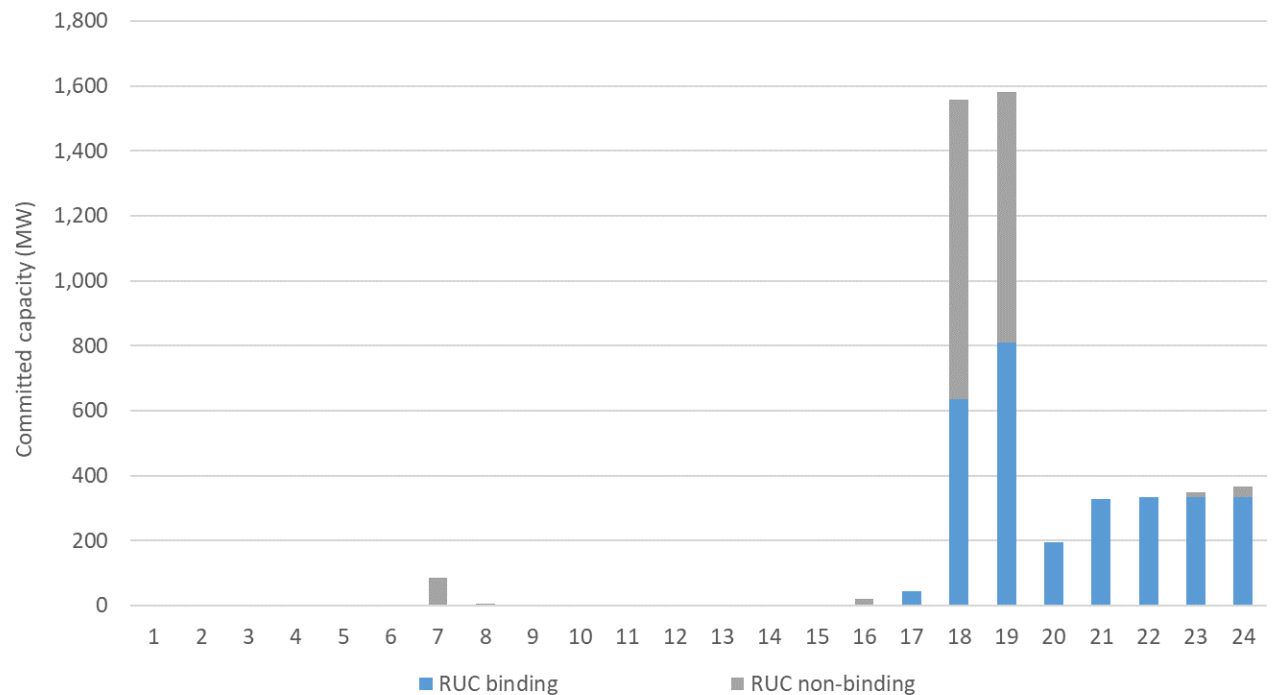
About one third of the RUC adjustment would have been met by increasing already-committed supply



Out of all additional supply due to the RUC adjustments, one third of the supply would have been actually additional committed capacity for critical peak hours

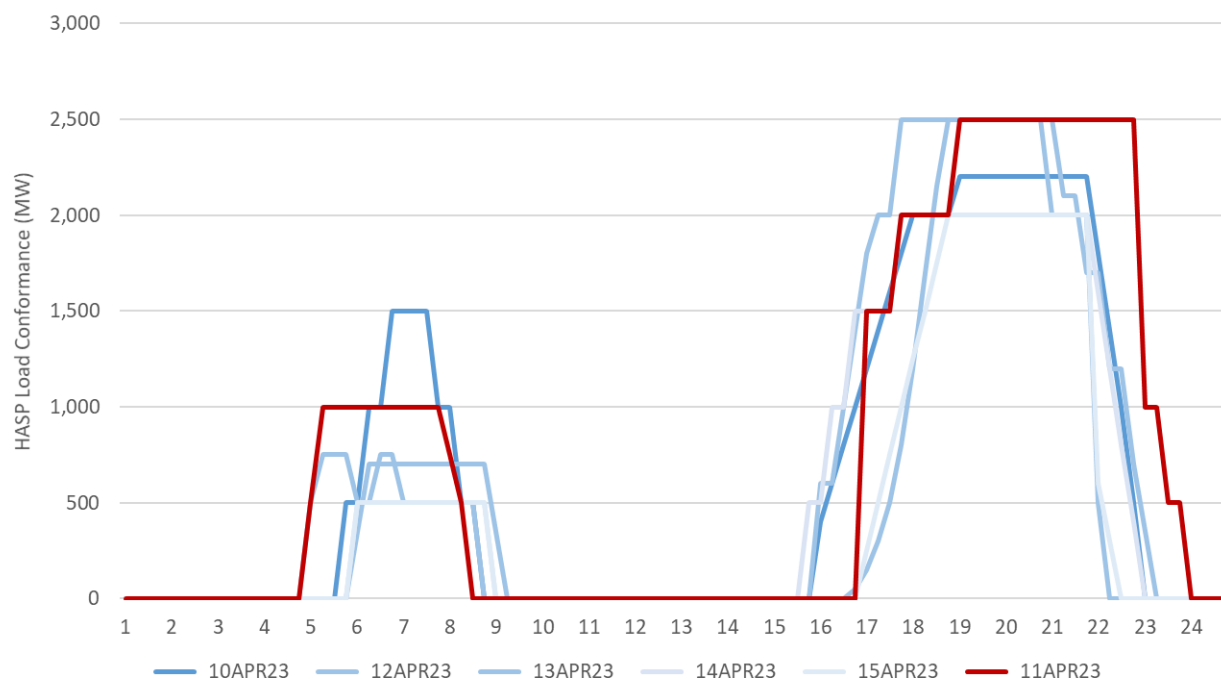
RUC commitments would have been only for

After the peak hours they would have to stay online. Potentially leading to oversupply for late hours

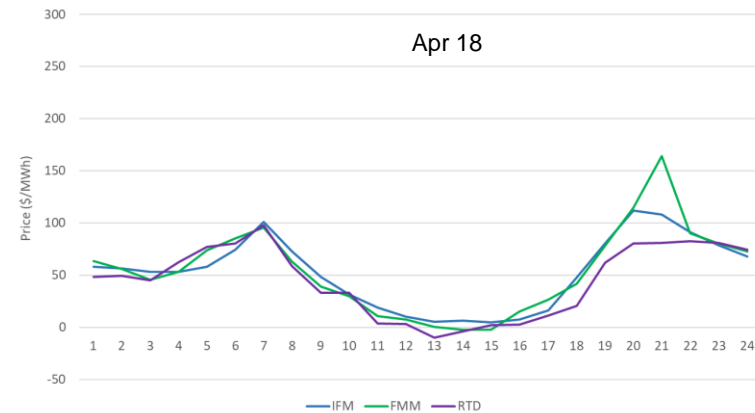
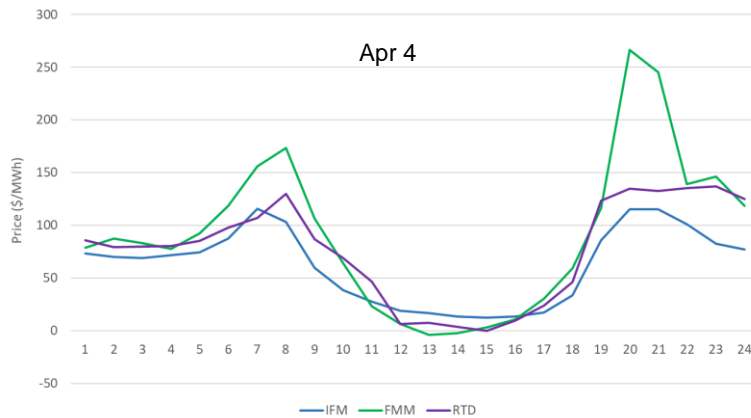
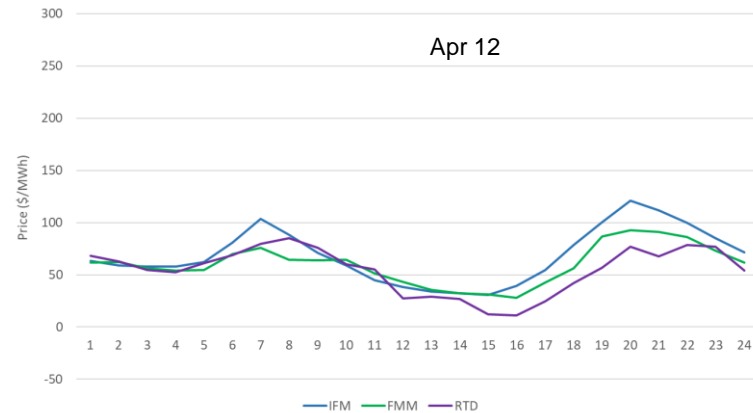
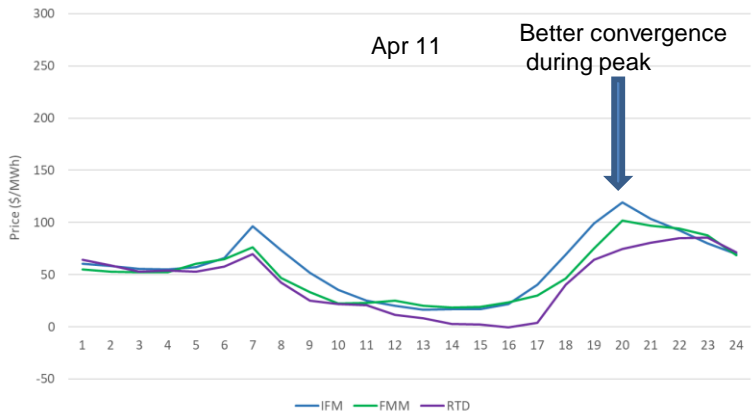


Needs for load conformance in HASP market seemed to stay within typical range; no obvious need for more HASP conformance to compensate for missing RUC adjustments

- Lacking RUC capacity, first opportunity is to secure more HASP supply through conformance
- No meaningful conformance change of magnitude or pattern to ride through the peak
- Only difference HASP conformance on the 11th stayed for later hours in the night



Was there any material impact on price convergence from DAM to RTM? Inconclusive



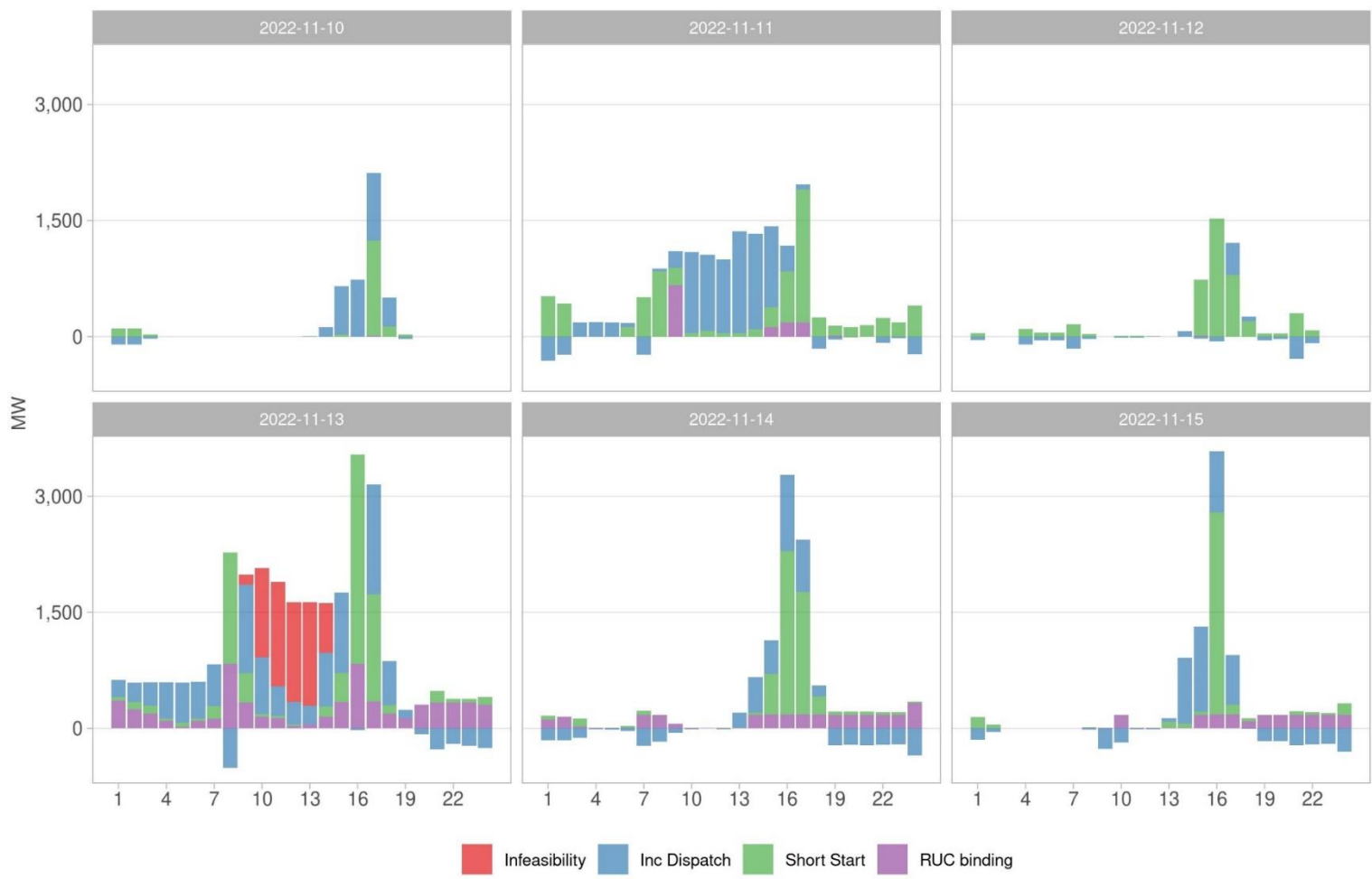
Is the outcome of the Study case an outlier?

- Similar assessment was also done for RUC adjustments for a set of days for different seasons of the year
 - Extreme weather conditions; September 4-10
 - Shoulder month into Winter: November 10-15
 - Shoulder month into Spring: March 15-20

RUC adjustments in high load/summer conditions result in large infeasibilities



Shoulder months going into winter conditions.
Peak hours met with incremental schedules and short starts.



Shoulder months going into Spring. Basically, RUC adjustments met with incremental supply and short starts



RUC adjustments did mute oversupply conditions for middle of the day

Next steps

- Continue with Pilot program to identify impacts and supply changes from load conformance
- Identify drivers for the need for load conformance
- Assessing to switch to use logic of Imbalance Reserve to guide the RUC adjustments instead of separate uncertainty adders

Assistance Energy Transfer

Assistance Energy Transfer process kicked off for trading date July 1, 2023

- Assistance energy transfers allow the WEIM to provide reliability benefits to balancing authority areas (BAAs) deficient in capacity or flexibility
- Designation requests must be submitted by 11am Pacific Time at least 5 business days in advance of the effective start date
- Designation requests must be labeled as either “opt-in” or “opt-out” and must include both an effective start date and end date

CAISO will assess for CAISO BAA on a daily basis whether to OPT IN or not

- Criteria for CAISO to OPT in is based on
 - Supply sufficiency based on gross load
 $\text{RA capacity} + \text{credits} < \text{load forecast} + \text{AS obligation} + 5\% \text{ adder}$
 - Supply sufficiency based on net load
 $\text{Net RA capacity} + \text{credits} < \text{net load forecast} + \text{AS obligation} + 5\% \text{ net adder}$
- CAISO will post a market message when it OPTS IN
- CAISO started this process on June 23 for trade date July 1, 2023
- So far CAISO has not OPT'ed in for first five days of July

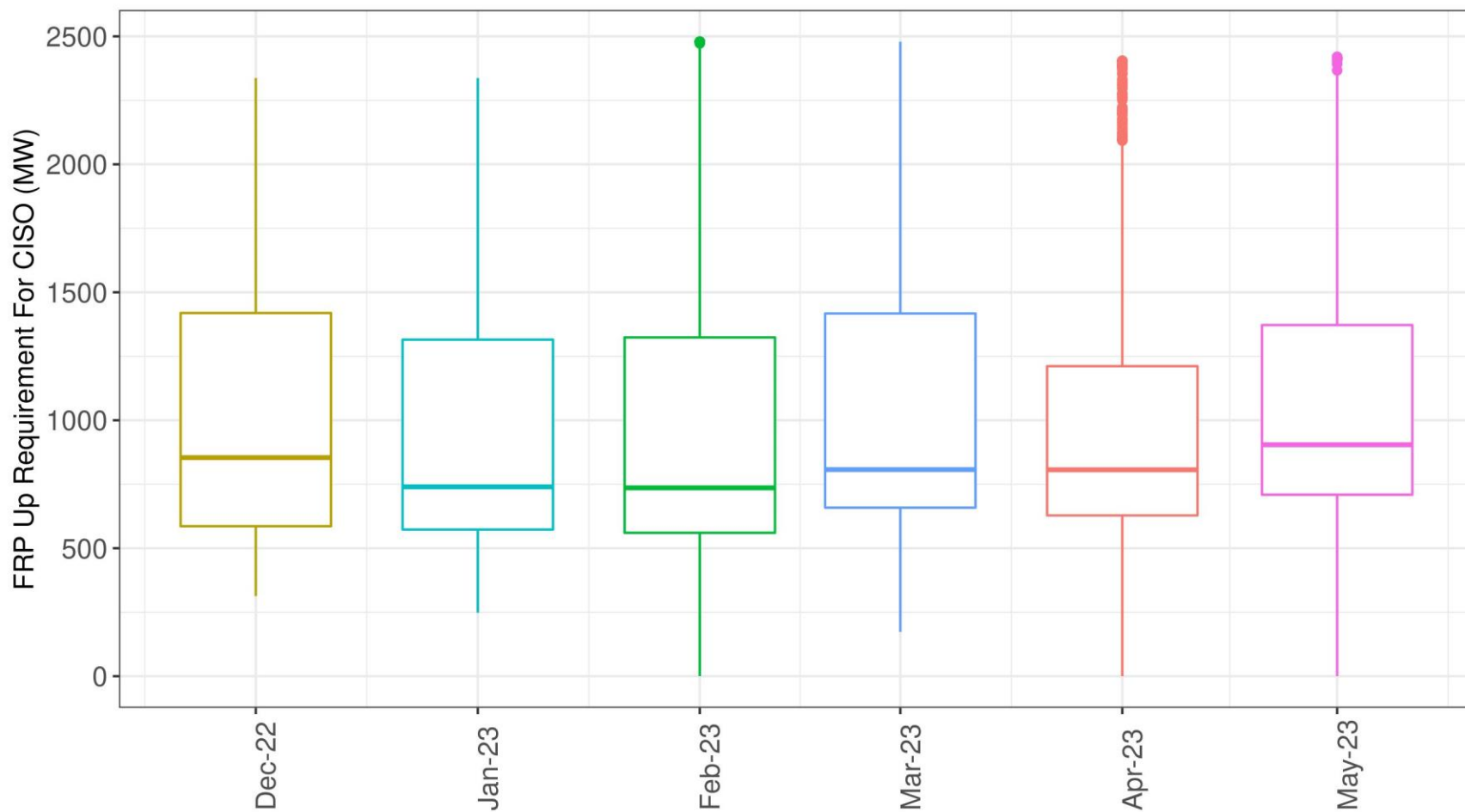
STALE EIM RENEWABLE FORECAST

Stale and Missing EIM VER Forecasts in Market

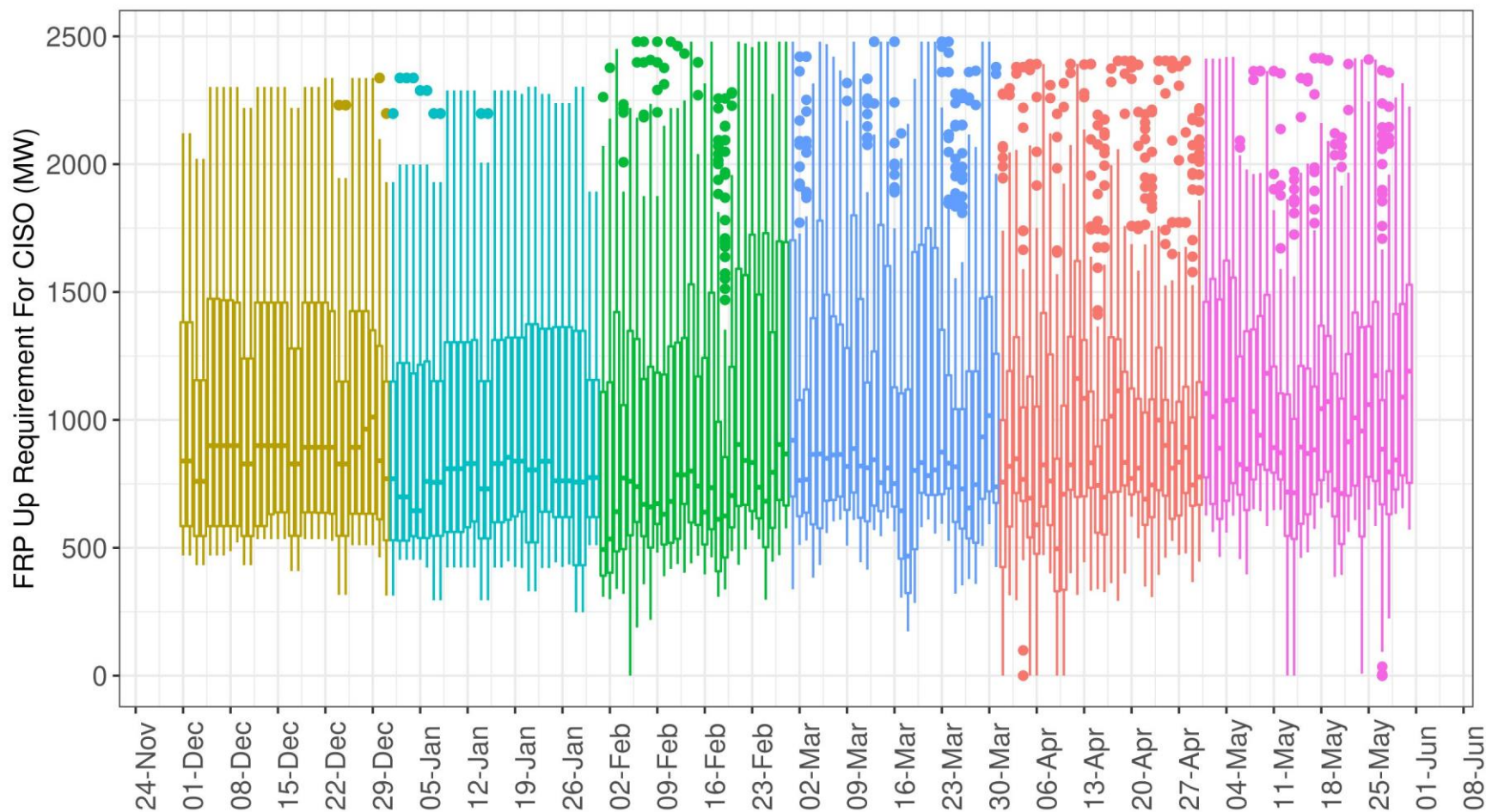
- Event Summary:
 - Error during server fallback resulted in EIM VER forecasts not updating
 - Time affected: 5/23/23 2:54 PM – 5/24/23 5:06 AM
- Impact:
 - EIM VER forecasts did not have published updates for around 14 hours.
 - This resulted in stale or no forecasts being used for EIM entities for Real Time Optimization.
 - Once forecasted intervals ran out from payload received prior to 2:54 PM, resources would have no forecast
 - Largest accuracy impact was for EIM resources not on persistence
- Follow-up Actions:
 - Alert has been setup to alert CAISO teams when EIM VER forecasts aren't published
 - Backfill of correct forecast data in FRP is in progress

FRP Update

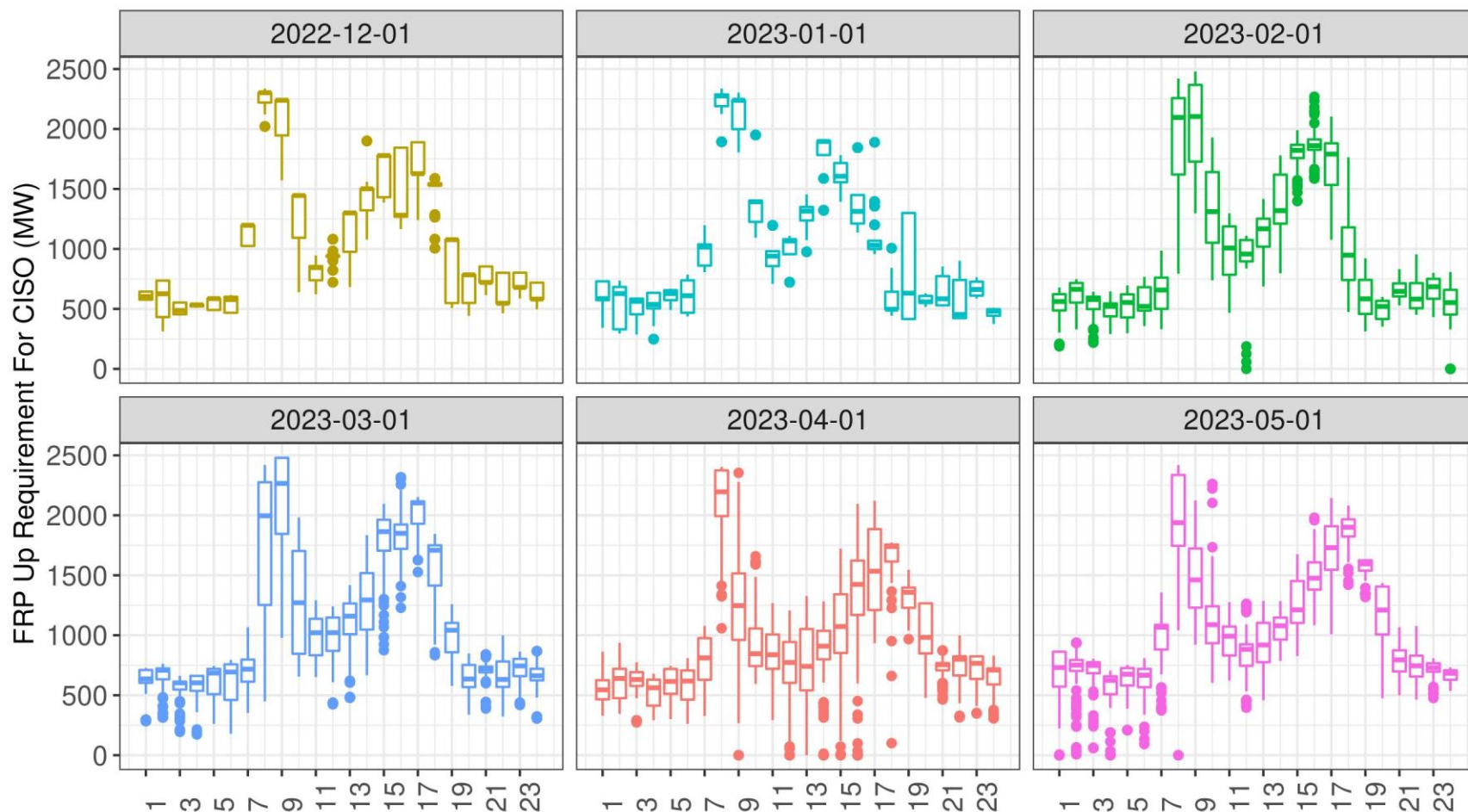
Uncertainty Requirement in the up direction trends within typical ranges



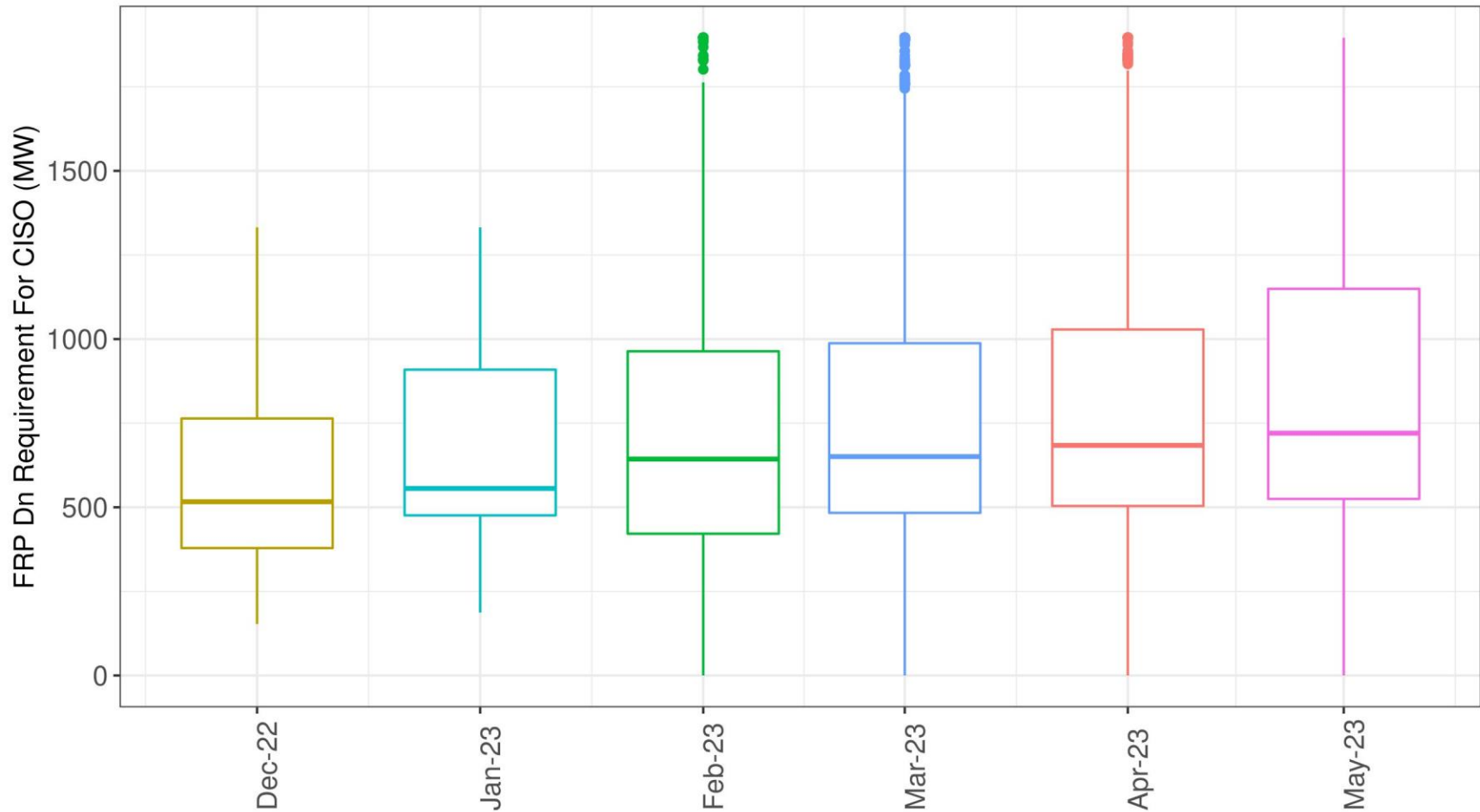
Uncertainty Requirement in the up direction remain within typical ranges



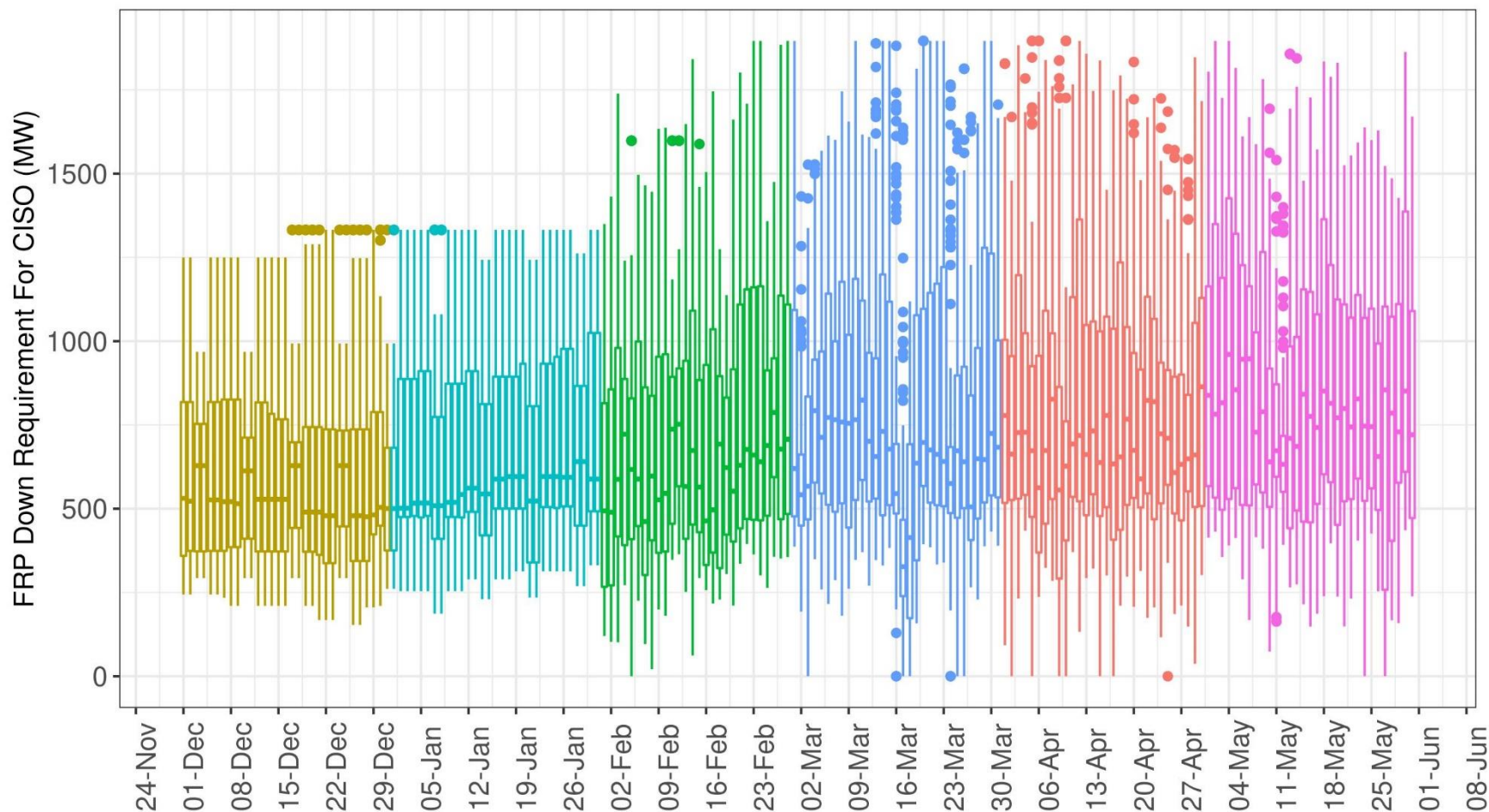
Hourly profile of uncertainty Requirement in the upward direction showed a more defined pattern since February



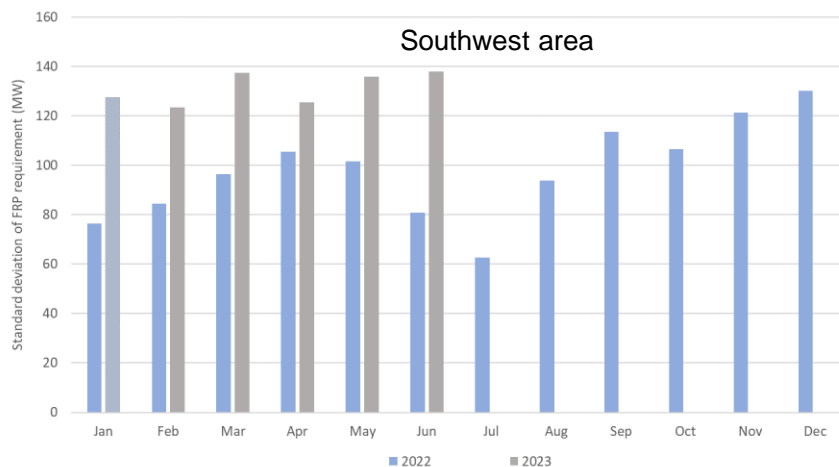
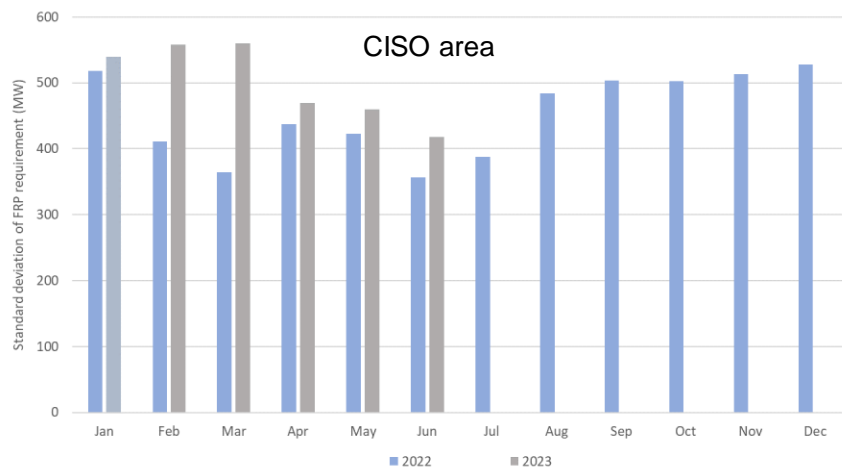
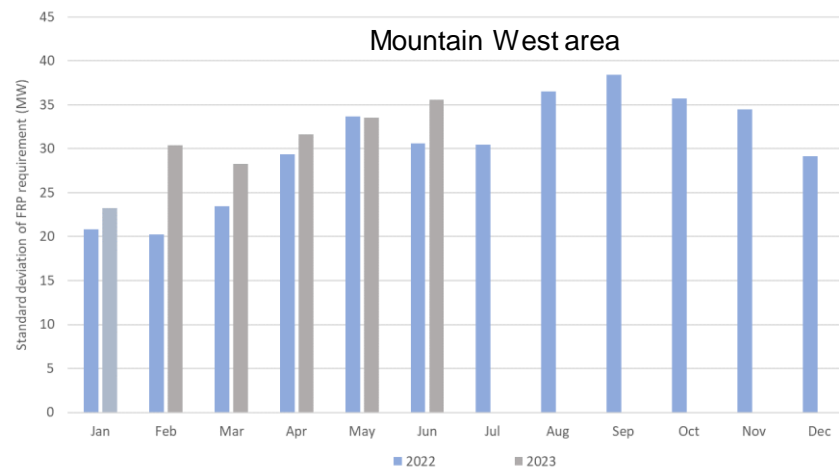
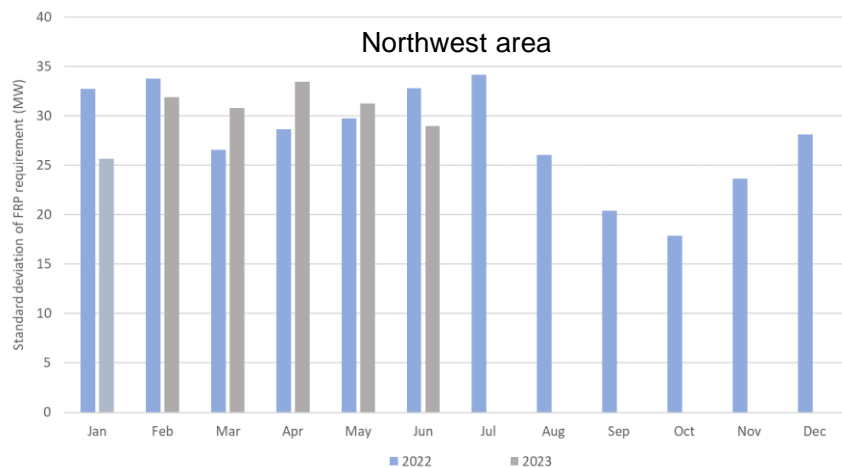
Uncertainty Requirement in the down direction increased fairly since February



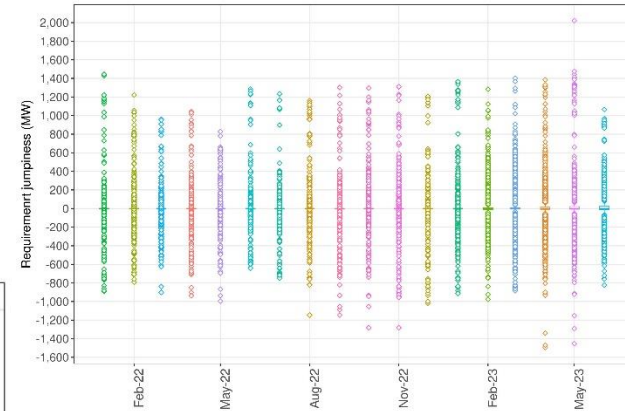
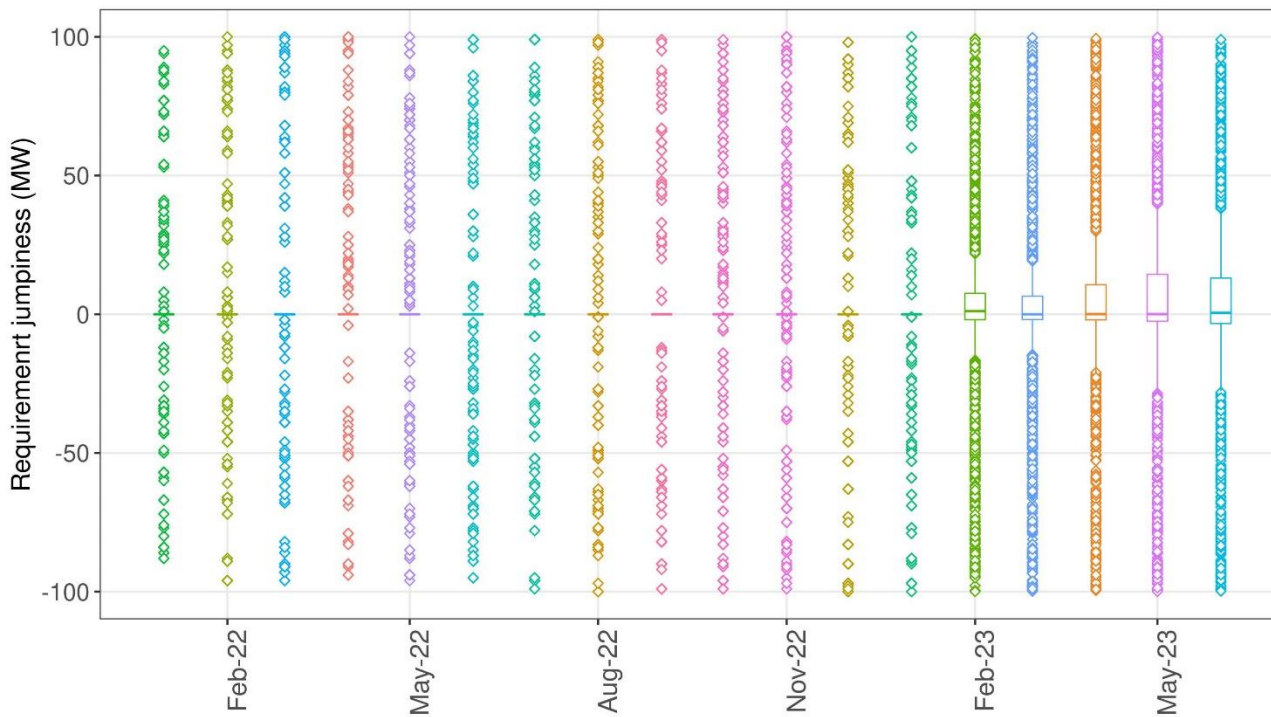
Uncertainty Requirement in the down direction increased fairly since February 2023



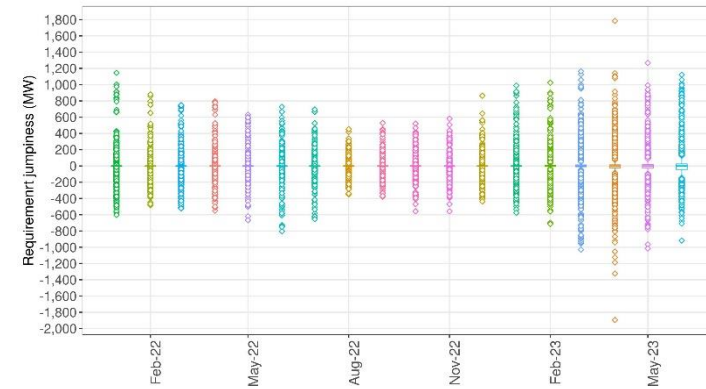
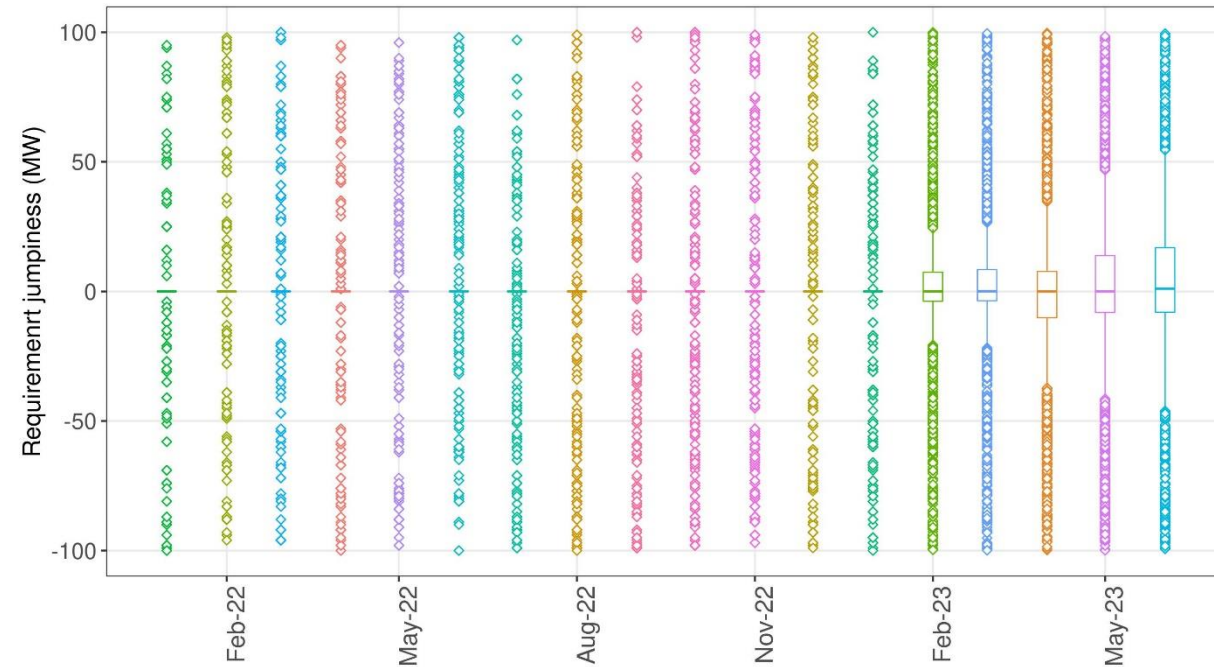
Variation of FRP requirements measured by a standard deviation has increased in certain areas



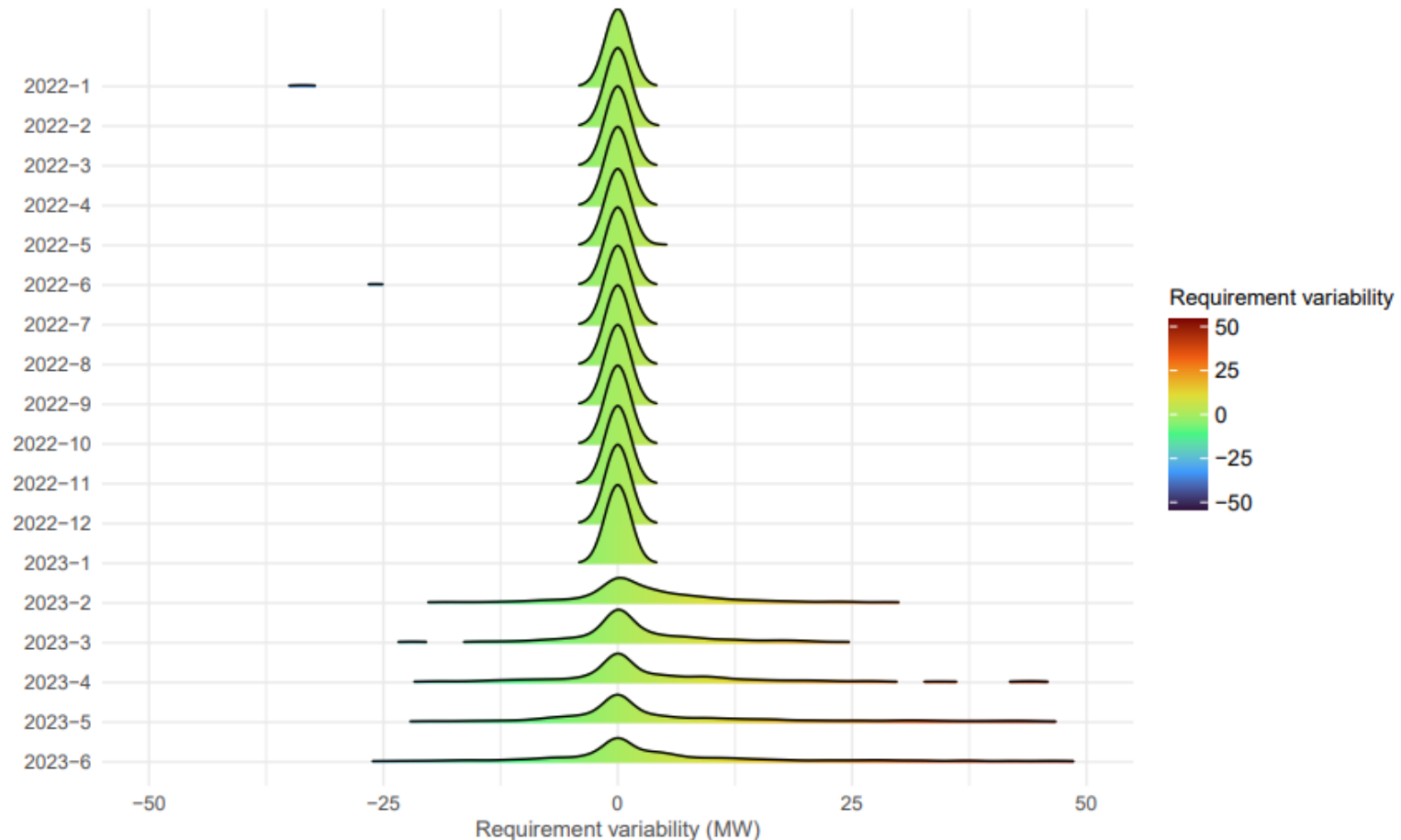
Variability of Up FRP requirement between adjacent intervals exhibits a different distribution since February



Variability of Down FRP requirement between adjacent intervals exhibits a different distribution since February

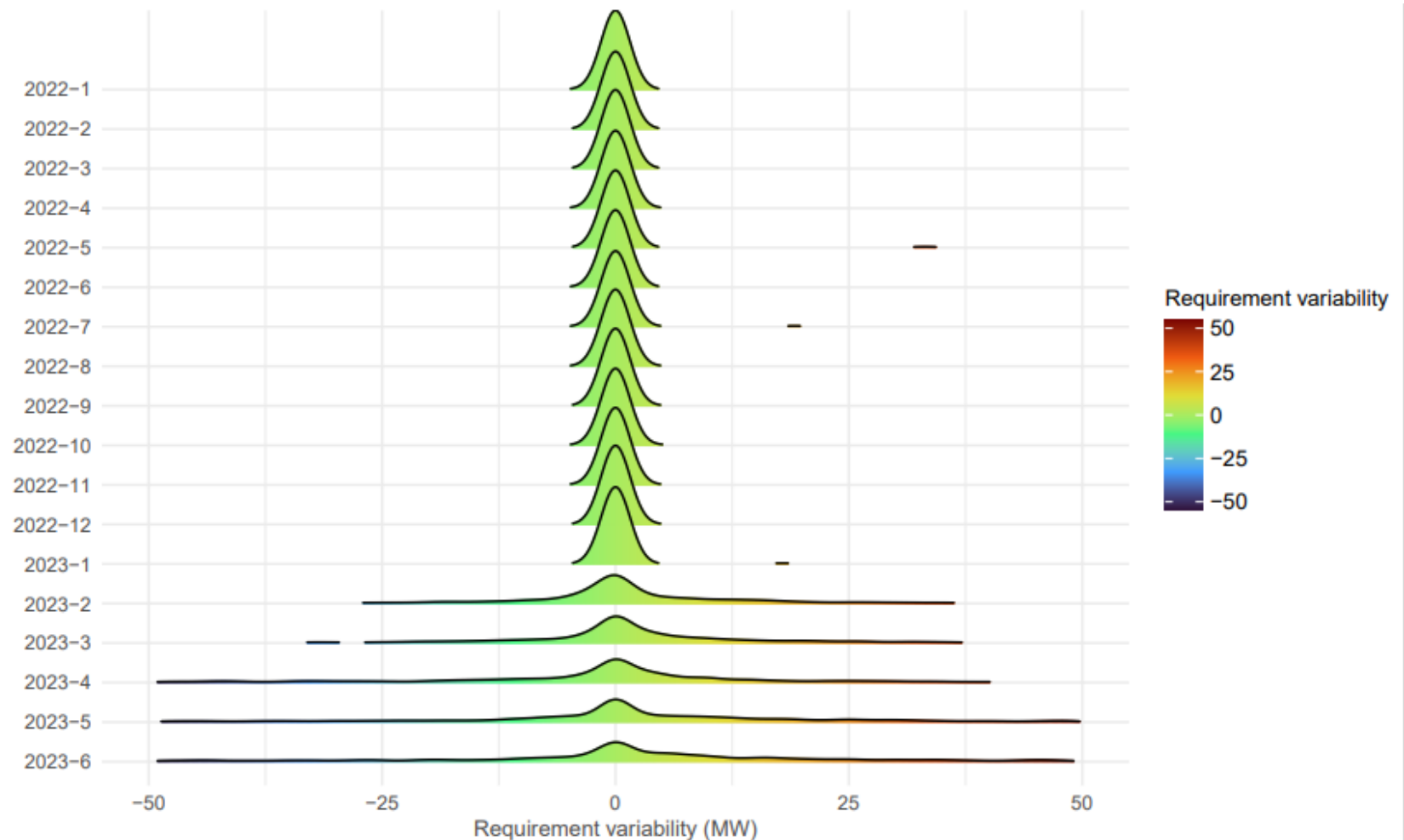


Variability of 15-min upward requirement has increased with new logic calculation. CISO upward FRP variability.



There is a higher frequency of non-zero deltas between adjacent intervals; the deltas are larger

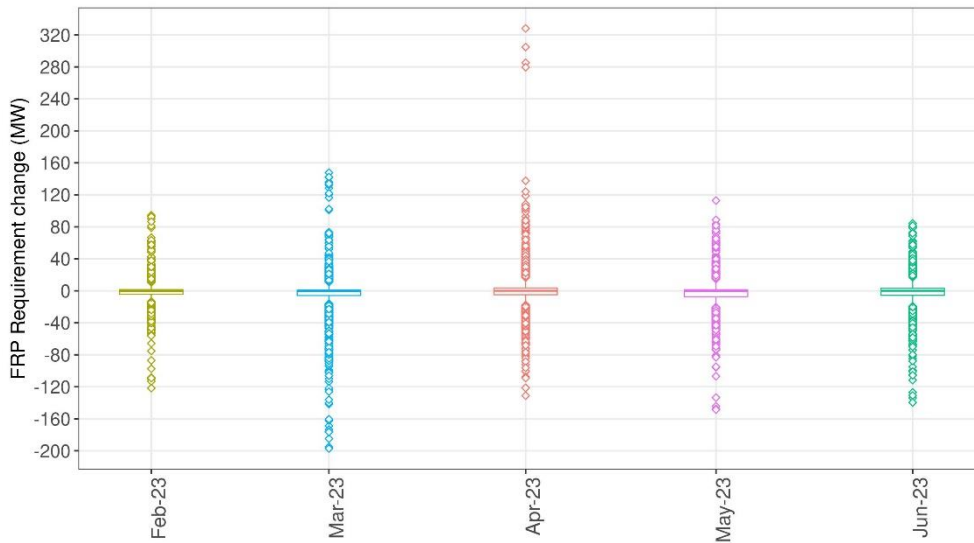
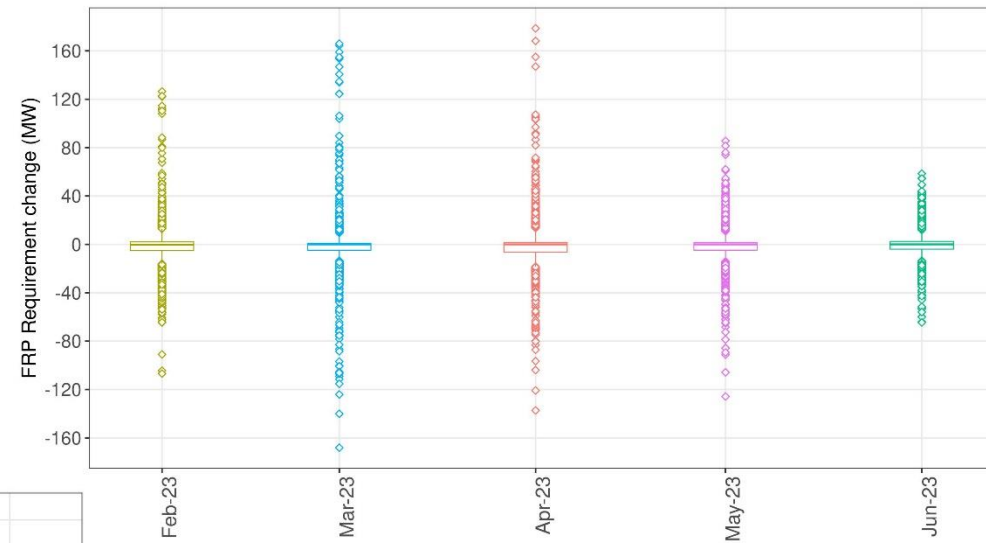
Variability of downward requirement has increased with new logic calculation. CISO downward FRP variability.



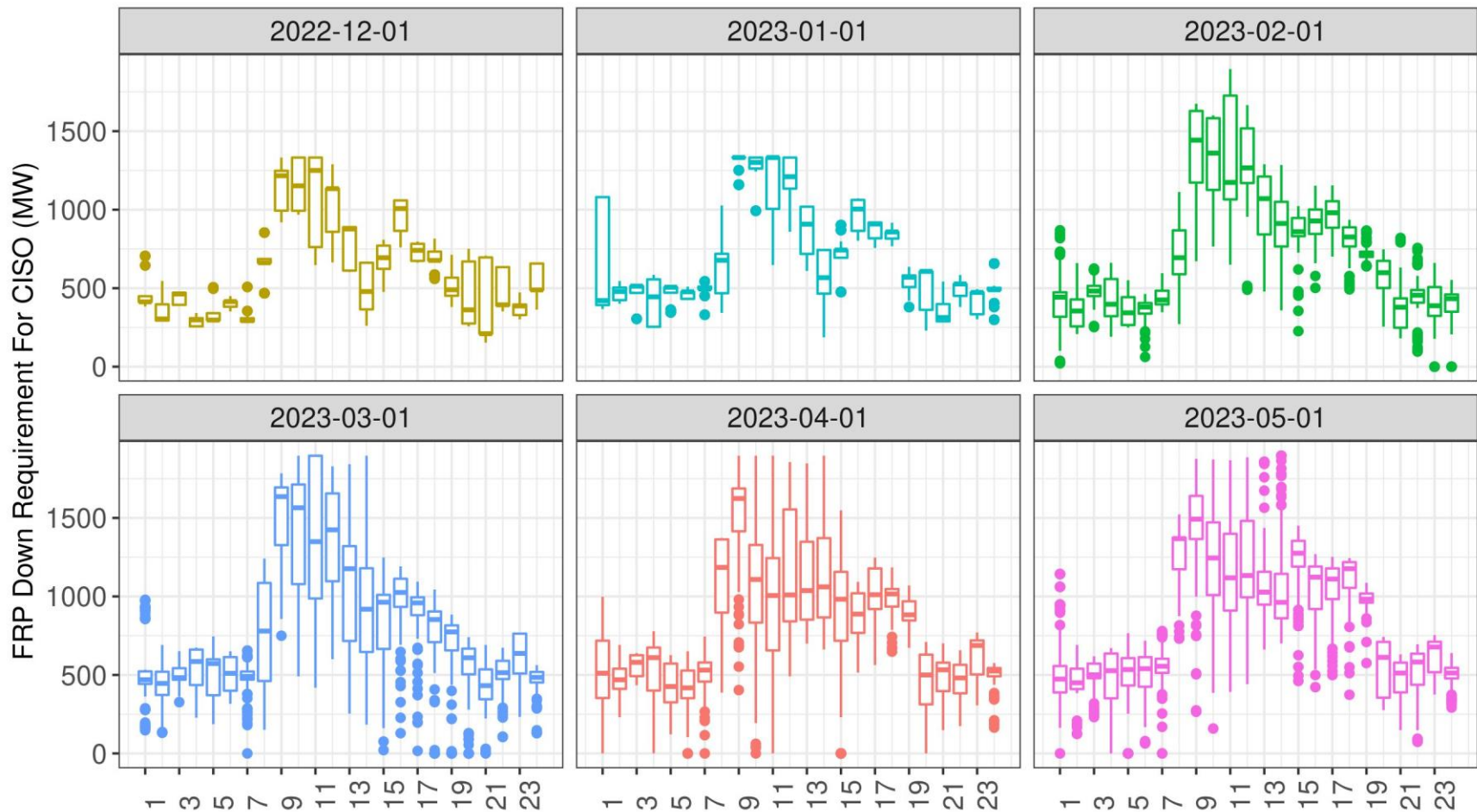
The FRP requirement changes from T-75 to T-55 have been modest

Positive value of change: T-55 > T-75

No changes from T-55 to T-40

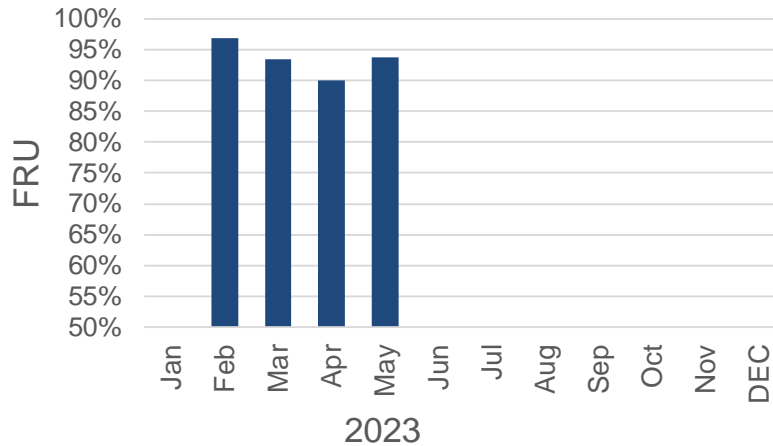


Uncertainty Requirement in the down direction increased more markedly in the early hours of the day

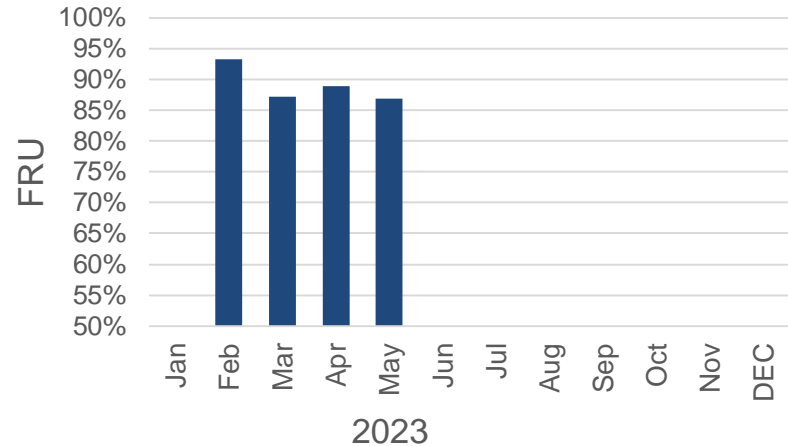


FRP Coverage

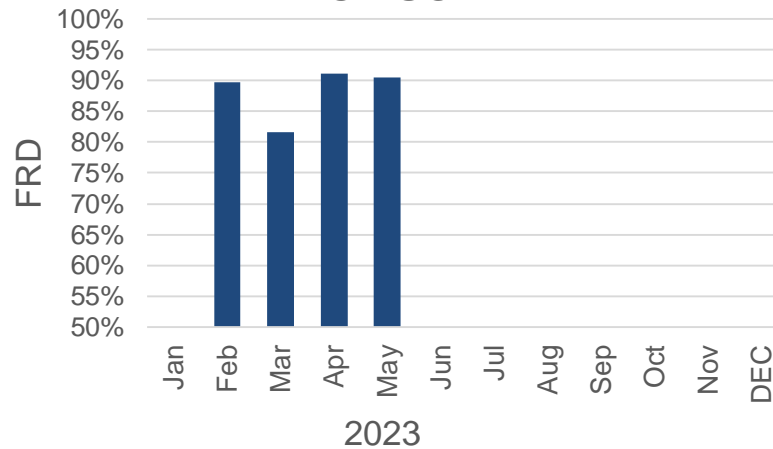
CAISO



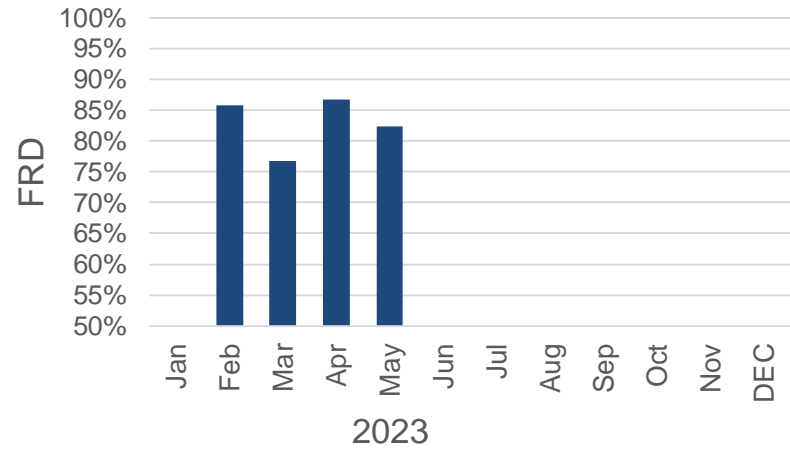
WEIM AREA



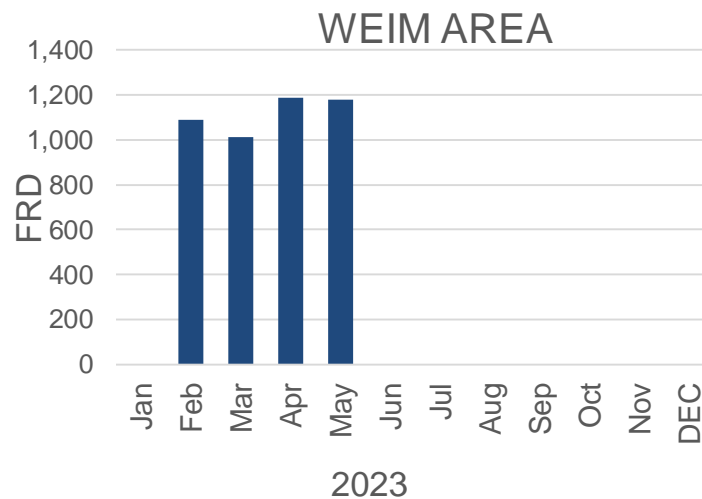
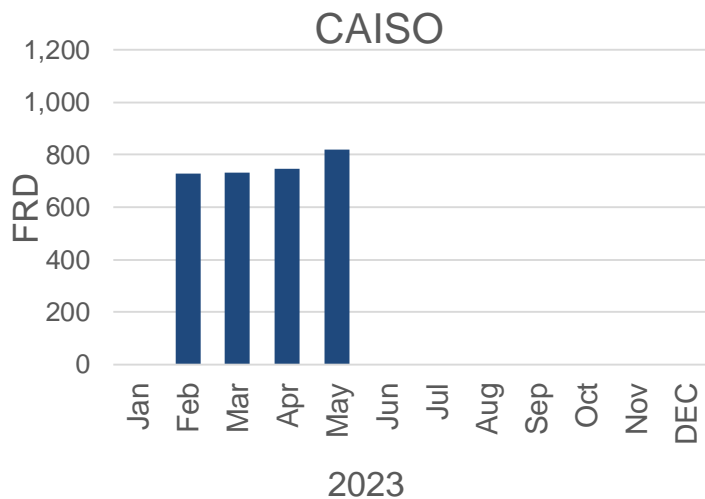
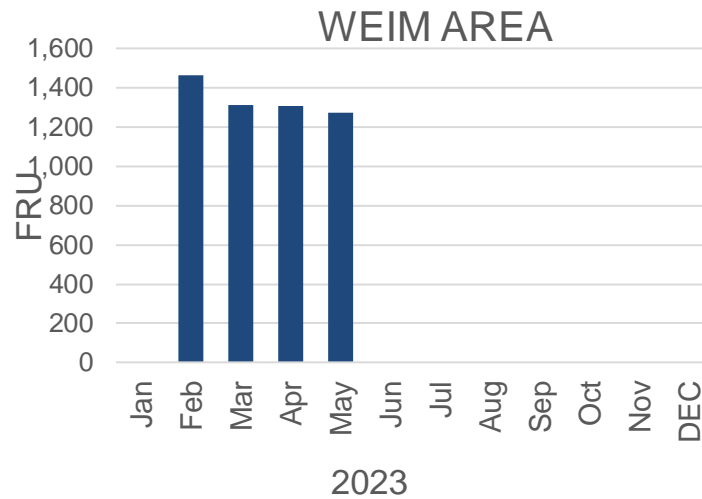
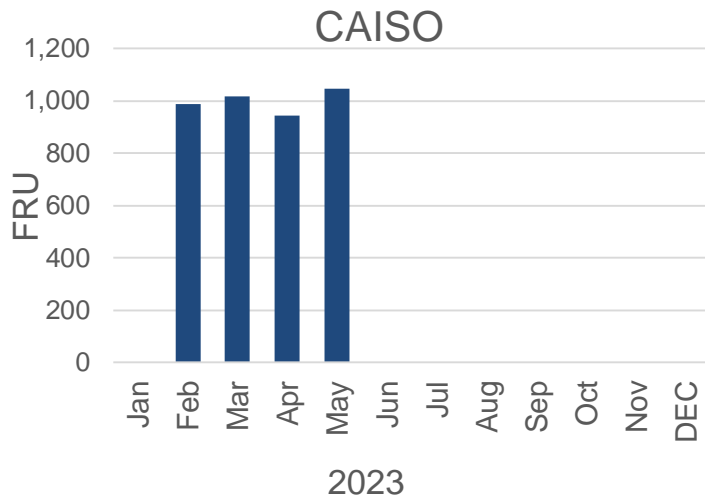
CAISO



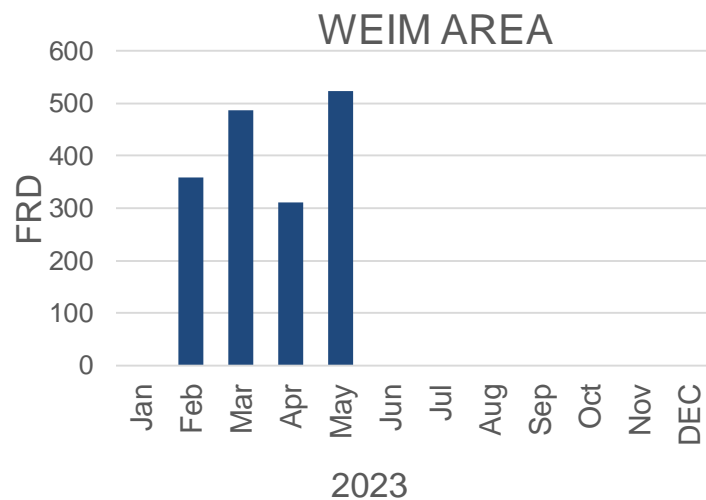
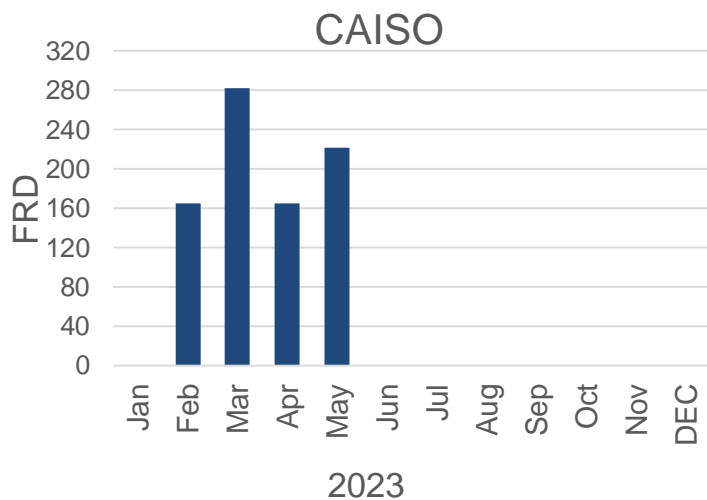
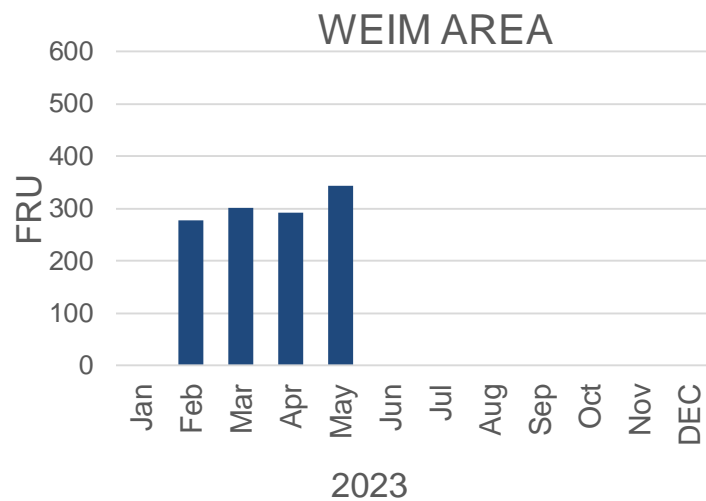
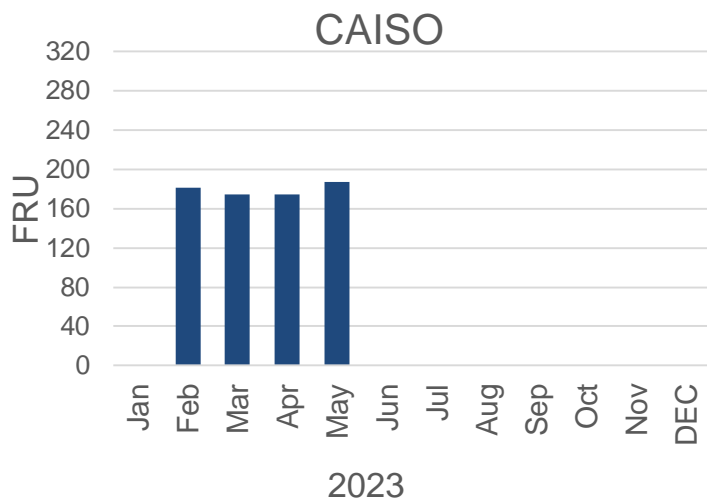
WEIM AREA



FRP Requirement



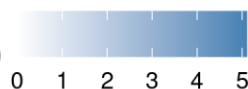
FRP Exceedance



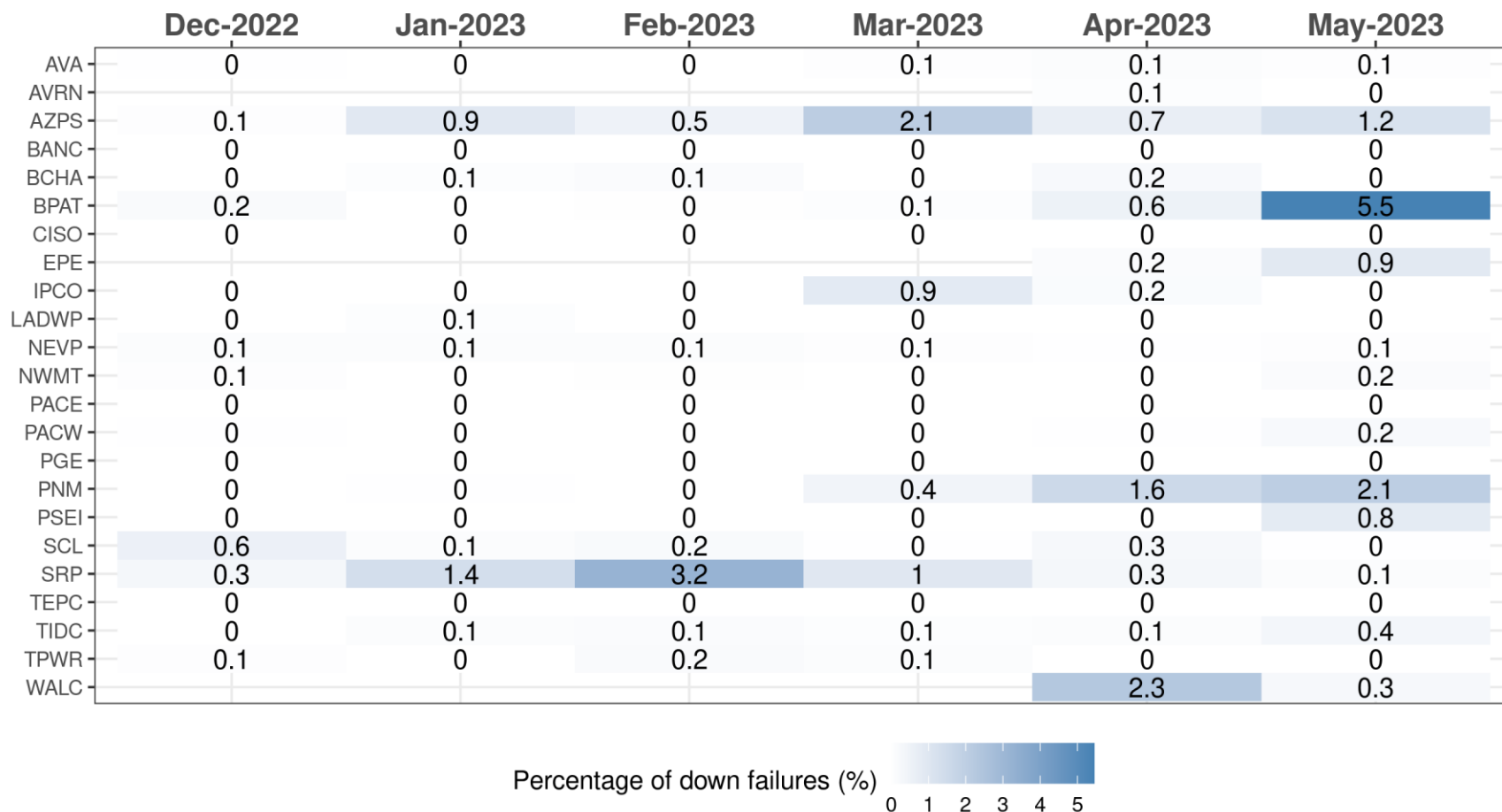
Flexible Ramping Test – percentage of Up failed intervals increased modestly in April/May 2023

| | Dec-2022 | Jan-2023 | Feb-2023 | Mar-2023 | Apr-2023 | May-2023 |
|-------|----------|----------|----------|----------|----------|----------|
| AVA | 0.1 | 0 | 0 | 0 | 0.2 | 0.2 |
| AVRN | | | | | 1 | 0.7 |
| AZPS | 0.4 | 0.9 | 1.8 | 2.5 | 1.1 | 0.2 |
| BANC | 0 | 0 | 0 | 0 | 0 | 0.1 |
| BCHA | 0 | 0 | 0.2 | 0 | 0 | 0 |
| BPAT | 0.4 | 0 | 0.1 | 0.6 | 0.2 | 1.2 |
| CISO | 0 | 0 | 0 | 0 | 0 | 0 |
| EPE | | | | | 0.8 | 0.6 |
| IPCO | 0 | 0 | 0.1 | 0.3 | 0.3 | 0.5 |
| LADWP | 0 | 0 | 0.3 | 0 | 0.1 | 0 |
| NEVP | 0 | 0.1 | 0.3 | 0 | 0.1 | 0.1 |
| NWMT | 0.8 | 0.3 | 0.1 | 0.2 | 0.8 | 0.3 |
| PACE | 0 | 0.1 | 0 | 0 | 0.1 | 0 |
| PACW | 0 | 0.1 | 0.1 | 0 | 0.1 | 0.6 |
| PGE | 0.1 | 0 | 0.1 | 0 | 0.1 | 1.5 |
| PNM | 0.8 | 0.2 | 0 | 1.2 | 5.1 | 0.9 |
| PSEI | 0 | 0 | 0.1 | 0.8 | 0.2 | 1 |
| SCL | 0 | 0 | 0.1 | 0 | 0 | 0 |
| SRP | 0.8 | 3.5 | 1.2 | 1.8 | 2 | 0.6 |
| TEPC | 0.2 | 0.3 | 0.3 | 0.3 | 0.1 | 0.1 |
| TIDC | 1.2 | 0 | 0 | 0 | 0 | 0 |
| TPWR | 0 | 0.2 | 0.1 | 0.2 | 0 | 0.1 |
| WALC | | | | | 2 | 0.7 |

Percentage of up failures (%)



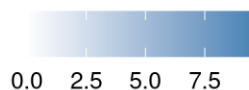
Flexible Ramping Test – percentage of Down failed intervals increased modestly in May 2023



Flexible Ramping Test – percentage of Up failed intervals by hour in May 2023 is mainly concentrated in peak 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 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| AVRN | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 2 | 2 | 2 | 5 |
| AZPS | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 |
| BANC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 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 | 0 | 0 | 0 |
| BPAT | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 6 | 2 | 0 | 0 | 0 | 4 | 2 | 0 | 2 | 2 | 3 |
| 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 |
| EPE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 8 | 2 | 0 | 0 | 0 |
| IPCO | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 4 | 2 | 0 | 0 | 0 |
| LADWP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NEVP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| NWMT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 1 | 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 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| PGE | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 4 | 4 | 6 | 6 | 10 | 0 | 0 |
| PNM | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 4 | 2 | 2 | 0 | 0 | 0 |
| PSEI | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 2 | 2 | 4 | 2 | 0 | 1 | 3 | 3 | 0 |
| SCL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SRP | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 6 | 1 | 0 | 0 | 0 |
| TEPC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 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 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WALC | 3 | 5 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 |

Percentage of up failures (%)



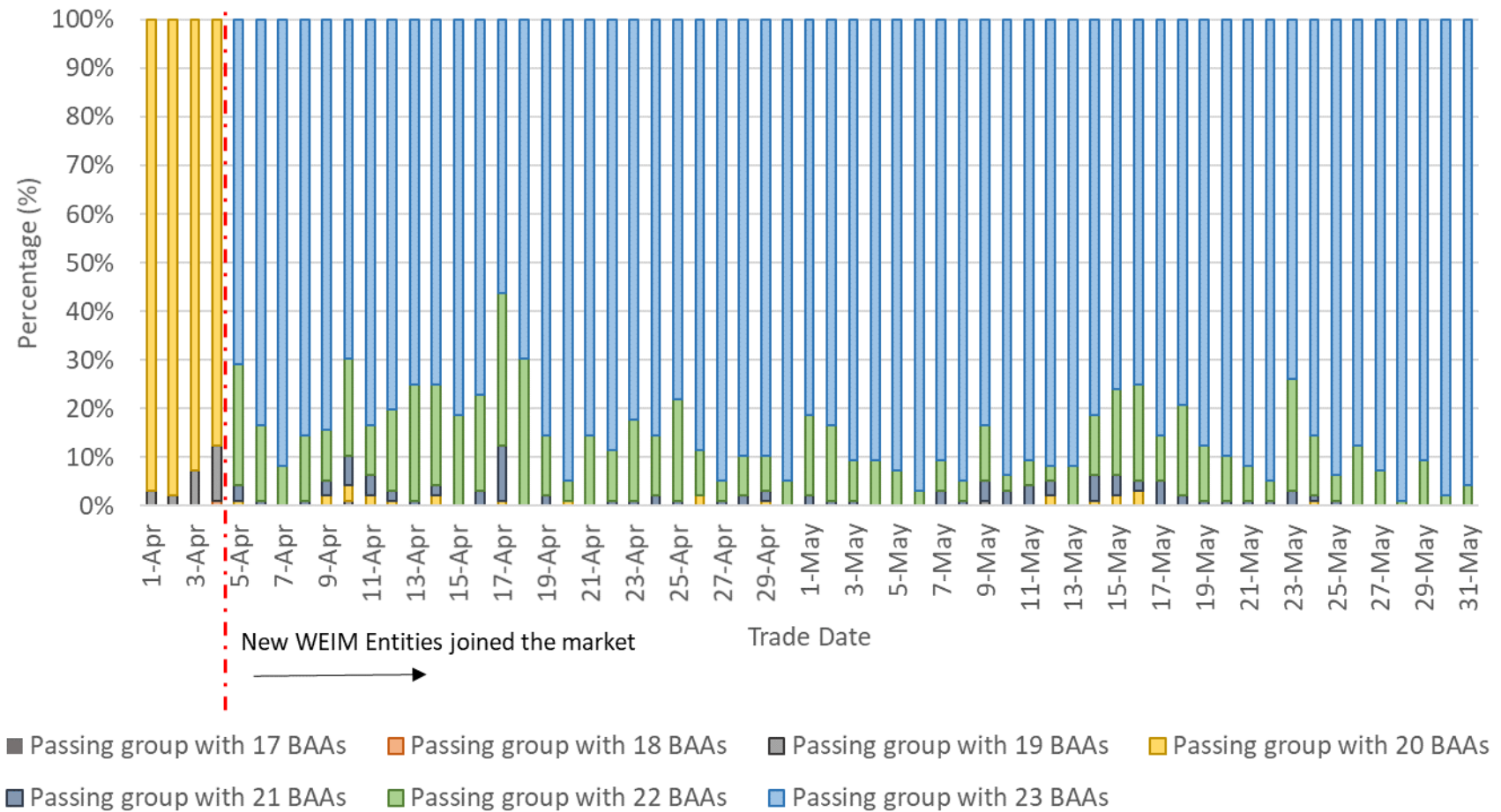
Flexible Ramping Test – number of Down failed intervals by hour in May 2023 is mainly concentrated in morning hours

| | 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 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AVRN | 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 | 3 | 0 | 2 | 4 | 3 | 3 | 9 | 1 | 0 | 0 | 4 | 0 | 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 | 0 | 0 | 0 |
| BPAT | 6 | 7 | 10 | 13 | 10 | 6 | 3 | 3 | 3 | 3 | 10 | 12 | 6 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 3 | 6 | 6 | 7 |
| 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 |
| EPE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 12 | 4 | 1 | 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 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NWMT | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 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 | 3 | 2 | 1 | 2 | 1 | 0 | 6 | 13 | 2 | 6 | 2 | 0 | 3 | 3 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| PSEI | 0 | 3 | 3 | 3 | 0 | 4 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SCL | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SRP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TPWR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WALC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |

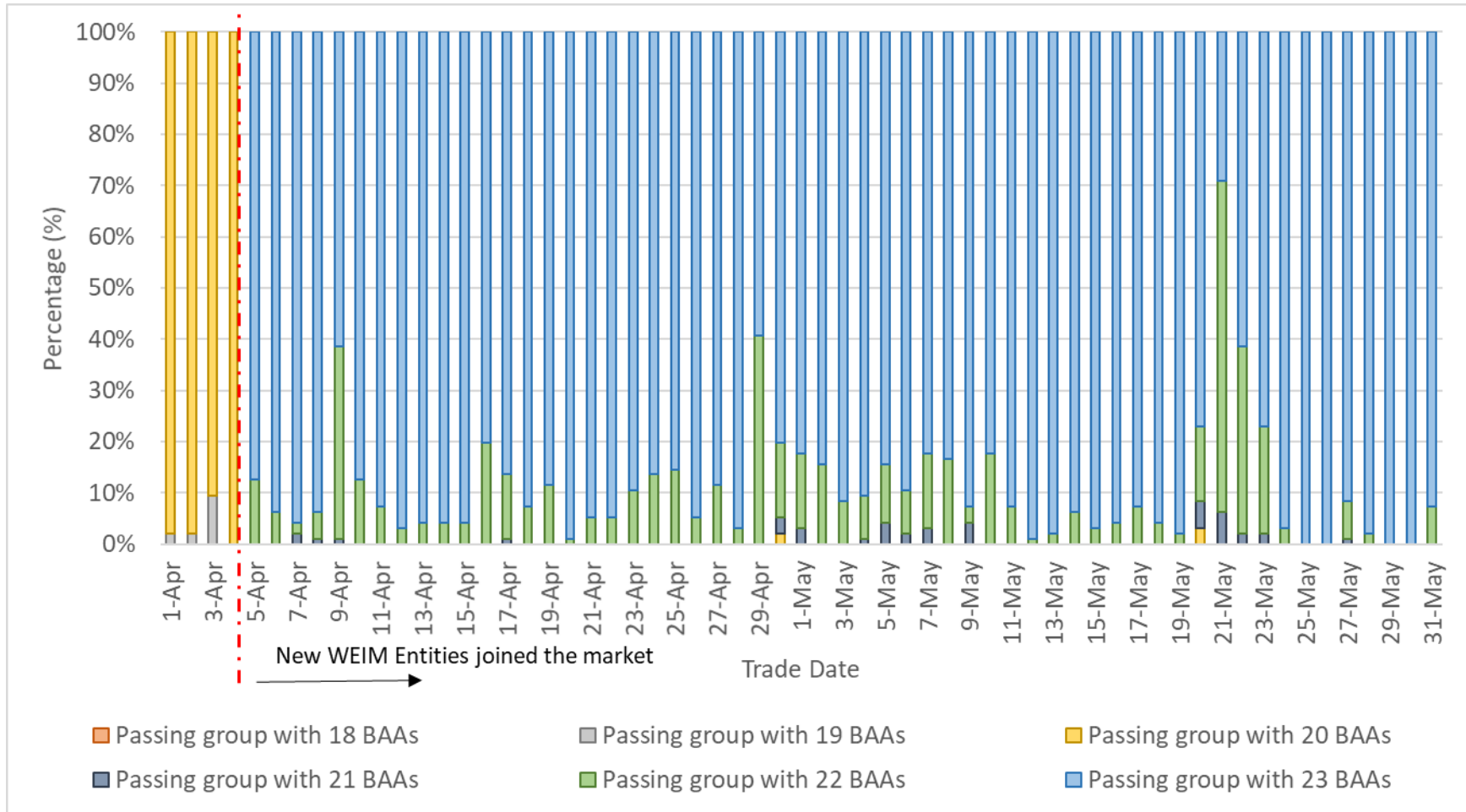
Percentage of down failures (%)

0.0 2.5 5.0 7.5 10.0 12.5

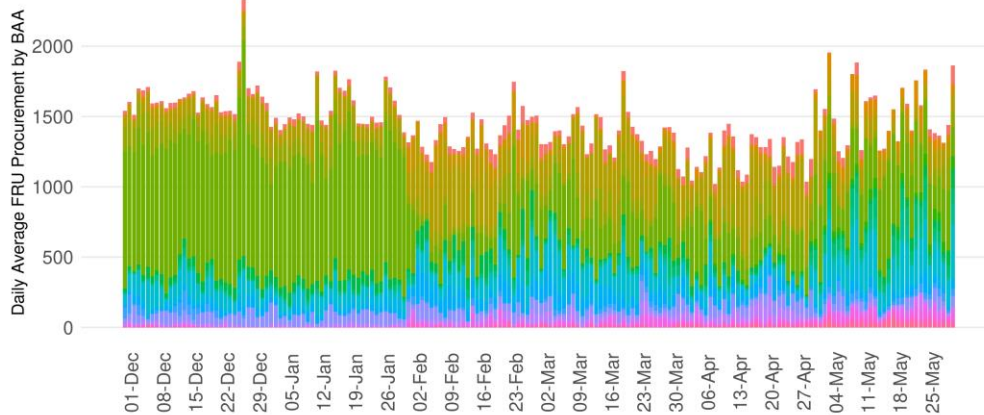
Over 80 percent of the time, the passing group for FRU consists of all WEIM areas



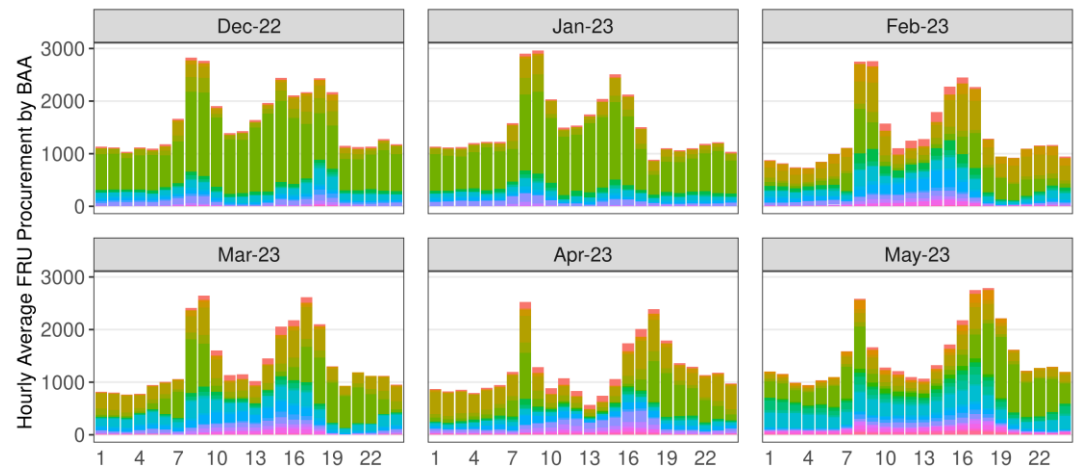
Over 80 percent of the time, the passing group for FRD consists of all WEIM areas



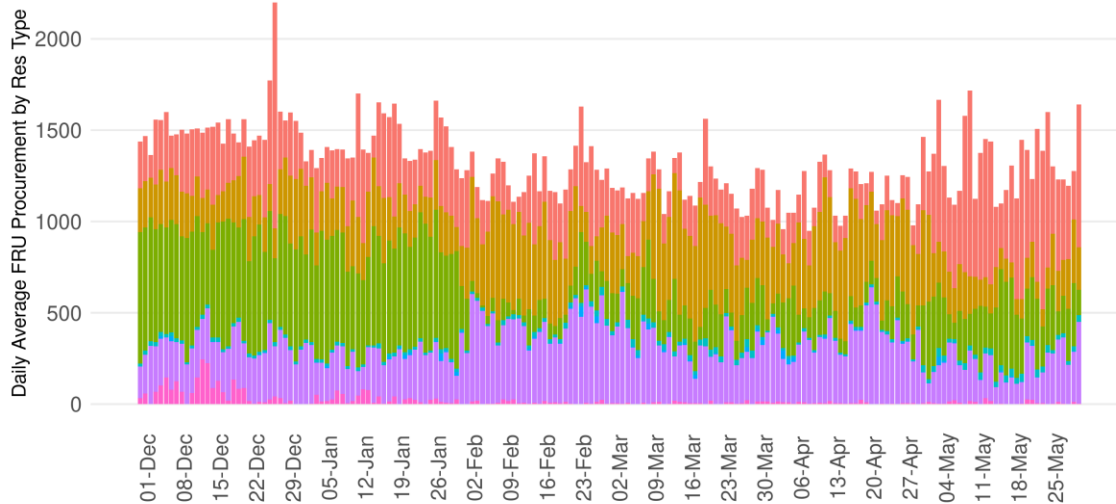
Composition of FRP procurement –All WEIM areas



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

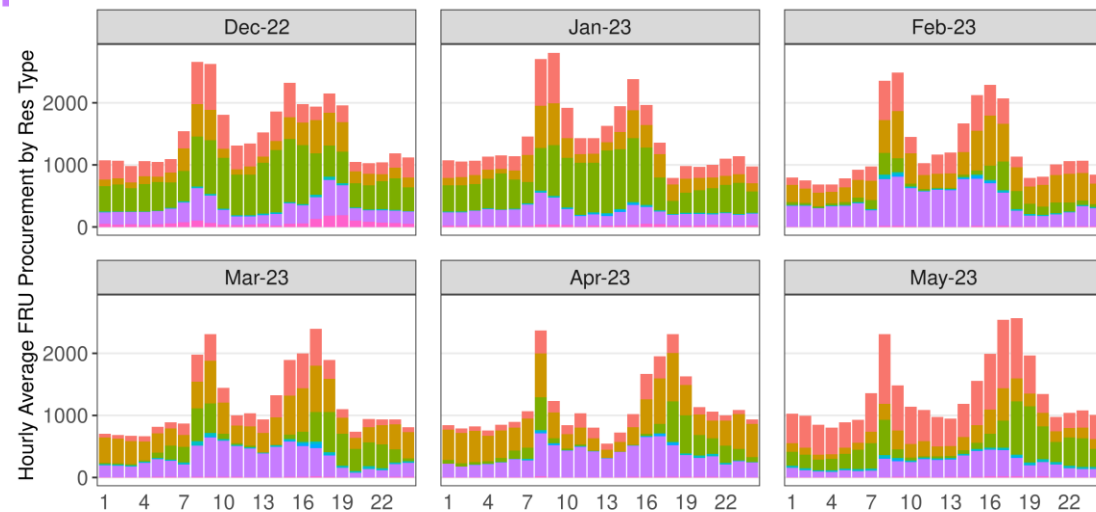


FRU Procurement by Resource Type



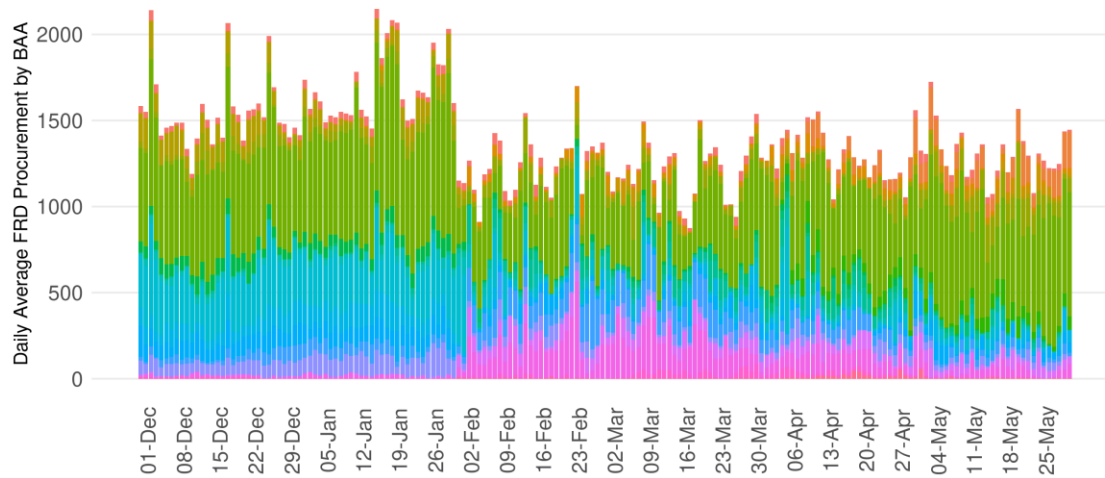
There is a noticeable change in the Type of resource procuring FRP after the introduction of nodal logic

GAS GNRC LESR OIL OTHER SOLAR WATER WIND

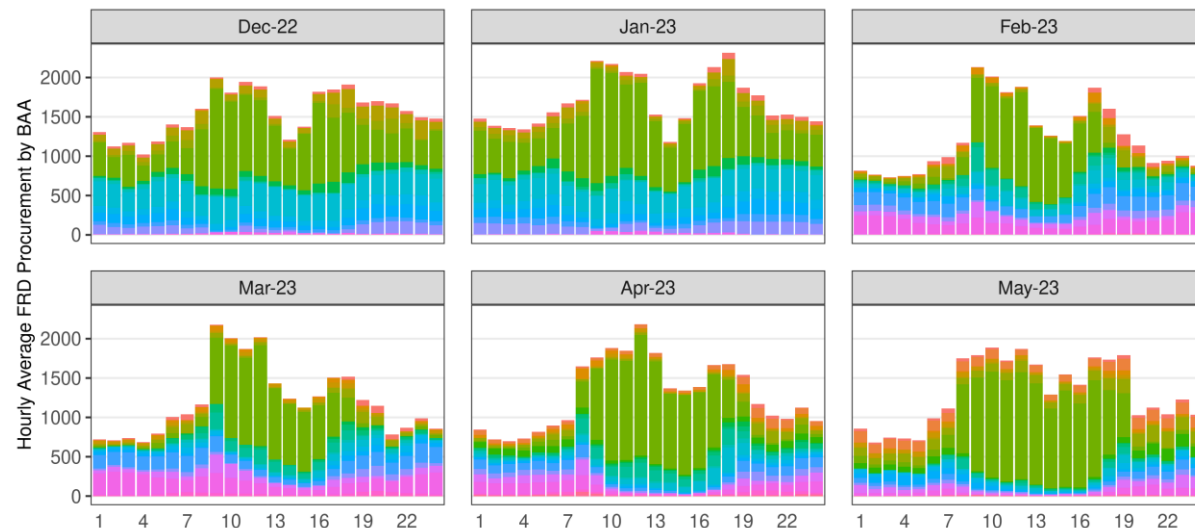


GAS GNRC LESR OIL OTHER SOLAR WATER WIND

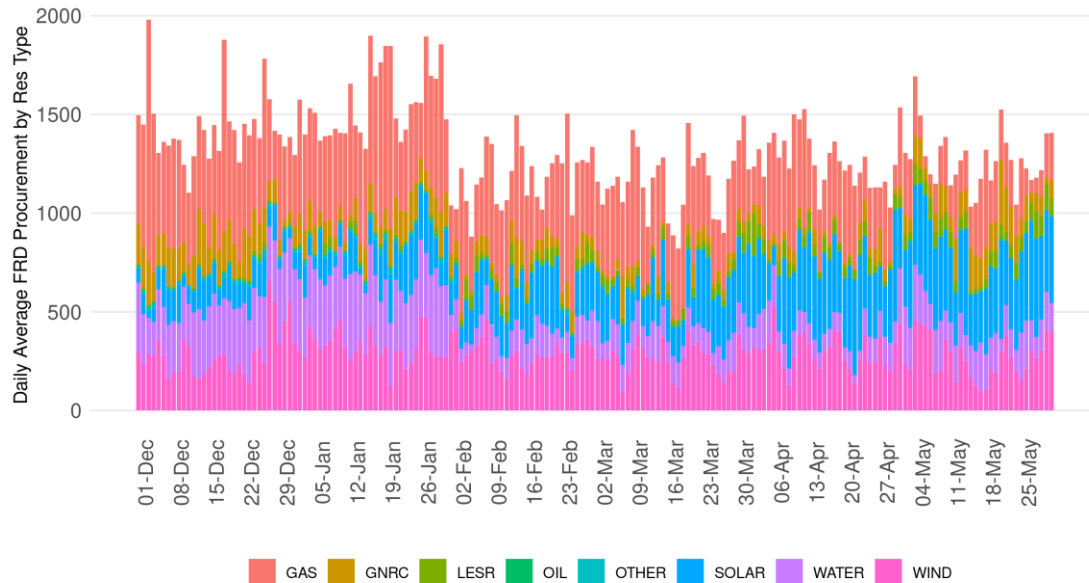
FRD Procurement by BAA



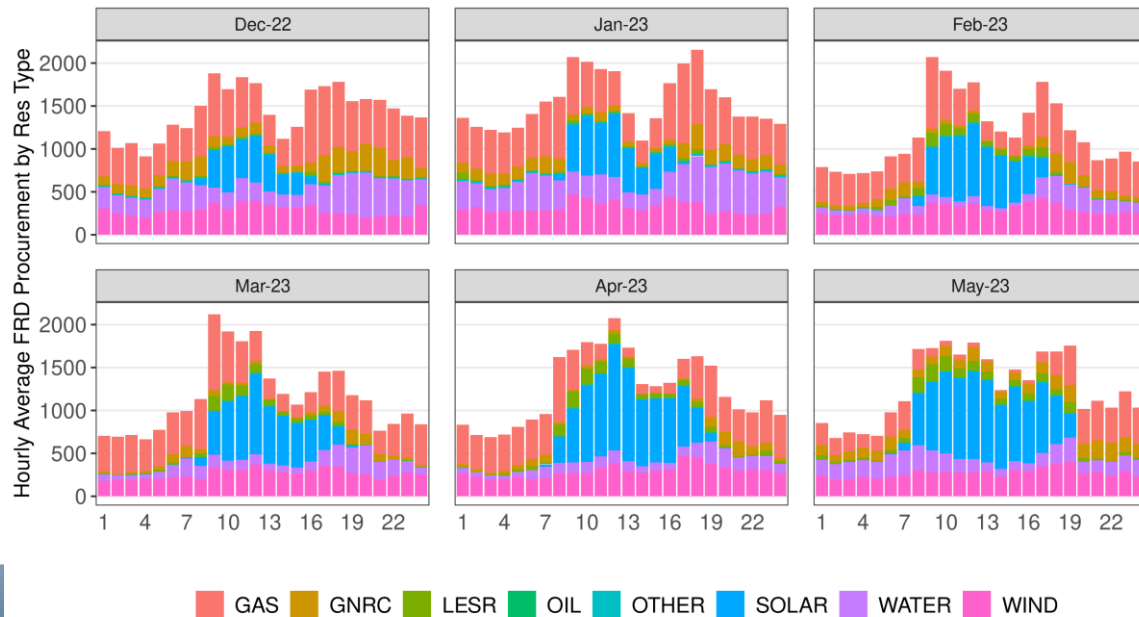
There is a noticeable change in the source of FRP procurement with the introduction of nodal logic



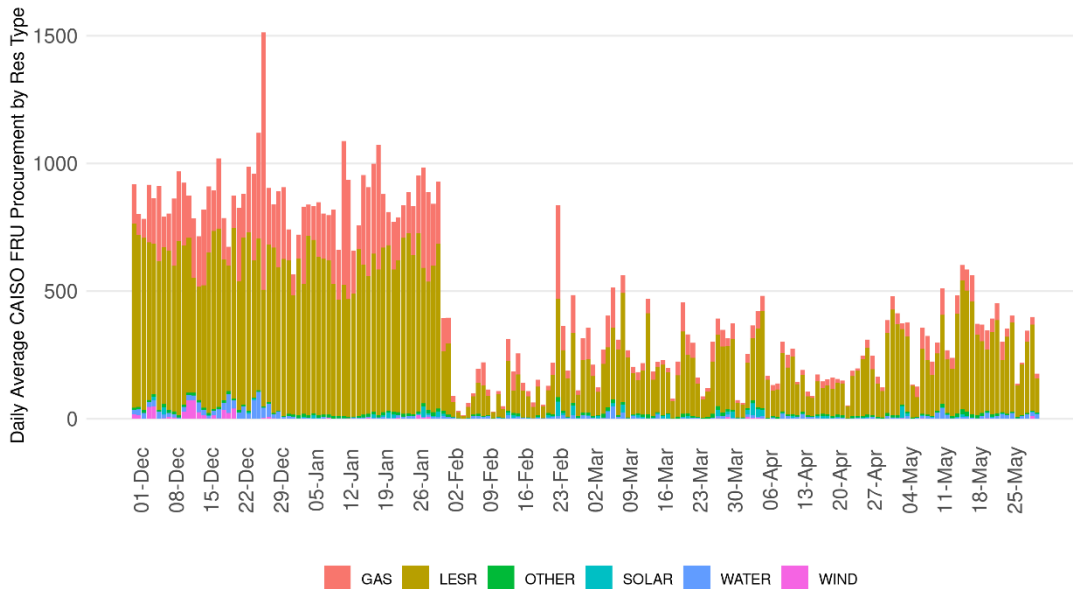
FRD Procurement by Resource Type



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

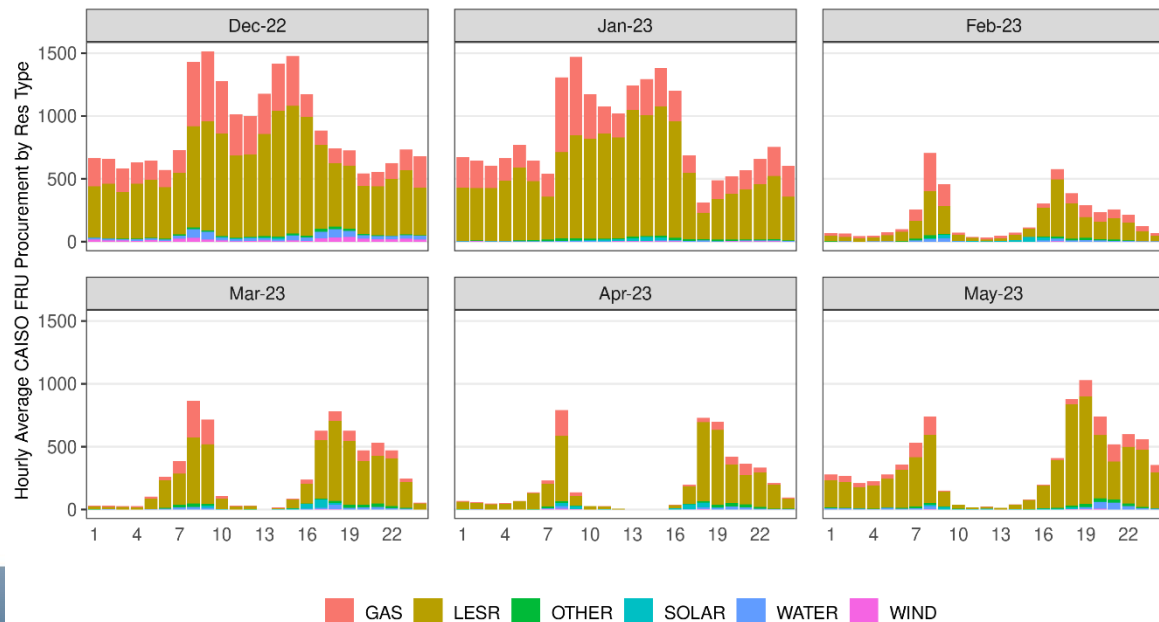


CAISO FRU procurement by resource type

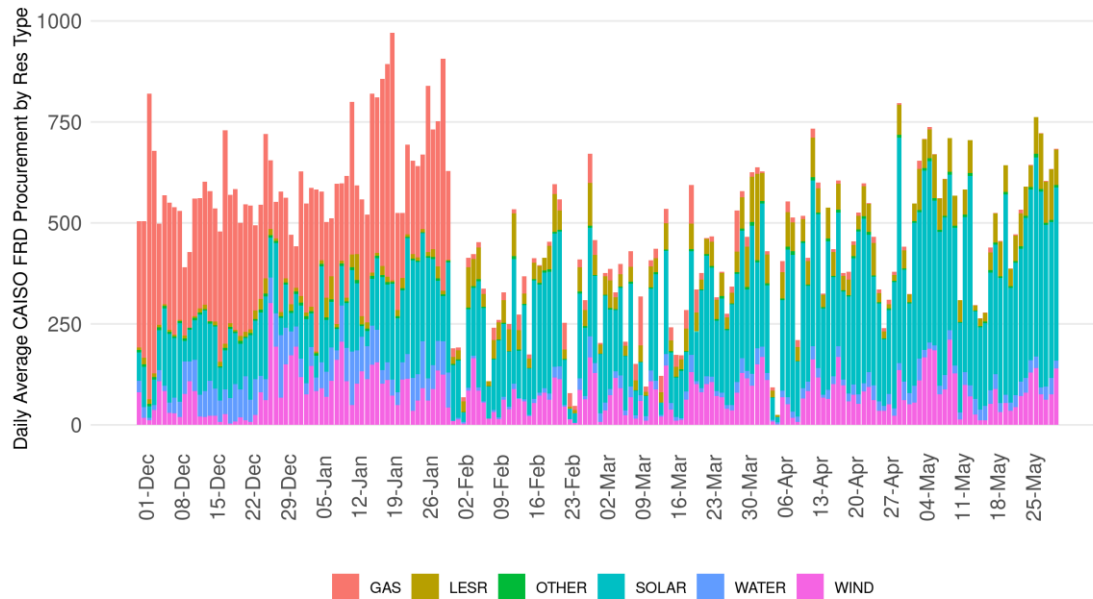


Procurement from CAISO area
Dropped significantly with introduction
of nodal procurement

No minimum requirement
imposed for CAISO area



CAISO FRD procurement by resource type

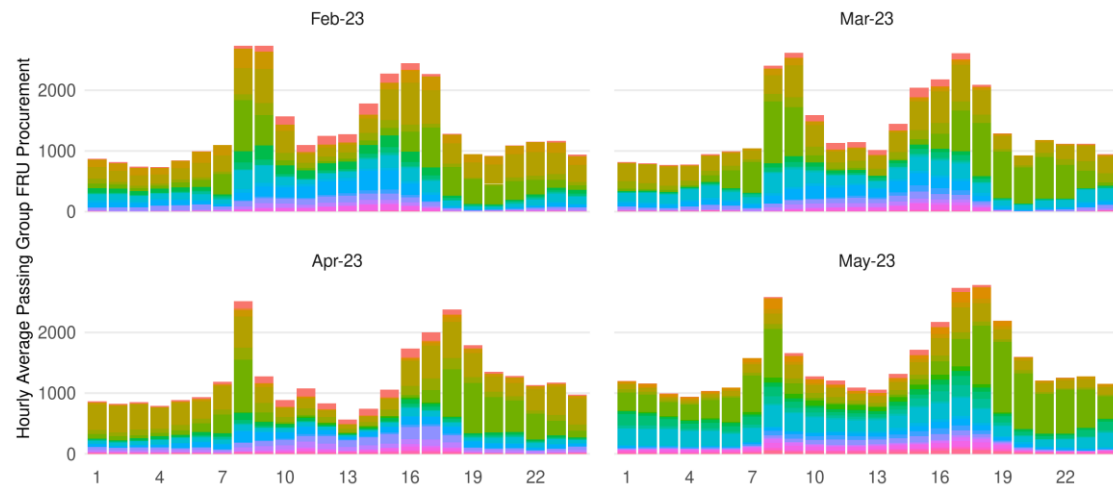
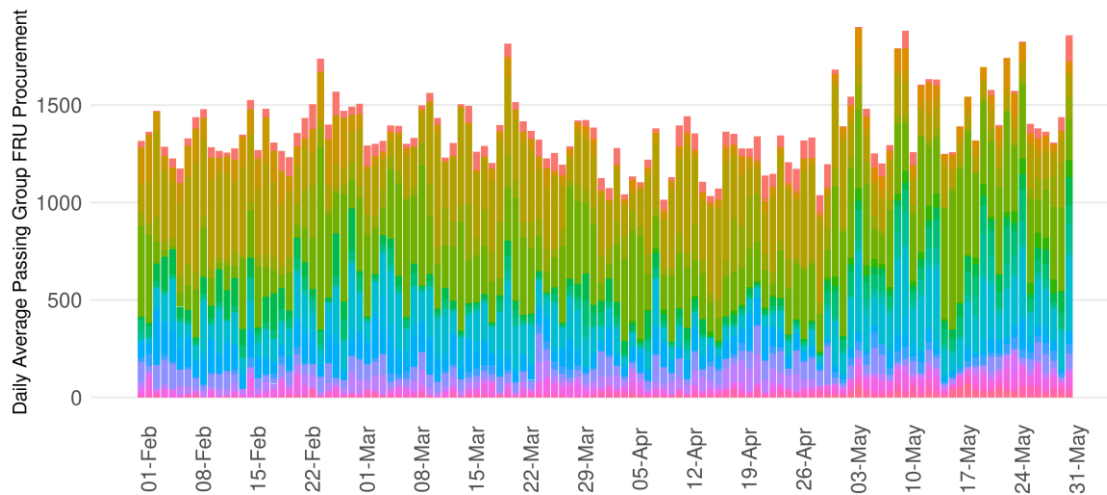


Procurement from CAISO area
Dropped fairly with introduction
of nodal procurement, mainly
from gas resources

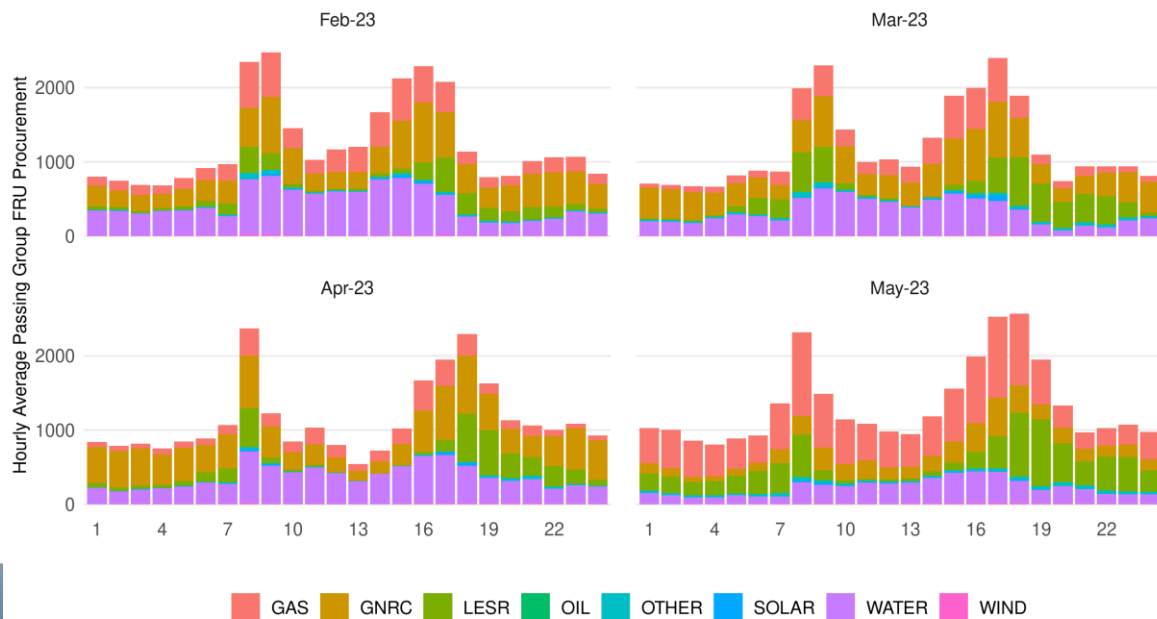
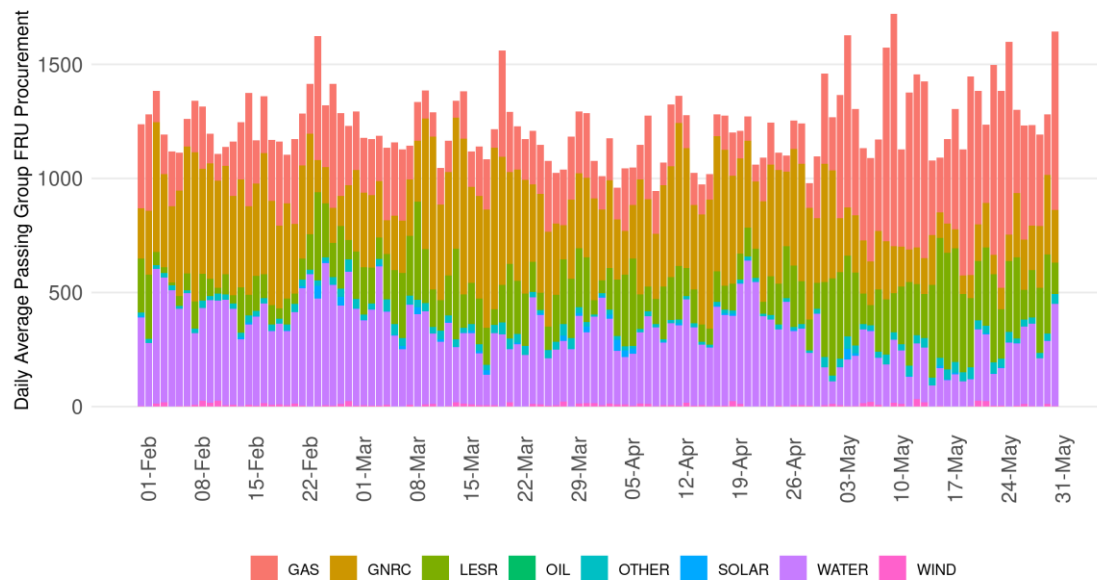
No minimum requirement
imposed for CAISO area



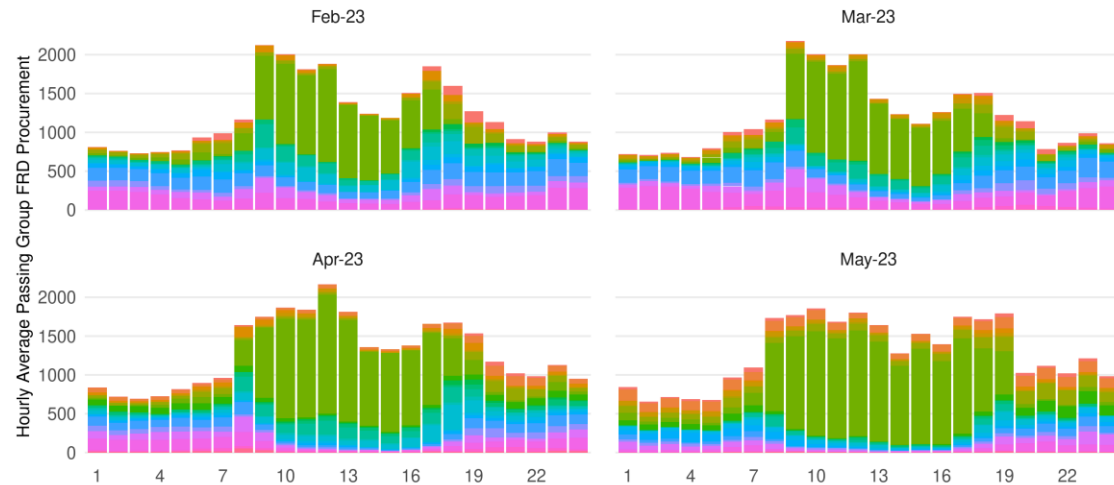
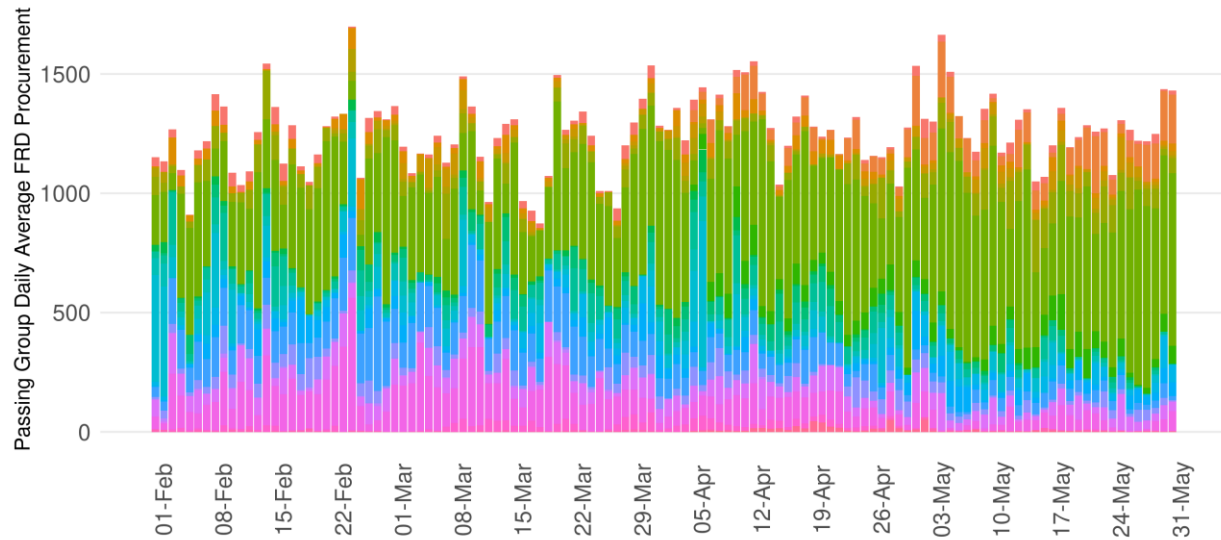
Passing Group FRU Procurement by BAA



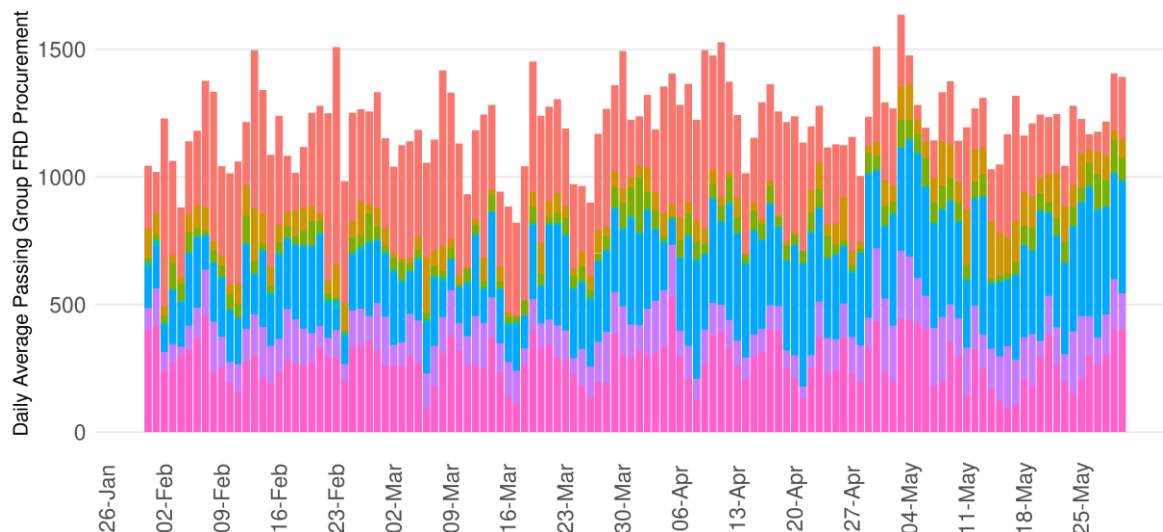
Passing Group FRU Procurement by Resource Type



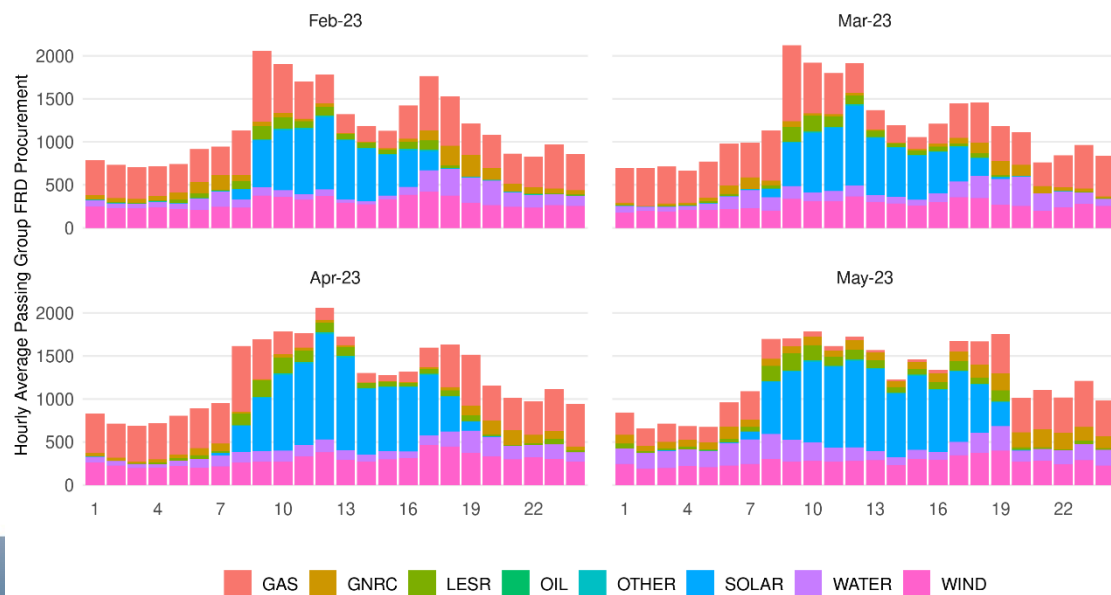
Passing Group FRD Procurement by BAA



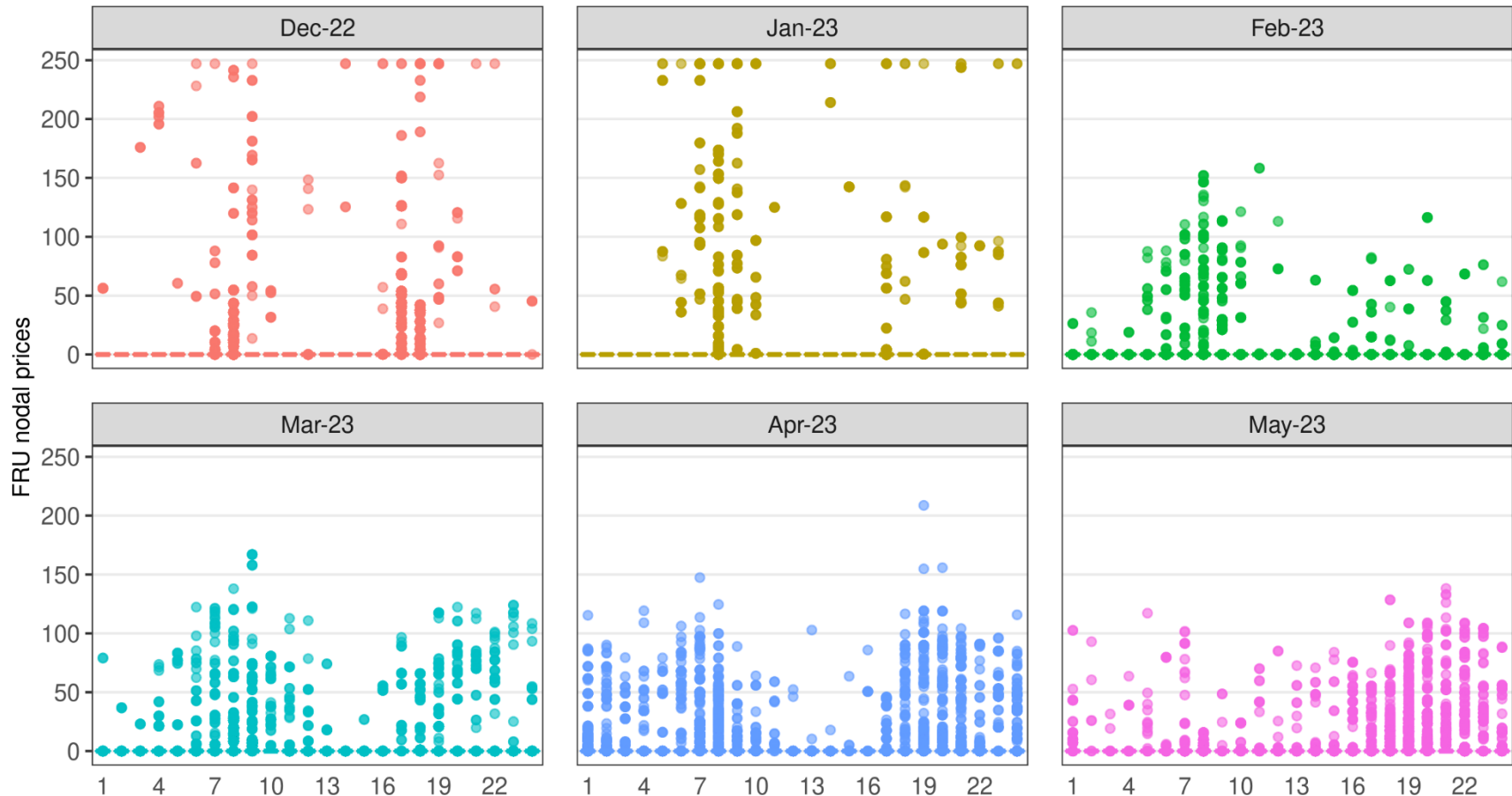
Passing Group FRD Procurement by Resource Type



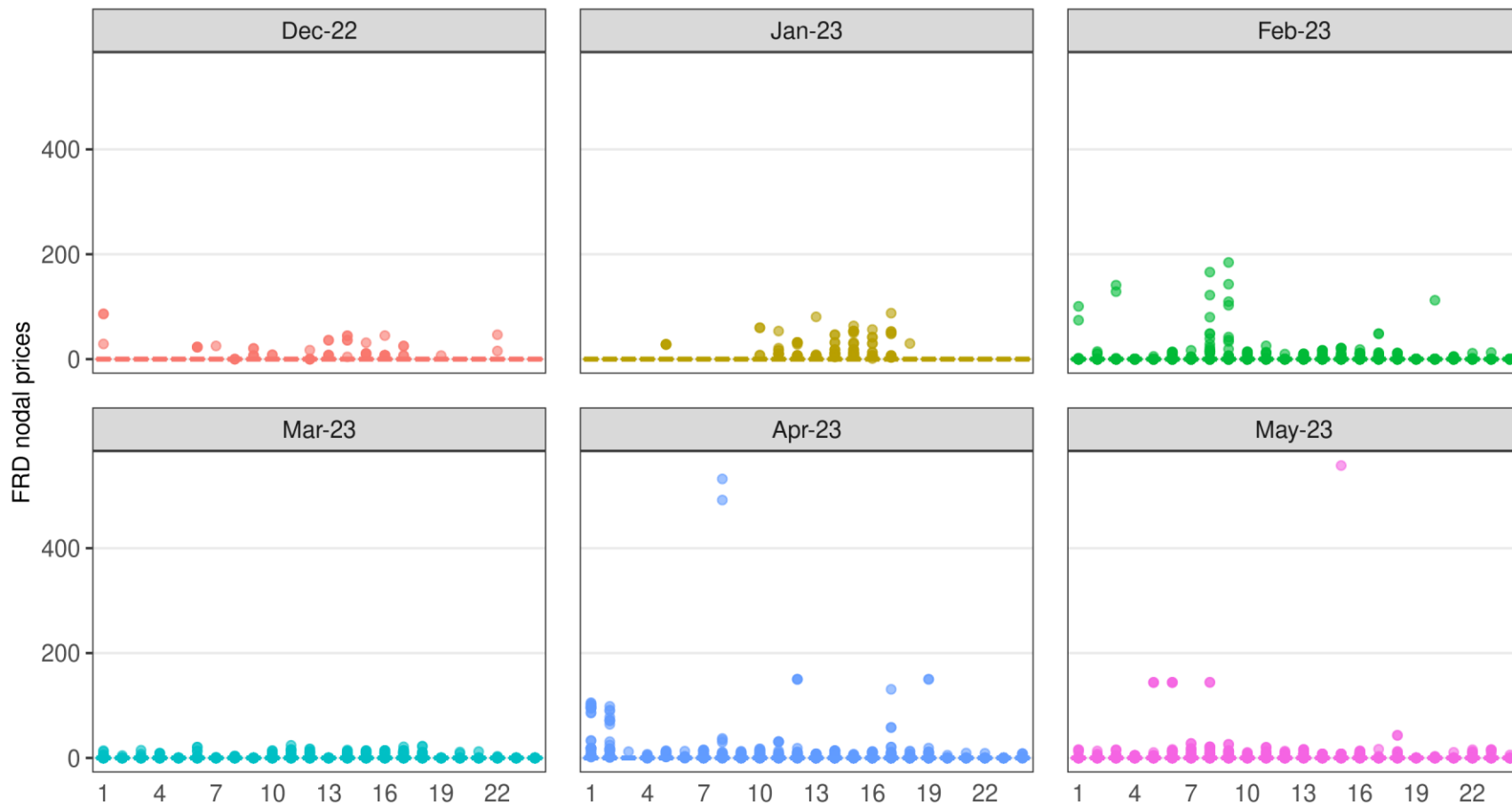
■ GAS
 ■ GNRC
 ■ LESR
 ■ OIL
 ■ OTHER
 ■ SOLAR
 ■ WATER
 ■ WIND



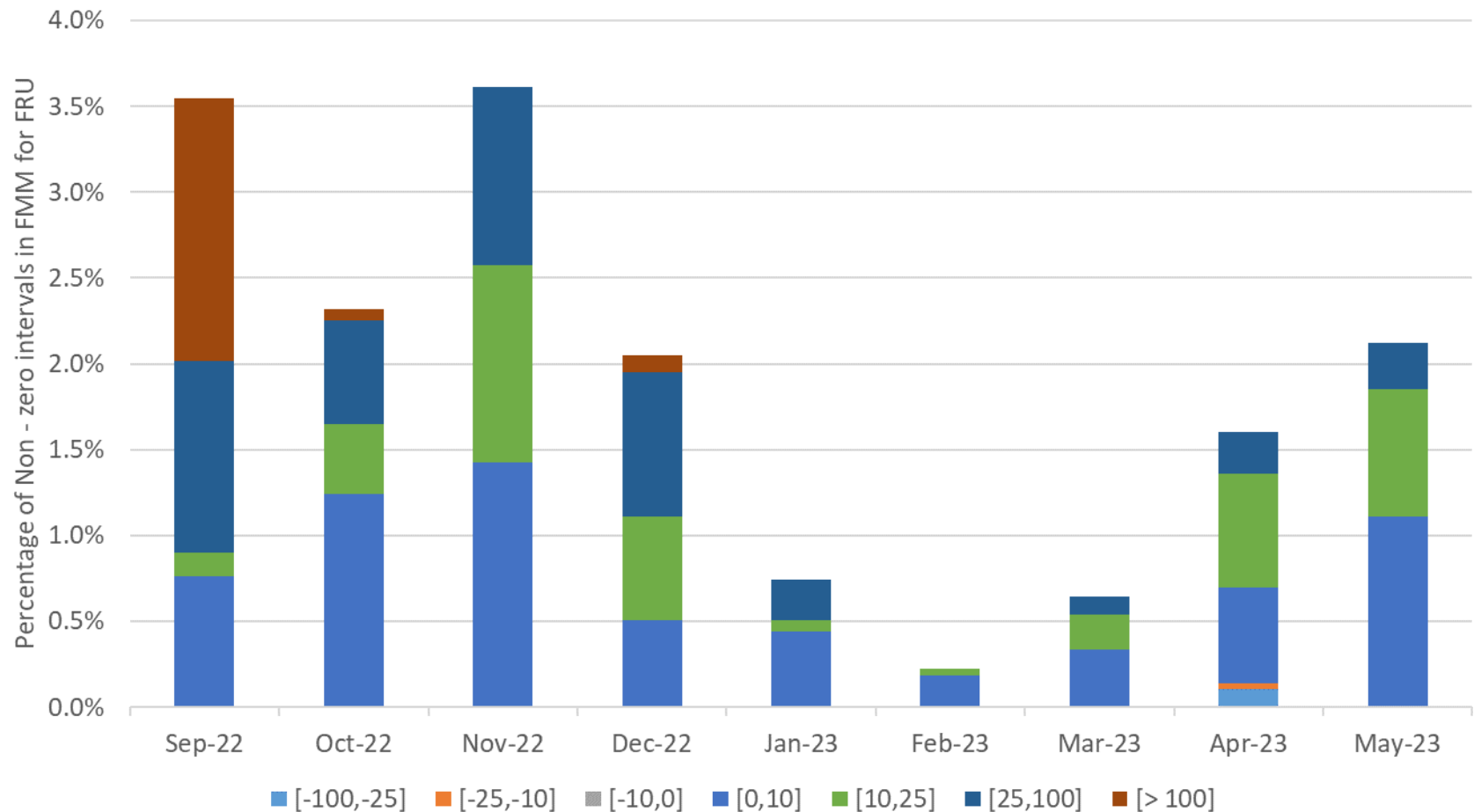
FRU Nodal prices in the FMM market have moderate spreads and remain low



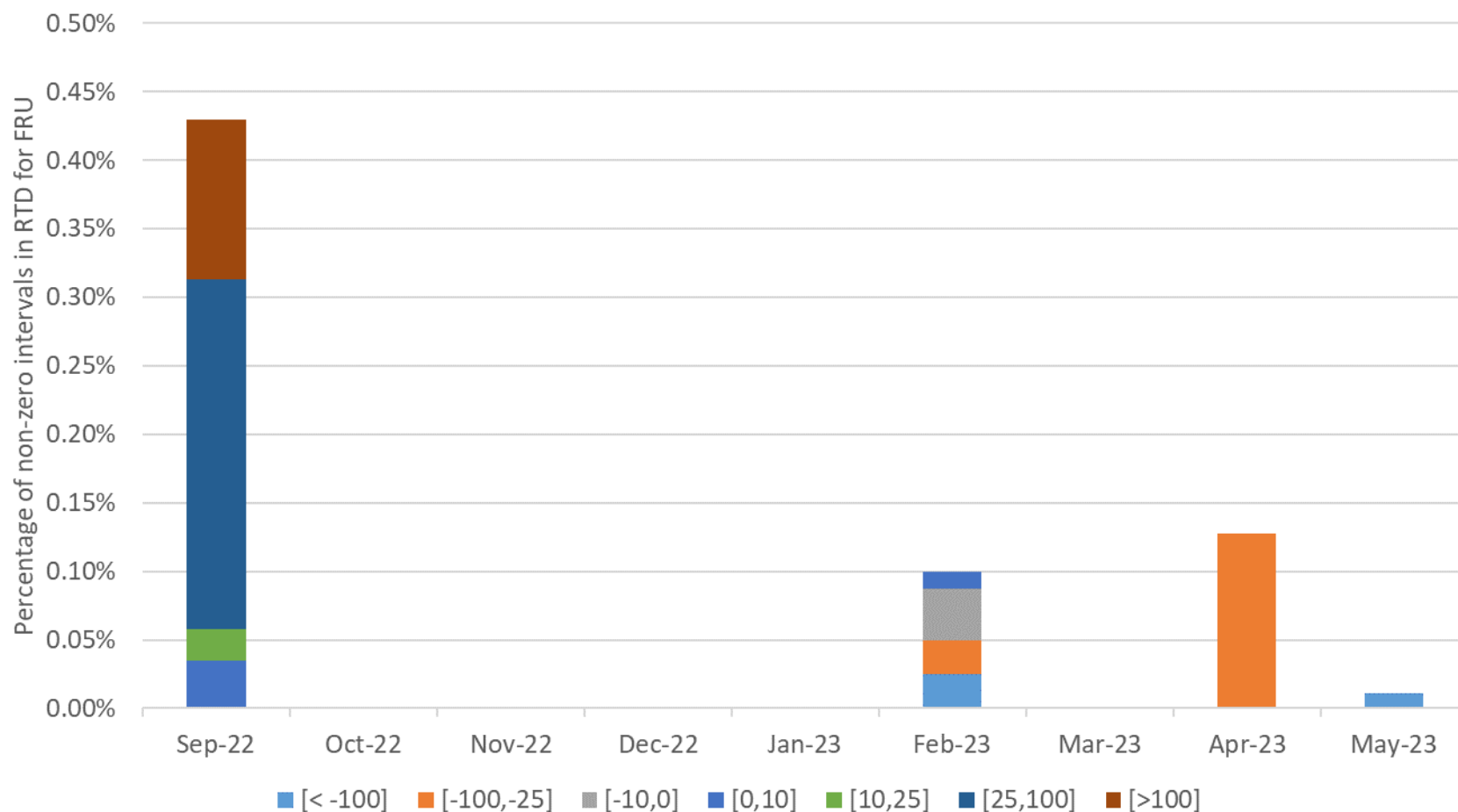
FRD Nodal Prices remain low



Frequency of intervals with non-zero shadow prices in FMM market in the up direction for ISO have increased since implementation, even though remains at low levels



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

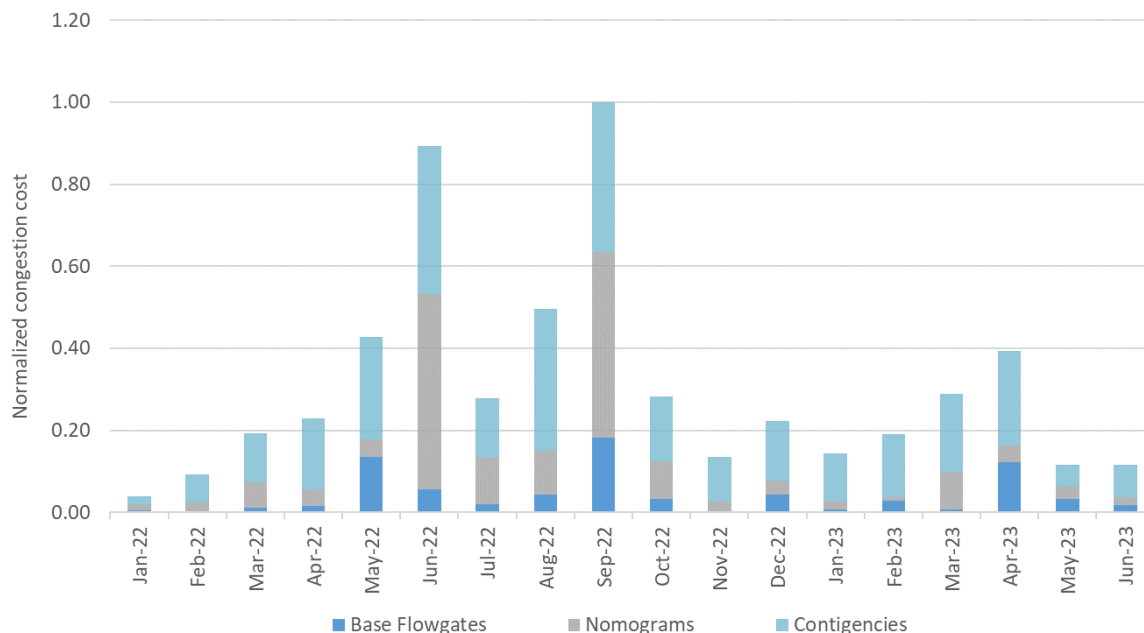
- Flow-based transmission constraints in CAISO's markets can be
 - Base flowgates
 - Contingency flowgates
 - Nomograms
- There are also Scheduling limits and transfers
- Since go-live on Feb 2023, for flow-based constraints only base flowgates are enforced for FRP nodal procurement
- FRP nodal model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

Further considerations of FRP nodal functionality

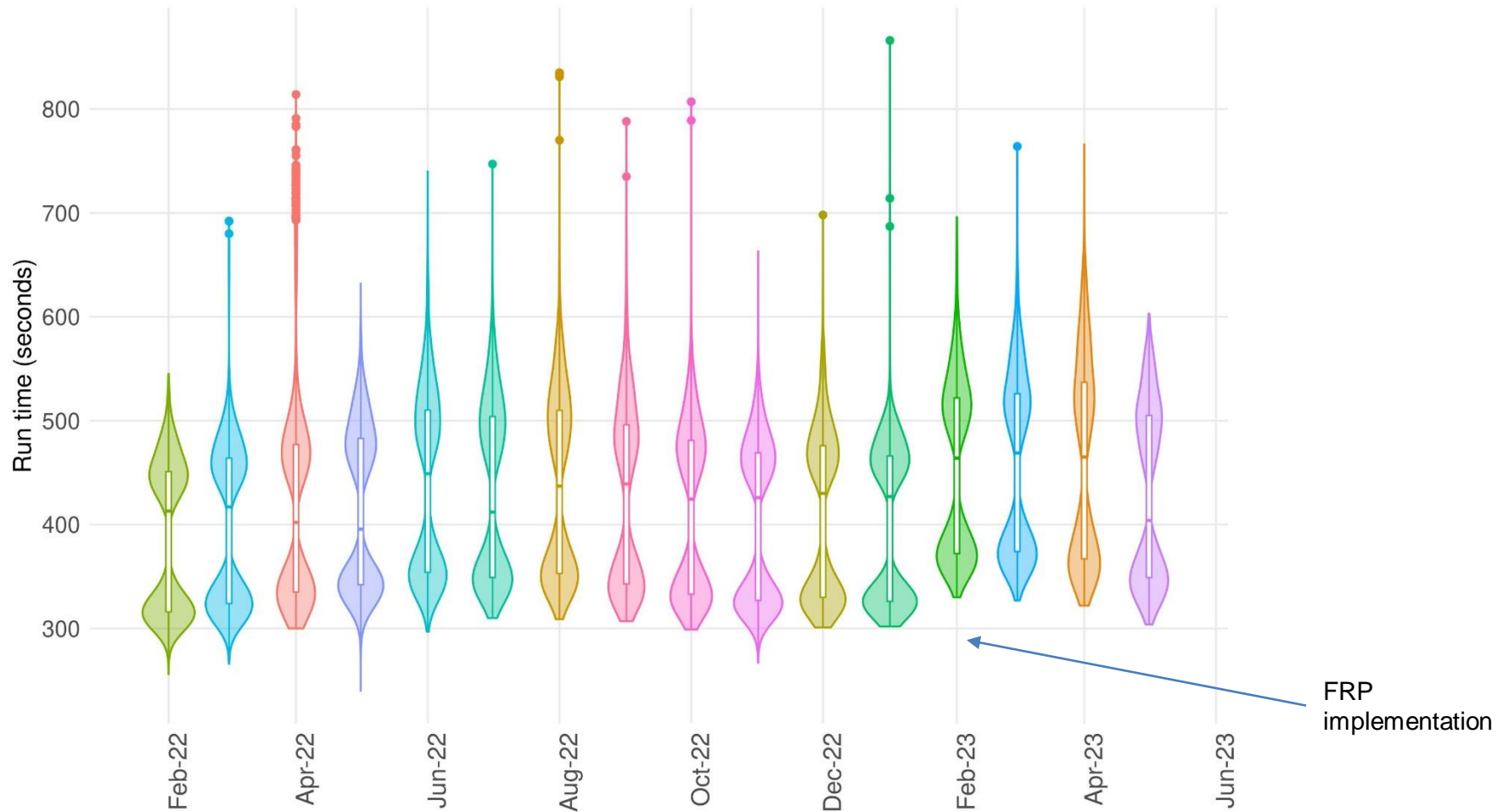
- Functionality is currently being expanded for nomograms
- CAISO will further assess conditions for enforcement of contingencies

Given seasonal patterns,
Recent months observed
moderate level of congestion

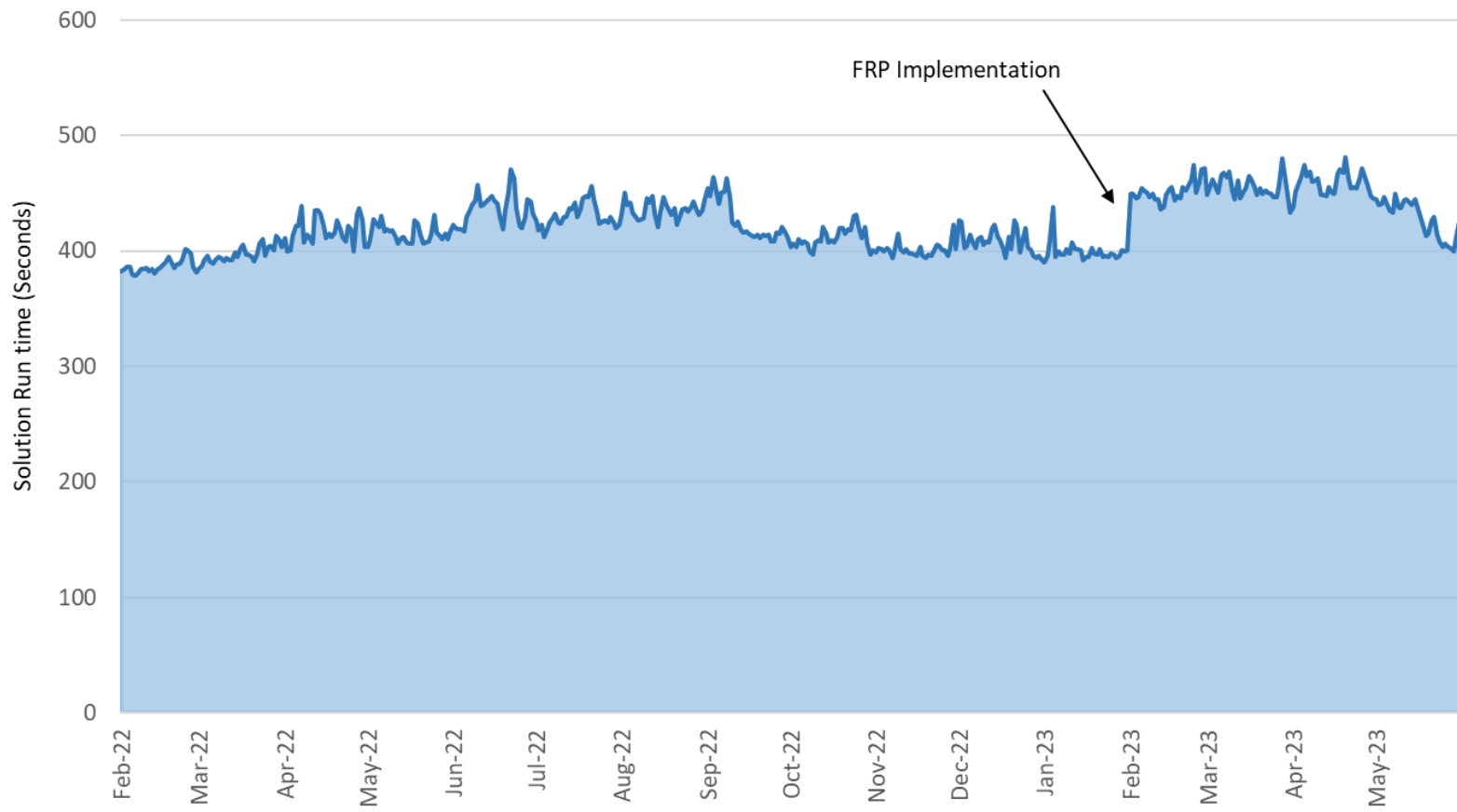
Few constraints for base
flowgates applicable to FRP
were binding



Real-time computational times have increased with the implementation of nodal FRP



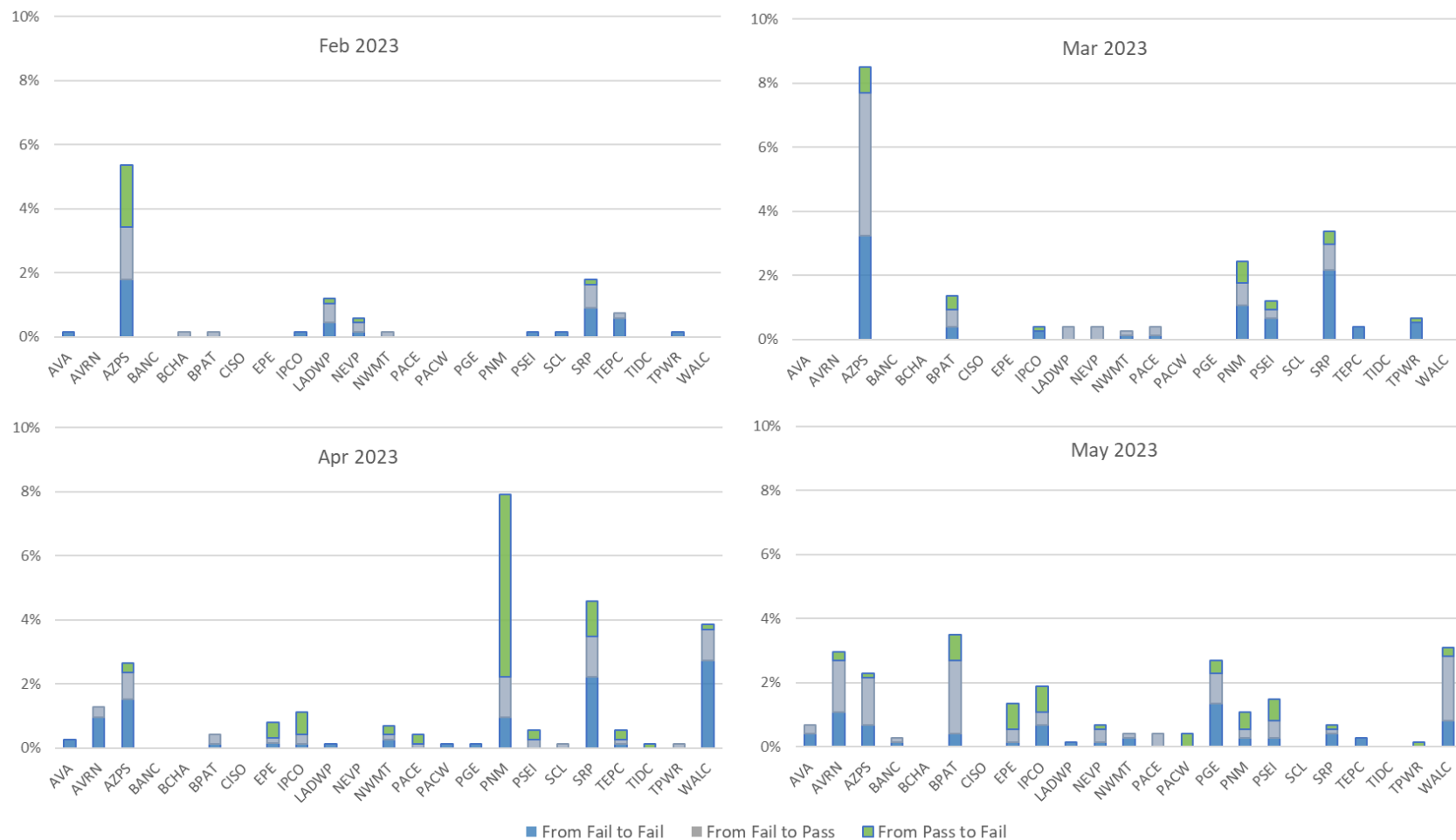
Solving for nodal FRP increases the set of transmission constraints to manage, resulting in longer computational times



Further consideration of FRP implementation

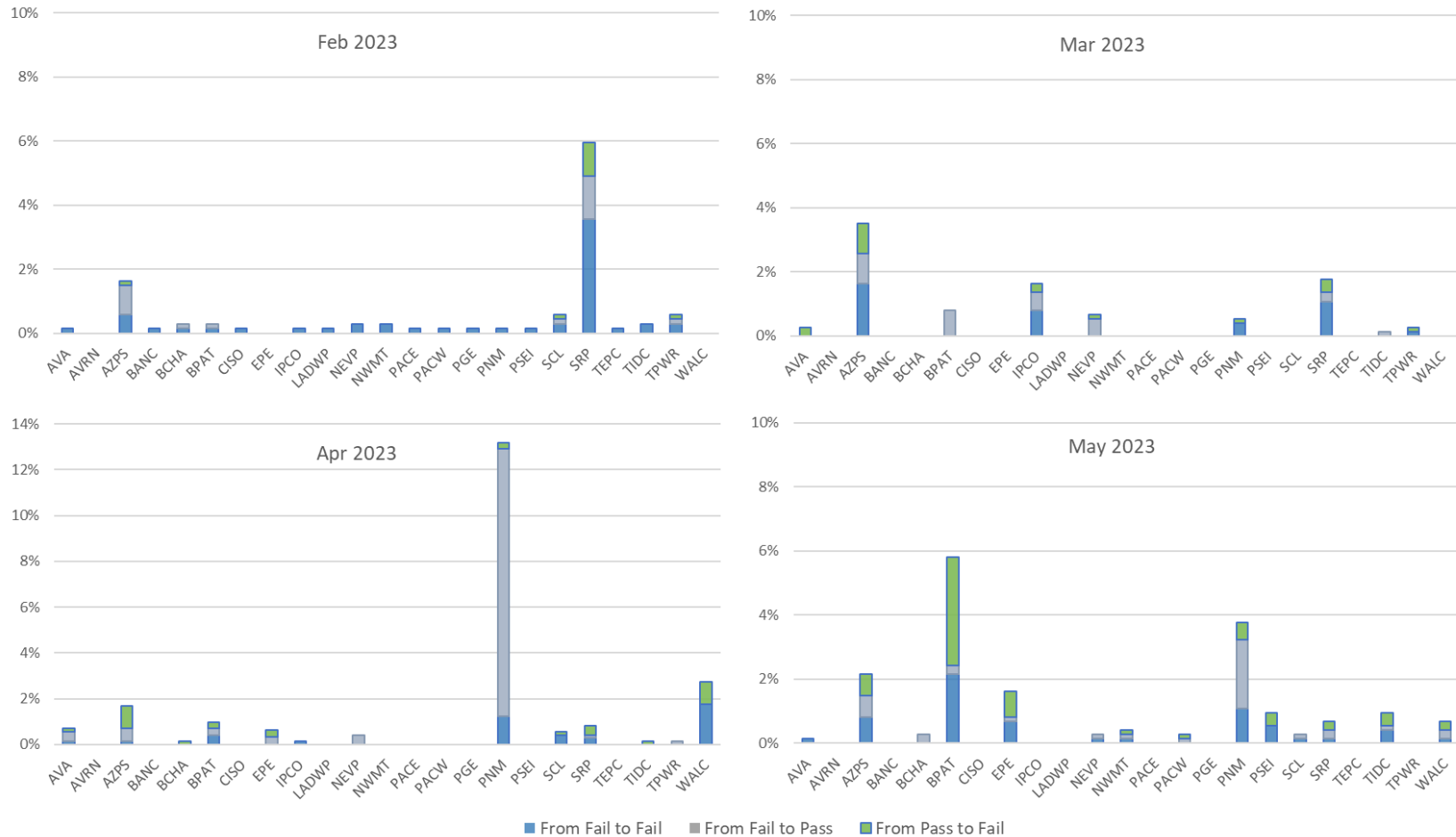
- CAISO continues to assess the performance of FRP enhancement, and has identified areas for more transparency or enhanced logic, including
 - The results of the T-55 test are now used to determine if an entity pass or not the test for consideration in the run of the first interval of the hour in the real-time market. Tariff language has been revised and available at <http://www.caiso.com/Documents/Mar31-2023-Tariff-Amendment-ResourceSufficiencyEvaluationEnhancements-ER23-1534.pdf>
 - Treatment of negative but negligible FRP requirement shadow prices
 - Consideration of energy limits in the FRP procurement for certain energy-limited resources
 - FRP demand curve erroneous calculation

The results of the T-55 test are now binding for first interval of the hour in the real-time market. Upward Flex test



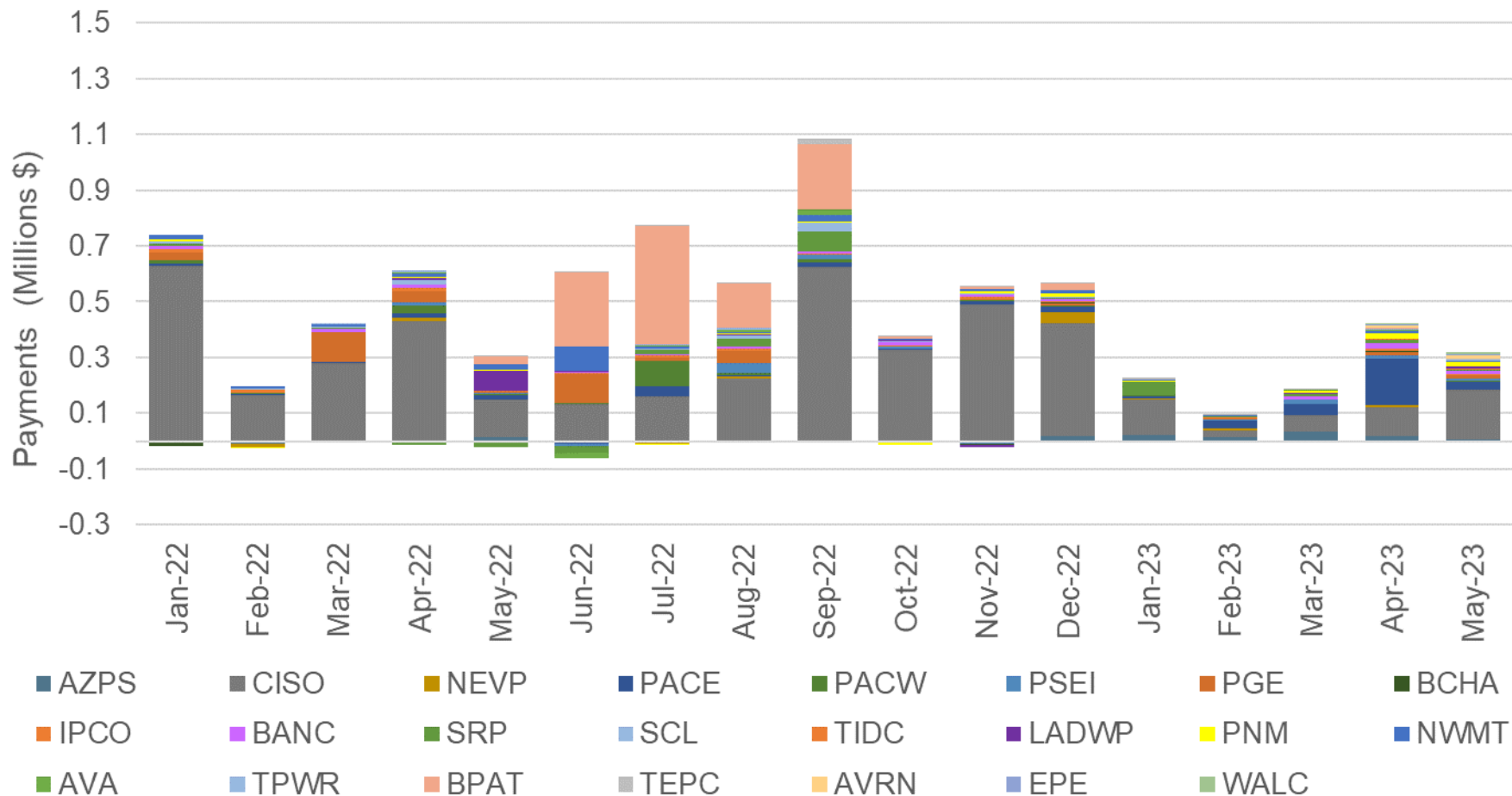
This measures the impact of using T-55 instead of T-40 as the relative change of the test outcome between these two runs

The results of the T-55 test are now binding for first interval of the hour. Downward flex test.

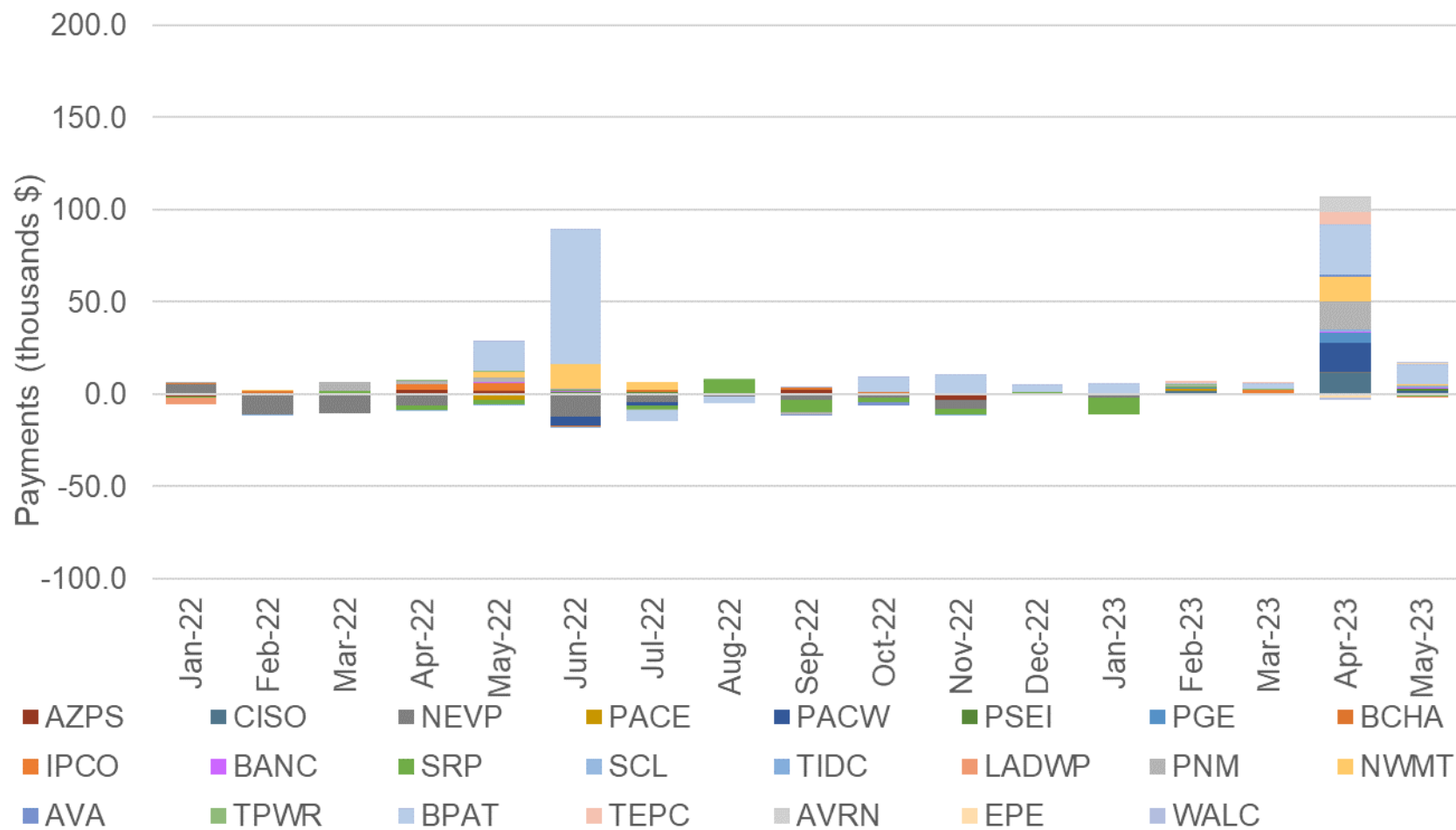


This measures the impact of using T-55 instead of T-40 as the relative change of the test determination between these two runs

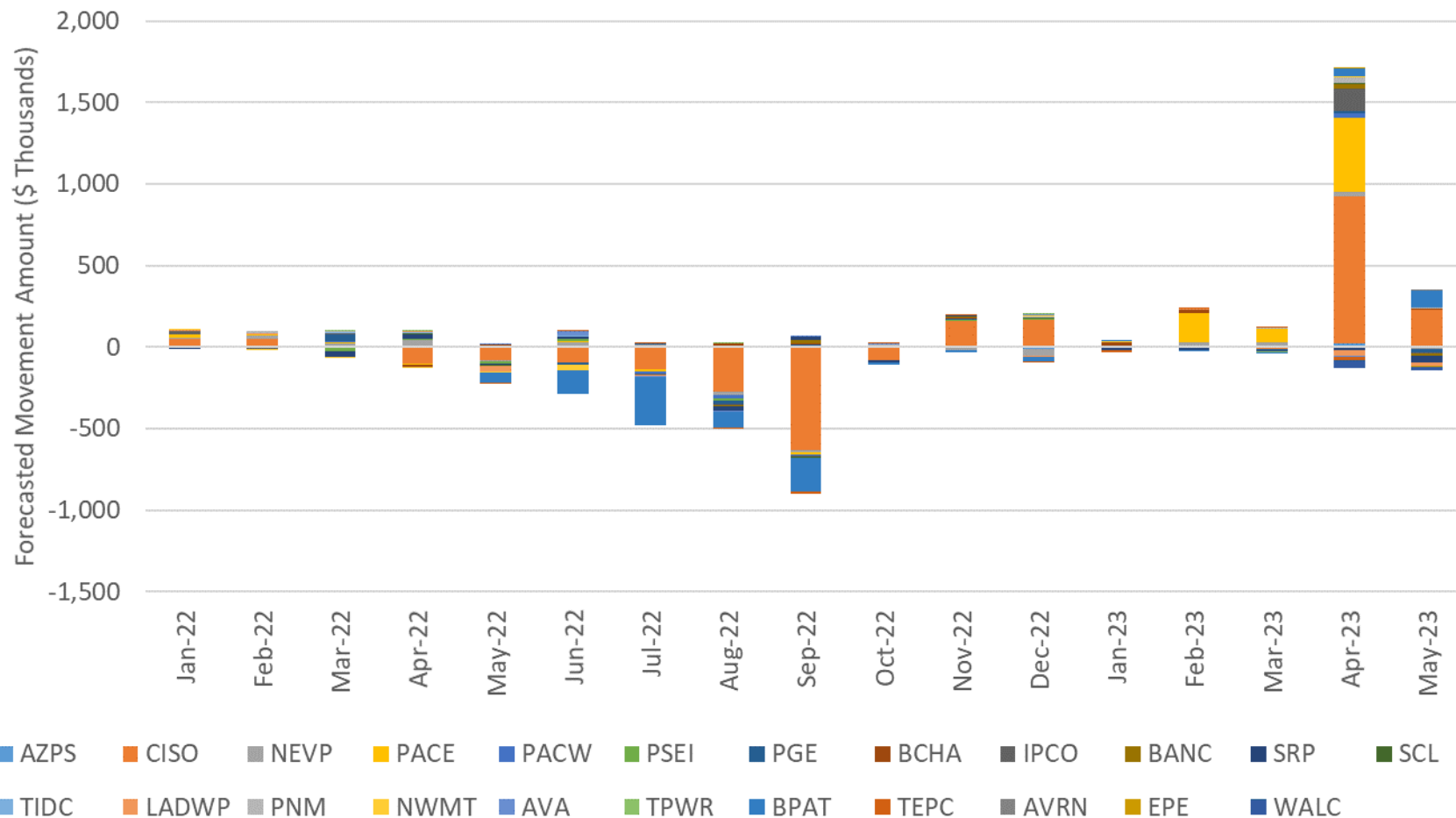
FRP Uncertainty Up Settlement Amount



FRP Uncertainty down settlement amount

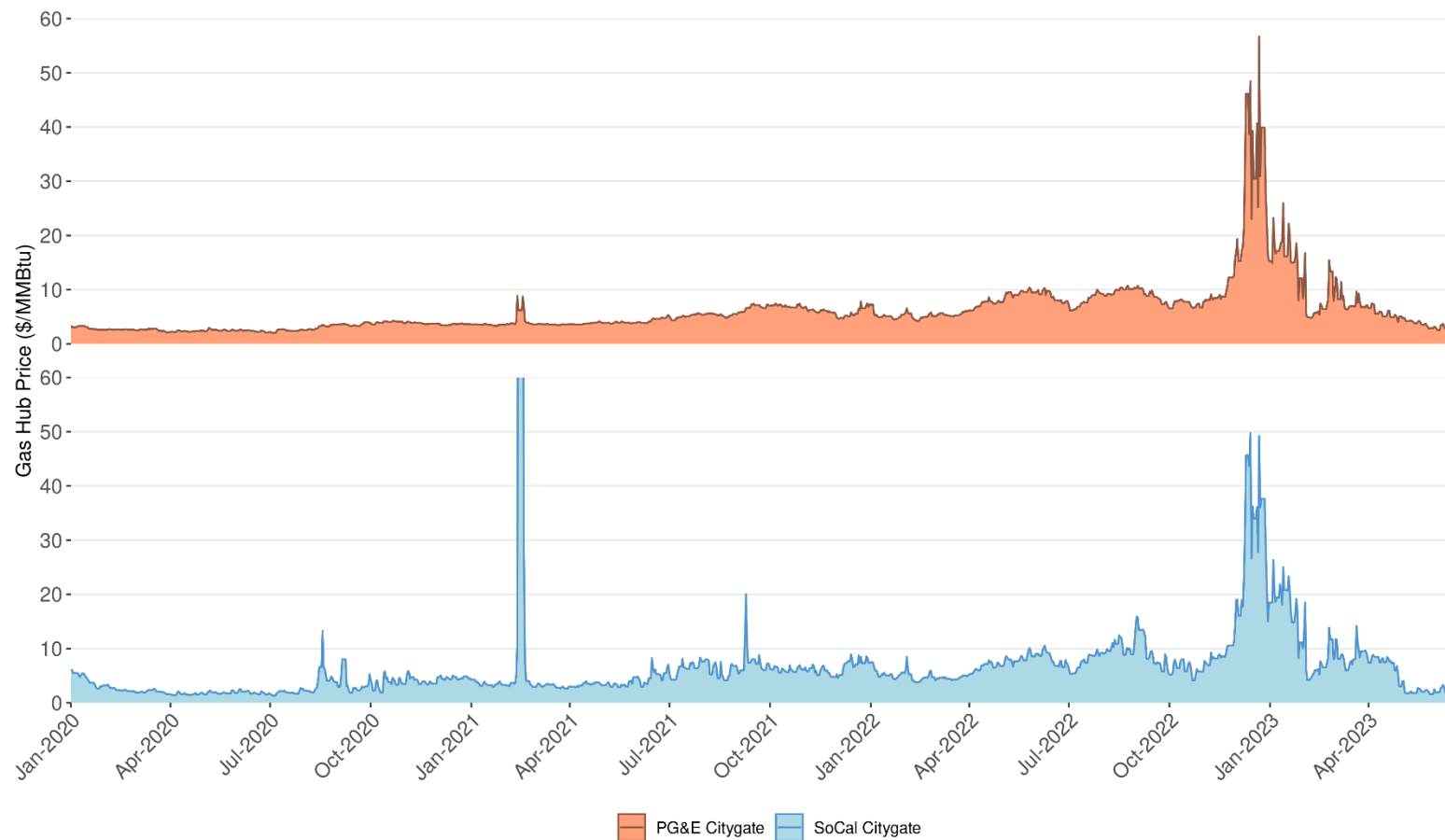


Forecasted Movement settlements by BAA

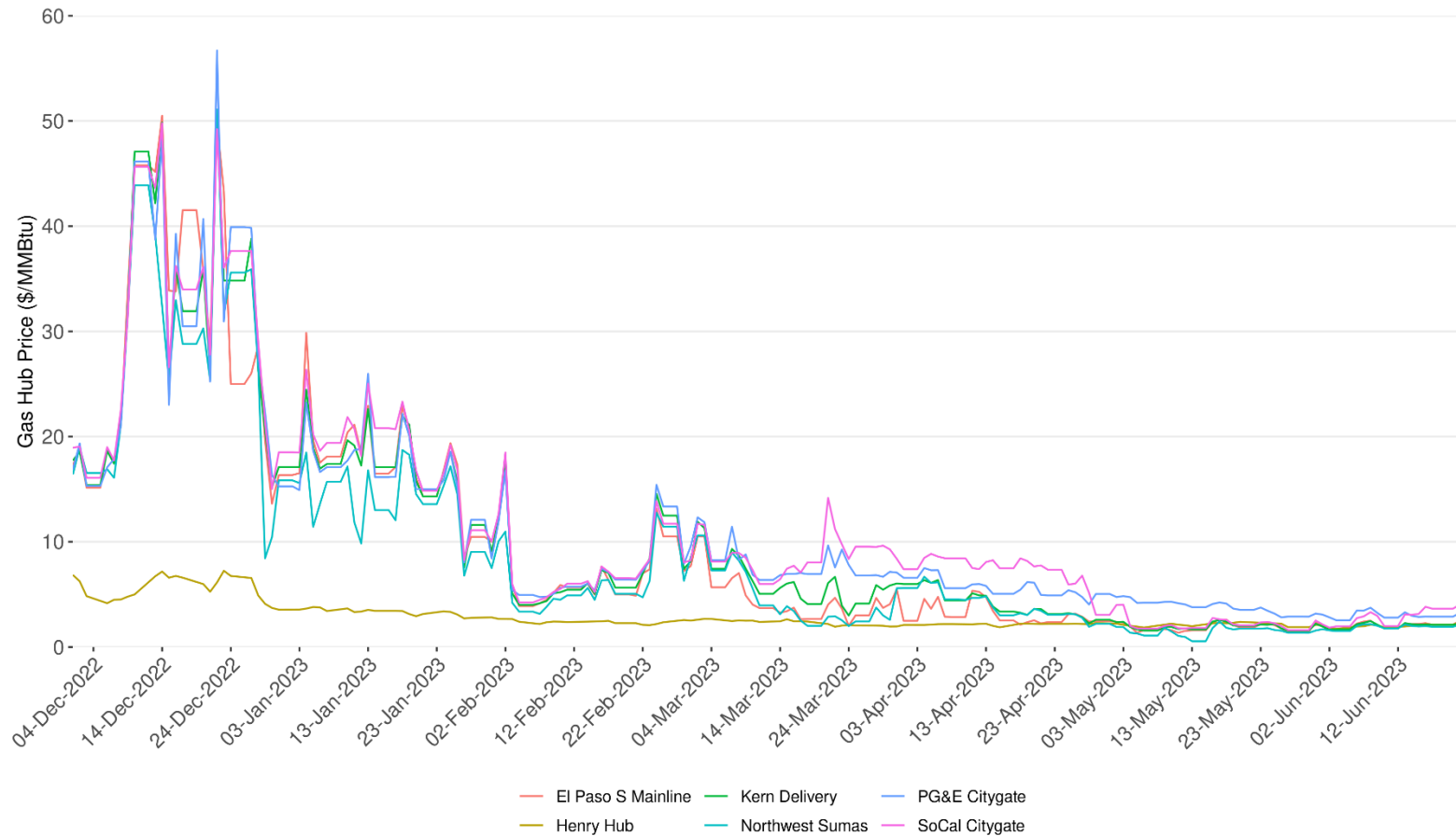


Gas Conditions and CAISO's market costs in 2023

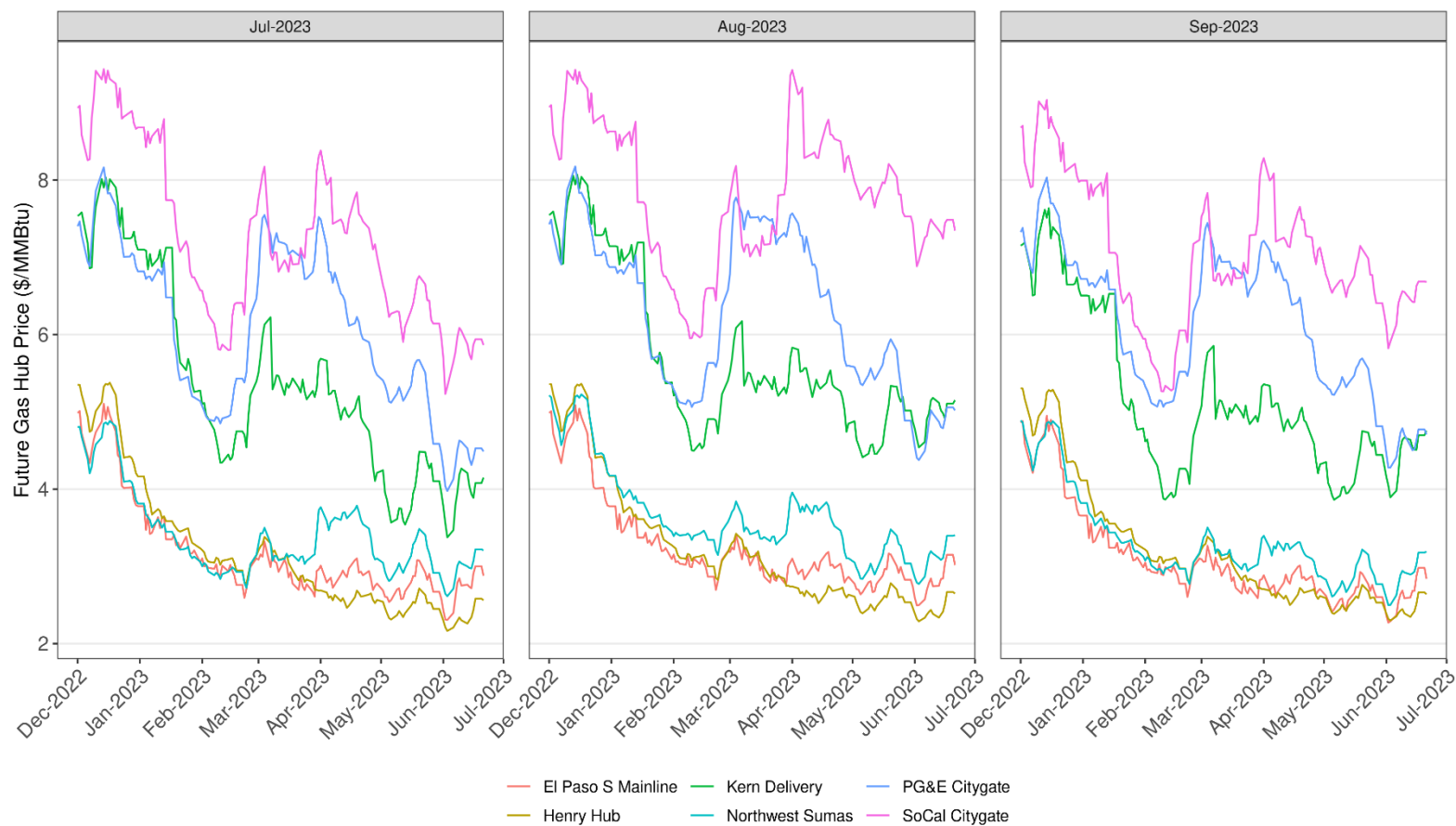
California next-day gas prices trend lower following December 2022 price volatility



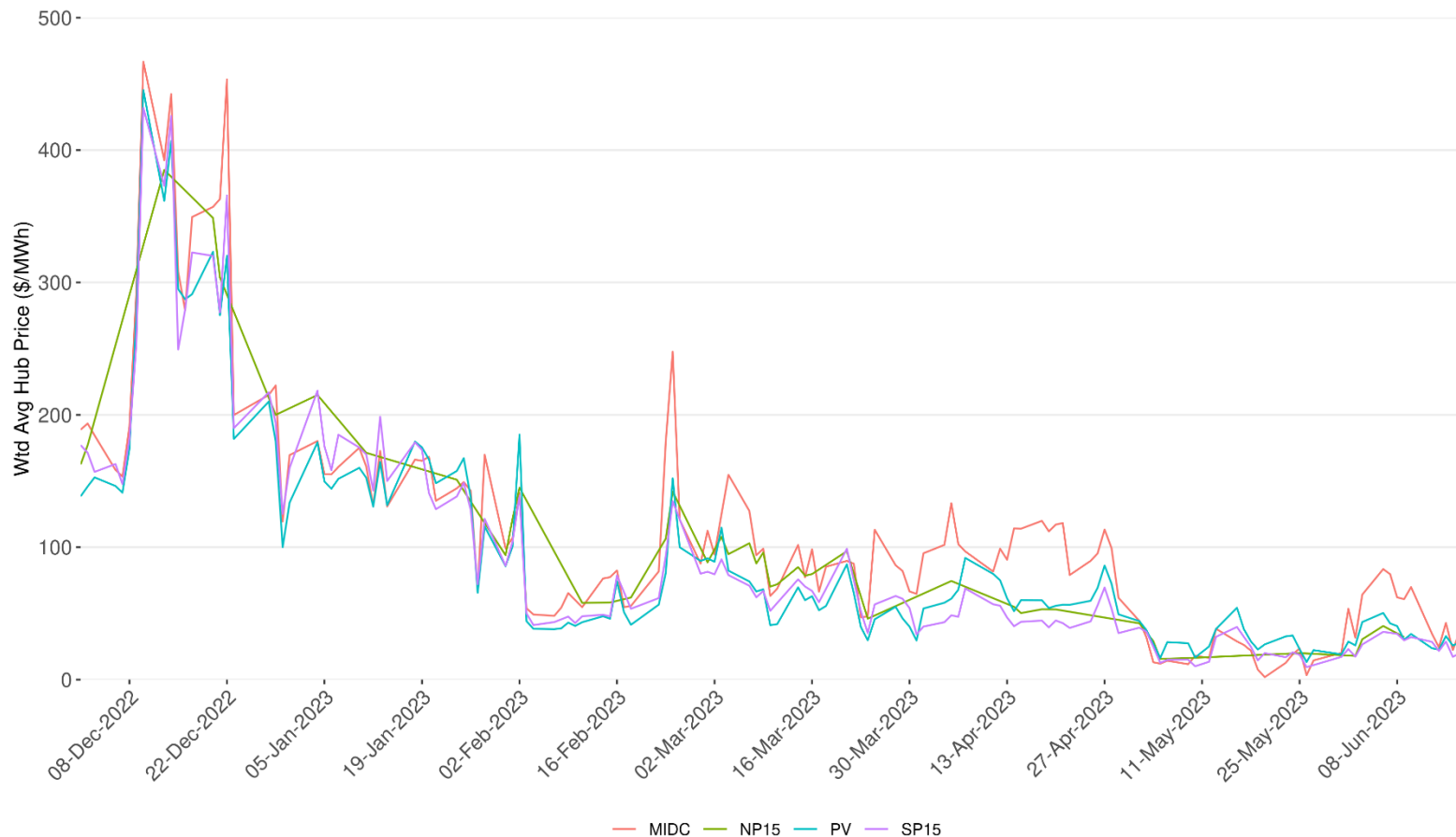
Western next-day gas prices generally trend lower since January 2023; some prices reaching Henry Hub levels



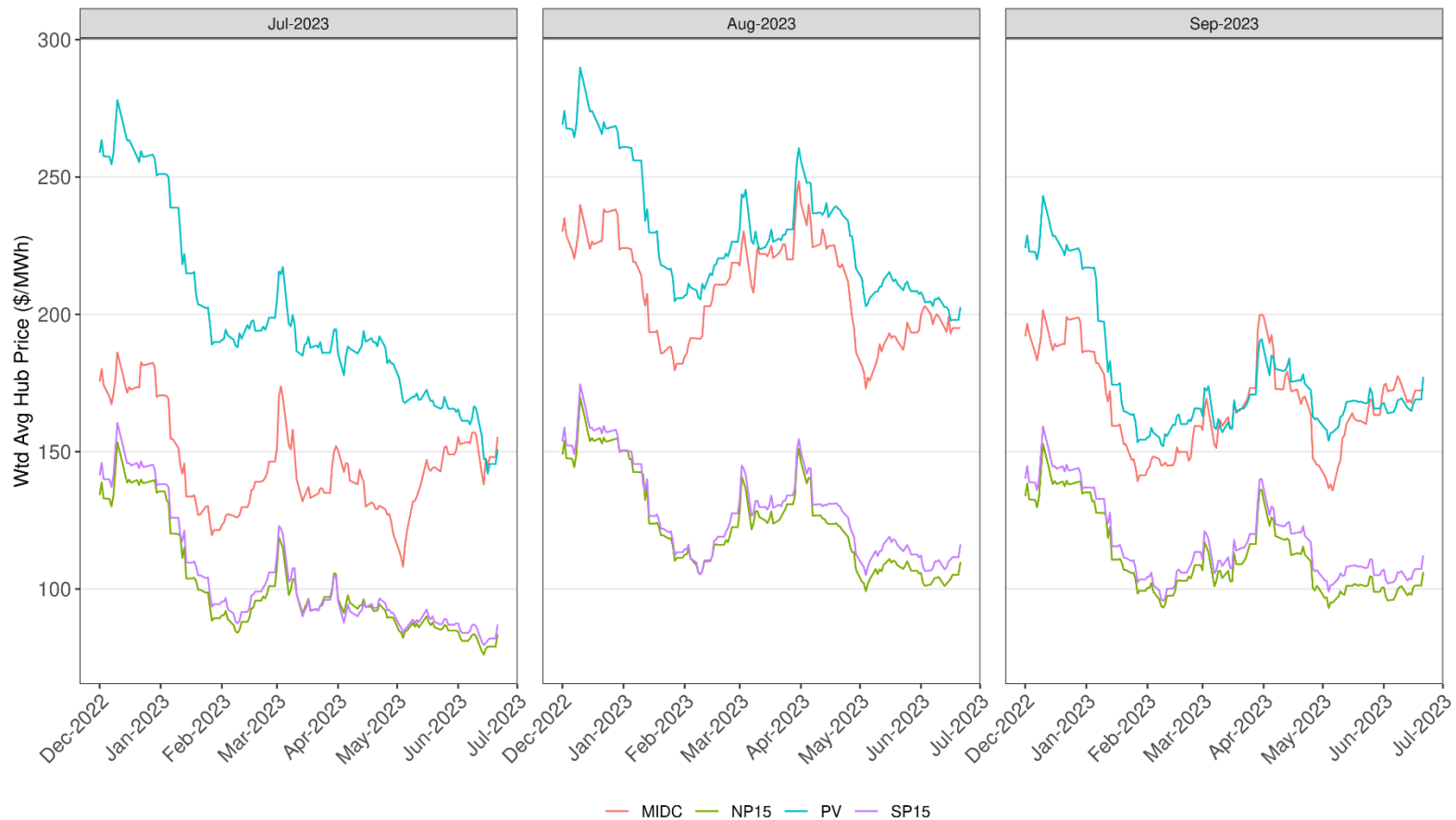
Future gas prices for summer 2023 rose in March/April but have trended lower in recent trading dates



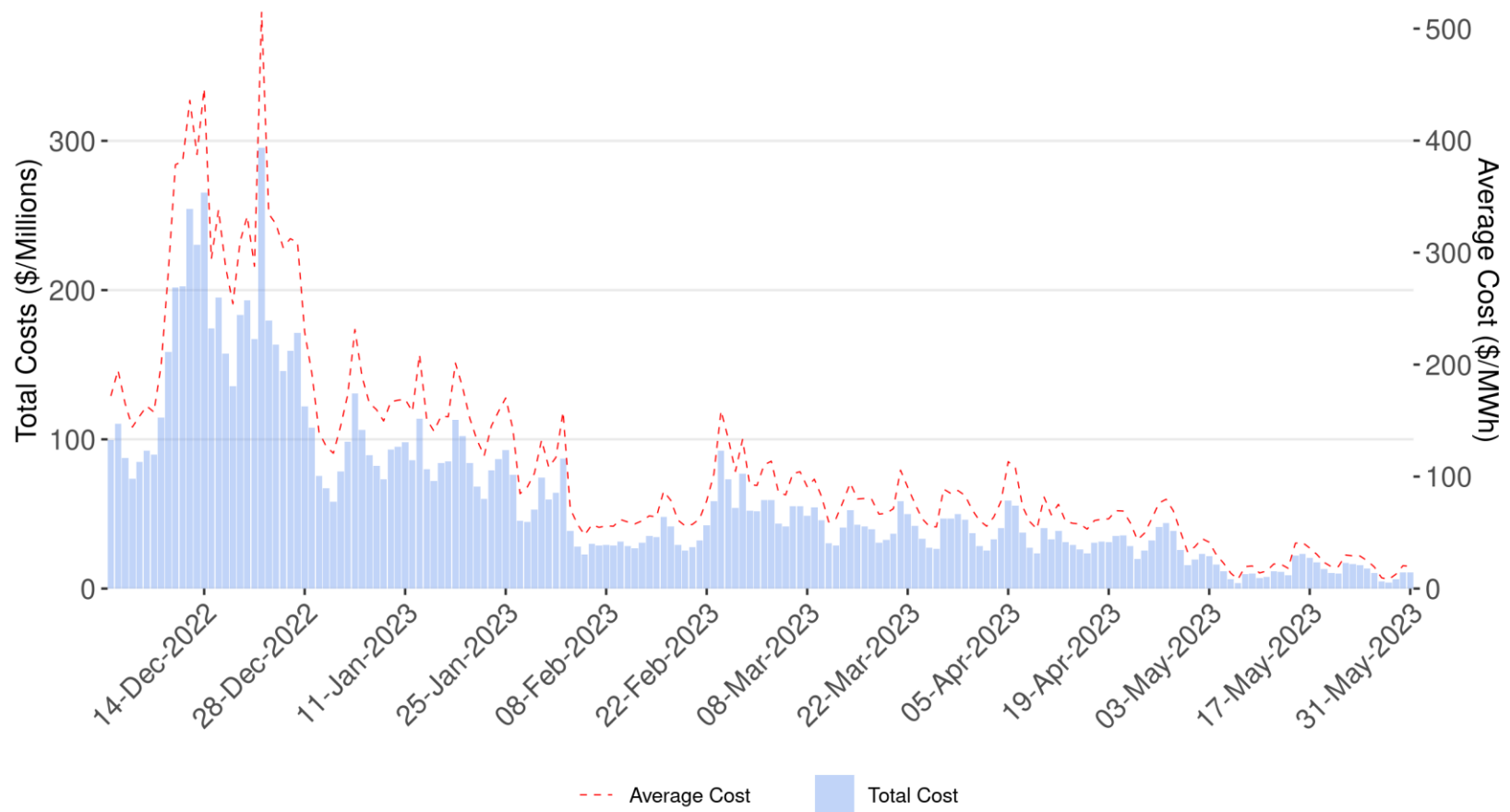
Next-day peak bilateral power prices follow similar downward trends since December 2022; Mid-C prices see some higher prices



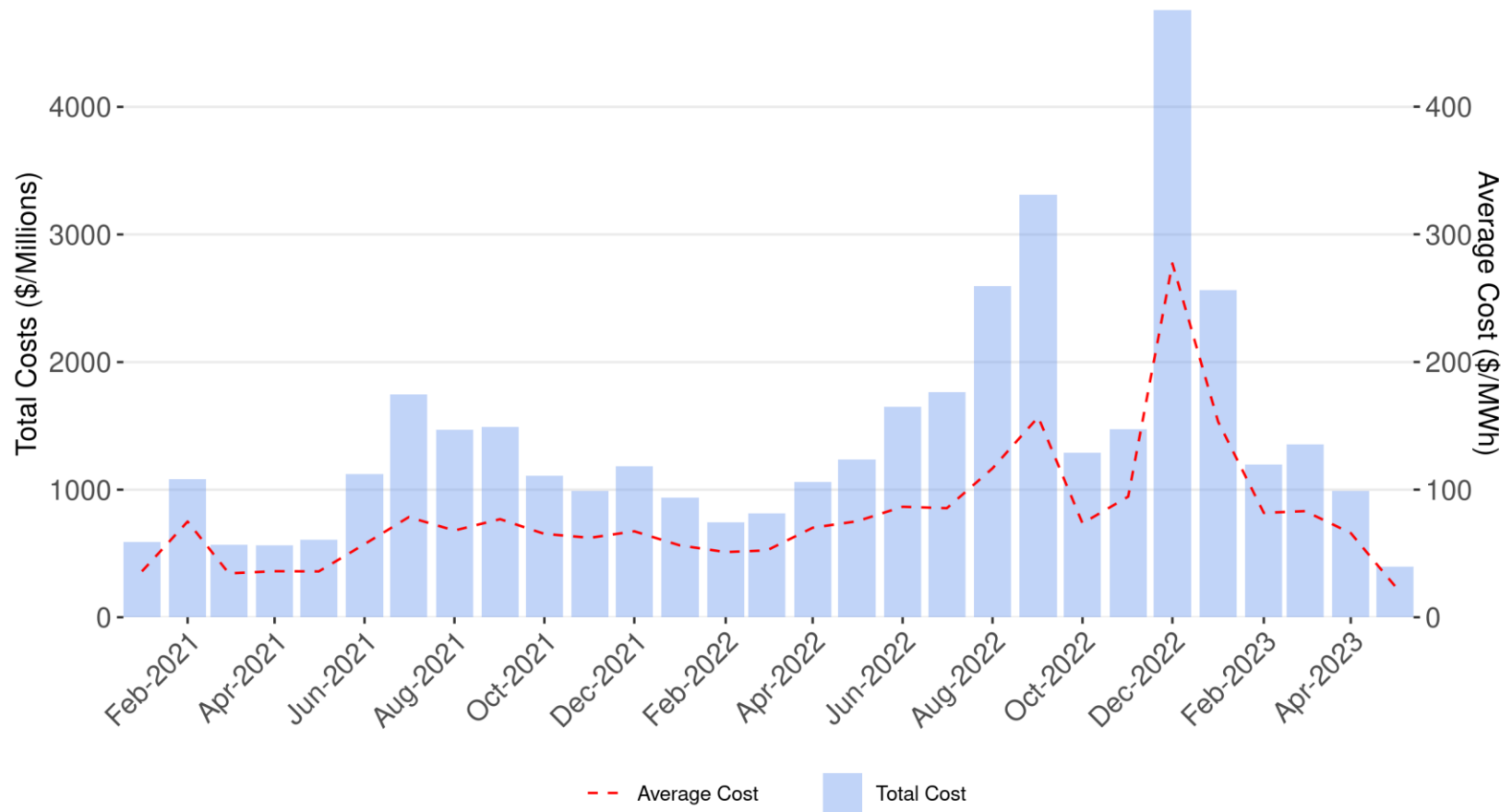
Future bilateral power prices follow similar seasonal trends with some uptick in recent trading



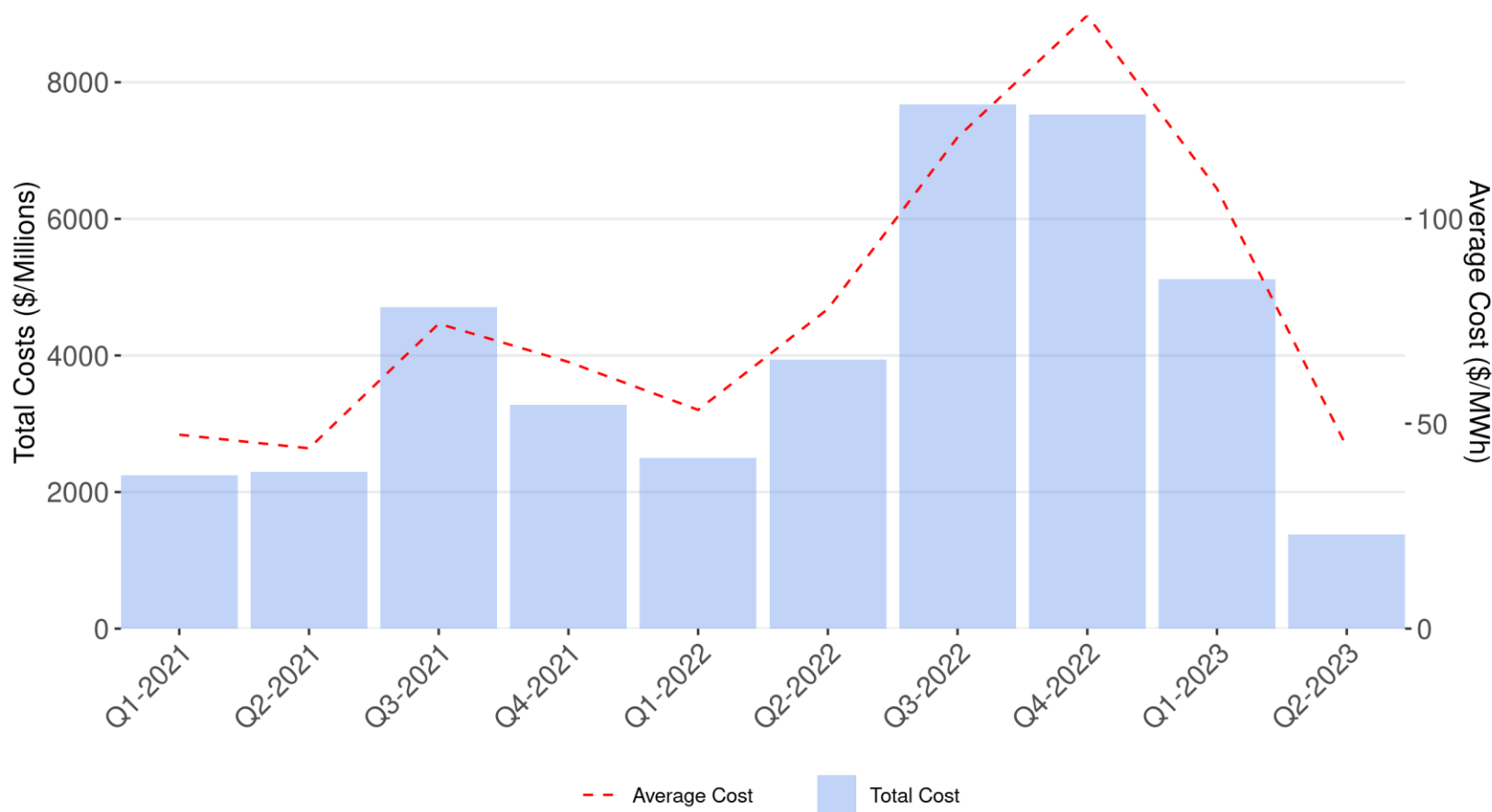
Daily market costs trend lower throughout the first half of the year, down from higher levels in December 2022/January 2023



Monthly totals reflect a similar downward trend since December 2022/January 2023

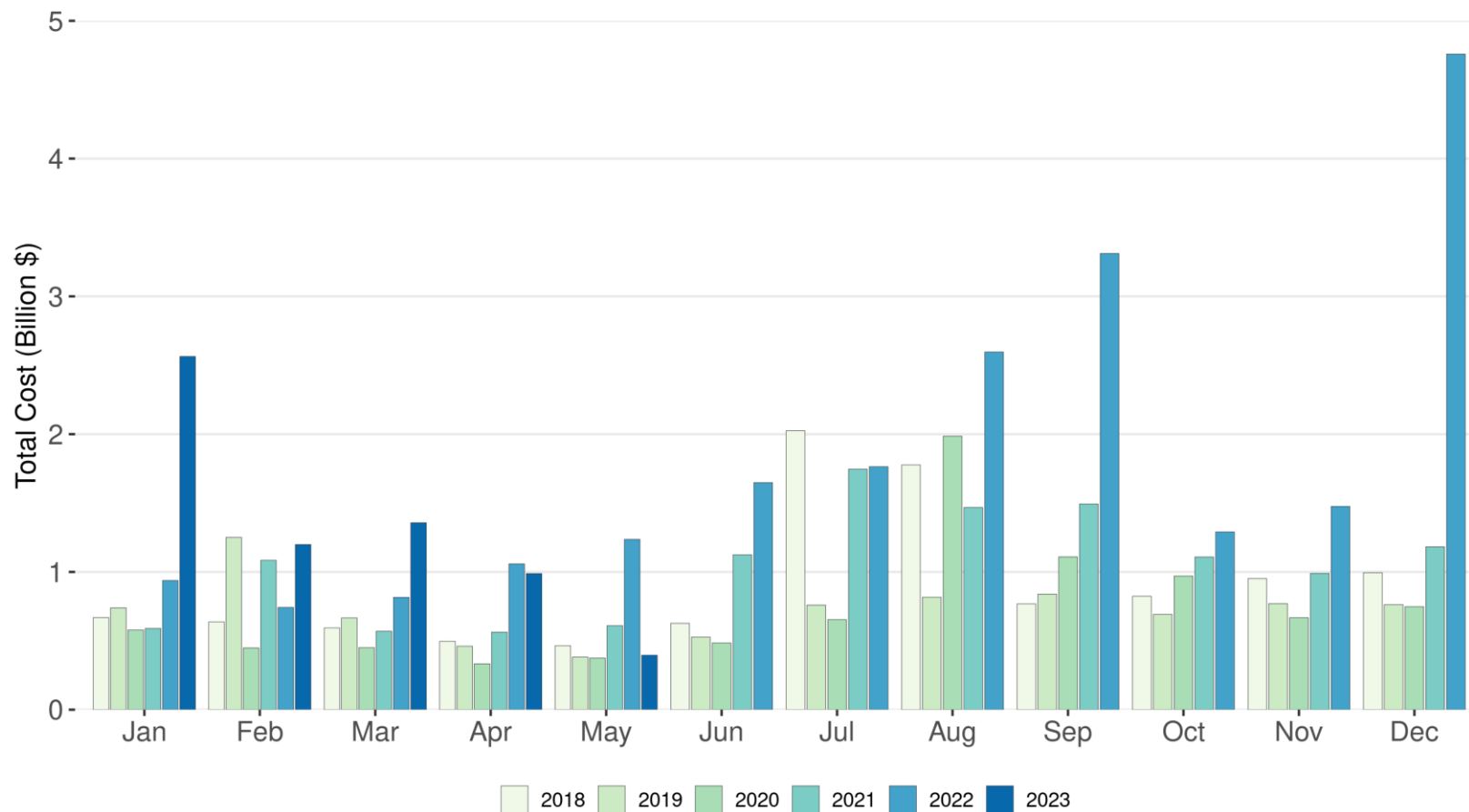


Q1 2023 total costs are \$2.6B higher than Q1 2022 total costs, primarily due to January 2023 higher costs



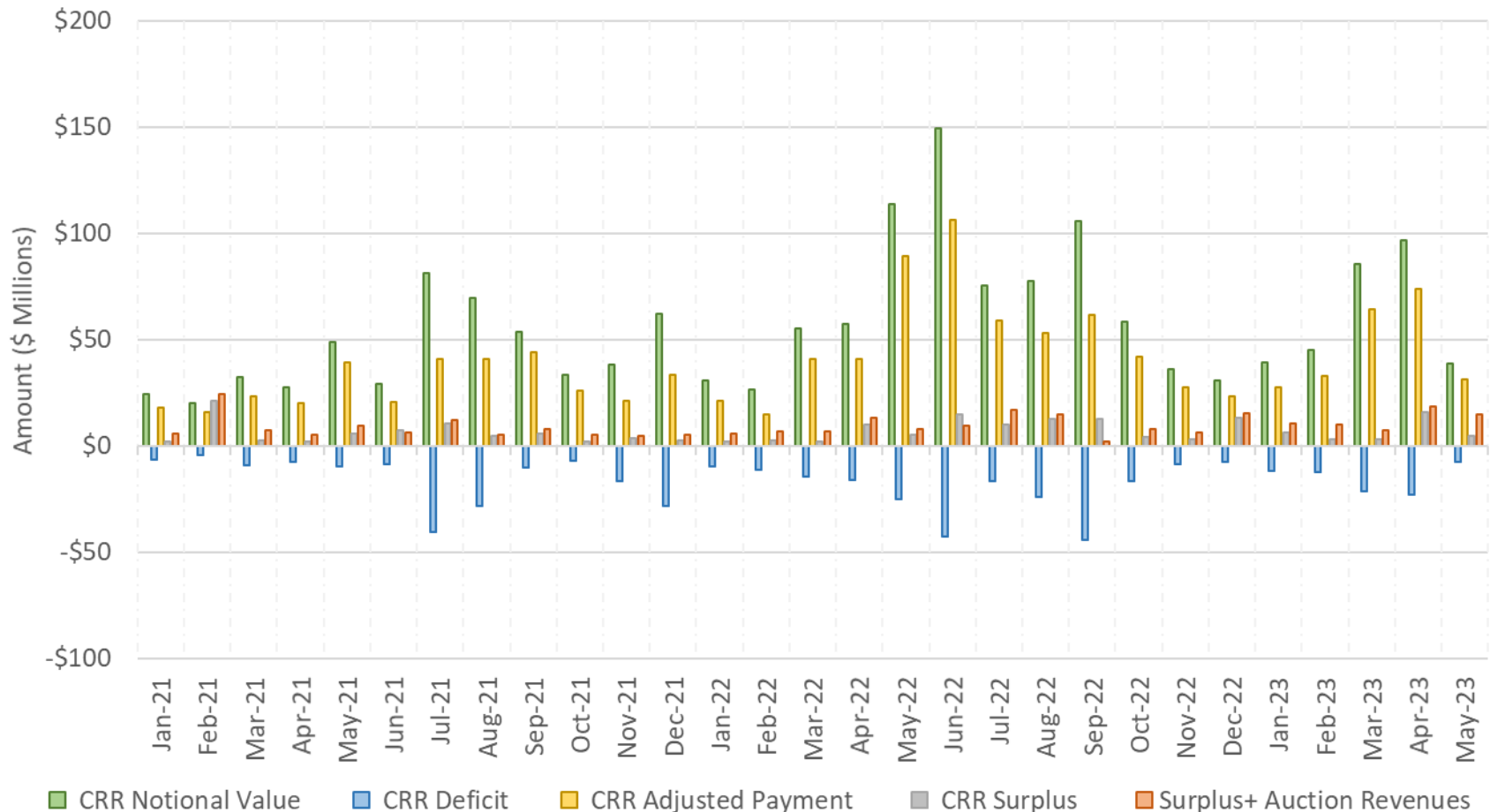
Note: Q2 2023 includes data for April and May only

Monthly totals for January 2023 were highest since 2018; subsequent months in 2023 are more closely aligned with historical monthly totals

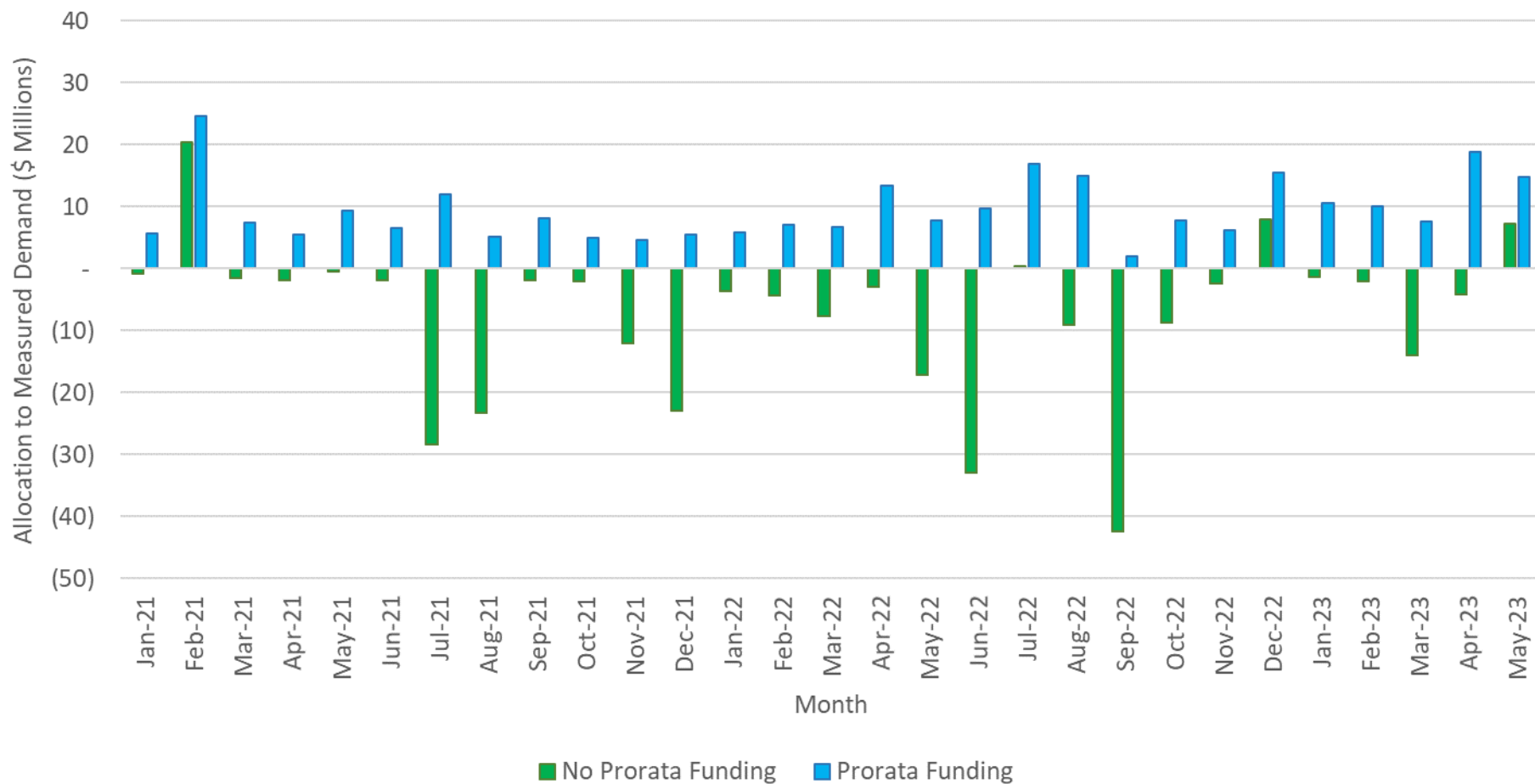


CRR Update

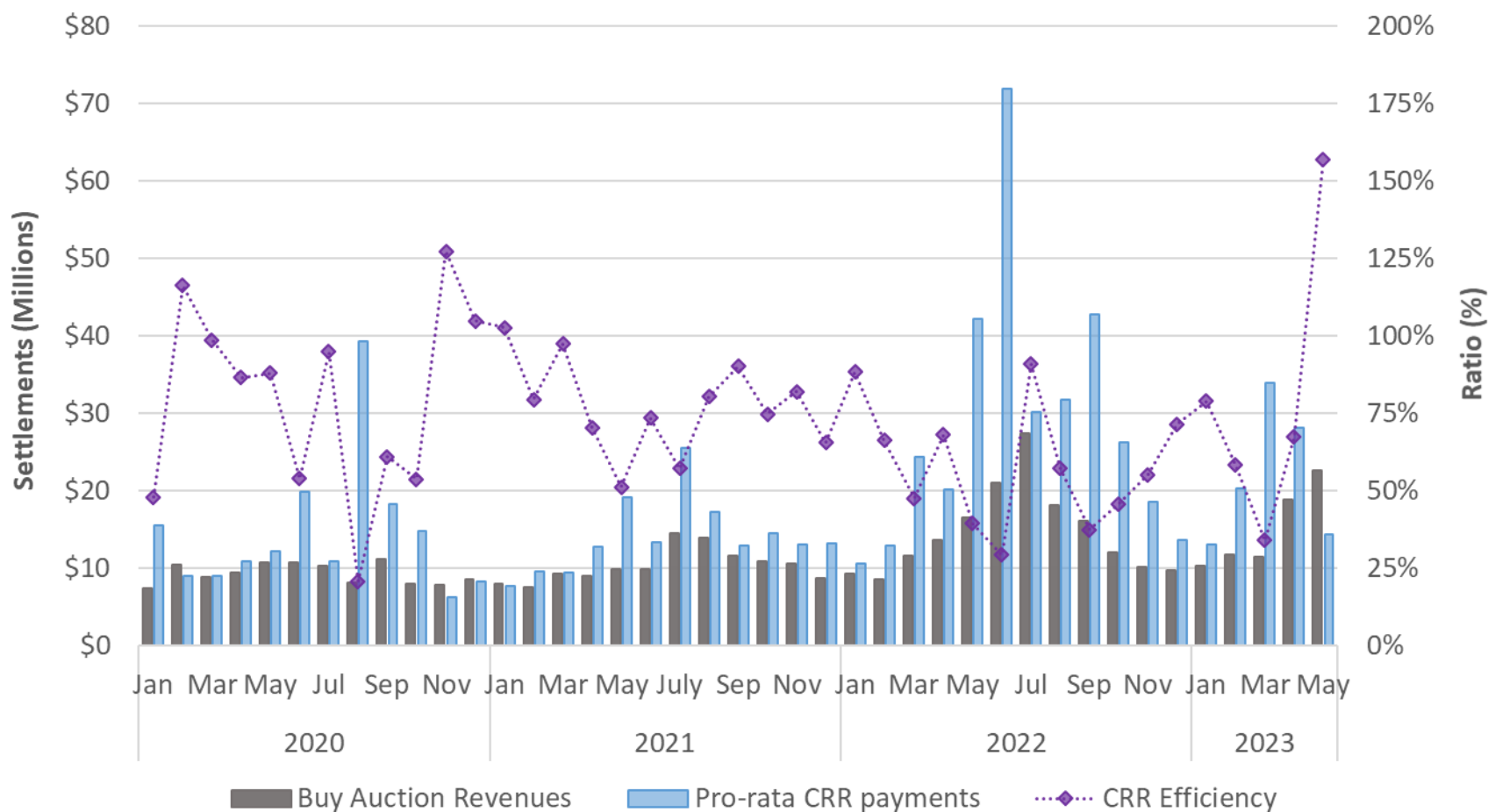
The magnitude of the overall CRR settlements has decreased after summer



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

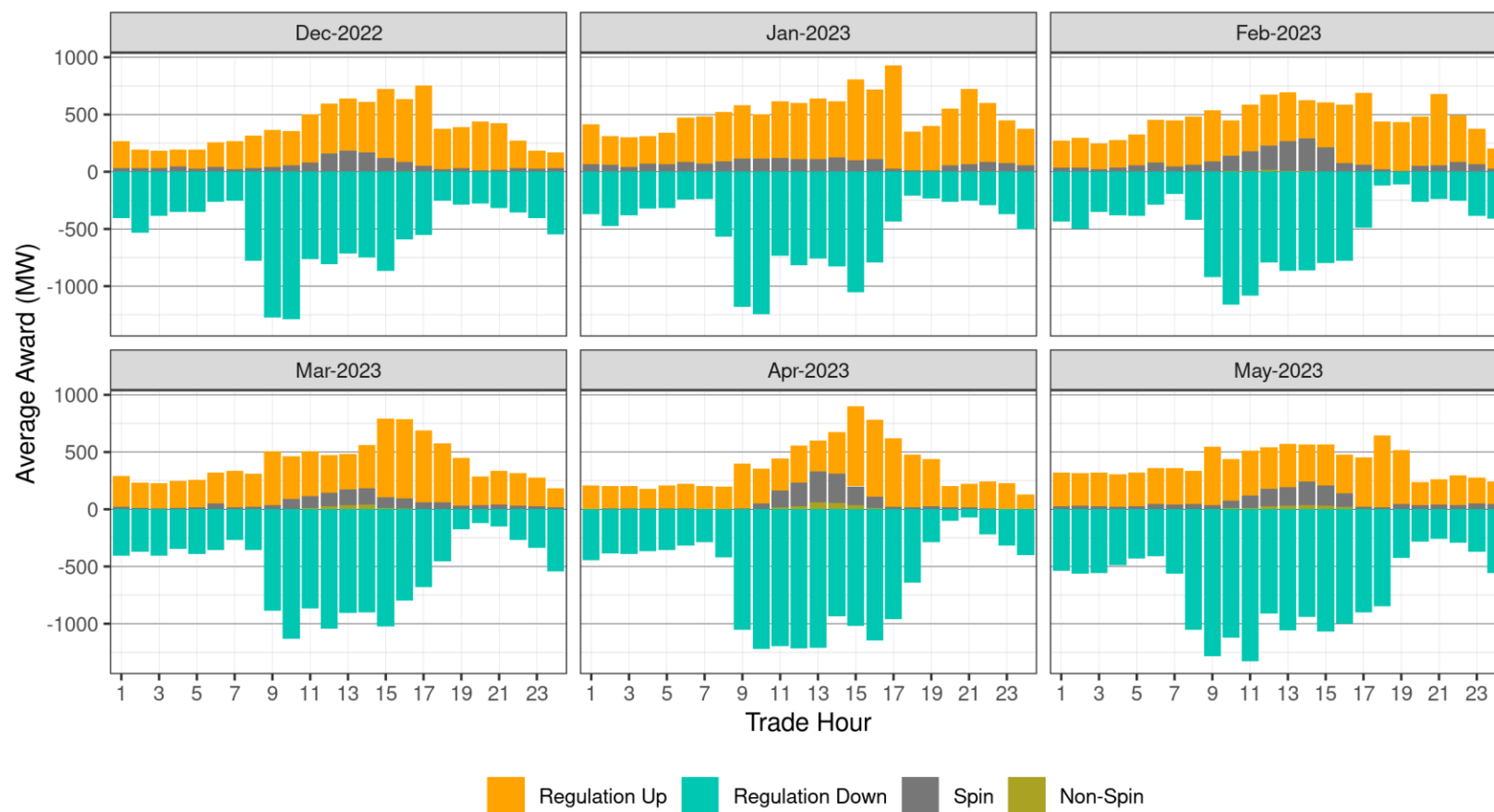


Auction efficiency improved in recent months as congestion decreased

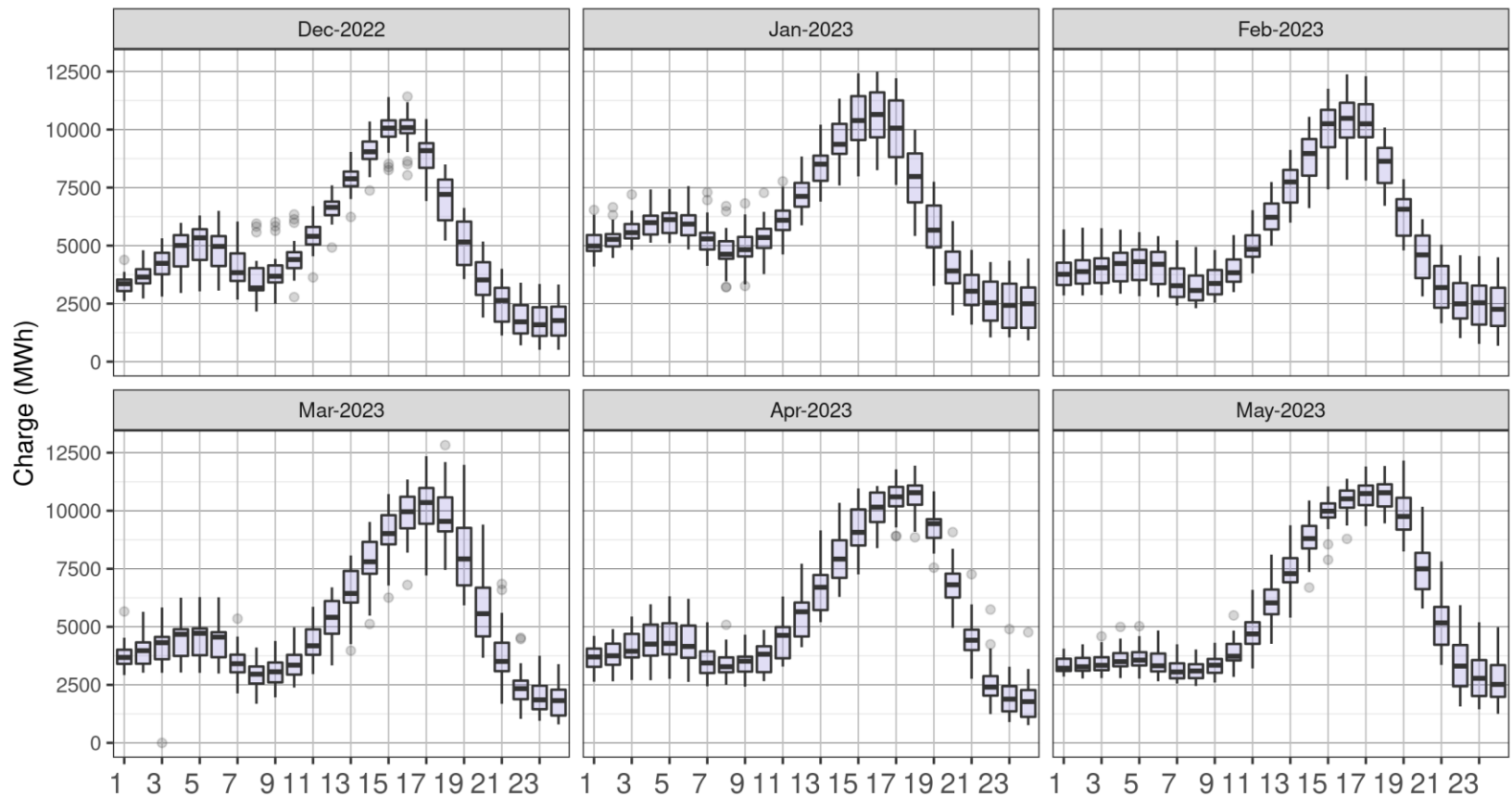


Batteries

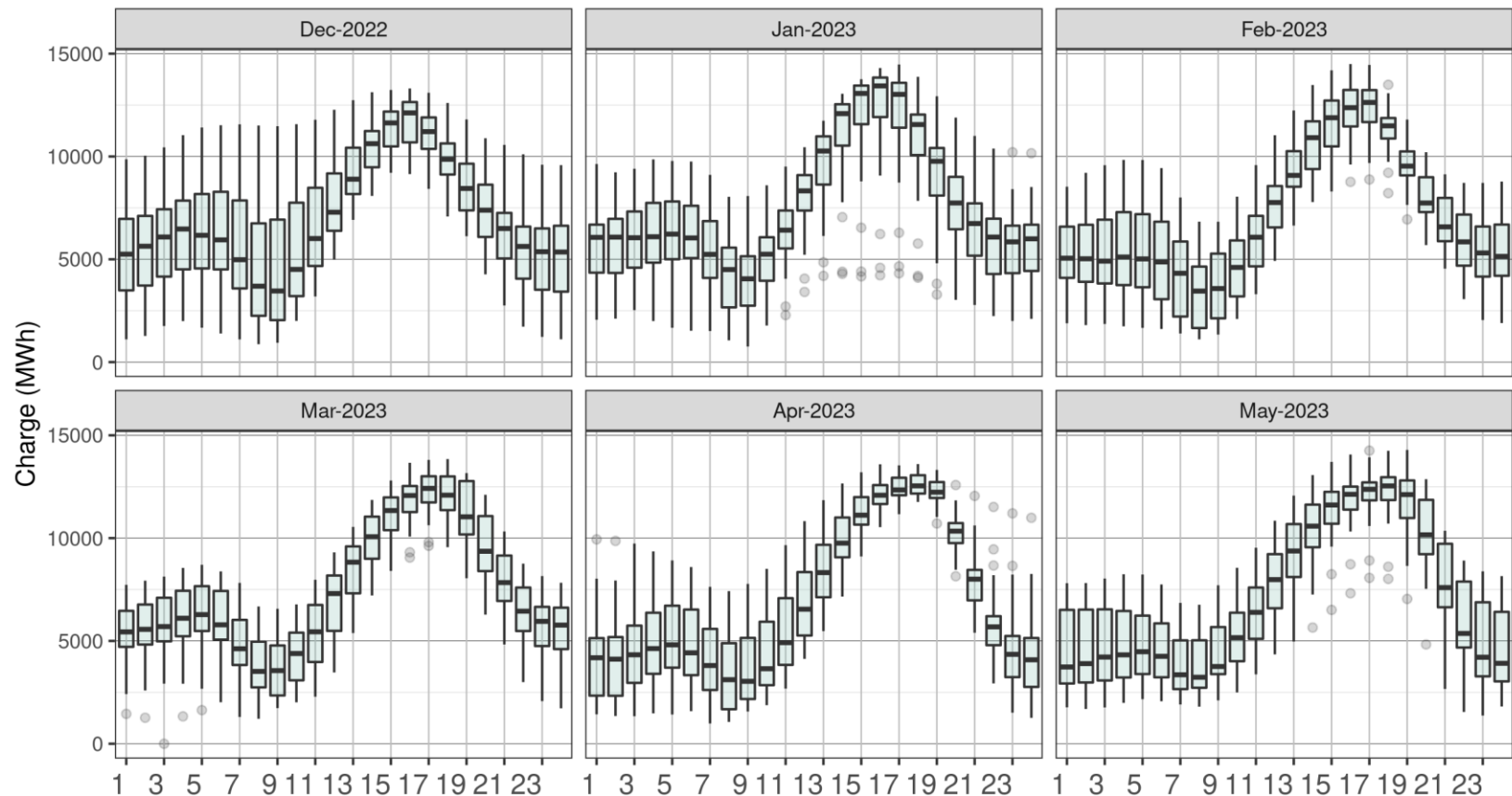
Batteries continue to provide a significant share of both Regulation up and Regulation down



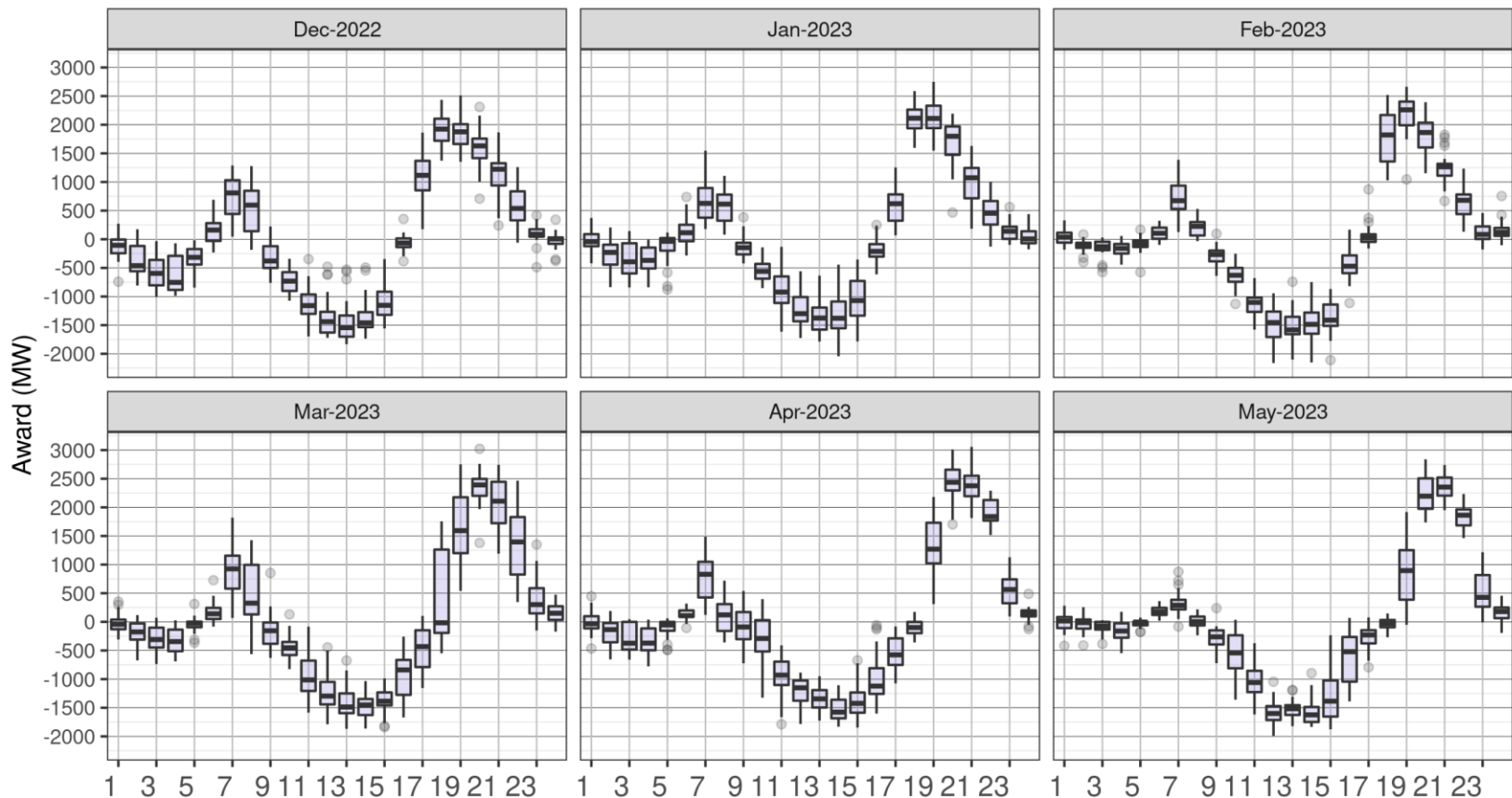
Day-Ahead state of charge for storage resources was the highest in hour ending 14 through 17



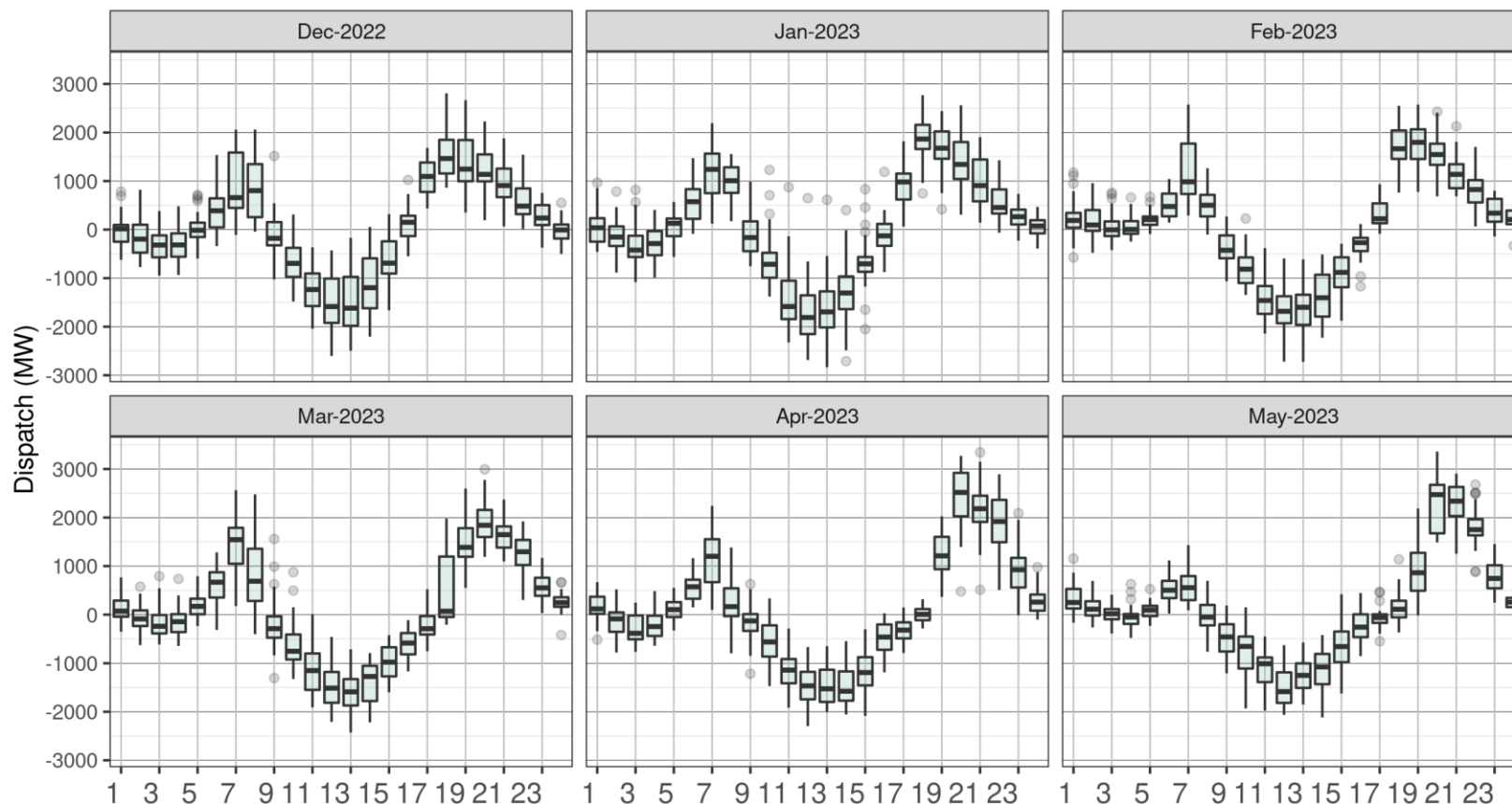
Real-Time State of charge for storage resources was in line with the day-ahead state of charge



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

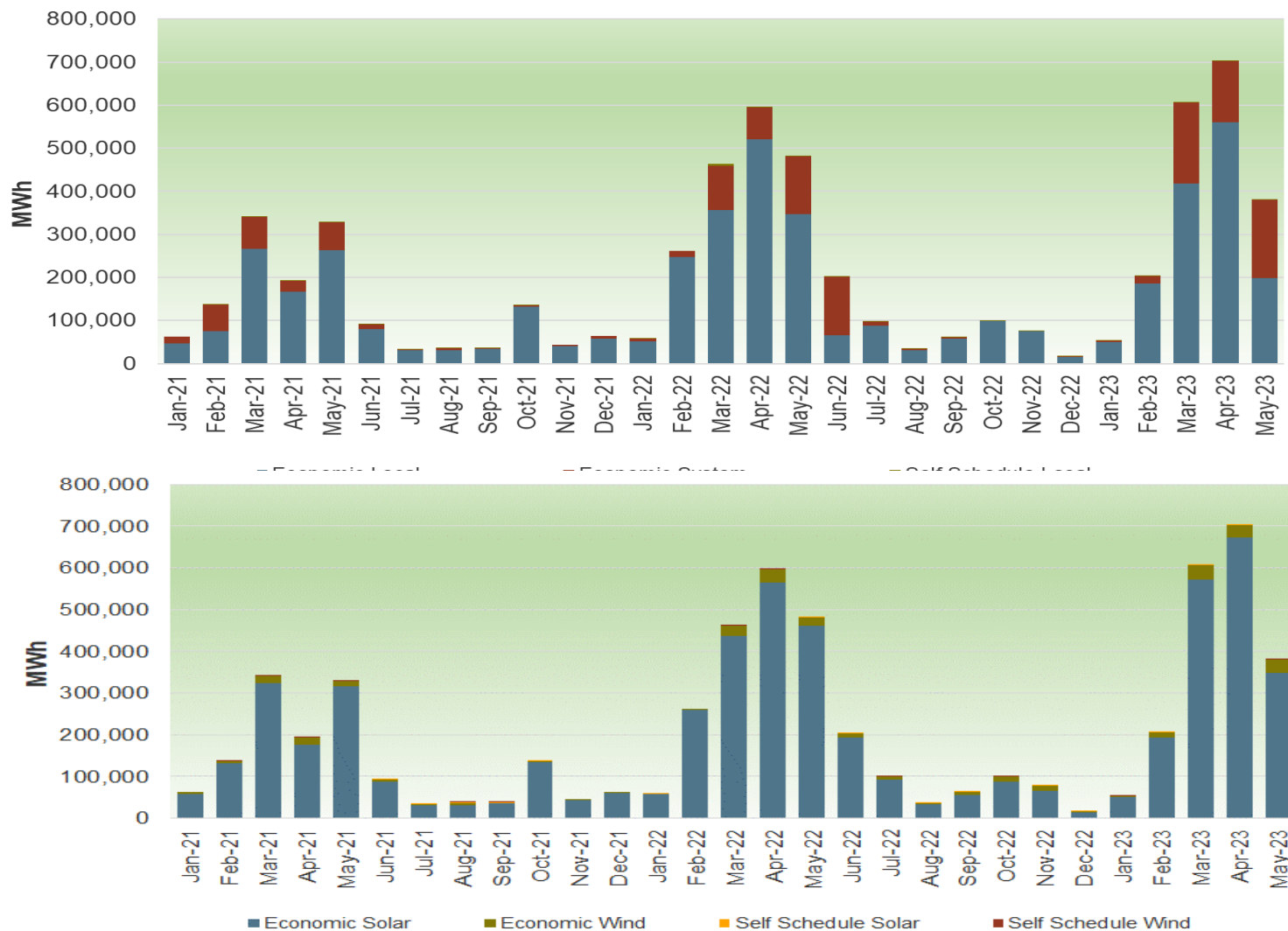


Storage resources were consistently charging during solar hours and discharging during net load peaks

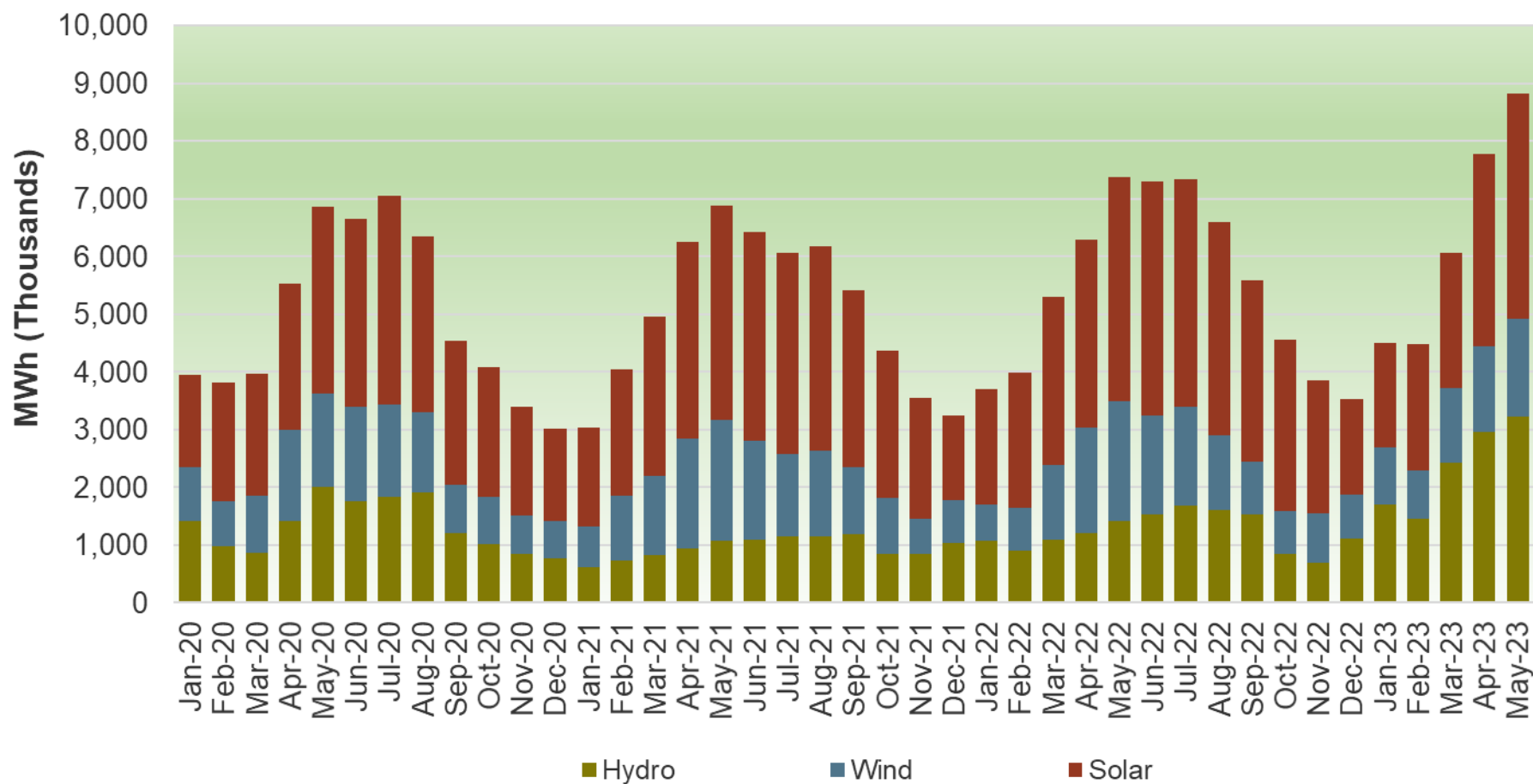


Market Performance Metrics

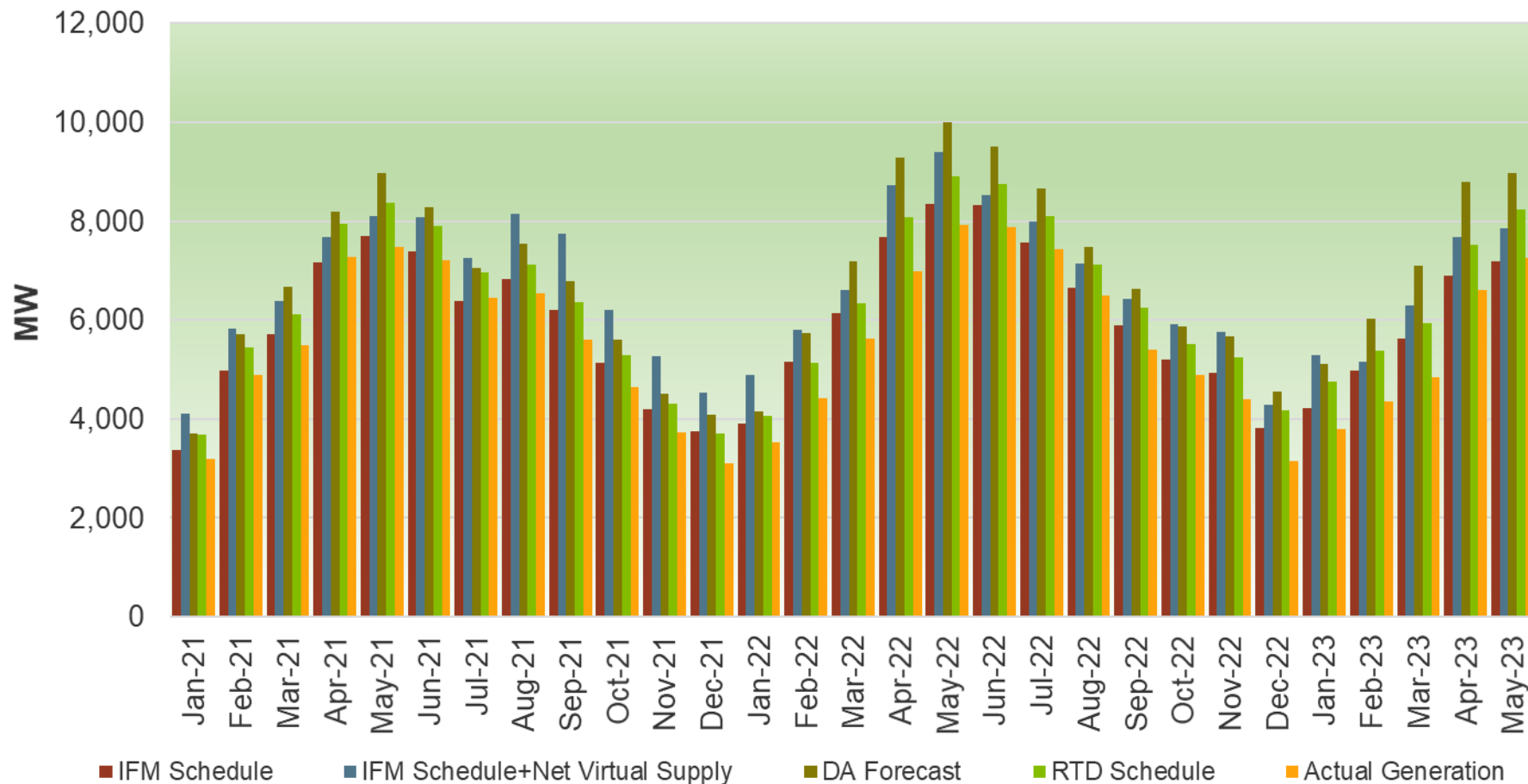
RTD renewable (VERs) curtailment increased in February following seasonal patterns



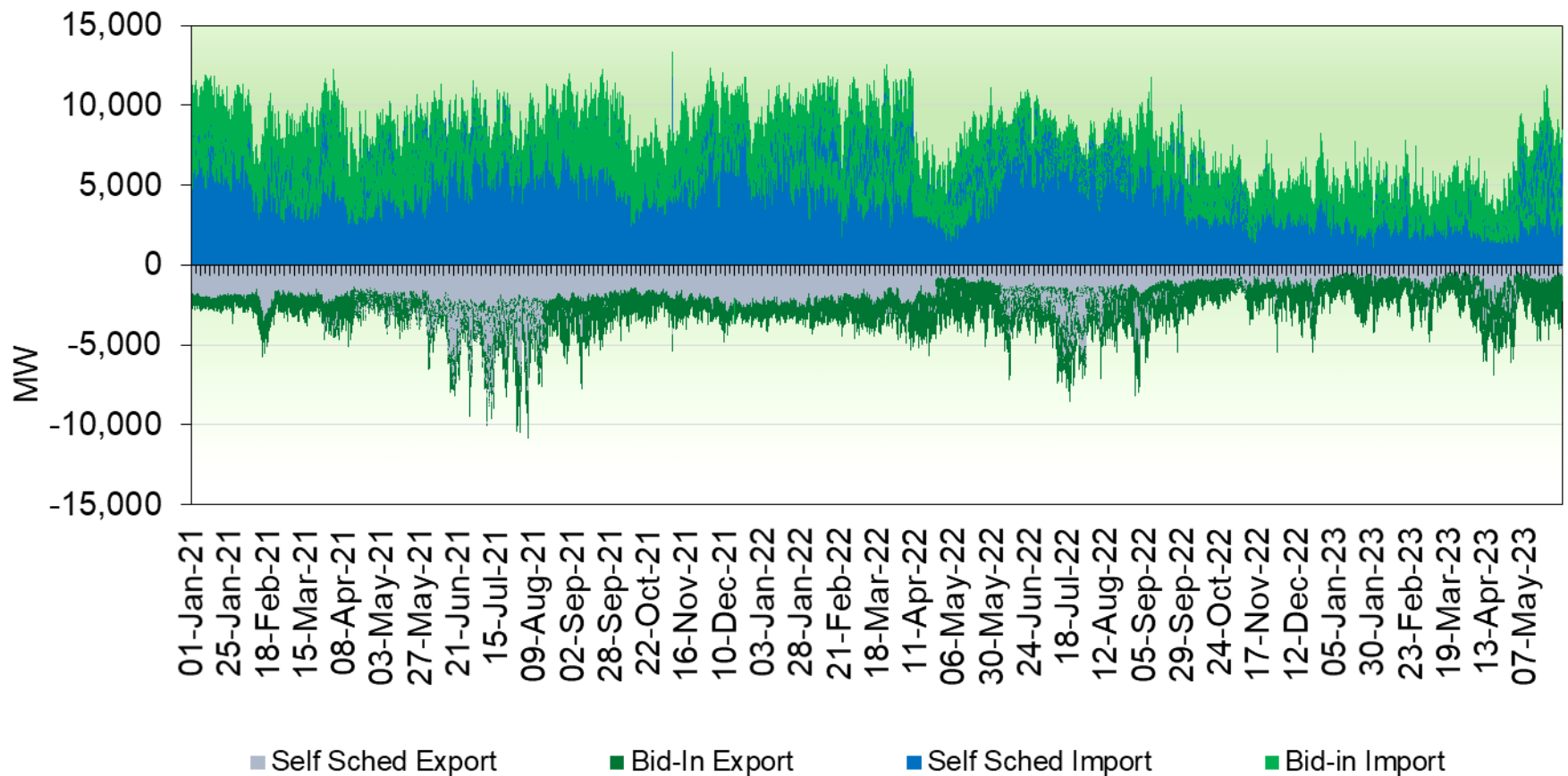
Hydro production fairly higher compared to previous years



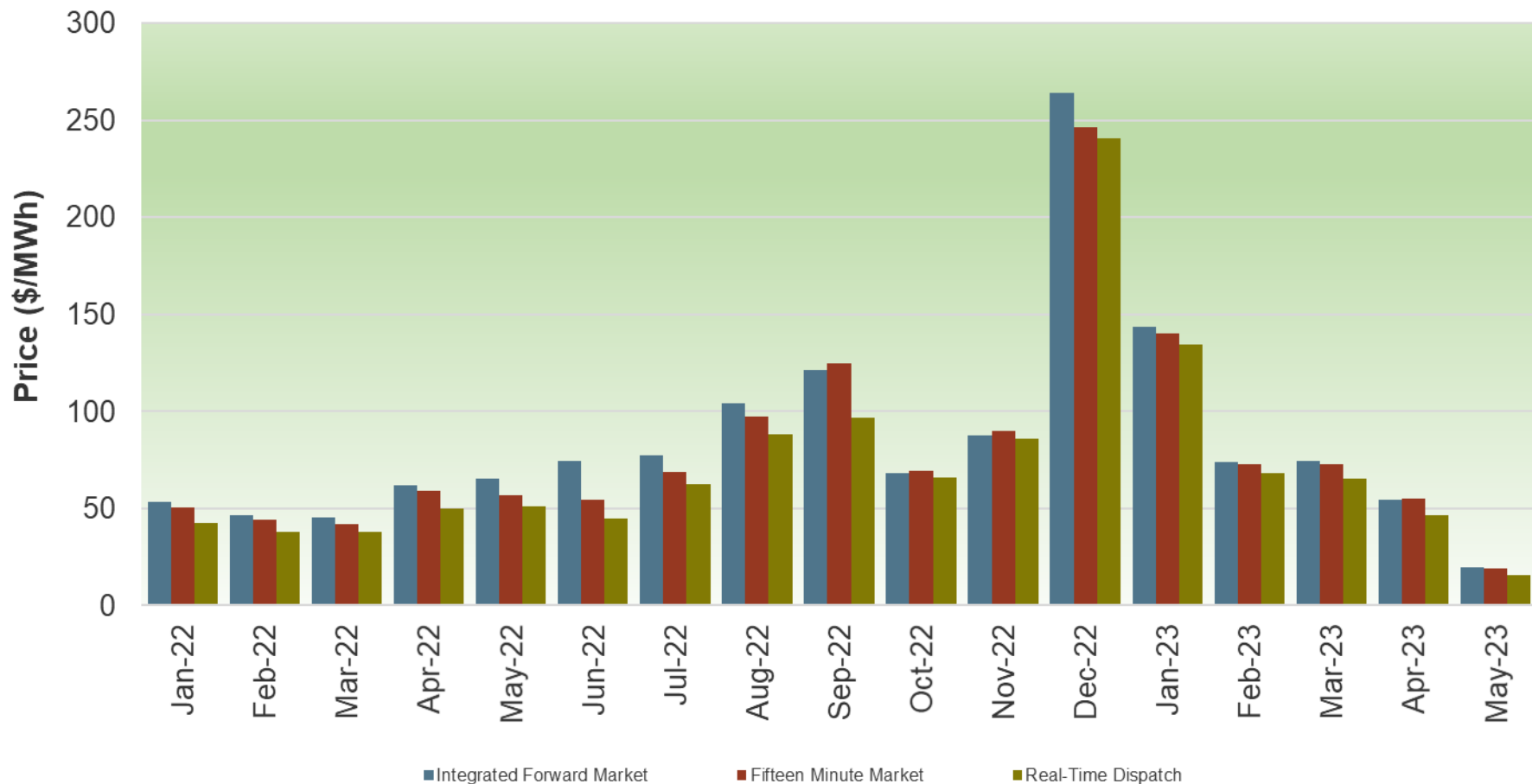
ISO total monthly VERS schedules and forecasts compared to actuals



Self scheduled exports trended downward since last September

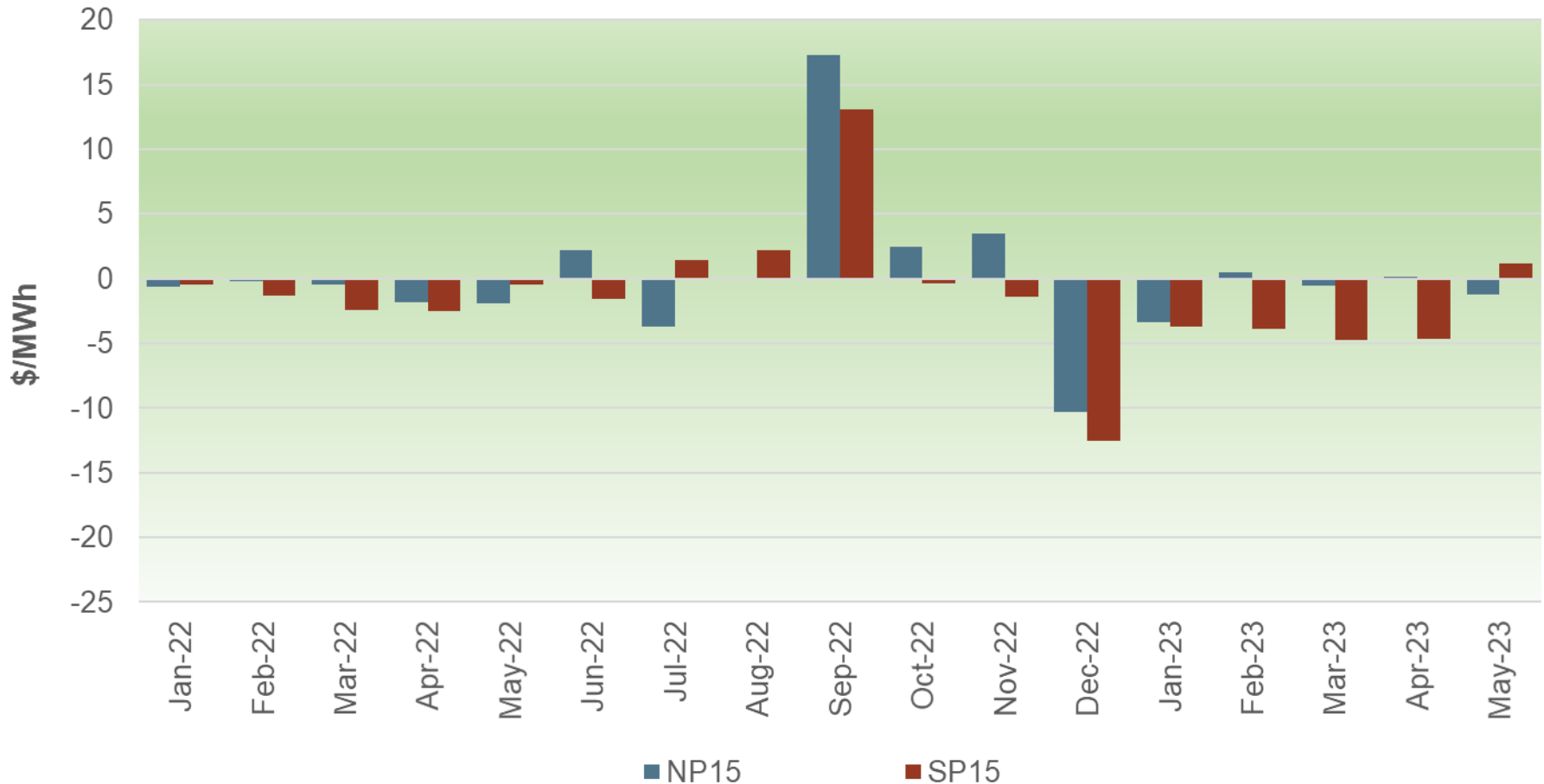


Lower prices in the shoulder months with low demand levels

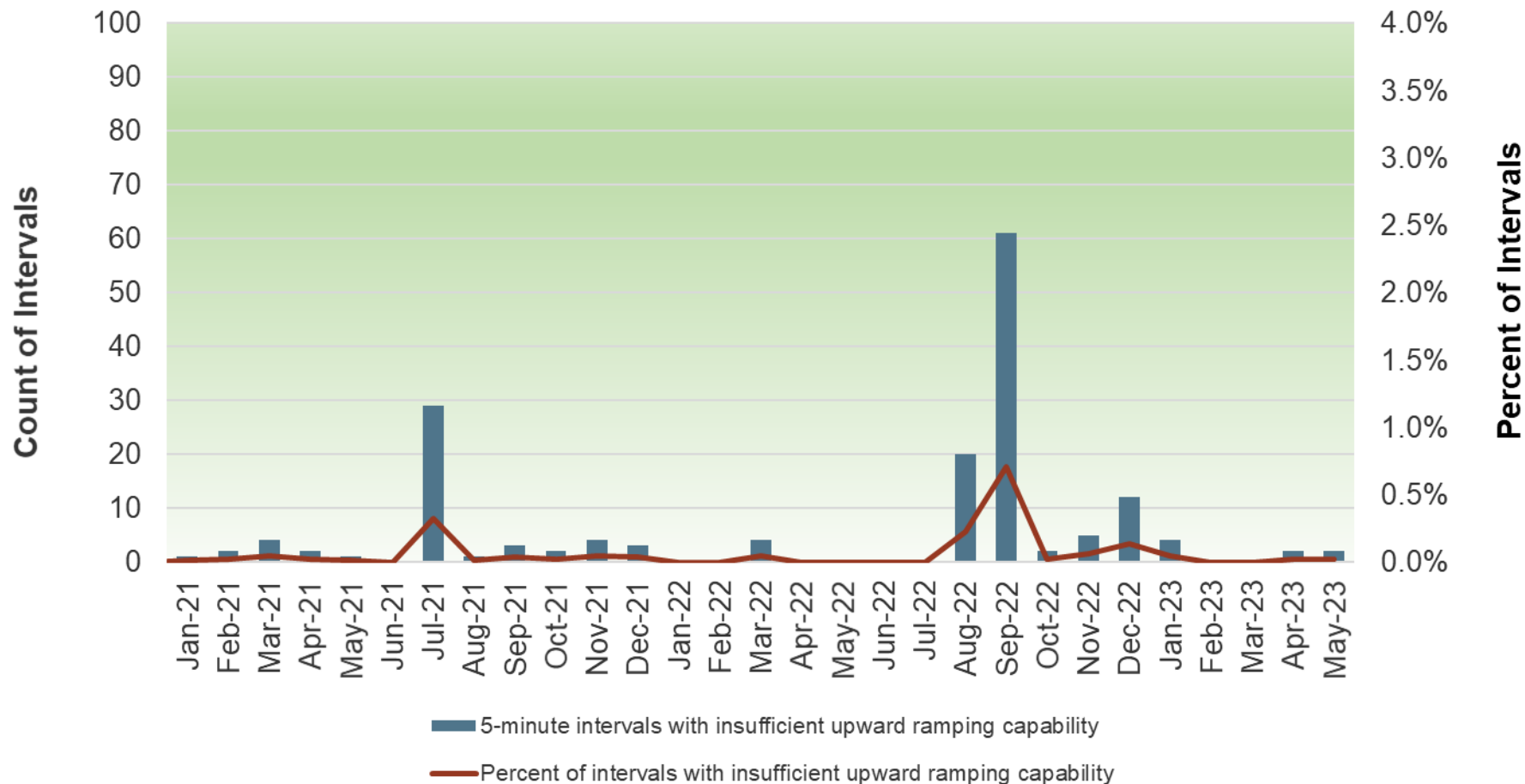


Note: Metric Based on System Marginal Energy Component (SMEC)

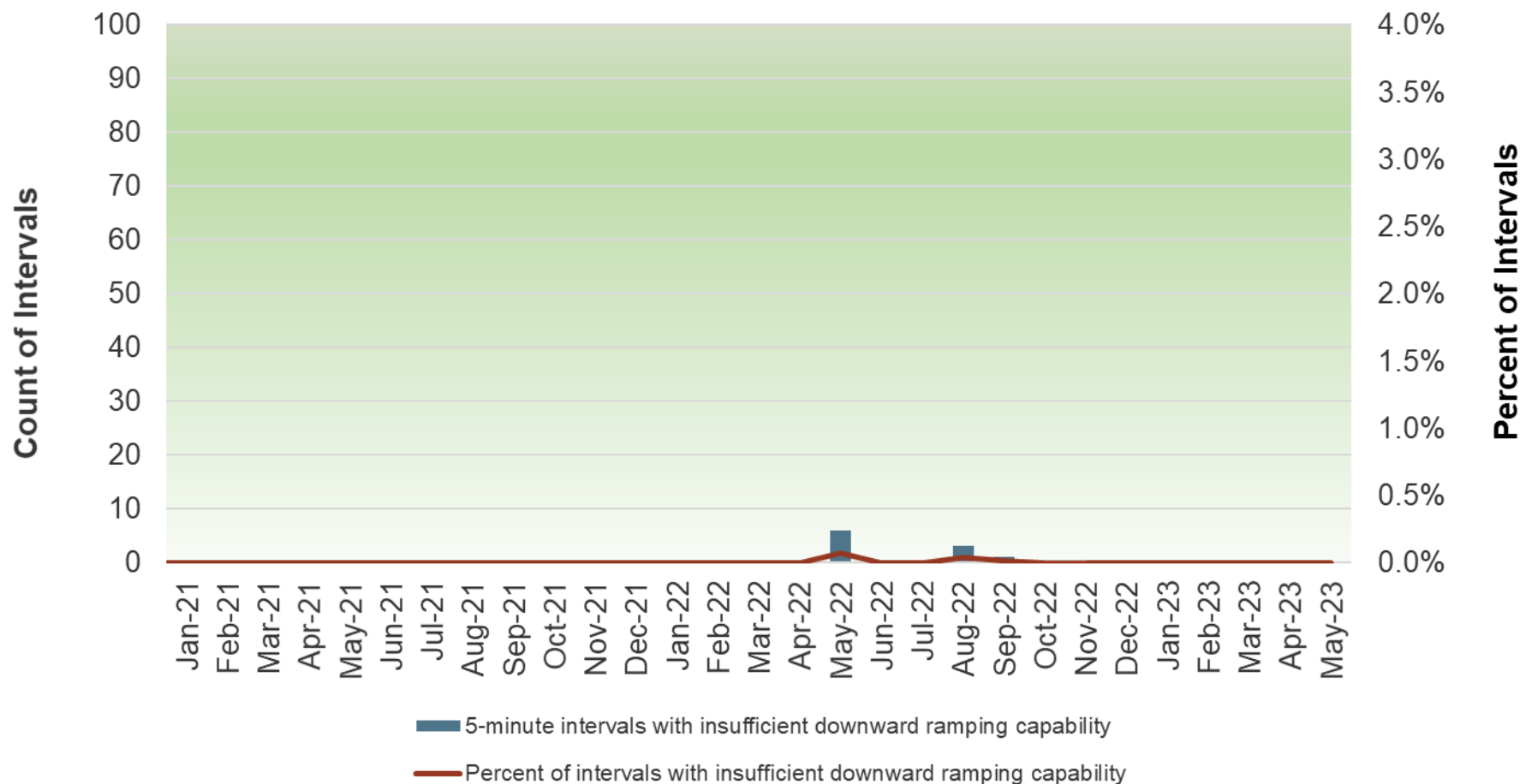
Real-time prices lower than day-ahead prices for both NP15 and SP15 in the past three months



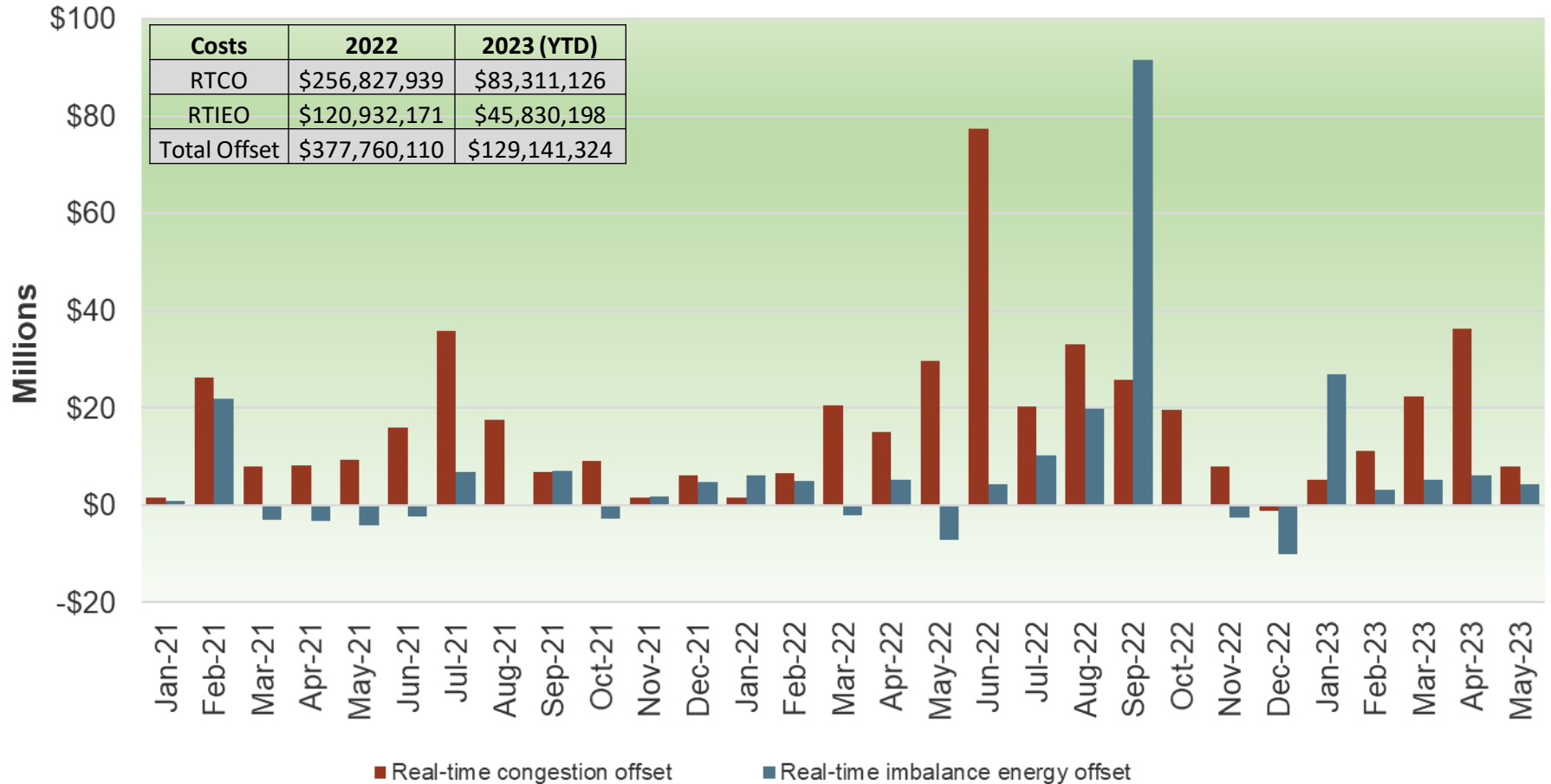
Insufficient upward ramping capacity in ISO real-time increased continued to be low



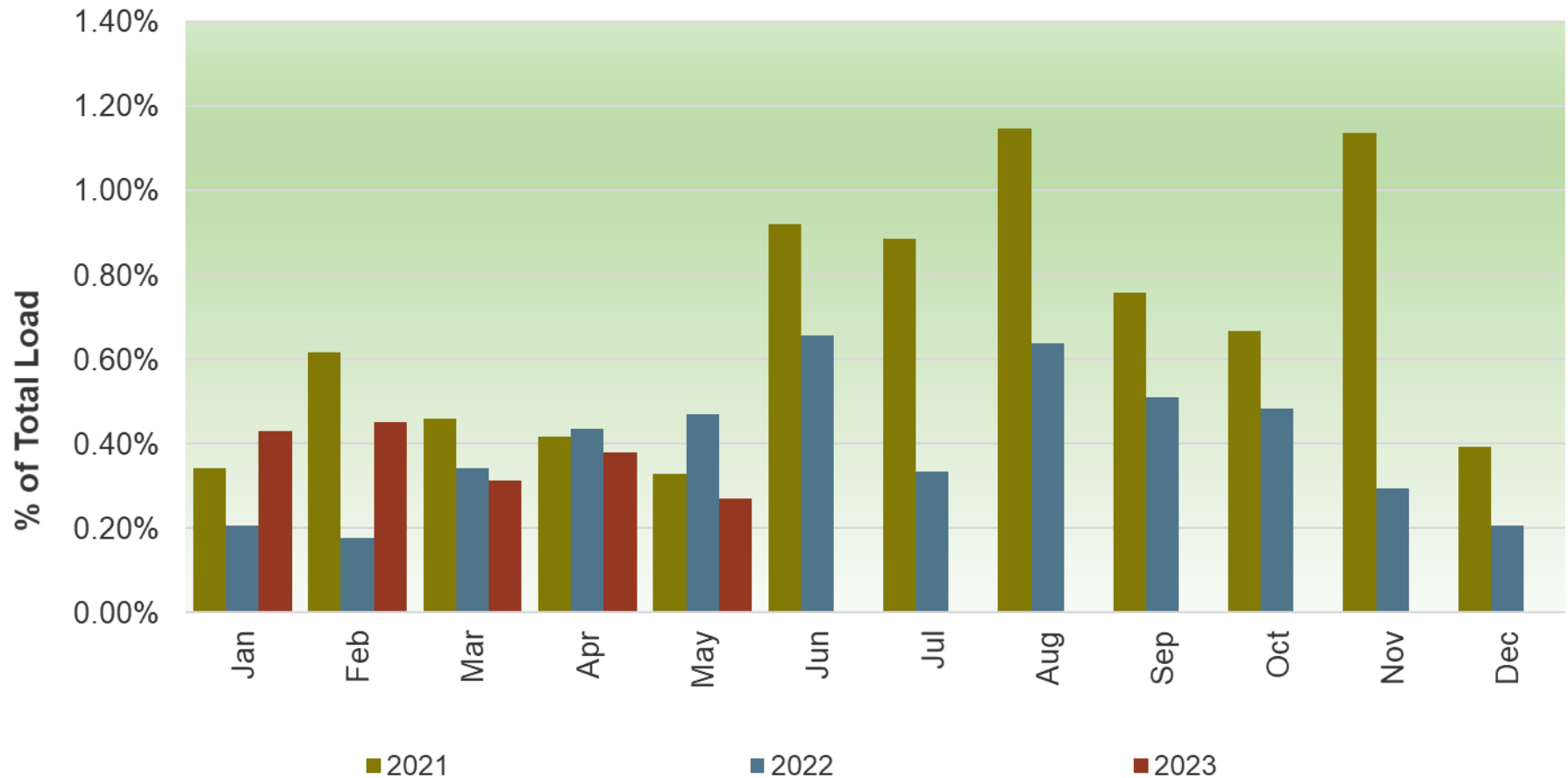
Insufficient downward ramping capacity in real-time stayed low



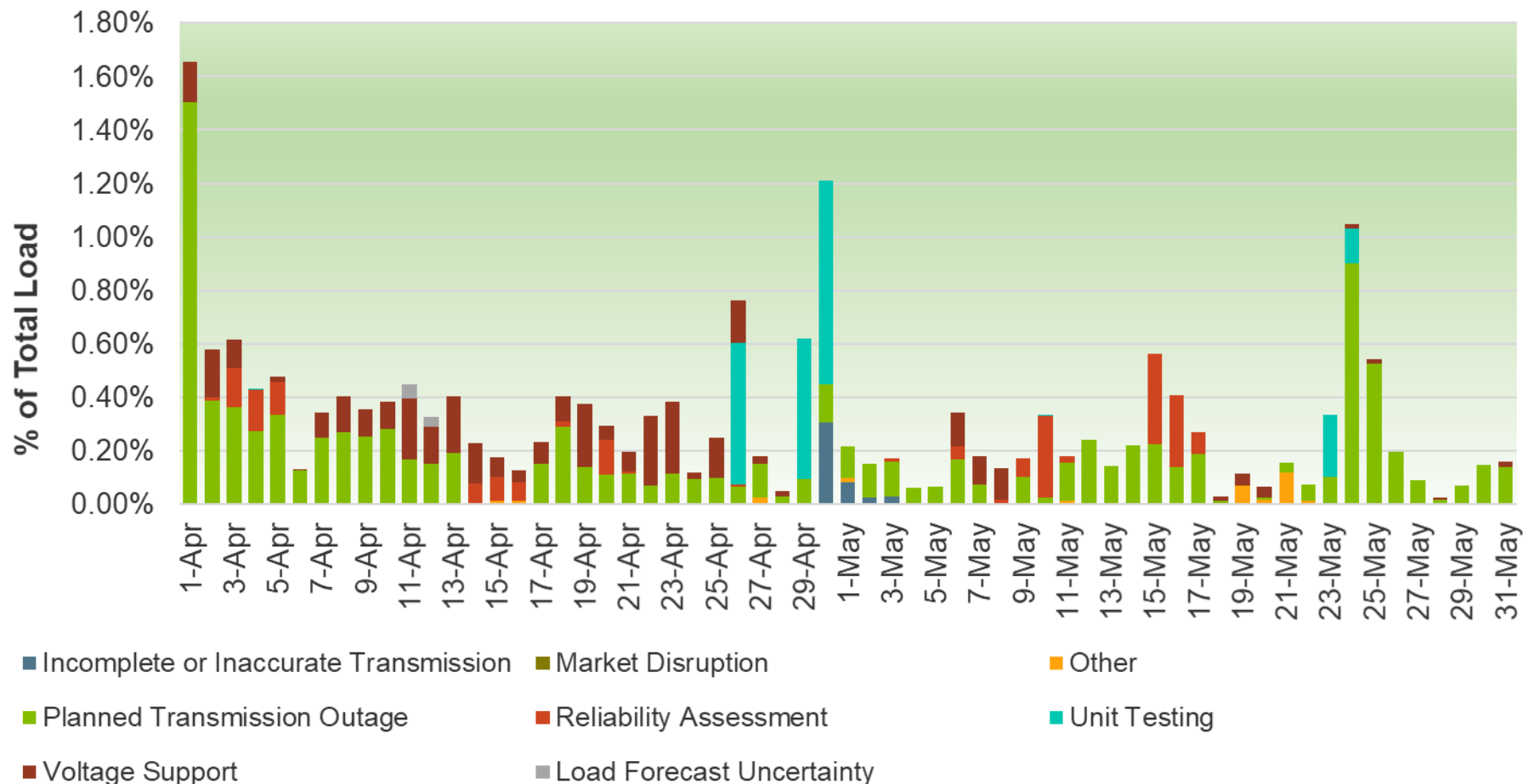
ISO area real-time congestion offset increased in April



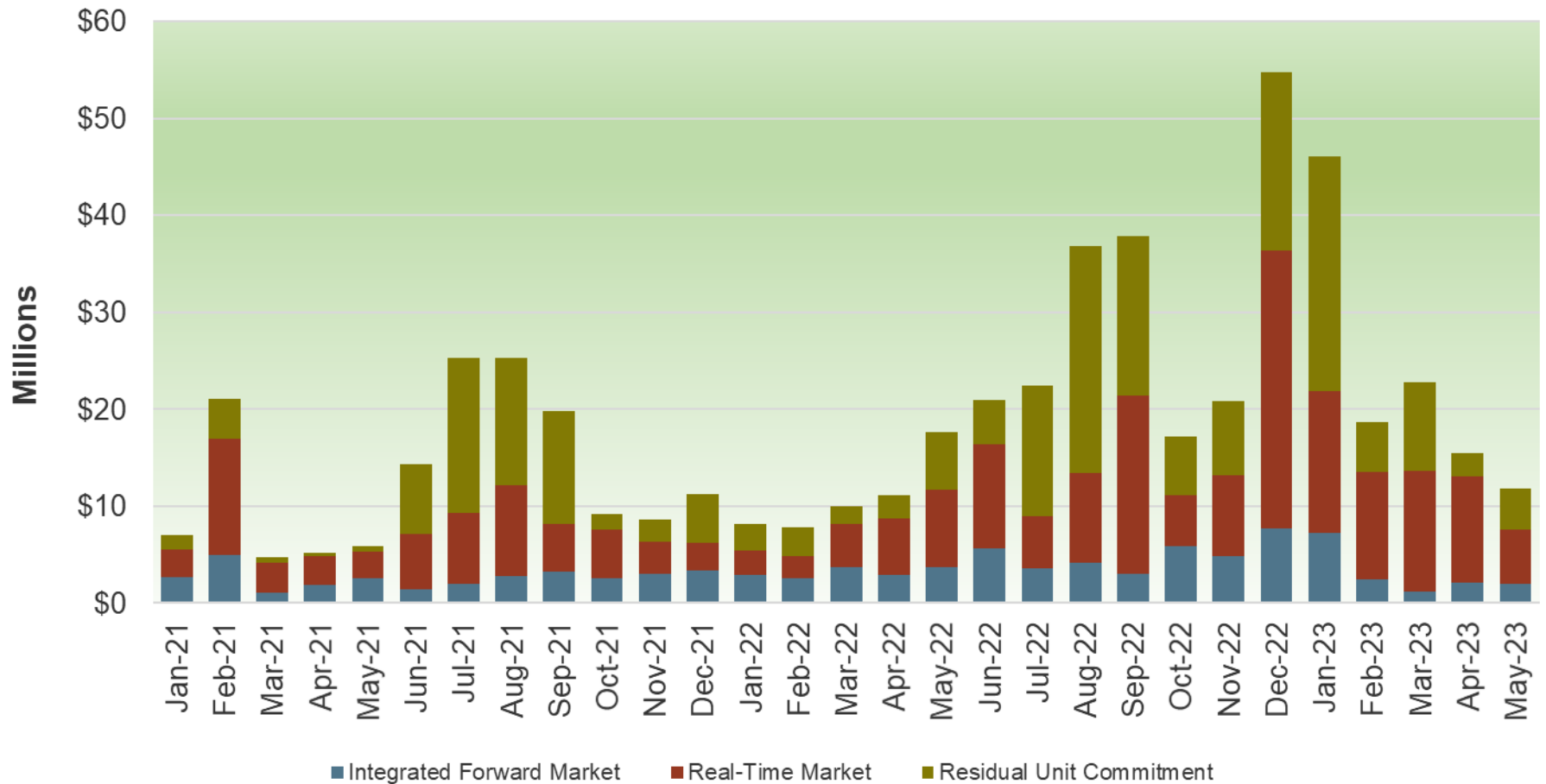
Exceptional dispatch volume in the ISO area are at low levels



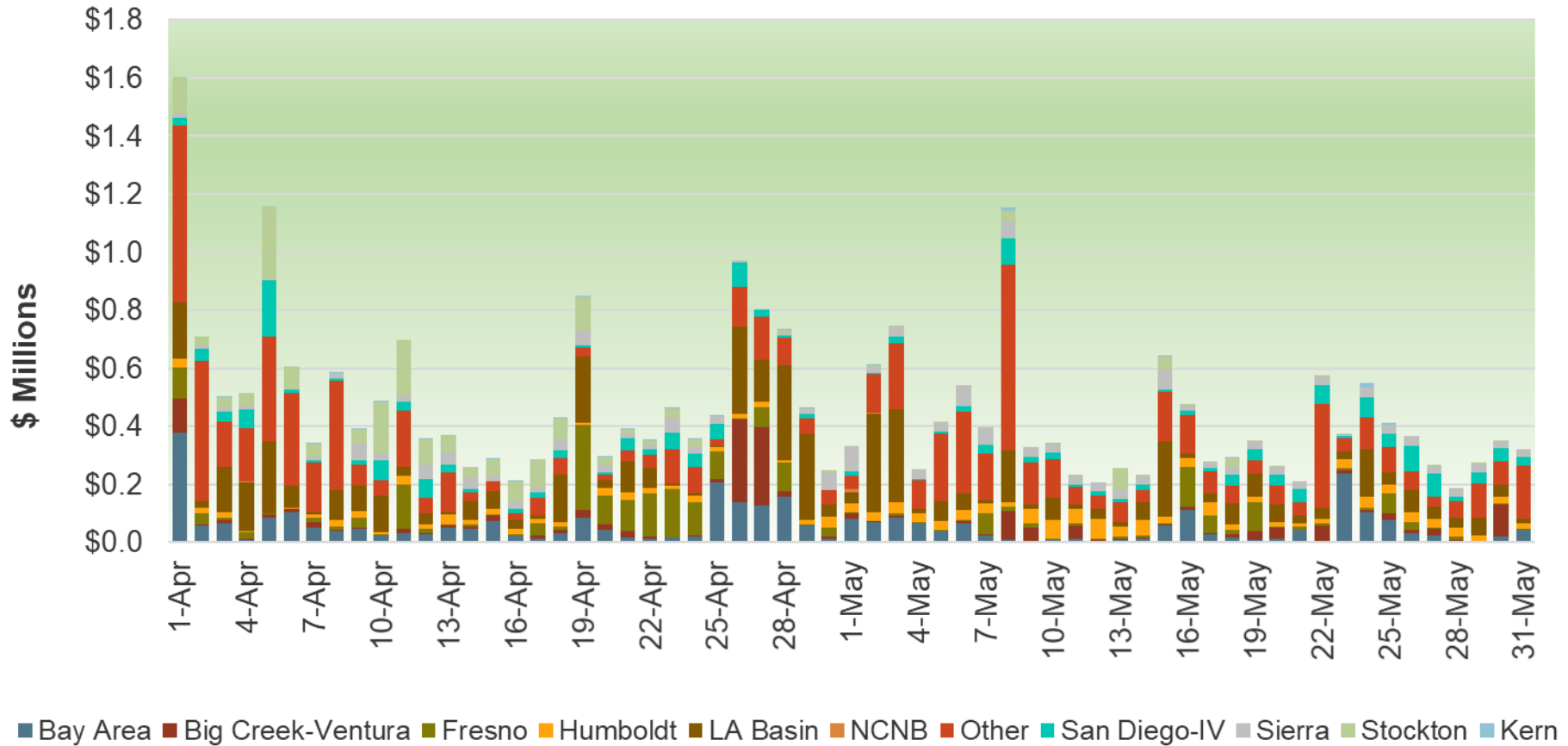
Exceptional dispatches volume driven by a variety of reasons



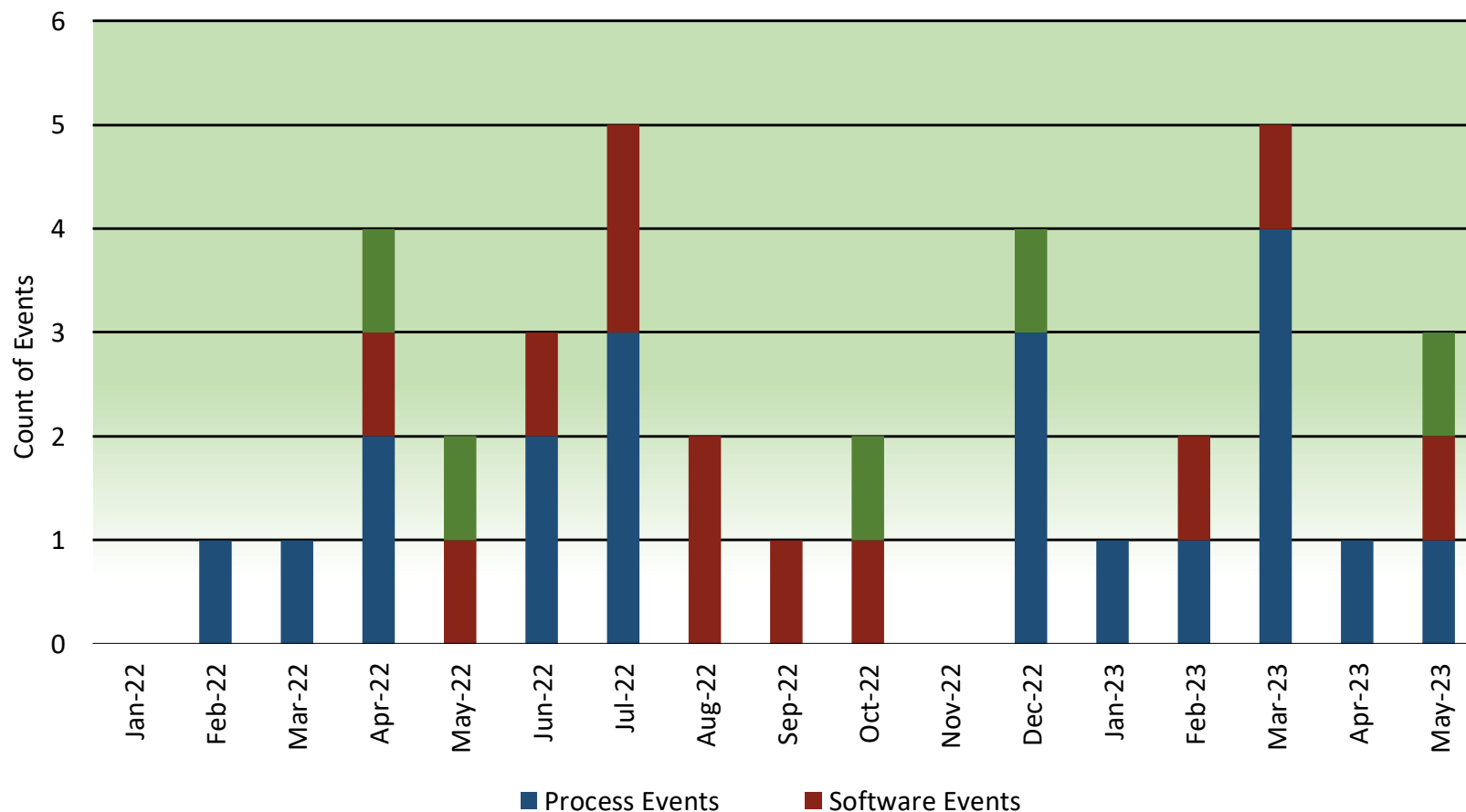
Bid cost recovery continues a downward trend



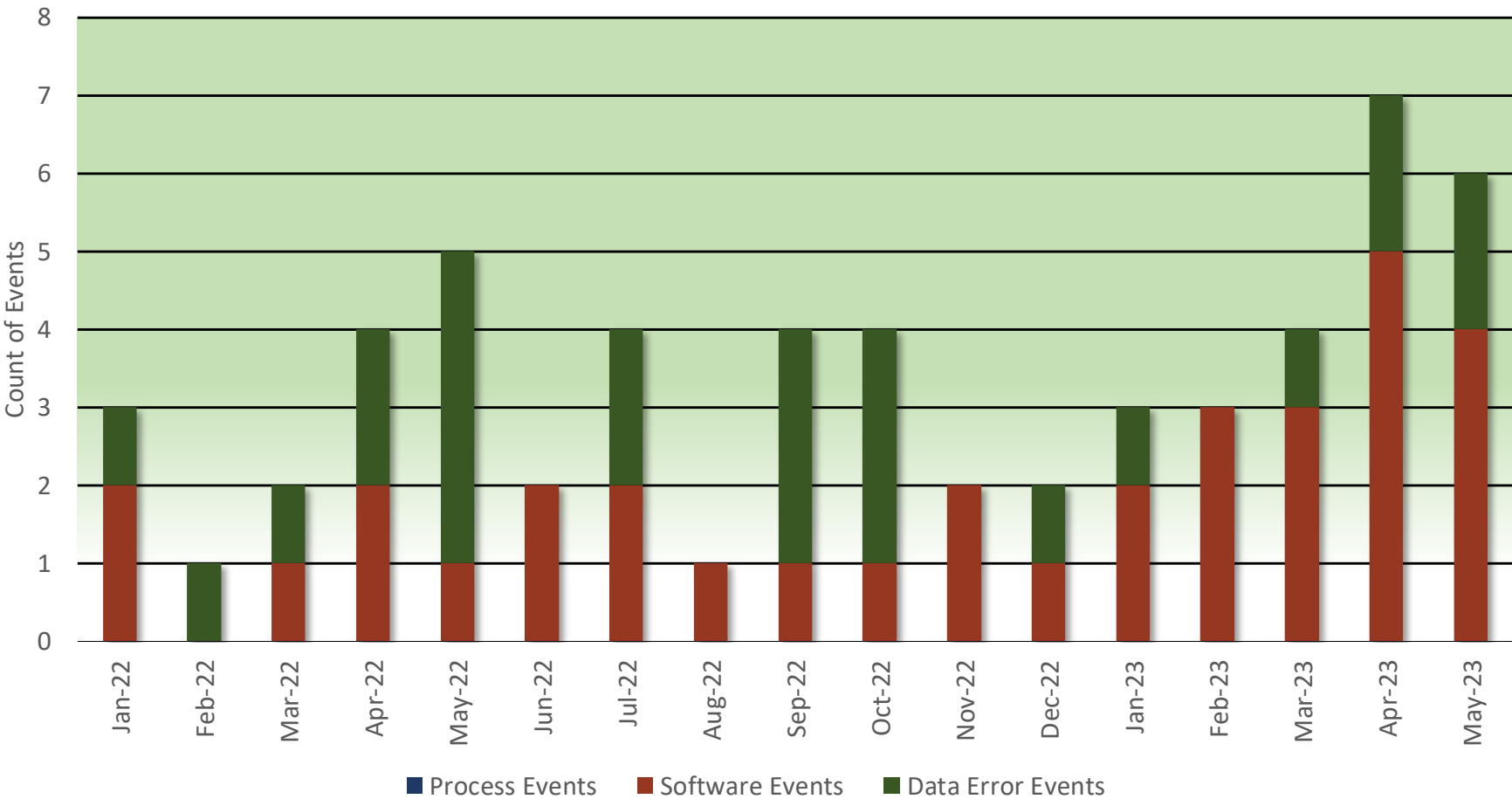
Bid cost recovery (BCR) by Local Capacity Requirement area



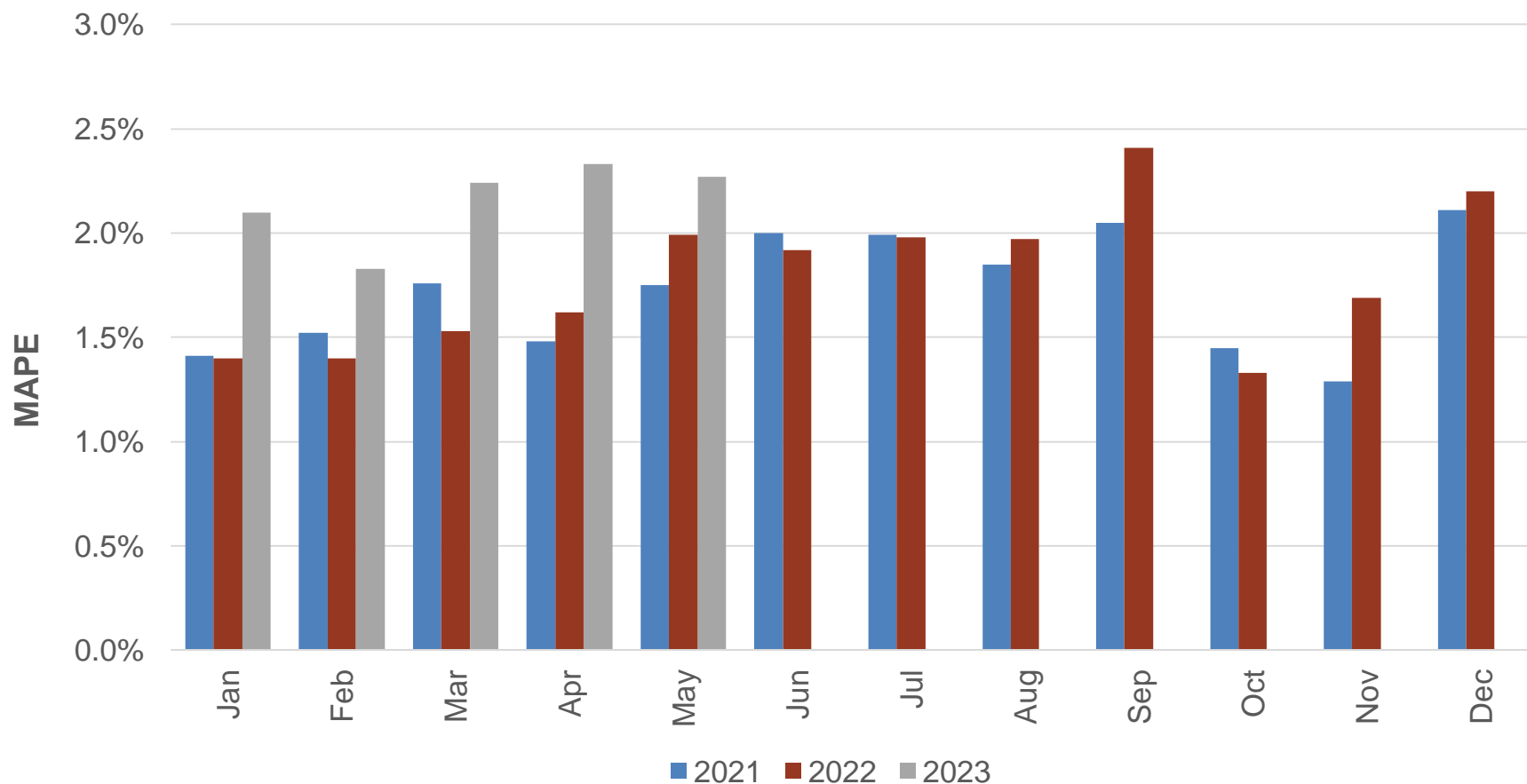
CAISO price correction events increased in March and May



EIM-related price corrections increased in April and May

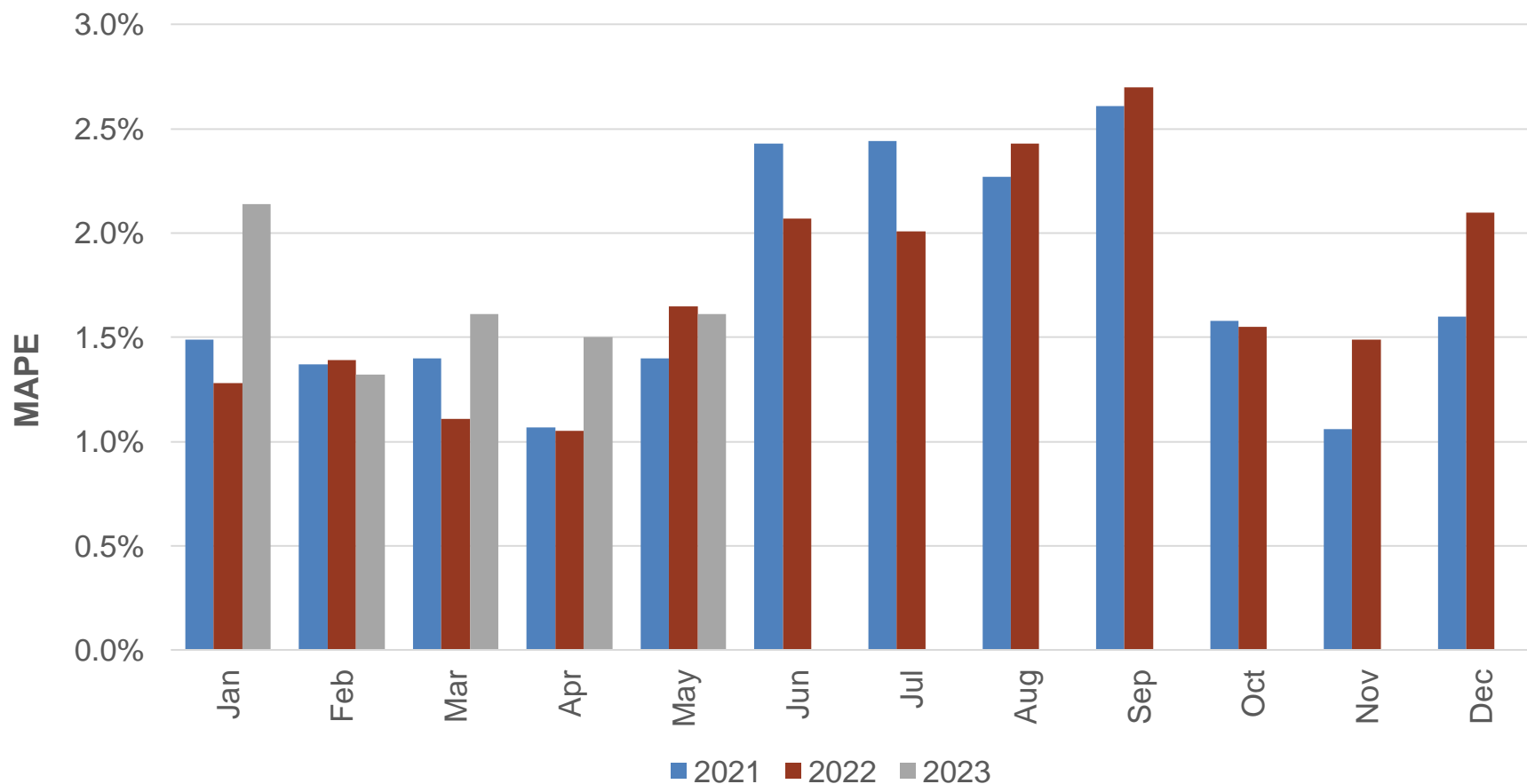


Day-ahead load forecast



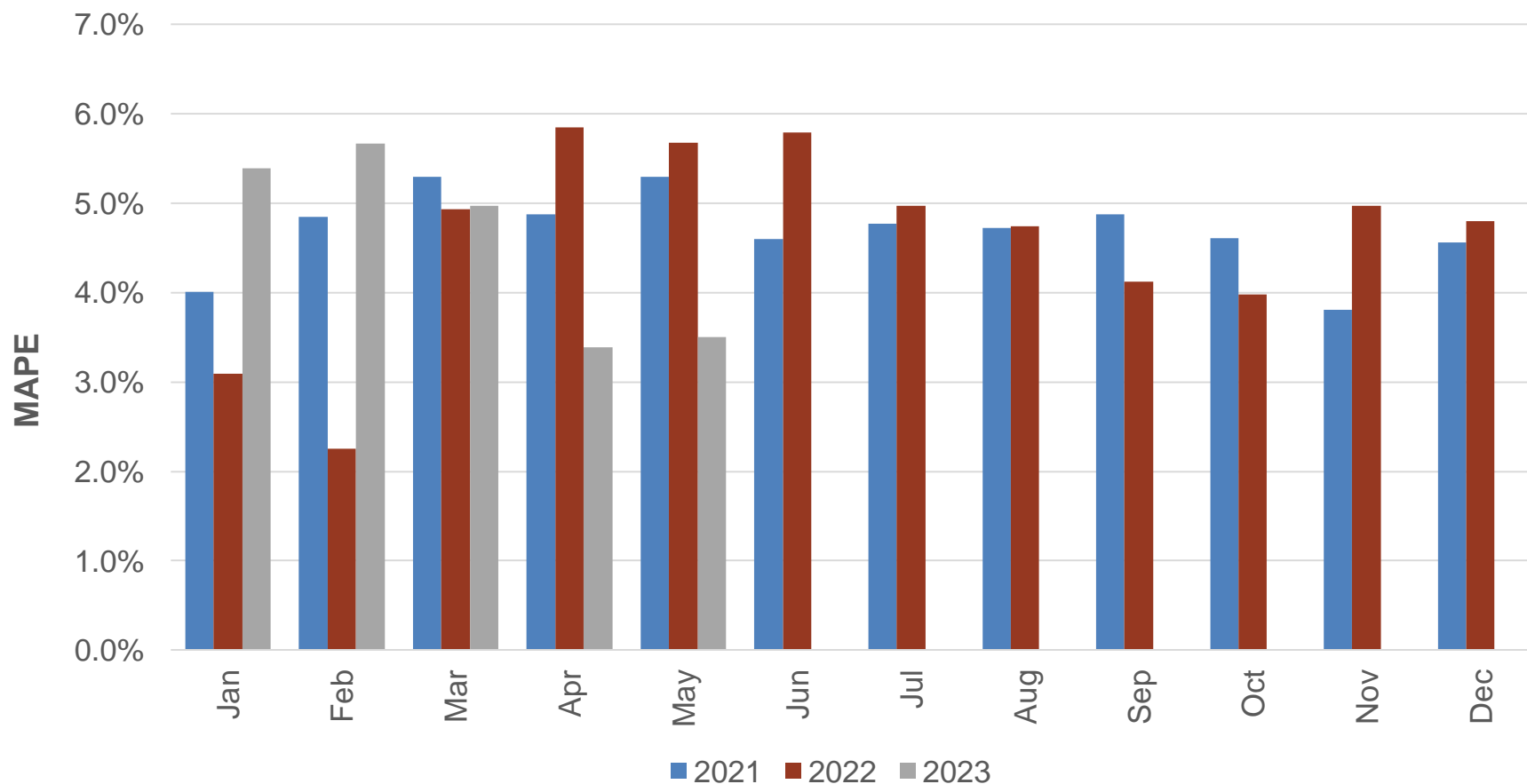
**MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Actual}$

Day-ahead peak forecast



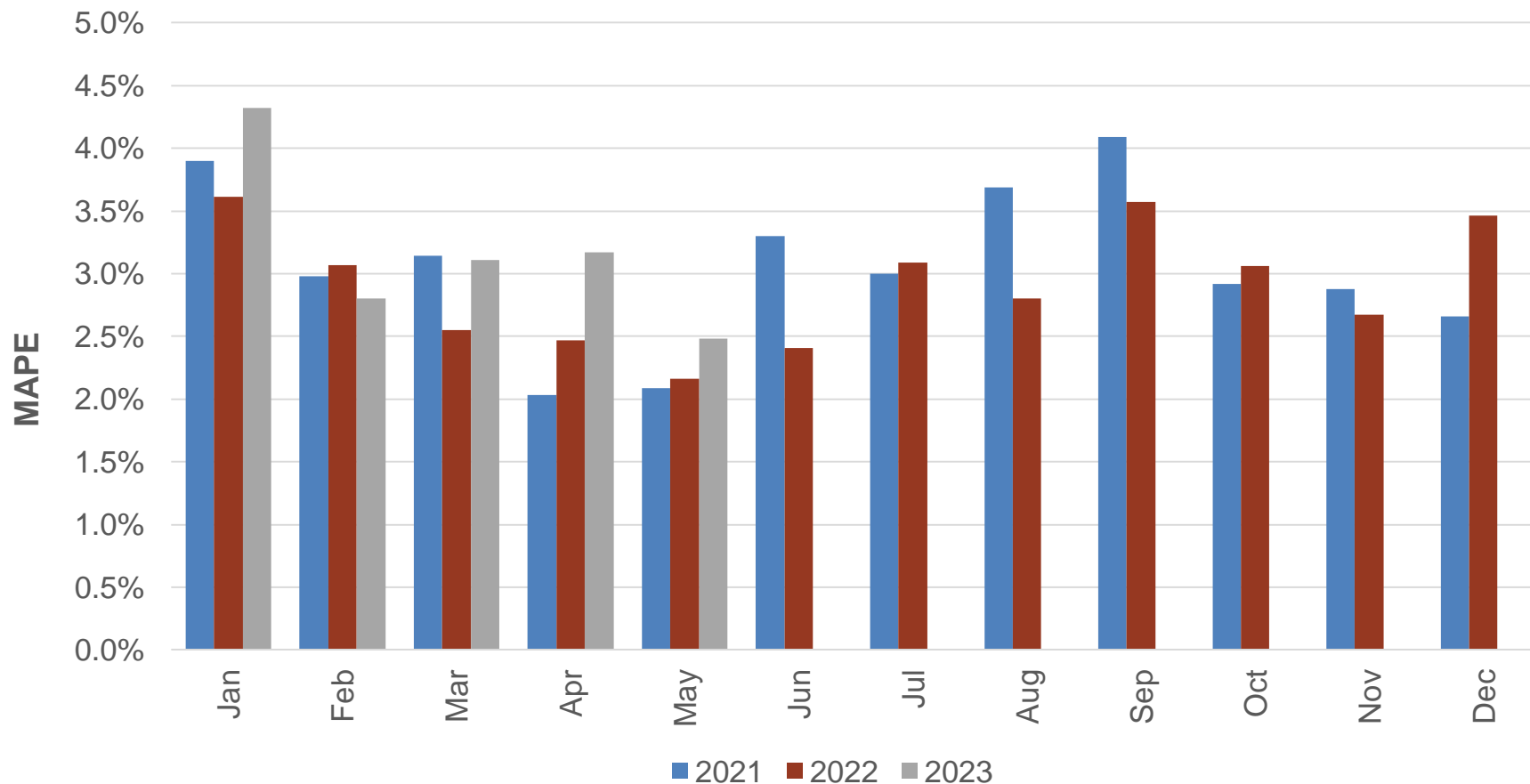
**MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Actual}$

Day-ahead wind forecast



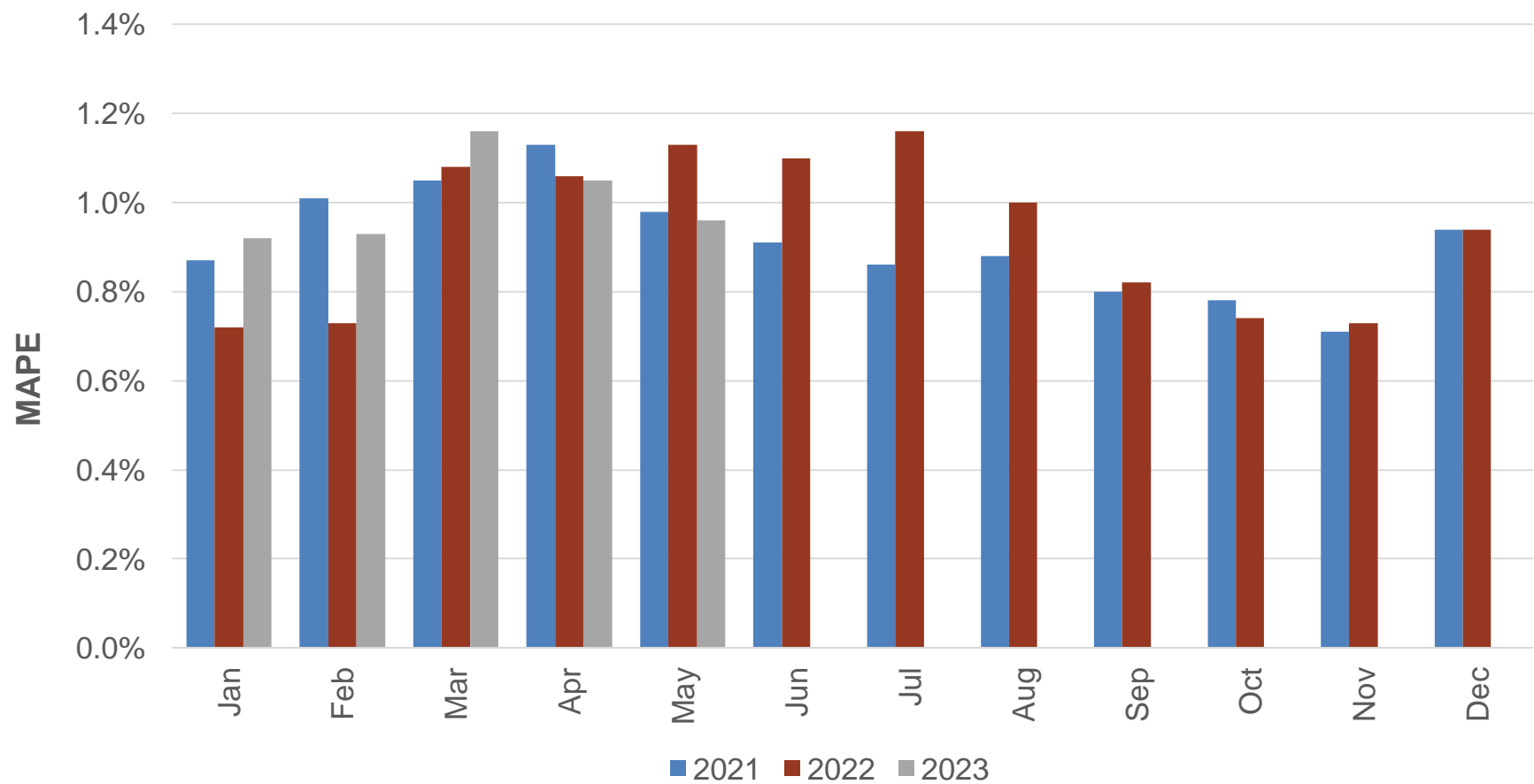
**MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Capacity}$

Day-ahead solar forecast



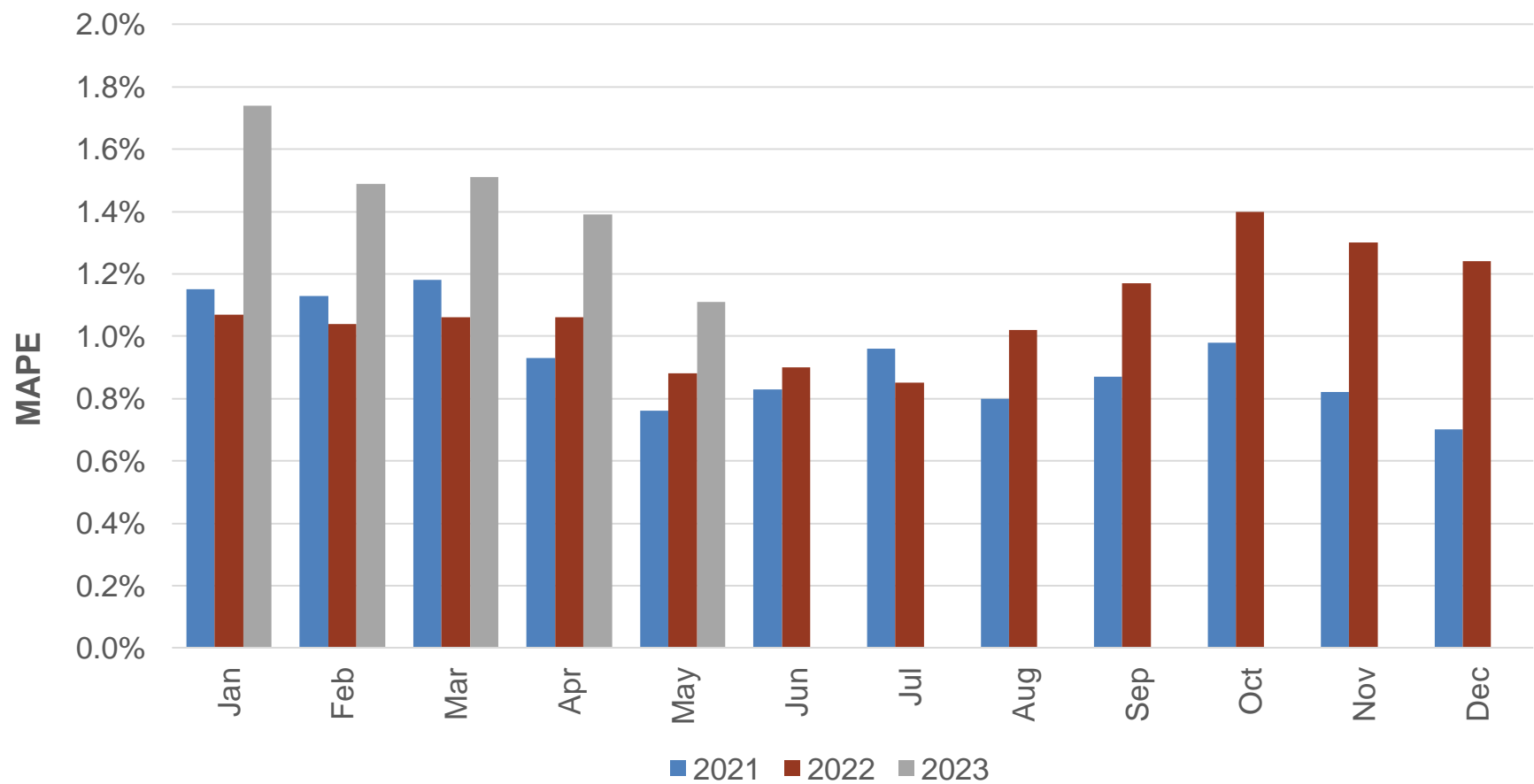
**MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Capacity}$

Real-time wind forecast



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

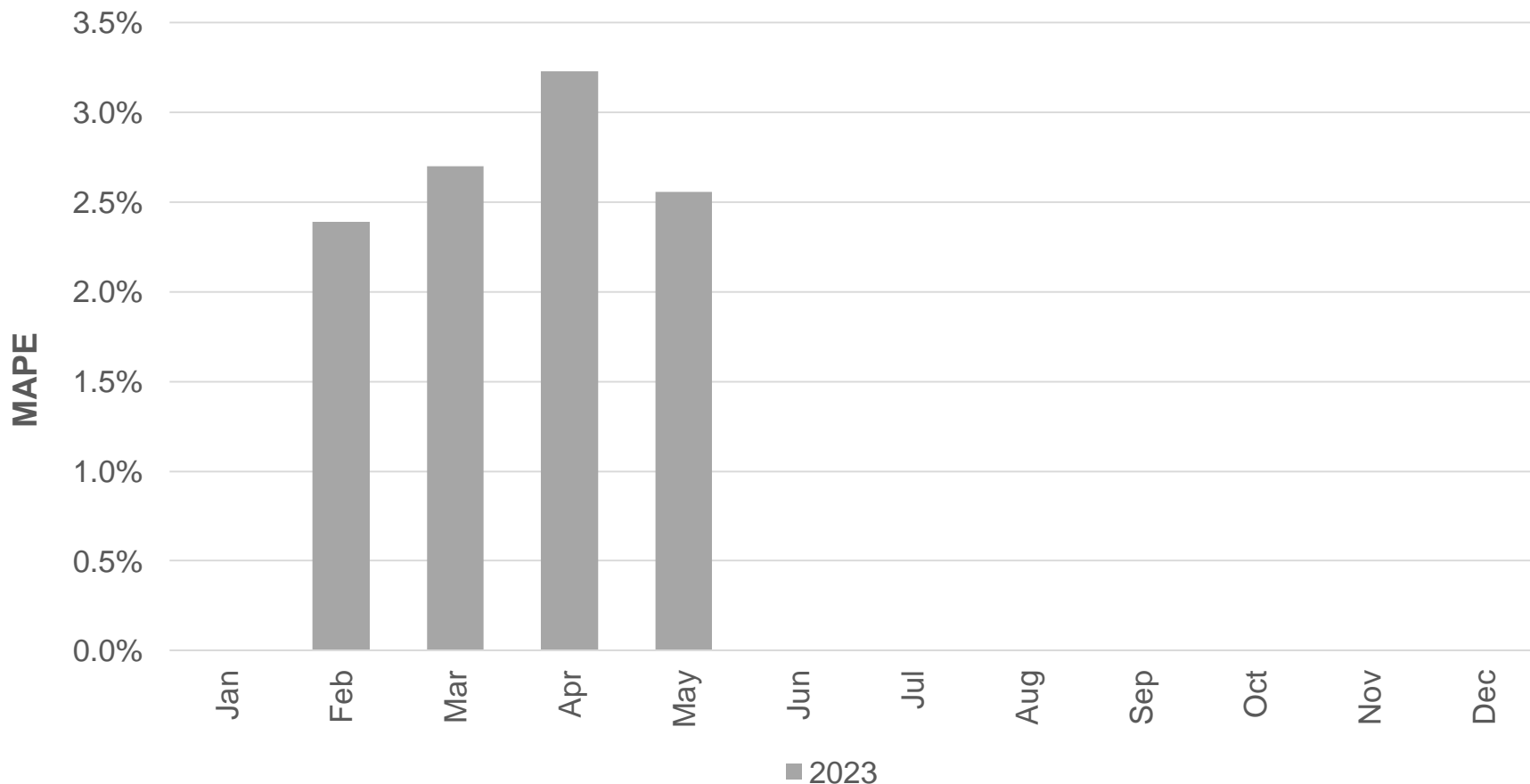
Real-time solar forecast



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

Real Time Solar Hybrid Performance

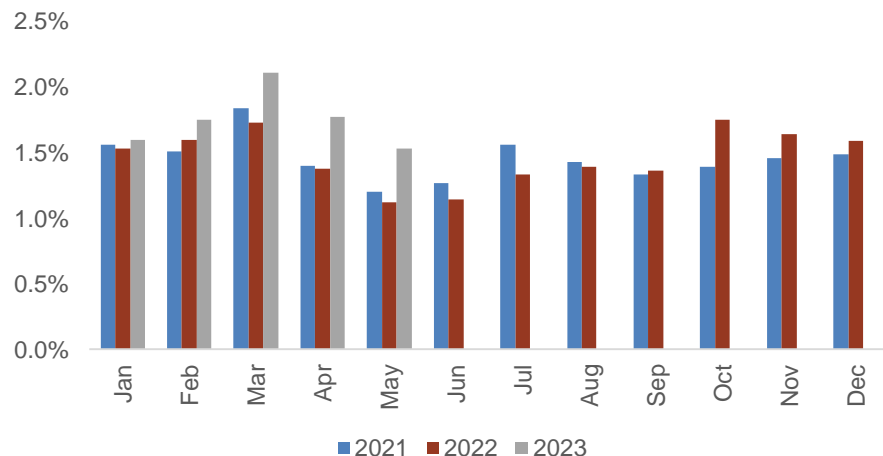
****Comparison of DOT to MW Production**



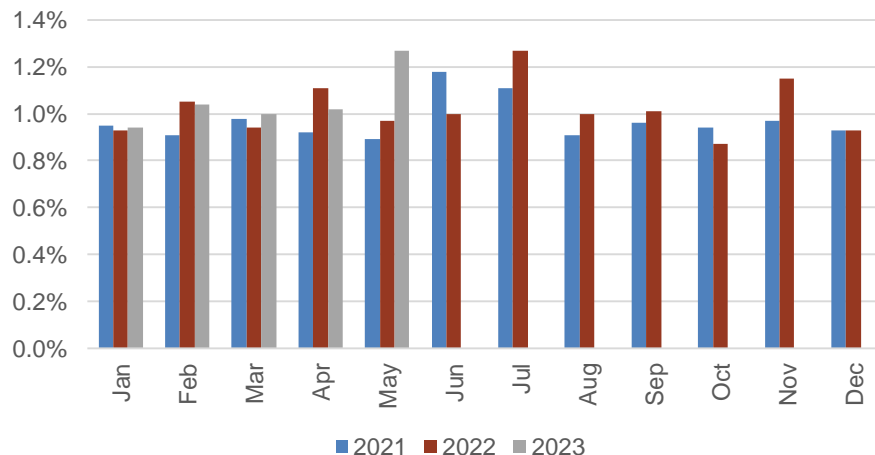
****MAPE = $\text{abs}(\text{DOT} - \text{Actual}) / \text{Capacity}$**

EIM T-60 forecast

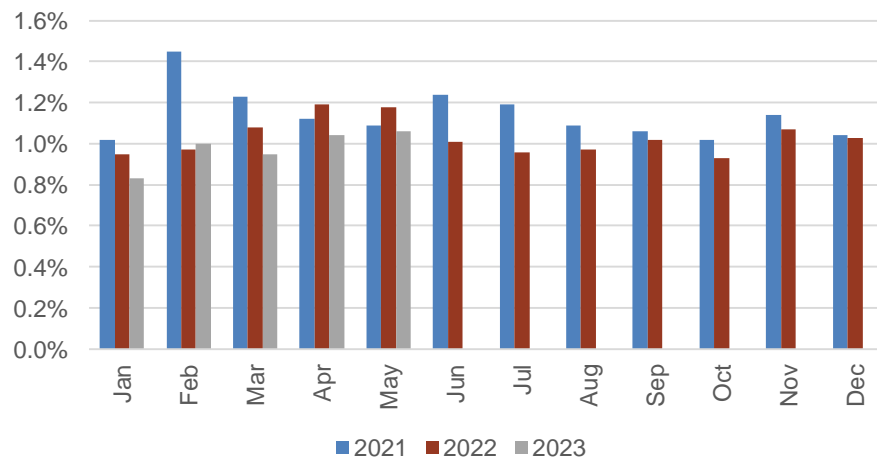
AZPS T-60 Forecast



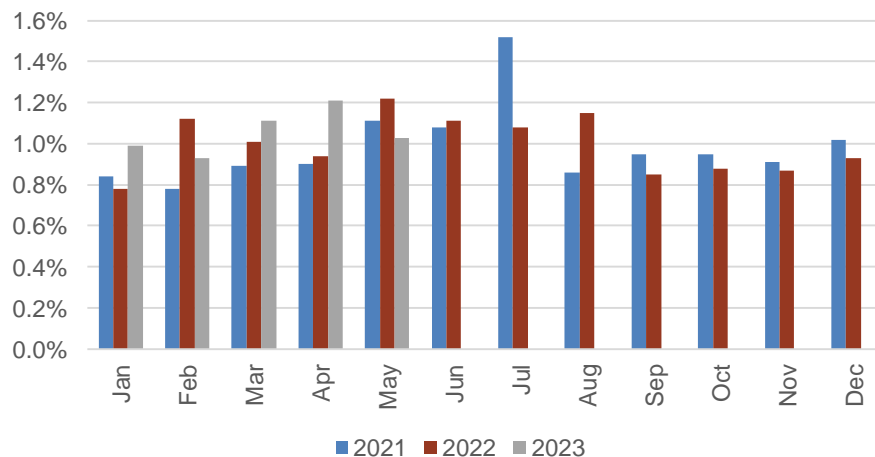
IPCO T-60 Forecast



PGE T-60 Forecast

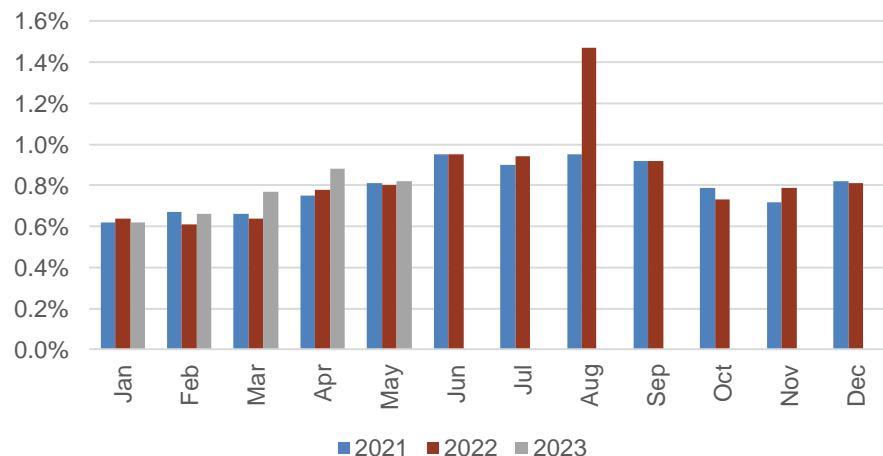


NVE T-60 Forecast

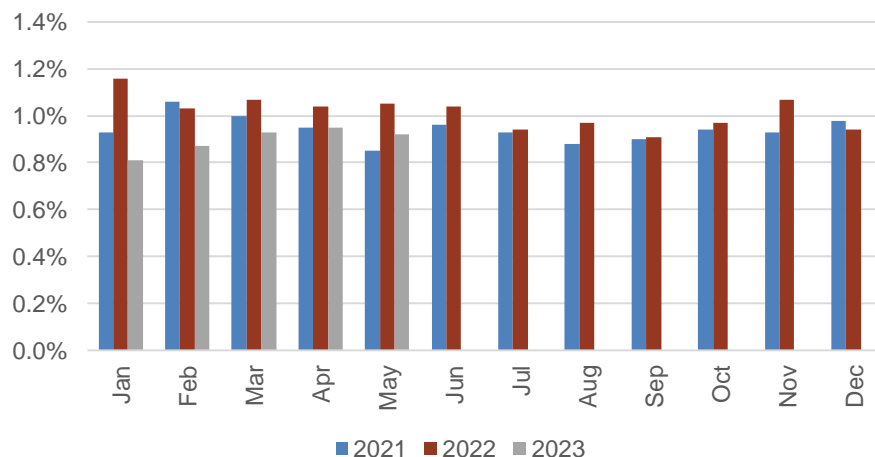


EIM T-60 forecast

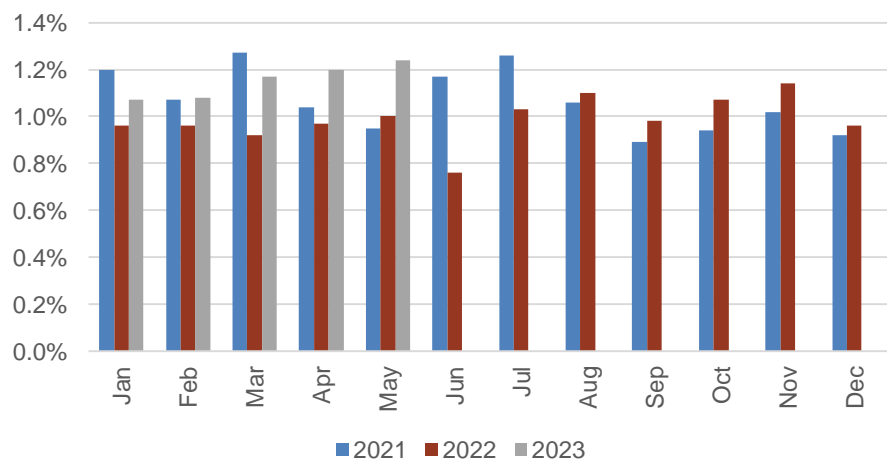
PACE T-60 Forecast



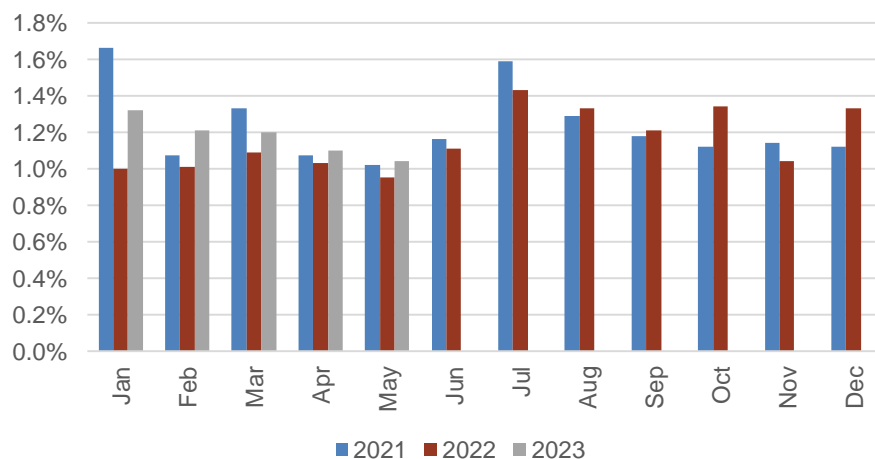
PACW T-60 Forecast



PSE T-60 Forecast

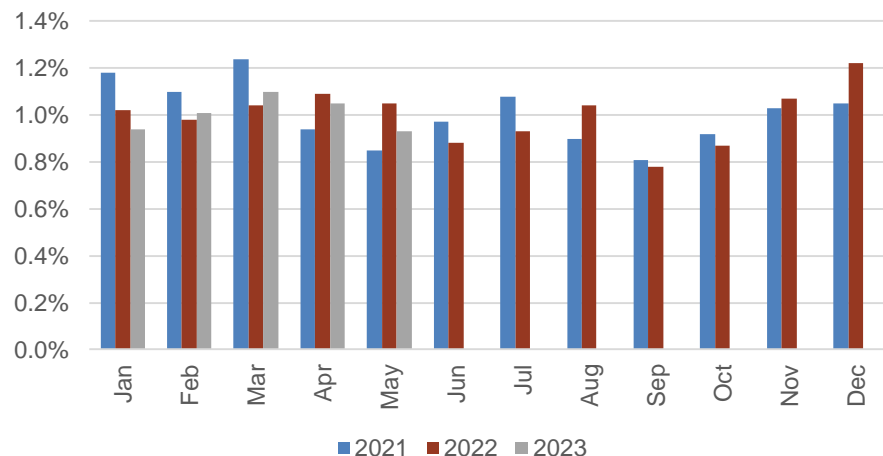


SRP T-60 Forecast

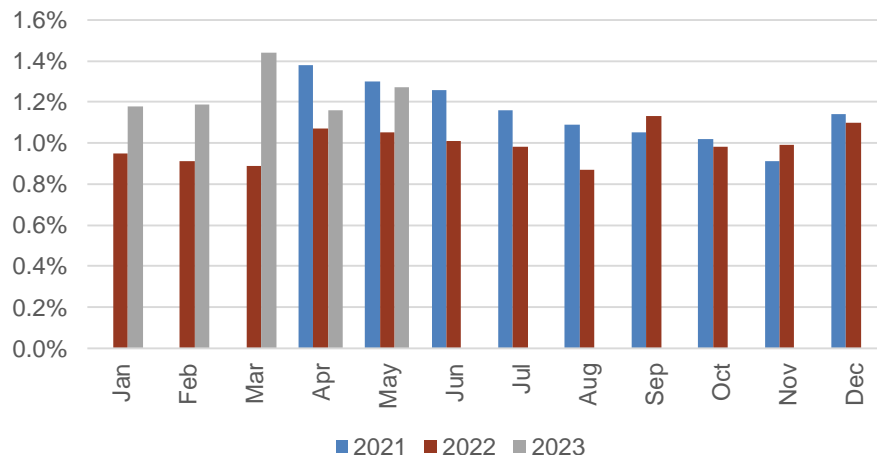


EIM T-60 forecast

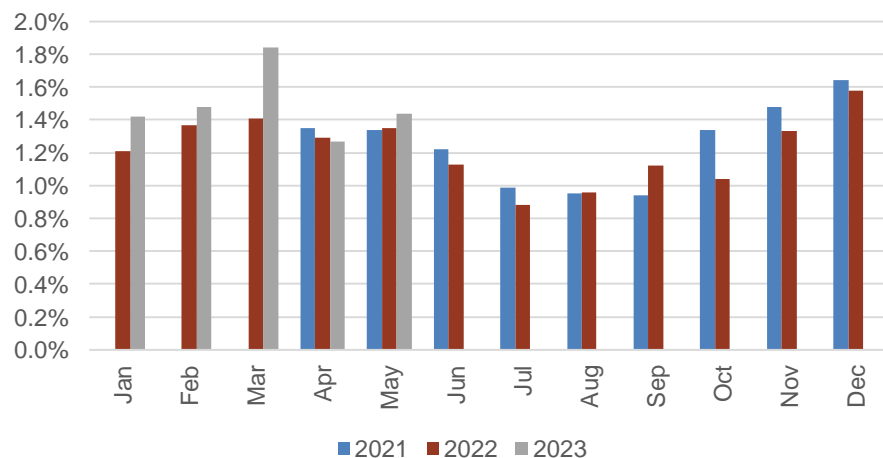
SCL T-60 Forecast



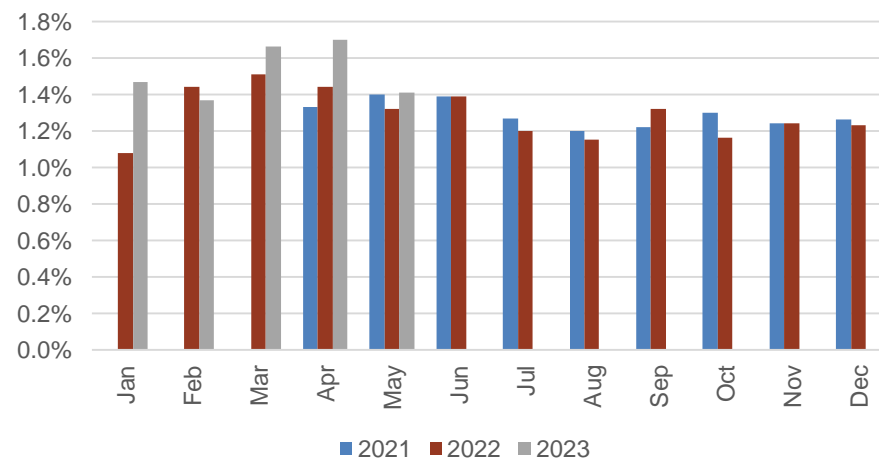
LADWP T-60 Forecast



TIDC T-60 Forecast

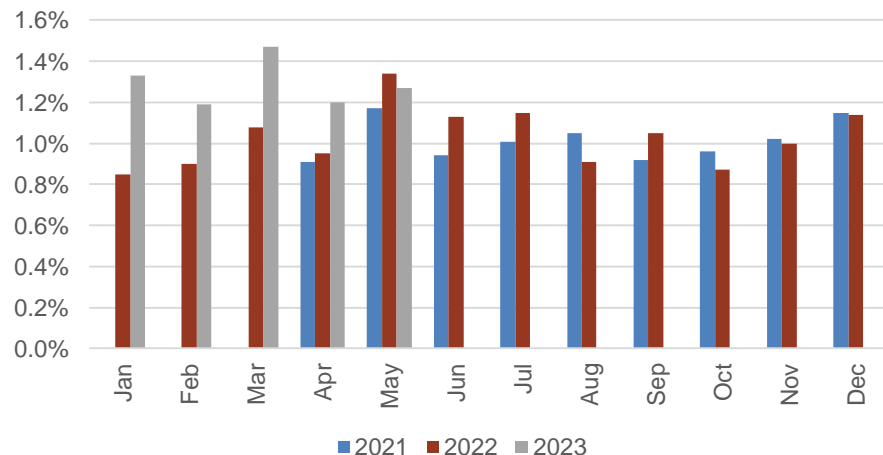


PNM T-60 Forecast

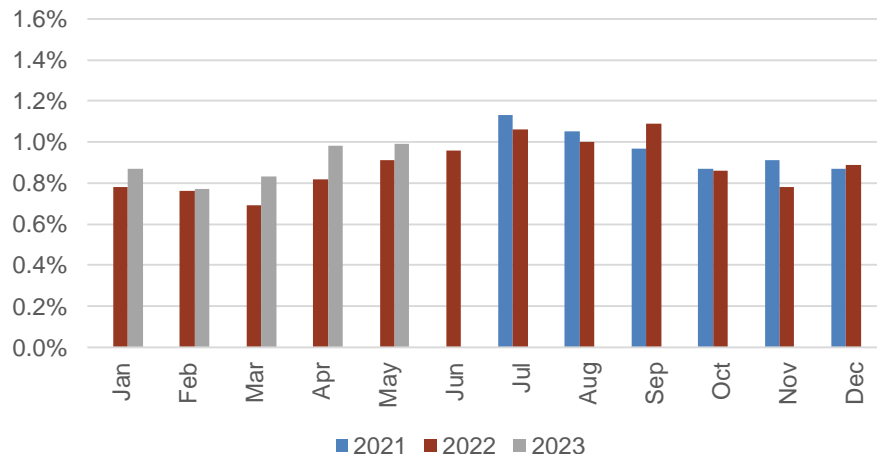


EIM T-60 forecast

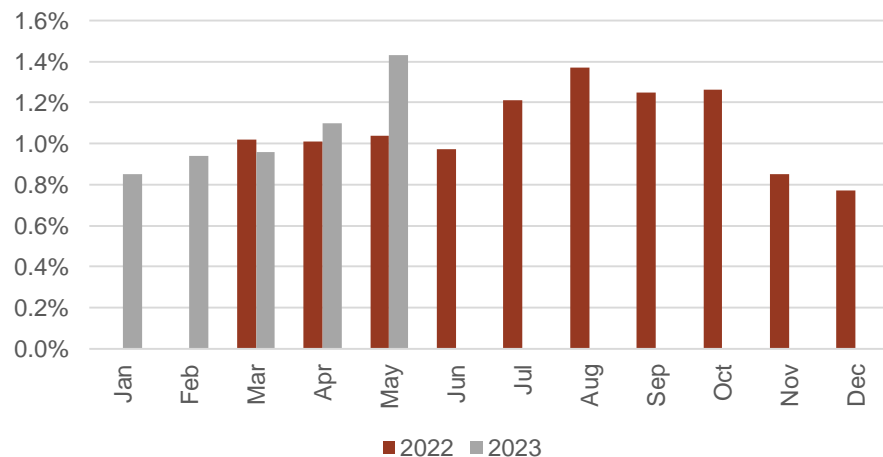
BANC T-60 Forecast



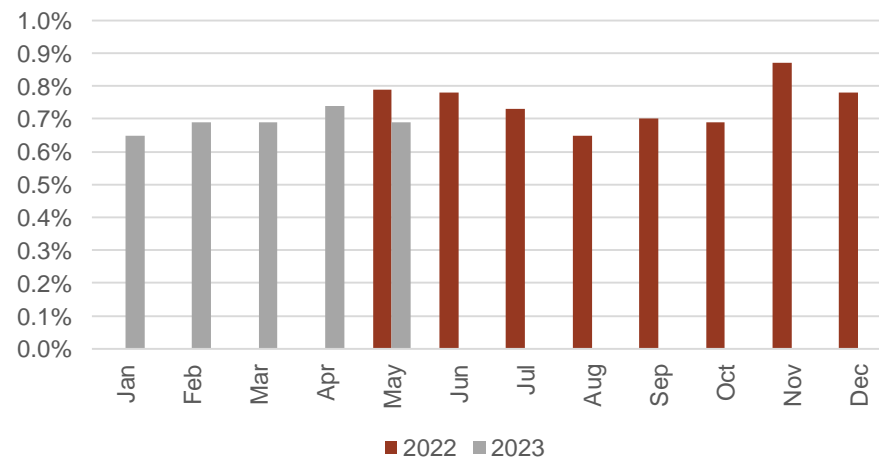
NWMT T-60 Forecast



AVA T-60 Forecast

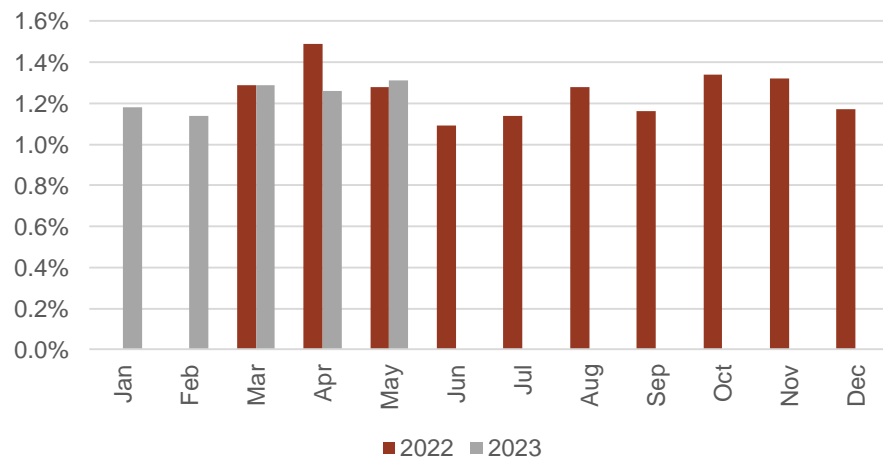


BPA T-60 Forecast

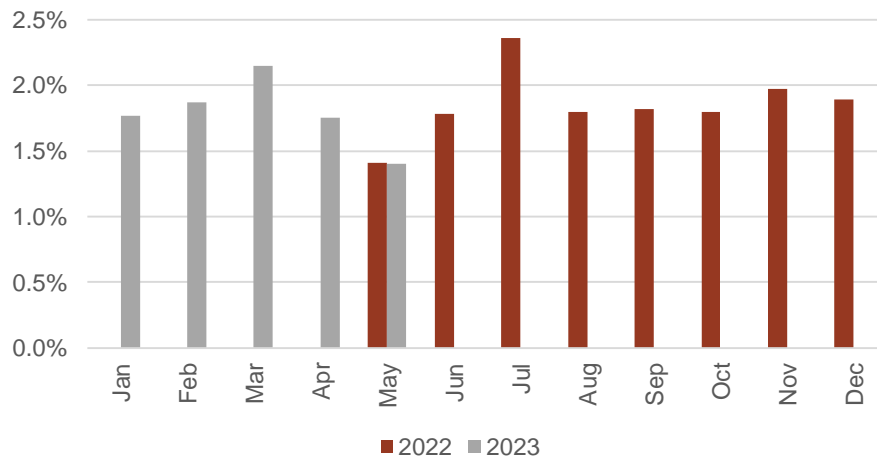


EIM T-60 forecast

TPWR T-60 Forecast



TEP T-60 Forecast



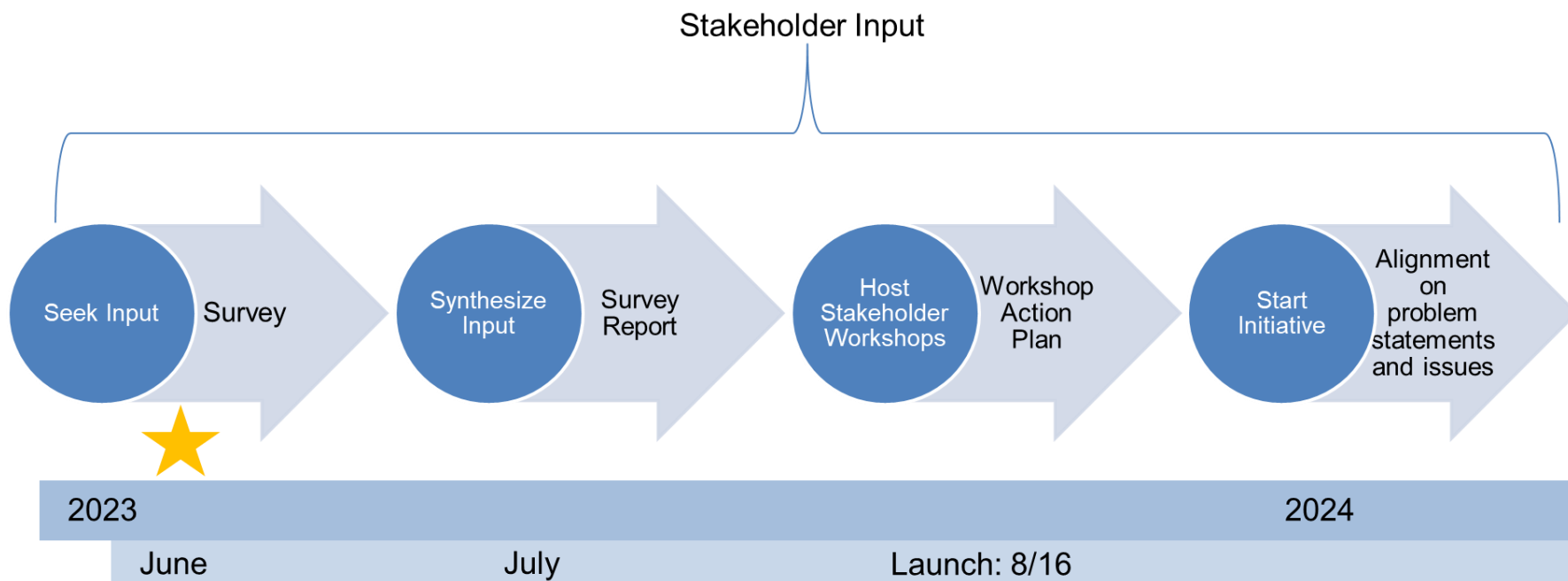
Policy Update

Gillian Biedler

Policy Integration and Governance Manager

Greenhouse Gas (GHG) Coordination Working Groups

- The ISO will launch a series of working group meetings to continue the evolution of the GHG accounting framework in EDAM and WEIM.
- We are requesting your feedback on the topics and problem statements to address by completing our [GHG coordination working group survey](#). Feedback is requested by **Friday, June 30, 2023**.



Gas Management Working Groups

Objective: Revisit existing gas resource participation options, identify potential participation gaps and possible solutions

- As part of the development process, the ISO and stakeholders will focus on four key components of the working groups:
 1. Defining the topics and scope of the working groups;
 2. Determining the role and deliverables, set expectations, and determine the tangible outcomes;
 3. Establish a cadence to balance CAISO staff resource workload and stakeholder bandwidth; and
 4. Outline the ISO's roles as facilitators, subject matter experts, and data analytics.
- Status:
 - Working groups to take place July 2023 – Fall 2023

WEIM Resource Sufficiency Evaluation Enhancements

– Phase 2

- Scope:
 - Creation of WEIM assistance energy transfer product
 - Adjusting RSE obligations to account for low-priority exports
 - New rules requiring low-priority exports purchased from the CAISO market to be e-tagged as firm provisional (G-FP)
- Status:
 - Dec 2022 CAISO Board and WEIM Governing Body approval
 - May 2023 FERC approval
 - July 1, 2023 Implementation

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
 - Approved Mar 2023 CAISO Board meeting

Capacity Procurement Mechanism – Track 2

- Scope: Re-examine the \$6.31/kw-month CPM soft offer cap, as required by ISO tariff
- Decisional Classification: CAISO Board only
- Status:
 - Stakeholder workshop held on 5/11/23
 - Stakeholder comments submitted on 6/1/23
 - Straw proposal will be posted tomorrow (6/30/23)
 - Planning for November 2023 Board of Governors decision

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:
 - Revised Draft Tariff Language posted Mar 15
 - Jun 01, 2023 FERC approval (ER23-1533)
 - Mar 31, 2023 Tariff amendment (ER23-1533)
 - Summer 2023 Track 1 - Jul 01, 2023 Activation
 - Fall 2023 Track 2

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 Q3 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
- Status:
 - May 2023 CAISO Board and WEIM Governing Body meeting approval
 - Jun 23, 2023 Draft Tariff Language Meeting
 - July 2023 Revised Draft Tariff Language Meeting
 - Mid-Aug 2023 FERC filing

Extended Day-Ahead Market

- Scope: Extending day-ahead market to WEIM entities. Scope includes:
 - Design elements that facilitate efficient commitment of generation in the day-ahead market across the wider footprint, providing economic, reliability and environmental benefits.
- Status:
 - Feb 2022 CAISO Board and WEIM Governing Body meeting approval
 - July 26, 2023 stakeholder call on revised draft tariff language
 - Mid-August 2023 FERC filing

Transmission Services and Market Scheduling Priorities

- Scope:
 - Process for wheeling transactions through the CAISO BAA to establish market scheduling priority.
- Status:
 - Feb 2023 CAISO Board and WEIM Governing Body approval
 - Jun 30, 2023 stakeholder call on Track 1 (ATC and short-term wheeling) revised draft tariff language
 - Mid-July 2023 Track 1 FERC filing
 - Jan 2024 Track 2 (long-term wheeling and upgrades) FERC filing

Price Formation Enhancements

- Scope:
 - Phase 1
 - Scarcity pricing enhancements
 - BAA-level market power mitigation
 - Analysis of fast-start pricing in the CAISO markets
 - Phase 2
 - Review of market pricing to incentivize and appropriately compensate flexible resources (fast-start pricing, extended FRP horizon)
 - Phase 3
 - Review of multi-interval optimization impact on storage resources
 - Market changes to facilitate real-time co-optimization of ancillary services
- Decisional Classification: Joint CAISO Board and WEIM Governing Body
- Status:
 - Jul 12, 2022 Issue paper posted
 - Initiative update call was held June 26, 2023
 - Working Groups Kick off: First week of August
 - Phase 1 Straw proposal Q4 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:**
 - Revised final proposal posted- Mar 14, 2023
 - Approval Joint CAISO Board and WEIM Governing Body and meeting Mar 2023
 - May 31, 2023 Tariff amendment filing (ER23-2020)

EDAM ISO BAA Participation Rules

- Scope: Initiative consists of three tracks (A1, A2, B) and addresses ISO BAA-specific elements required for EDAM participation.
 - Transfer resource settlement and transfer revenue distribution
 - Process for recovering historical WAC revenues
 - Criteria to set the ISO BAA's net EDAM export transfer constraint
 - Allocating ISO BAA EDAM RSE failure surcharges and revenues
 - Options for curing ISO BAA EDAM advisory RSE shortfalls
- Decisional Classification: CAISO Board
- Track A1 Status:
 - Draft final proposal posting July 13
 - Stakeholder call on July 20-21
 - Final proposal and draft tariff language posting in Aug 2023
 - ISO Board of Governors decision on Sep 20, 2023

WEIM Base Schedule Submission Deadline

- Scope: Proposal to revise WEIM base schedule submission to withdraw previously approved enhancement to create a new final WEIM resource sufficiency evaluation at T-30.
- Decisional Classification: Joint CAISO Board and WEIM Governing Body
- Status:
 - Proposal to remove T-30 RSE functionality posted June 13, 2023
 - Joint ISO Board of Governors and WEIM Governing Body decision on July 19, 2023

Generation Deliverability Methodology Review

- Scope: New initiative to respond to industry concerns with access to deliverability for resources seeking to compete in procurement processes
- Decisional Classification: TBD
- Status:
 - Update paper posted Dec 12, 2022
 - Issue paper posted May 2023
 - Straw proposal Jul 2023
 - Winter CAISO Board meeting

Rules of Conduct Enhancements – Track 1

- Scope: The first track is addressing meter data penalties and urgent topics that call for a streamlined stakeholder process. The second track will examine other potential enhancements and benefit from deeper stakeholder engagement.
- Decisional Classification: Joint Authority
- Status:
 - Jul 05, 2023 Straw Proposal
 - Jul 13, 2023 Stakeholder meeting
 - Aug 01, 2023 Draft Final Proposal
 - Sept 20, 2023 WEIM/BOG Decision

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
 - Track 1: Focused on immediate adjustments to the Cluster 15 study schedule and out-of-state wind.
 - Track 2: Focuses on targeted modifications to the interconnection process.
- Decisional Classification: CAISO Board only
- Status:
 - IPE 2023 Track 1 – Approved at May 2023 CAISO Board meeting
 - IPE 2023 Track 2
 - May 2023: Released discussion paper
 - Summer 2023: Ongoing stakeholder workshops
 - December 2023: CAISO Board meeting (targeted)

Release Plan Update

Trang Vo
Senior Project Manager,
Project Management

Release Plan Summary

Summer 2023 Release

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

Fall 2023 Release

- Energy Storage Enhancements Track 2
- WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2
- Washington WEIM Greenhouse Gas Enhancements & Interim Solution Effective May 1, 2023
- Maximum Import Capability Enhancements

Independent 2023 Releases

- WEIM Enhancements: Shared Ramping Constraint
- Hybrid Resources Phase 2C – RIMS
- URL & IP Changes – Application Delivery Resiliency

2024

- WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3
- Transmission Service & Market Scheduling Priorities Phase 2
- Day-Ahead Market Enhancements
- Extended Day-Ahead Market
- Congestion Revenue Rights System Upgrade

Summer 2023 Release

Summer 2023 Release Overview

| Project | BOG | Tariff | BRS | Settlements CG | Settlements Effective Date | Technical Specifications | Market Simulation Scenarios | Market Simulation | Production Activation |
|---|-------------------|---|---|--|--|---|-----------------------------|-----------------------------|-----------------------|
| Energy Storage Enhancements Track 1 | Approved 12/14/22 | <ul style="list-style-type: none"> Draft 02/10/23 Revised DTL 03/15/23 Filed 03/31/23 Accepted 06/01/23 | <ul style="list-style-type: none"> 02/08/23 03/29/23 1.4 | NA (Settlements is in Track 2 Fall 2023) | NA (Settlements is in Track 2 Fall 2023) | NA | NA | May 01, 2023 – Jun 19, 2023 | 07/01/23 |
| WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 1 | Approved 12/14/22 | <ul style="list-style-type: none"> Revised 12/12/22 Final Revised DTL 03/07/23 Revised Final DTL 03/21/23 Filed 03/31/23 Accepted 05/31/23 | <ul style="list-style-type: none"> 02/10/23 03/31/23 1.1 • 06/27/23 1.2 | <ul style="list-style-type: none"> 02/17/23: Tech Doc 03/15/23: 1st Draft CG 04/05/23: 2nd DCG 04/27/23: 3rd DCG 05/23/23: 4th DCG 06/21/23: Pre-Prod file & Final Artifacts 06/28/23: Deploy & Final Settlement Config Output File | 1 st of the month; new CCs | 03/30/23 OASIS 7.3.0 04/03/23 CMRI 6.3.0 | 04/07/23 | May 01, 2023 – Jun 09, 2023 | 07/01/23 |
| Hybrid Resources Phase 2C - Settlements | | | <ul style="list-style-type: none"> 01/31/23 | | 1 st of the month | NA | NA | May 01, 2023 – Jun 09, 2023 | 07/01/23 |
| Ancillary Service State of Charge Constraint | | Filed 09/19/22 Accepted 11/18/22 | 02/09/23 | | Retroactive to 09/20/22 | 04/03/23 CMRI 6.3.0 | NA | May 01, 2023 – Jun 09, 2023 | 07/01/23 |

Summer 2023 – Energy Storage Enhancements Track 1

| Project Information | Details |
|-------------------------------------|---|
| High Level Business Problem or Need | <p>This initiative evolves processes and systems to help storage resource scheduling coordinators better manage resource state of charge and continue to ensure efficient market outcomes. The purpose of this initiative is to enhance reliability tools with regards to storage resources. The enhancements include updates to bidding rules, exceptional dispatch of storage resources, and storage resource opportunity costs. The scope of Track 1 covers the enhancements slated for Summer 2023 Release. The remaining scope in the Energy Storage Enhancements Policy will be covered in Track 2 for Fall 2023 Release.</p> |
| High Level Project Scope | <p>Reliability Enhancements</p> <ul style="list-style-type: none"> • Include expected impacts from regulation in State of Charge (SOC) Deferred • Require storage to bid energy in the opposite direction of Ancillary Service (AS) awards <ul style="list-style-type: none"> • A resource providing reserves, regulation up, or regulation down must have energy bids to charge/discharge (respectively) • Energy bids must be 50% of AS awards <p>Reference Level Enhancements</p> <ul style="list-style-type: none"> • Update DA storage resource default energy bid (DEB) to include storage specific opportunity cost |
| BPM Changes | Market Instruments, Market Operations |
| Impacted Systems | SIBR, Market |

Summer 2023 – Energy Storage Enhancements Track 1

| System | High Level Changes |
|--------|--|
| SIBR | New rules to require storage resources to bid energy in the RT market in the opposite direction of their DA AS awards (applies to all AS awards—spin/non-spin, regulation up, and regulation down) |
| Market | <ul style="list-style-type: none">• Update state of charge (SOC) to include Regulation Up and Regulation Down awards (includes multipliers) Deferred• Update storage resource DA DEB to include Opportunity Cost |

Summer 2023 – Energy Storage Enhancements 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 Post External BRS 1.4 | Feb 08, 2023 Mar 29, 2023 | ✓ ✓ |
| Settlements Config Guides | NA (Settlements is in Track 2 Fall 2023) | NA | |
| Tech Spec | NA | NA | |
| Tariff | Draft Tariff Language Revised Draft Tariff Language File Tariff FERC Response | Feb 10, 2023 Mar 15, 2023 Mar 31, 2023 Jun 01, 2023 | ✓ ✓ ✓ ✓ |
| BPM | PRR 1516 for MI PRR for MO | Jun 08, 2023 In Progress | ✓ |
| Training | Training Refresher Training | May 02, 2023 Jun 22, 2023 | ✓ ✓ |
| Market Sim | Market Sim | May 01, 2023 – Jun 19, 2023 | ✓ |
| Production Activation | Energy Storage Enhancements Track 1 | Jul 01, 2023 | |

Summer 2023 – Energy Storage Enhancements Track

1

TRACK 1 SCOPE

Reliability Enhancements

Regulation Award Clarifications: Include expected impacts from regulation in State of Charge (SOC) – **Will not activate TD 7/1/23 (attenuation factors/AS multipliers to be set to 0), to be activated at a later date**

Bidding Requirements for AS: Require storage to bid energy in the opposite direction of Ancillary Service (AS) awards – **Will activate 7/1/23**

A resource providing reserves, regulation up, or regulation down must have energy bids to charge/discharge (respectively)

Energy bids must be 50% of AS awards

Reference Level Enhancements

DEB Enhancements: Update DA storage resource default energy bid (DEB) to include storage specific opportunity cost – **Will activate 7/1/23**

Summer 2023 – Energy Storage Enhancements Track

1

As announced on the 6/19 market simulation forum, the ISO has confirmed the ESET1 Attenuation Factors for Production will be set to zeros for TD 7/1/23 until further notice.

The MAP Stage Market Simulation environment Attenuation Factors has been set to be zeros for:

DA for TD June 22, 2023

RT for:

RTD June 20, 2023 14:35 binding interval

RTPD June 20, 2023 15:15 binding interval

STUC June 20, 2023 15:30

Summer 2023 – WEIM Resource Sufficiency Evaluation Enhancements

Phase 2 Track 1

| Project Information | Details |
|--------------------------|---|
| High Level Project Scope | <ul style="list-style-type: none"> Track-1 <ul style="list-style-type: none"> Item1A – Count hourly Exclude RTLPT exports and RT economic (RTECON) exports in RSE Capacity Upward/Downward Test and Flexible Ramping Sufficiency Upward/Downward Test for CAISO BAA. Item1B – Facilitate assistance energy transfer between WEIM BAAs into the WEIM BAAs that failed RSE upward test: <ul style="list-style-type: none"> Added as ex-post surcharge through Settlements. Market broadcasts needed data to Settlements. Item1C – Clarification of Post-HASP Block Hour Low-Priority Export <ul style="list-style-type: none"> 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)” via utilizing existing Market Path Product and Misc Info fields. |
| BPM Changes | Western Energy Imbalance Market, Market Operations, Settlements and Billing |
| Tariff Changes | Sections 29.11, 29.34 |
| Impacted Systems | MF, Market, Settlements, OASIS, CMRI |

Summer 2023 – WEIM Resource Sufficiency Evaluation Enhancements

Phase 2 Track 1

| System | High Level Changes |
|--------------------|--|
| MF | <ul style="list-style-type: none"> Define Assistance Energy Transfer Opt In/Out flag for each WEIM BAA receipt of assistance energy transfer Make BAA Assistance Energy Transfer Opt In/Out Flag accessible to downstream systems. |
| Market | <ul style="list-style-type: none"> Exclude RTLPT Exports and RTECON Exports Associated with Latest RTPD Run from RSE Tests for CAISO BAA Only Opted-Out / Opted-Inn Assistance Energy Transfer |
| Settlements | <ul style="list-style-type: none"> Calculate RT Assistance Energy Transfer Ex-Post Surcharge for Insufficient WEIM BAAs. Allocate Collected RT Assistance Energy Transfer Ex-Post Surcharge Revenue from Insufficient WEIM BAAs to all other WEIM BAAs that Pass Upward RSE Tests Pro Rata to their Net Exports. BAA Sub-Allocation of Charged Assistance Energy Transfer Ex-Post Surcharge Cost to Measured Demand for CISO BAA. <ul style="list-style-type: none"> WEIM Entities sub allocation of the charged assistance energy transfer ex-post surcharge cost will be performed per their defined OATT of these WEIM Entities (outside CAISO's Settlements system). BAA Sub-Allocation of Received Assistance Energy Transfer Ex-Post Surcharge Revenue to SCs Providing Incremental RT Imbalance Energy for CISO BAA. <ul style="list-style-type: none"> WEIM Entities sub allocation of the received assistance energy transfer ex-post surcharge revenue will be performed per their defined OATT of these WEIM Entities (outside CAISO's Settlements system). |
| OASIS | <ul style="list-style-type: none"> Consume RTM Bid Cap from SIBR. Consume corrected RSE Failure Capacities Publish RTM Bid Cap. Publish corrected values of RSE Failure Capacities. |
| CMRI | <p>Retire publication of new data in the following reports; new data will be available in OASIS</p> <ul style="list-style-type: none"> EIM > Bid Range Capacity Test Results EIM > Flexible Ramp Requirement Sufficiency Test Results |

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 Post External BRS v1.1 Post External BRS v1.2 | Mar 10, 2023 Mar 31, 2023 Jun 27, 2023 | ✓ ✓ ✓ |
| Settlements Config Guides | First Draft Technical Documents First Draft Configuration Output File + Draft Release Artifacts Second Draft Configuration Output File (Remove ESET1) Third Draft Configuration Output File Fourth Draft Configuration Output File Pre-Production Configuration Output File + Final Release Artifacts Production Deployment & Final Config Output File | Feb 17, 2023 Mar 15, 2023 Apr 05, 2023 Apr 27, 2023 May 23, 2023 Jun 21, 2023 Jun 28, 2023 | ✓ ✓ ✓ ✓ ✓ ✓ ✓ |
| Tech Spec | Create ISO Interface Spec (Tech spec) – OASIS 7.3.0 Create ISO Interface Spec (Tech spec) – CMRI 6.3.0 | Mar 30, 2023 Apr 03, 2023 | ✓ ✓ |
| Tariff | Revised Tariff Final Revised Draft Tariff Language Revised Final Draft Tariff Language File Tariff FERC Response | Dec 12, 2022 Mar 07, 2023 Mar 21, 2023 Mar 31, 2023 May 31, 2023 | ✓ ✓ ✓ ✓ ✓ |
| BPMs | Draft BPM changes – WEIM Draft BPM changes – Market Instruments Draft BPM changes – Market Operations Draft BPM changes – Settlements & Billing | Mar 30, 2023 Apr 03, 2023 Mar 30, 2023 Mar 29, 2023 | ✓ ✓ ✓ ✓ |
| Training | Training Course | Apr 26, 2023 | ✓ |
| Market Sim Scenarios | Market Sim Scenarios | Apr 07, 2023 | ✓ |
| Market Sim | Market Sim | May 01, 2023 – Jun 09, 2023 | ✓ |
| Production Activation | Resource Sufficiency Evaluation Enhancements Phase 2 Track 1 | Jul 01, 2023 | |

Summer 2023 – Hybrid Resources 2C Settlements

| Project Information | Details/Date |
|--|--|
| High Level Business Problem or Need | <p>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.</p> <p>Prior to this initiative, Phase 1 identified a first set of modifications generally concerned with setting up and operating co-located resources.</p> <p>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.</p> |
| High Level Project Scope | <p>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.</p> |
| BPM Changes | Settlements & Billing |
| Impacted Systems | <p>Summer 2023: Settlements</p> <p>Independent 2023: RIMS</p> <p>Completed: Today's Outlook, ISO Today Mobile Application, Reports</p> |
| Requirements | http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf |

Summer 2023 – Hybrid Resources 2C Settlements

| Milestone Type | Milestone Name | Dates | Status |
|---------------------------|--|--|--------|
| External BRS | Publish External BRS | Jan 31, 2023 | ✓ |
| Settlements Config Guides | First Draft Technical Documents | Feb 17, 2023 | ✓ |
| | First Draft Configuration Output File + Draft Release Artifacts | Mar 15, 2023 | ✓ |
| | Second Draft Configuration Output File (Remove ESET1) | Apr 05, 2023 | ✓ |
| | Third Draft Configuration Output File | Apr 27, 2023 | ✓ |
| | Fourth Draft Configuration Output File | May 23, 2023 | ✓ |
| | Pre-Production Configuration Output File + Final Release Artifacts Production Deployment & Final Config Output File | Jun 21, 2023 Jun 28, 2023 | ✓ |
| Tech Spec | Create and Publish ISO Interface Spec (Tech Specs) | NA | |
| BPMs | Draft BPM changes – Settlements & Billing | Mar 31, 2023 | ✓ |
| Training | CIDI Knowledge Article: KAS-23-430 Participating in the ISO Market as a Hybrid Tie-Gen Resource | May 26, 2023 | ✓ |
| Market Sim | Market Sim Window – Settlements | May 01, 2023 – Jun 09, 2023 | ✓ |
| Production Activation | Hybrid Resources 2C – Settlements | Jul 01, 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 | <p>Make storage resources ineligible for Bid Cost Recovery (BCR) uplift for certain market intervals in real time:</p> <ul style="list-style-type: none"> • 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

| Milestone Type | Milestone Name | Dates | Status |
|------------------------------|---|--|--------|
| External BRS | Publish External BRS | Feb 09, 2023 | ✓ |
| Settlements Config Guides | First Draft Technical Documents | Feb 17, 2023 | ✓ |
| | First Draft Configuration Output File + Draft Release Artifacts | Mar 15, 2023 | ✓ |
| | Second Draft Configuration Output File (Remove ESET1) | Apr 05, 2023 | ✓ |
| | Third Draft Configuration Output File | Apr 27, 2023 | ✓ |
| | Fourth Draft Configuration Output File | May 23, 2023 | ✓ |
| | Pre-Production Configuration Output File + Final Release Artifacts Production Deployment & Final Config Output File | Jun 21, 2023 Jun 28, 2023 | ✓ |
| Tech Spec | Create and Publish ISO Interface Spec (Tech Specs) – CMRI 6.3.0 | Apr 03, 2023 | ✓ |
| Tariff | File Tariff ER22-2881 | Sep 19, 2022 | ✓ |
| | Tariff Accepted | Nov 18, 2022 | ✓ |
| Training | Training Course | May 01, 2023 | ✓ |
| Market Sim | Market Sim | May 01, 2023 – Jun 09, 2023 | ✓ |
| | Market Sim – CMRI Data in New Market Active Constraint Report | May 09, 2023 | ✓ |
| Production | Ancillary Service State of Charge Constraint – Activation | Jul 01, 2023 | |
| | Ancillary Service State of Charge Constraint – Effective Date Retroactive | Sep 20, 2022 | |
| | Settlements & CMRI will have retroactive ASSOCC data from TD 9/20/22 | | |
| | The retroactive data in Settlements will be processed according to the Production schedule for recalc/reruns http://www.caiso.com/Documents/CalifornialSOPaymentsCalendar2023.xlsx | | |

Fall 2023 Release

Fall 2023 Release Overview

| Project | BOG | Tariff | BRS | Settlements CG | Settlements Effective Date | Technical Specifications | Market Simulation Scenarios | Market Simulation | Production Activation |
|---|---------------------|--|--|--|---------------------------------------|--------------------------|-----------------------------|-------------------|-----------------------|
| Energy Storage Enhancements Track 2 | Approved 12/14/22 | <ul style="list-style-type: none"> Draft 02/10/23 Revised DTL 03/15/23 Filed 03/31/23 | 05/25/23 | <ul style="list-style-type: none"> 02/17/23: Tech Doc | 1 st of the month; new CCs | ADS CMRI OASIS | Yes | Yes | Fall 2023 |
| WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 | Approved 12/14/22 | Yes | <ul style="list-style-type: none"> 02/10/23 03/31/23 1.1 06/27/23 1.2 | NA | NA | MFRDT | Yes | Yes | Fall 2023 |
| Washington WEIM Greenhouse Gas Enhancements | Oct 2022 - Approved | Filed 11/21/22 Accepted 02/10/23 Filed Amendment 03/13/23 Amendment Accepted 04/20/23 | 02/06/23 | NA | NA | MFRDT OASIS | NA | NA | Fall 2023 |
| MIC Enhancements | Nov 2022 – Approved | Draft 11/23/21 | 04/11/22 | NA | NA | OASIS | Yes | Yes | Fall 2023 |

Fall 2023 Release Overview – System Impacts

| Project | ADS | ALFS | BAAOP | CIRA | CMRI | ITS | Master File | MF RDT | OASIS | OMS | RIMS | Settlements | Market | SIBR |
|---|-----|------|-------|------|------|-----|-------------|--------|-------|-----|------|-------------|--------|------|
| Energy Storage Enhancements Track 2 | X* | | | | X* | X | X | | X* | X | X | X | X | X |
| WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 | X | | | | | X | X | X* | | | | | X | |
| WA WEIM GHG Enhancements | | | | | X* | | X | X* | X* | | | X | X | X |
| MIC Enhancements | | | | X | | | | | X* | | | | | |

X* = Technical Specifications

Fall 2023 Release Overview – System Interface

| System | Project | UI | API | Data | Tech Specs |
|---------|---------|---|--|--|------------|
| ADS* | ESET2 | Existing | Existing | New ED Reason Codes: “SOC Hold” and “SOC Charge” | Yes |
| CMRI* | ESET2 | 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 | | Yes |
| OASIS* | ESET2 | Existing: Energy > System > Operator-Initiated Commitment report | Existing: System > Operator-Initiated Commitment report | New ED type Reason Code: “SOC Hold” and “SOC Charge” | Yes |
| MF RDT* | RSEE2T2 | 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 | | Yes |
| RIMS | ESET2 | 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 | NA |
| ITS | RSEE2T2 | 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: <ul style="list-style-type: none"> 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)”: <ul style="list-style-type: none"> o RTPT exports that clear HASP o DAPT exports that clear both RUC and HASP | NA |

Fall 2023 Release Overview – System Interface Changes

| System | Project | UI | API | Data | Technical Specifications |
|---------|--------------|---|--|---|--------------------------|
| CMRI* | WA WEIM GHGE | Existing | Existing | New Attributes/Records to indicate state/include GHG index price for each state | Yes |
| 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 | Yes |
| 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 | Yes |
| SIBR | WA WEIM GHGE | Existing | Existing | Consume WA GHG adders | NA |

Fall 2023 – Energy Storage Enhancements Track 2

| Project Information | Details |
|--|--|
| High Level Business Problem or Need | <p>This initiative evolves processes and systems to help storage resource scheduling coordinators better manage resource state of charge and continue to ensure efficient market outcomes. The purpose of this initiative is to enhance reliability tools and the co-located model with regards to storage resources. The reliability enhancements include updates to bidding rules, exceptional dispatch of storage resources, storage resource opportunity costs, and local area minimum online constraints. The co-located model enhancements include preventing co-located resources from charging when beyond generation levels for on-site resources and allowing pseudo-tied resources to use the co-located model. The scope of Track 1 covered the enhancements for Summer 2023 Release. The remaining scope in the Energy Storage Enhancements Policy is covered in Track 2 for Fall 2023 Release.</p> |
| High Level Project Scope | <p>Reliability Enhancements</p> <ul style="list-style-type: none"> • Include lost opportunity from not generating in storage compensation due to hold Exceptional Dispatch (ED) to hold SOC (i.e. 0 MW ED) <ul style="list-style-type: none"> • Calculate counterfactual energy revenues with and without the SOC hold ED • If prices are below bids counterfactuals will not include discharges • Use actual LMPs (the ISO will not generate counterfactual LMPs) • Include SOC hold ED period through the end of the day in time horizon • Allow for Exceptional Dispatches (EDs) to be issued for storage resources to hold SOC <ul style="list-style-type: none"> • Develop functionality within ED User Interface; automate existing excel tool functionality • Storage may receive a traditional ED or an SOC ED, but not both <p>Co-Located Model Enhancements</p> <ul style="list-style-type: none"> • Develop an electable co-located model available to all storage resources <ul style="list-style-type: none"> • Storage schedules to never exceed renewable schedules (i.e. no grid charging) • Storage may deviate down to match solar, when solar is producing less than schedules in real-time • Deviations to be subject to imbalance energy charges • Require storage resources to submit outages when depleted and unable to charge • Require all resources to respond to operator and ED instructions within physical bounds of operation • Allow for co-located pseudo-tie resources to apply Aggregate Capability Constraint (ACC) <ul style="list-style-type: none"> • Resources under an ACC must be pseudo-tied from the same BAA |
| BPM Changes | Market Operations, Settlements & Billing |
| Impacted Systems | Settlements, Market, CMRI, RIMS, MF, OASIS, ADS, OMS, ITS |

Fall 2023 – Energy Storage Enhancements Track 2

| System | High Level Changes |
|--------------------|--|
| Market | <ul style="list-style-type: none"> Allow operator to enter exceptional dispatch (ED) in the market to allow for EDs of storage resources by SOC in addition to capacity Update the definition of EDs to allow the operator to enter EDs for storage resources identified with two new Reason Codes under Instruction Type: System Emergency (“SYSEMR”) |
| ADS | ADS consumes new ED Reason Codes (“SOC Hold” and “SOC Charge”) applicable to storage resources |
| Settlements | <ul style="list-style-type: none"> New rules to align with Tariff settlement language for SOC formula New inputs for the storage resource ED opportunity cost values Design and configure new charge code for the allocation of ED SOC uplift Modify real-time bid cost recovery (BCR) charge code to account for revenue from storage resources ED SOC uplift Configure No Pay rules and assessment for ED SOC |
| CMRI | Receive and shall publish the ED SOC information using new UI and API on a new report entitled “Exceptional Dispatch Hold State of Charge” |
| OASIS | Receive and publish new ED reason Codes (“SOC Hold” and “SOC Charge”) under System Emergency Instruction Type as “Reason” on the Operator Initiated Commitment OASIS Report |
| RIMS | <ul style="list-style-type: none"> Add field for storage resource duration (hours) Add field for calculated MWh Calculate energy (MWh) using duration*MW Allow pseudo tied resources to be modeled as co-located |
| MF | <ul style="list-style-type: none"> Apply co-located flag to pseudo tied resources Set minimum ACC constraint to zero for co-located resources that cannot or choose not to not grid charge New MF attribute to denote resources that select to not grid charge |
| OMS | <p>Storage resources must submit outage cards if:</p> <ul style="list-style-type: none"> The co-located VER cannot provide the charging energy as forecasted per Tariff requirements System shall require storage resources to submit outage cards if the resource has depleted its SOC and there is no ability to charge the resource per Tariff requirements |
| ITS | <p>System shall model pseudo-tied and dynamic co-located storage resources following the standard NRI pseudo-tie and dynamic rules and practices</p> <p>Note: pseudo-tied and dynamic storage resources must be registered as TNGR resources</p> |

Fall 2023 – Energy Storage Enhancements Track 2

| 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 | May 26, 2023 | ✓ |
| Settlements Config Guides | First Draft Technical Documents | Feb 17, 2023 | ✓ |
| Tech Spec | Publish Interface Specification – ADS Publish Interface Specification – CMRI Publish Interface Specification – OASIS | Yes | |
| Tariff | File Tariff FERC Response File Extension of MSOC FERC Approval of Extension of MSOC | Mar 31, 2023 Jun 01, 2023 Mar 28, 2023 May, 25, 2023 | ✓ ✓ ✓ ✓ |
| BPMs | Draft BPM changes – Market Operations Draft BPM changes – Market Settlements & Billing | Yes Yes | |
| Market Sim | Market Sim Window | Yes | |
| Production Activation | Energy Storage Enhancements Track 2 | Fall 2023 Release | |

Fall 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2

Track 2

| Project Information | Details |
|--------------------------|--|
| High Level Project Scope | <ul style="list-style-type: none"> • Track-2 <ul style="list-style-type: none"> • Item2A – Clarification of Post-HASP Block Hour Low-Priority Export <ul style="list-style-type: none"> • Operator-Driven Low-Priority Export Curtailment <ul style="list-style-type: none"> • CAISO operator's ability to initiate pro-rata curtailment based on identified MW, given the following priority order: <ul style="list-style-type: none"> • RTECON (RT economic hourly block export schedules that clear HASP). • RTLPT (RT Self-Schedule hourly block export schedules not backed by Generation from non-RA Capacity and cleared HASP). • Non-high-priority DA export [i.e. DAECON (DA economic hourly block export schedules that clear both RUC and HASP), or DALPT (DA hourly block export schedules not backed by Generation from non-RA Capacity that also cleared both RUC and HASP and are protected Self-Schedules)] • CAISO operator's ability to identify/filter exports by market priority types as well as "Firm Provisional Energy (G-FP)" eTag identifier. • Publish resource-specific market priority types and their associated MW data to ADS. • Item2B – Develop MF resource identification Capacity Test Failed-to-Start Rule Exemption flag to allow SCs of WEIM and CISO short start units that start with non-positive telemetry to identify specific resources that will be exempted from this functionality in RSE Capacity test. (Implemented in Phase 1 – enhancements needed) |
| BPM Changes | WEIM, Market Instruments, Market Operations |
| Tariff Changes | Yes |
| Impacted Systems | MF, Market, ITS, ADS |

Fall 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2

| System | High Level Changes |
|---------------|---|
| MF | <ul style="list-style-type: none"> • Definition and Submission of Resource-Specific Capacity Test Failed-to-Start Rule Exemption Flag via GRDT • Make Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag accessible to downstream systems. |
| ITS | <ul style="list-style-type: none"> • Clarification of Post-HASP Block Hour Low-Priority Export • Consume DAM Resource-Specific Market Priority Types and Resource-specific RUC Energy Awards from RUC. • Consume All Resource-Specific Market Priority Types from RTM. • SCs shall be required to submit Misc Info field Prior Type attribute for “Firm Provisional Energy (G-FP)” e-tags to identify RTECON, DAECON, RTLPT, DALPT. • SCs shall be required to submit Misc Info field Prior Type attribute for “Firm Energy (G-F)” e-tags to identify RTPT, DAPT. • Validate submitted export e-Tags against data received from RUC and RTM to approve/deny and adjust (if warranted) the submitted e-Tags. |
| Market | <ul style="list-style-type: none"> • Access Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag from MF. • Exempt Specific Resources from Capacity Test Failed-to-Start Rule/Functionality. • Clarification of Post-HASP Block Hour Low-Priority Export • Broadcast All Resource-specific market priority types to ITS (from RTM). |
| ADS | <ul style="list-style-type: none"> • Clarification of Post-HASP Block Hour Low-Priority Export <ul style="list-style-type: none"> • Consume Resource-Specific Market Priority Types and their Associated MW Data from RTM. • Publish Resource-Specific Market Priority Types and their Associated MW Data. • Include Resource-Specific Market Priority Types in ADS Query Functionality. |

Fall 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2

| 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 Post External BRS v1.1 Post External BRS v1.2 | Mar 10, 2023 Mar 31, 2023 Jun 27, 2023 | ✓ ✓ |
| Settlements Config Guides | NA | NA | |
| Tech Spec | Create ISO Interface Spec (Tech spec) – MF RDT | Yes | |
| Tariff | Tariff | NA | |
| BPMs | Draft BPM changes – WEIM Draft BPM changes – Market Instruments Draft BPM changes – Market Operations | Yes | |
| Market Sim Scenarios | Market Sim Scenarios | Yes | |
| Market Sim | Market Sim Window | Yes | |
| Production Activation | Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 | Fall 2023 Release | |

Fall 2023 – WEIM Resource Sufficiency Evaluation

Enhancements Phase 2 Track 2 BRS 1.2

Updated for:

- Section 1.3 (Scope), Section 4 (Details of Business Need/Problem), Section 5.1 (Business Practice Manual (BPM)), Section 5.2 (Other)
 - Updated to add CMRI publishing of market priority types MW schedules breakdown for export resources.
- RSEE2-BRQ-02040 (Track-3) – Item3A
 - Updated to only support 5-min granularity submission (removed 15-min and hourly granularity).
- RSEE2-BRQ-02160 (Track-3) – Item3A
 - Updated to only support 5-min granularity data for submitted, included and excluded LF Adjustments (removed 15-min and hourly granularity).
 - Updated to support 5-min granularity adjustment for Percentage of the submitted Non-Participating DR Schedules that are included in ALFS LF.
 - Removed Existing System Functionality.
- RSEE2-BRQ-02170 (Track-3) – Item3A
 - Updated to only account for the 5-min granularity data for the hourly-aggregate calculations (removed 15-min and hourly granularity).
 - Updated to add calculation for the hourly aggregate of Percentage of the submitted Non-Participating DR Schedules that are included in ALFS LF.
 - Updated to add an example for the calculations.
- RSEE2-BRQ-03060 (Track-1) – Item1C
 - Corrected to remove Track-2 from the BRQ ID since the eTag submission requirements are now in Track-1.
- RSEE2-BRQ-03160 (Track-2) – Item2A
 - Updated to add verbiage of not overloading the scheduling limits resulted from eliminating the exports counter-flow on them due to the exports curtailments.
- RSEE2-BRQ-03180 (Track-2) – Item2A
 - Added for the logic of not violating the scheduling limits resulted from eliminating the exports counter-flow on them due to the exports curtailments.
- RSEE2-BRQ-08560, RSEE2-BRQ-08580 (Track-2) – item2A
 - Added for CMRI publishing of market priority types MW schedules breakdown for export resources.
- Appendix-B: Formulas, Calculation Details, and Examples
 - Added Track-2 – Logic of Operator-Driven Export Curtailment without Violating Scheduling Limits.

Fall 2023 – WA WEIM GHG Enhancements - Overview

| Project Information | Details/Date |
|--|---|
| High Level Business Problem or Need | <p>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.</p> <p>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.</p> |
| High Level Project Scope | <ul style="list-style-type: none"> • Identify resources within WA State boundary • Update WA State associated resources’ greenhouse gas (GHG) reference levels with dynamic pricing using vendor-provided indices <ul style="list-style-type: none"> • 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 |

Fall 2023 – WA WEIM GHG Enhancements - Overview

| System | High Level Changes |
|-----------------|--|
| MF | <ul style="list-style-type: none">• 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<ul style="list-style-type: none">• Exception: BPA—not subject to WA reporting rule |
| Internal System | <ul style="list-style-type: none">• Reference level (commitment costs/DEBs) changes to reflect GHG costs<ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• Add WA GHG index prices to existing GHG Index Price OASIS report<ul style="list-style-type: none">• Only applicable for dynamic GHG pricing |

Fall 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 | NA | |
| Tech Spec | MFRDT OASIS | Yes | |
| Tariff | File Tariff ER23-474 Tariff Accepted Filed Amendment Amendment Accepted | Nov 21, 2022 Feb 10, 2023 Mar 13, 2023 Apr 20, 2023 | ✓ ✓ ✓ ✓ |
| BPMs | Publish Draft BPM for Interim Solution – WEIM PRR 1506 Publish Draft BPM for Interim Solution – Market Instruments PRR 1507 | Apr 26, 2023 Apr 26, 2023 | ✓ 🔄 |
| Market Sim | Market Sim Window | NA | |
| Production Activation | Interim Solution WA WEIM GHG Enhancements | May 01, 2023 Fall 2023 Release | ✓ |

2023 – WA WEIM GHG Enhancements – Interim Solution

- ✓ **Effective May 1, 2023**, the CAISO has implemented an alternative interim solution to activate functionality in the Washington WEIM GHG Enhancements initiative.
- The alternative interim solution would allow SCs for resources in Washington to reflect their GHG costs in the default energy bids and commitment costs.
- This effectively activates the tariff language for this initiative and the alternative interim solution will remain in effect until it is replaced with the full initiative implementation later this year. We don't expect the interim solution to delay the implementation of the full functionality.

Fall 2023 – MIC Enhancements

| Project Information | Details |
|---------------------------------|--|
| High Level Project Scope | <p>The purpose of this initiative is to address potential improvements to either the calculation of Maximum Import Capability or the process used to allocate and track it during Resource Adequacy validation process. This initiative will focus on the following scope items:</p> <ol style="list-style-type: none">1. Additional transparency with making data publicly available2. Inclusion of contractual data from non-CPUC jurisdictional LSEs into the main portfolio3. Request for MIC expansion4. Give “same day priority” to the step 13 unallocated Remaining Import Capability for LSEs with existing RA Contracts5. Update Tariff and BPM language to be consistent with current approved practice |
| BPM Changes | Reliability Requirements, Transmission Planning Process, Market Instruments |
| Tariff Changes | Yes |
| Impacted Systems | CIRA, OASIS |

Fall 2023 – MIC Enhancements

| Milestone Type | Milestone Name | Dates | Status |
|-----------------------|---|-------------------|--------|
| Board Approval | Obtain Board Approval | Nov 03, 2021 | ✓ |
| External BRS | Post External BRS | Apr 11, 2022 | ✓ |
| Tariff | Tariff | Yes | |
| BPMs | Draft BPM changes – Reliability Requirements Draft BPM changes – Transmission Planning Process Draft BPM changes – Market Instruments | Yes | |
| Market Sim Scenarios | Market Sim Scenarios | Yes | |
| Market Sim | Market Sim Window | Yes | |
| Production Activation | Maximum Import Capability (MIC) Enhancements | Fall 2023 Release | |

Independent 2023 Releases

2023 - 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 | <ul style="list-style-type: none"> 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) | <p>✓ BAAOP: ETSR detail screen May 8, 2023</p> <ul style="list-style-type: none"> 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" |
| Real-Time Market (RTM) | <p>BAAOP: WEIM shared ramping constraint IS NOT editable through UI. 2023</p> <ul style="list-style-type: none"> 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 |

2023 – Hybrid Resources 2C RIMS

| Project Information | Details/Date |
|--|--|
| High Level Business Problem or Need | <p>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.</p> <p>Prior to this initiative, Phase 1 identified a first set of modifications generally concerned with setting up and operating co-located resources.</p> <p>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.</p> |
| High Level Project Scope | <p>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.</p> |
| BPM Changes | <p>Settlements & Billing</p> |
| Impacted Systems | <p>Summer 2023: Settlements</p> <p>Independent 2023: RIMS</p> <p>Completed: Today's Outlook, ISO Today Mobile Application, Reports</p> |
| Requirements | <p>http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf</p> |

2023 – Hybrid Resources 2C RIMS

| Milestone Type | Milestone Name | Dates | Status |
|------------------------------|--|--------------|--------|
| External BRS | Publish External BRS | Jan 31, 2023 | ✓ |
| Settlements Config Guides | NA for RIMS | NA | |
| Tech Spec | Create and Publish ISO Interface Spec (Tech Specs) | NA | |
| Market Sim | Market Sim Window – RIMS | NA | |
| Production Activation | Hybrid Resources 2C – RIMS | 2023 | |

2023 – Application Delivery Resiliency

- Areas
 - Access Policy Manager - Application Authentication
 - Local Traffic Manager - Load Balancing
 - Application Security Manager - Web Application Firewall
- User Impacts & Actions
 - New IP ranges requiring firewall changes
 - Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space
 - New URLs for UIs and APIs requiring cutover
 - No application functionality changes expected
 - No provisioning changes expected

2023 – Application Delivery Resiliency

| Interface | In Scope | In Progress | Finished |
|-----------|---------------|---|--|
| UI | All remaining | <ul style="list-style-type: none"> • SIBR • BSAP • RCBSAP • BAAOP | <ul style="list-style-type: none"> • Developer • RCPortal • GMS • CIDI • PIVision • DRRS - Fall 2020 Release • ADS - Fall 2020 Release • AIM • CIRA • MRI-S • Public Website – May 26, 2021 <ul style="list-style-type: none"> • www.caiso.com • ISO Today Mobile Application • Stakeholder Comments Tool • content.caiso.com – July 29, 2022 • BPM - July 14, 2021 • WesternEIM - July 14, 2021 • Dev Site - July 2021 • RIMSPUB – September 14, 2021 • RIMS – September 14, 2021 • OASIS – Dec 2021 (No URL change) • OMS – June 14, 2022 |
| API | All | | <ul style="list-style-type: none"> • ADS - Fall 2020 Release • OASIS – Dec 2021 (No URL change) |

2023 – Application Delivery Resiliency

Remaining API Cutovers

- BAAOP
- BSAP
- CIRA
- CMRI
- DRRS
- EIDE
- ALFS
- MF
- PISOA
- RCBSAP
- RCSERVICES (RCEIDE)
- SIBR
- STLMT
- OMS

Plan

- MAP-Stage and Production will have soft cutovers to have current and new API URLs available in parallel for 60 days in each environment
- Current API URLs remain available while new API URLs are introduced as they become verified and ready for customer use
- MAP-Stage new API URLs available as of May 18, 2023
- Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space to access new API URLs

URL Changes (Application Delivery Resiliency)

Plan

- MAP-Stage new API URLs available as of May 18, 2023 for 60 days to transition
- Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space to access new API URLs

| API | Existing MAPSTAGE | New MAPSTAGE |
|---------------------|---|---|
| BAAOP | https://wsmap.caiso.com/sst/baaop | https://mapstage-ws.caiso.com/sst/baaop |
| BSAP | https://wsmap.caiso.com/sst/bsap | https://mapstage-ws.caiso.com/sst/bsap |
| CIRA | https://wsmap.caiso.com/sst/cira | https://mapstage-ws.caiso.com/sst/cira |
| CMRI | https://wsmap.caiso.com/sst/cmri | https://mapstage-ws.caiso.com/sst/cmri |
| DRRS | https://wsmap.caiso.com/sst/drrs | https://mapstage-ws.caiso.com/sst/drrs |
| EIDE | https://wsmap.caiso.com/sst/eide | https://mapstage-ws.caiso.com/sst/eide |
| ALFS (& FDR) | https://wsmap.caiso.com/sst/runtime.asvc | https://mapstage-ws.caiso.com/sst/runtime.asvc |
| MF | https://wsmap.caiso.com/sst/runtime.asvc | https://mapstage-ws.caiso.com/sst/runtime.asvc |
| PISOA | https://wsmap.caiso.com/sst/runtime.asvc | https://mapstage-ws.caiso.com/sst/runtime.asvc |
| RCBSAP | https://wsmap.caiso.com/sst/rcbsap | https://mapstage-ws.caiso.com/sst/rcbsap |
| RCSERVICES (RCEIDE) | https://wsmap.caiso.com/sst/rcservices | https://mapstage-ws.caiso.com/sst/rcservices |
| SIBR | https://wsmap.caiso.com/sst/sibr | https://mapstage-ws.caiso.com/sst/sibr |
| STLMT | https://wsmap.caiso.com/sst/stlmt | https://mapstage-ws.caiso.com/sst/stlmt |
| OMS | https://wsmap.caiso.com/sst/weboms | https://mapstage-ws.caiso.com/sst/weboms |
| ECIC | https://wsmap.caiso.com/sst/ecic | https://mapstage-ws.caiso.com/sst/ecic |

Future Releases

Future Releases Overview

| Project | BOG | Tariff | Production Activation |
|---|--|--|------------------------------|
| WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3 | Dec 14, 2022 – Approved | <ul style="list-style-type: none"> • NA | Summer 2024 |
| Transmission Service & Market Scheduling Priorities Phase 2 | Feb 2023 – Approved | <ul style="list-style-type: none"> • 03/27/23: Draft Tariff Language • 06/14/23: Revised DTL | Summer 2024 |
| Day-Ahead Market Enhancements | Feb 2023 – Briefing May 17, 2023 – Approved | <ul style="list-style-type: none"> • 06/02/23: Draft Tariff Language, Draft Tariff Matrix • 06/16/23: Comments due on DTL • 06/23/23: Meeting • File Aug 2023 | Fall 2024 |
| Extended Day-Ahead Market On-Boarding | Feb 2023 – Approved | <ul style="list-style-type: none"> • 03/30/23: Draft Tariff Language • 05/24/23: Working DTL • 06/08/23: Revised DTL • 07/06/23: Comments due on DTL • 07/26/23: Meeting • File Aug 2023 | Fall 2024 Spring 2025 |

2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2

Track 3

| Project Information | Details |
|--------------------------|---|
| High Level Project Scope | Track-3 <ul style="list-style-type: none">Item3A – DR Inclusion with RSE via ALFS (RSEE-1060) (Implemented in Phase 1 – enhancements needed)<ul style="list-style-type: none">Furnish ALFS-SOA API integration to DR SCs to automatically submit their DR LF Adjustment (that reflect Non-Participating DR Schedules) to account for DRs that are not explicitly modeled in real-time markets. |
| BPM Changes | Demand Response, WEIM |
| Tariff Changes | NA |
| Impacted Systems | MF, ALFS, Market, BAAOP |

2024 – WEIM Resource Sufficiency Evaluation Enhancements

Phase 2 Track 3

| System | High Level Changes |
|---------------|---|
| MF | <ul style="list-style-type: none"> RSEE-1060 – Business Process: Ensure DR Inclusion Flag Submission by WEIM Entity Only via CIDI. RSEE-1060 – Business Process: STF Notification of Changes to DR Inclusion Flag on WEIM Entity / WEIM Sub-Entity Level. |
| ALFS | <ul style="list-style-type: none"> Access DR Inclusion Flag on WEIM Entity/Sub-Entity Levels from MF. Translate the WEIM Entity/Sub-Entity DR Inclusion Flag to their associated LF zones (During MF transfer, the sub-area LF zone will adopt the WEIM Entity attestation flag). Receive Non-Participating DR Schedules from WEIM Entity or WEIM Sub-Entity Broadcast Non-Participating DR Schedules for WEIM Entity BAA or WEIM Sub-Entity. Broadcast DR LF Adjustment Data (that have been adjusted in ALFS) to downstream systems. |
| Market | <ul style="list-style-type: none"> Consume the following from ALFS: <ul style="list-style-type: none"> ALFS-DF-Submitted DR LF Adjustment (hourly aggregate) STF-DF-Excluded DR LF Adjustment (hourly aggregate) Accounting for DR LF Adjustments in RSE. |
| BAAOP | <p>Display DR LF Adjustments received from ALFS in BAAOP.</p> <p>Disable manual entry via BAAOP UI on a sunset date, after all participants transition to ALFS API submission.</p> |

2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3

| 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 Post External BRS v1.1 Post External BRS v1.2 | Mar 10, 2023 Mar 31, 2023 Jun 27, 2023 | ✓ ✓ |
| Settlements Config Guides | NA | NA | |
| Tech Spec | Create ISO Interface Spec (Tech spec) – ALFS | Yes | |
| Tariff | Tariff | NA | |
| BPMs | Draft BPM changes – Demand Response Draft BPM changes – WEIM | Yes | |
| Market Sim Scenarios | Market Sim Scenarios | Yes | |
| Market Sim | Market Sim Window | Yes | |
| Production Activation | Resource Sufficiency Evaluation Enhancements Phase 2 Track 3 | Summer 2024 | |

Fall 2024 – Day Ahead Market Enhancements

| Project Information | Details/Date |
|--|--|
| High Level Business Problem or Need | <p>In recent years, Variable Energy Resource (VER) have gained significant traction in the energy grid, playing a crucial role in achieving renewable energy targets and reducing greenhouse gas emissions. However, their increasing presence has introduced a new challenge energy imbalances between the Day Ahead and Real Time markets.</p> <p>Another reason for the energy imbalance is the day-ahead market operates on hourly time increments, whereas real-time market schedules energy in 15 and 5-minute intervals. This discrepancy in granularity results imbalances since the rea-l-time market schedules fluctuate within the hour while day-ahead market schedules remain fixed for the entire hour.</p> <p>These imbalances necessitates out-of-market interventions by operators, such as forecast biasing and dispatches, to uphold grid reliability. However, this situation presents an opportunity to improve our market software, enabling us to achieve a more efficient and economical solution while addressing the variability and reliability concerns within the market.</p> |
| High Level Project Scope | <p>Enhance the California ISO's (CAISO's) day-ahead market by:</p> <ul style="list-style-type: none"> • Introducing an imbalance reserve (IRU/IRD) product to provide flexible capacity to account for real-time ramping needs • Enhancing the residual unit commitment process to also ensure there is sufficient downward dispatch capability (RCU/RCD) • Enhancing the day-ahead market to maximize benefits of greater West-wide diversity in the day-ahead optimization for Western Energy Imbalance Market participants |
| BPM Changes | <p>Settlements and Billing, Market Instruments & Market Operations</p> |
| Tariff Changes | <p>Sections 27, 31, 34, 39</p> |
| Impacted Systems | <p>MF, SIBR, DAM, OASIS, CMRI, Settlements & Internal Systems</p> |

Fall 2024 – Day Ahead Market Enhancements

| System | High Level Changes |
|--------------------|--|
| MF | <ul style="list-style-type: none"> Define IRU, IRD, RCU, RCD eligibility for the resource ID in MF. |
| SIBR | <ul style="list-style-type: none"> IRU,IRD,RCU,RCD bid rules |
| DAM | <ul style="list-style-type: none"> Calculate IRU/IRD requirements MPM: Market Power Mitigation for IRU/IRD IFM: procure IRU/IRD IRU/IRD deployment scenarios IRU/IRD requirement distribution IRU/IRD in NA-AC power flow Include IRU/IRD in constraints RCU/RCD procurement RUC-MPM pass Impact on RUC performance with additional MPM pass LMP for EN, IRU/IRD, RCU/RCD |
| OASIS | <ul style="list-style-type: none"> IRU, IRC, RCU,RCD related public reports |
| CMRI | <ul style="list-style-type: none"> IRU, IRC, RCU,RCD related private reports |
| Settlements | <ul style="list-style-type: none"> IRU, IRC, RCU,RCD Settlements |

Fall 2024 – Day Ahead Market Enhancements

| Milestone Type | Milestone Name | Dates | Status |
|-----------------------|-------------------------------------|-----------------------------|--------|
| Board Approval | Board Briefing/Approval | May 17, 2023 | ✓ |
| External BRS | Publish External BRS | Jul 17, 2023 | |
| Config Guides | Post Draft Config Guides | Mar 25, 2024 | |
| Tech Spec | Publish Technical Specifications | Oct 05, 2023 | |
| Tariff | First Draft Tariff Posting | Jun 02, 2023 | ✓ |
| | Second Draft Tariff Posting | Jul 05, 2023 | |
| | FERC Filing | Aug 15, 2023 | |
| BPMs | Post Draft BPM Changes | Mar 18, 2024 | |
| External Training | External User Training | Aug 12, 2024 | |
| Market Sim | Market Sim Window | Jun 03, 2024 - Aug 23, 2024 | |
| Production Activation | Day Ahead Market Enhancements-EPL17 | Oct 01, 2024 | |

Congestion Revenue Rights (CRR) Upgrade

| Project Information | Details/Date |
|--------------------------|--|
| High Level Project Scope | <p>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.</p> <p>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.</p> <p>Congestion Revenue Rights (CRR) system replacement project scope is the roll-out of a:</p> <ul style="list-style-type: none"> • Brand new user-interface (UI) system with an updated new look-and-feel, to replace the existing legacy system implemented during the MRTU 2008 go-live and brought up to current ISO technology standards • Set of application-programming interfaces (APIs) to enable integration between ISO and market participant systems <p>Overall, to support the following in one consolidated CRR external-facing system:</p> <ul style="list-style-type: none"> • Annual/Monthly Auction and Allocation market participant bid submission and results retrieval • Load data submission by CRR LSEs, CEC • Load migration data submission by CRR UDCs • Secured "Congestion Revenue Rights Full Network Model" information access • Private and public access of CRR market input and output information |
| BPM Changes | <p>Congestion Revenue Rights</p> <ul style="list-style-type: none"> • 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. |

Congestion Revenue Rights (CRR) Upgrade

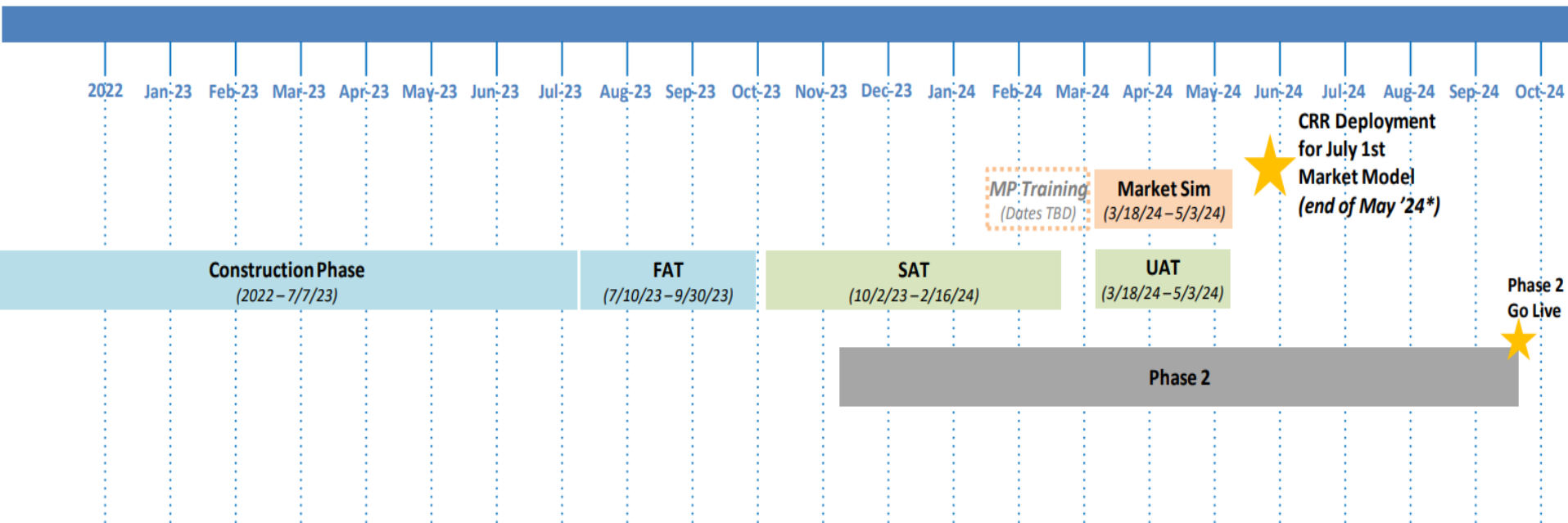
| System | High Level Changes |
|--------------------|---|
| CRR | Significant system upgrade including: <ul style="list-style-type: none"> • Enhancements made to the new CRR application. • Automatic publishing of CRR market results. • Automatic CRR notification. • New CRR schedule calendar. • New CRR FNM access. • New CRR data submission and download interface UI/API. • Other TBDs identified through BRS development. |
| AIM | <ul style="list-style-type: none"> • New users and roles to support new CRR functionality |
| CMRI | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • Broadcast |
| EMMS | <ul style="list-style-type: none"> • CRR will consume data from EMMS |
| IFM/RTN | <ul style="list-style-type: none"> • CRR will consume data from IFM/RTN |
| MQS | <ul style="list-style-type: none"> • MQS will consume and process SCID in a new format • MQS will consume ownership payload in bulk |
| Master File | <ul style="list-style-type: none"> • Master File will be modified as needed to support the new CRR functionality |
| MPP | <ul style="list-style-type: none"> • CRR will provide pre-configured external reports |
| Settlement | <ul style="list-style-type: none"> • Settlements will be modified as needed to support the new CRR functionality |
| WebOMS | <ul style="list-style-type: none"> • CRR will consume data from WebOMS |
| ETCC | <ul style="list-style-type: none"> • CRR will consume data from ETCC |

Congestion Revenue Rights (CRR) Upgrade

| Milestone Type | Milestone Name | Dates | Status |
|-----------------------------------|---|------------------------------|--------|
| Board Approval | Obtain Board of Governors Approval | NA | |
| External BRS | Publish External BRS BRS Revision v1.3 | Nov 16, 2022 Mar 29, 2023 | ✓ ✓ |
| Config Guides | Post Draft Config Guides | Yes | |
| Tech Spec | Publish Technical Specification | Feb 24, 2023 | ✓ |
| Deployment Plan | Draft Deployment Plan | Yes | |
| Training | Training | Yes | |
| Market Sim | Market Sim | Mar 18, 2024 – May 03, 2024 | |
| Customer Partnership Group | Next CPG | Jun 28, 2023 | |

Congestion Revenue Rights (CRR) Upgrade

Updated May 25, 2023



*Exact cutover date TBD

CRR System Upgrade – Get Connected

- CRR 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, 6/28 @ 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...

Calendar of Meetings, Training and Events

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

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

Market Sim

Market Sim

Release Users Group
(RUG)

Next RUG: July 25, 2023

Cancelled: July 11 RUG meeting

Contact for Questions & Agenda Requests: Trang Vo, tvo@caiso.com

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RUG Calendar 2023



2023

Release User Group Meetings

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

| January | | | | | | |
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Meeting

Holiday



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User Groups Calendar - 2023



2023

Settlement User Group Meetings

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

| July | | | | | | |
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2023

Technical User Group Meetings

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

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For reference

Visit user group webpage for more information:

<https://www.caiso.com/informed/Pages/MeetingsEvents/UserGroupsRecurringMeetings/Default.aspx>

- If you have any questions, please contact Brenda Corona at bcorona@caiso.com or isostakeholderaffairs@caiso.com

Upcoming meetings

The next MPPF is scheduled **hybrid*** on September 21, 2023.
User groups and recurring meetings > Market performance and planning forum > 2023



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 | | | | | | |
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| September | | | | | | |
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| December | | | | | | |
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 Meeting

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<http://www.caiso.com/about/Pages/Blog/default.aspx>.

Read a recent article featured in the blog:

The preview for the "Summer Readiness" article features a photograph of a bright sun rising over a landscape with silhouettes of high-voltage power transmission towers. The words "SUMMER READINESS" are overlaid in large, white, bold, sans-serif capital letters. To the right of the image, the article details are provided: the date "June 9, 2023", the category "Summer conditions", the title "Ready for summer? We spent the winter getting prepared", a short paragraph of text, and a "READ MORE" link.

June 9, 2023
Summer conditions

Ready for summer? We spent the winter getting prepared

During even the coldest and wettest days of winter, the California Independent System Operator (ISO) was intently focused on the hottest days of the year. High and prolonged heat, combined with wildfires and drought, has put increased strain on the grid in recent years, especially in the evenings, when temperatures remain hot and solar production rolls off the system.

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