

# Market Performance and Planning Forum



December 14, 2023 

# Housekeeping Forum 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

- 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 2023-2024 release plans, resulting from stakeholders inputs







California ISO

## Market Performance and Planning Forum

Agenda – Dec 14, 2023  
11 a.m. – 4 p.m. (PST)



Time:	Topic:	Presenter:
11:00 – 11:05	Introduction, Agenda	Brenda Corona, Stakeholder Affairs
11:05 – 11:30	Policy Update	Gillian Biedler, Market Strategy and Governance
11:30 – 12:00	Release Update	Trang Vo, Project Management
12:00 – 1:00	<i>Break</i>	
1:00 – 4:00	<ul style="list-style-type: none"><li>• Treatment of exports and wheels in Summer 2023</li><li>• Performance of Storage resources after enhancements</li><li>• System performance during the October Eclipse</li><li>• Load Conformance</li><li>• Assistance Energy transfer</li><li>• General market performance</li></ul>	Market Performance and Advanced Analytics Short-Term Forecasting

## Policy Update



Gillian Biedler

Policy Integration and Governance Manager

# Extended Day-Ahead Market and Day-Ahead Market Enhancements

- On August 22, the ISO filed the EDAM and DAME tariff amendments with FERC and filed answers to comments and limited protests on October 11
  - FERC decision expected by December 21, 2023
- The ISO continues internal EDAM implementation activities, including continued engagement with prospective participants
  - PacifiCorp and Balancing Authority of Northern California (BANC) have indicated their intent to participate in EDAM
- Planning and preparations for DAME implementation working groups underway and expected to begin in Fall 2024
- EDAM go-live is targeted for Spring 2026 to support implementation and readiness of participating entities

# Transmission Services and Market Scheduling Priorities

- On October 30, FERC issued an order approving the filed TSMSP phase 1 tariff amendments.
- The approved design provides for the calculation of available transfer capability (ATC) and the process for establishing market scheduling priority for wheeling through the ISO transmission system.
  - Engaging in implementation activities of functionality and timeline assessment to communicate with stakeholders.
- Currently undertaking the tariff development process for TSMSP phase 2 focused on the study and expansion process for establishing wheel through priority on a long-term basis.
  - Targeted FERC filing in Q1 2024

# 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:
  - ESE track 2 software successfully implemented as part of Fall 2023 software release
    - State-of-charge exceptional dispatch functionality and settlement
    - Co-located resource aggregated capability constraint
    - State-of-charge consideration of regulation

# 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 targeted for Q1 2024

# EDAM ISO BAA Participation Rules

- Scope: ISO BAA-specific elements required for EDAM participation.
  - Settlement of transfers that result from the EDAM optimization, as well as transfer revenue that accrues from congestion between participating balancing areas
  - Allocation of historical transmission revenue recovered amounts
  - Settlement for revenues and surcharges associated with the EDAM resource sufficiency evaluation
  - The ISO balancing area's use of the EDAM net-export constraint
- Decisional Classification: CAISO Board
- Status:
  - Approved by Board of Governors during September 2023 meeting
  - Filed with FERC in November 13, 2023
  - Planned PRR initiation to further define usages of EDAM net export constraint in 2024

# Day-Ahead Sufficiency

- Scope: daily processes to ensure the CAISO BAA is on track to meet its EDAM resource sufficiency evaluation (RSE) obligations
  - Advisory RSE results and complementary information
  - Accounting for reliability demand response resources
  - Accounting for strategic reliability reserve resources
  - Curing remaining upward RSE shortfalls
  - Incentives for tagging day-ahead imports
- Decisional Classification: CAISO Board
- Status:
  - Issue paper published on December 5, 2023
  - Stakeholder meeting on December 18, 2023 to discuss issue paper



# Rules of Conduct Enhancements

- Scope: The first track addressed 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:
  - September 20, 2023 WEIM/BOG approval
  - Tariff language under development
  - Track 2 dates forthcoming

# Reliability Demand Response Resource (RD RR) minimum run time

The ISO has commenced a narrowly scoped policy initiative to make a tariff change to the current one hour minimum run [on] time requirement for RD RRs. This initiative is being undertaken to:

- Provide operational benefit by more accurately reflecting RD RRs minimum on time in markets during stressed conditions.
- Retain customers in retail programs integrated as RD RRs and the demand reduction capacity they provide.
- Prevent roll back of preferred operational dispatch order of RD RRs directed by CPUC
  - Proposed Decisional Classification: Joint Authority
  - Planning for ISO Board of Governors and WEIM Governing Body decision in February 2024

# 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:
  - Straw proposal posted August 22
  - Draft final proposal posted November 06
  - Stakeholder meeting November 13
  - Winter 2023 Board of Governors Meeting (approval likely not necessary)

# Interconnection Process Enhancements Track 2

- Scope: Enhancing the CAISO's generator interconnection and deliverability allocation procedures
  - Track 2: Focuses on targeted modifications to the interconnection process.
- Decisional Classification: CAISO Board only
- Status:
  - IPE 2023 Track 2
    - December 12 Revised Straw Proposal posting
    - February 8, 2024 Draft Final Proposal posting
    - March 29, 2024 Final proposal posting
    - Note: April 4, 2024 FERC Order 2023 compliance deadline
    - May 2024 Board of Governors meeting

# Greenhouse Gas (GHG) Coordination Working Groups

The GHG Coordination Working Group is focused on continuing to evaluate and evolve the ISO's GHG accounting design.

Stakeholders have prioritized the following topics :

- Emissions tracking, analysis, and accounting to support market participants
- Market consideration of diverse state GHG reduction policies
- Review of market operations as well as the WEIM and EDAM GHG accounting design

The Working Group's effort will culminate in a GHG Action Plan report to inform a policy initiative.

Our next working group meeting is January 11<sup>th</sup>. Please email [inicosia@caiso.com](mailto:inicosia@caiso.com) if you are interested in presenting.

# Gas Resource Management Working Groups

The Gas Resource Management (GRM) Working Group is a holistic review of issues related to gas resource market participation to ensure policy accommodates the diversity of regional participant needs.

Topics identified by stakeholders fall into three categories:

1. Uncertainty around advance fuel procurement
2. Commodity market information used in ISO market processes
3. Tools for resource-specific cost adjustments

Status:

- July – Oct 2023: Problem Statement development
- Dec 2023 – Feb 2024: Problem statement data analysis, identify and benchmark feasible solutions
- March 2024: Issue Paper/Straw Proposal

# Resource Adequacy Working Groups

- The ISO has hosted three RA working group meetings, facilitated by Jeff McDonald of CEA Advisors
  - Related to these efforts, the ISO has facilitated two workshops this year on interoperability with the CPUC's Slice of Day reform
- The goal of the RA working group is to align on principles, problem statements and prioritization —culminating in an “Action Plan” to bridge the working group effort to policy development and sequence necessary RA reforms.
- Our next working group meeting is January 16th. If you would like to present, please email [jmcdonald@ceaadvisors.com](mailto:jmcdonald@ceaadvisors.com)

# Price Formation Enhancements Working Groups

- 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
- Status:
  - July 12, 2022 Issue paper posted
  - Initiative update call was held Jun 26, 2023
  - 8 working group meeting held to date. Next working group meeting Jan10, 2024, see notice on 12/15
  - Phase 1 Straw proposal expected in 2024



# Update to Policy Catalog and Roadmap processes

- Scope:
  - To better elicit and reflect stakeholder input as well as internal planning and prioritization efforts, the ISO is exploring changes to the policy catalog and roadmap processes
- Status:
  - Process documentation forthcoming
  - Level-setting meeting scheduled for 1/30/24

# Release Plan Update

Trang Vo  
Release Manager,  
Project Management



# Release Plan Summary

## Release Communication

### Independent 2023 Releases

- ✓ CMRI RTD Schedules Data - Market Alignment of WEIM Resource Awards During CAISO RTCD events to DOT & DOP coming from Advisory Data: 11/29/23
- ✓ Variable Operations & Maintenance Cost Review 12/1/23

### Summer 2024 Release

Transmission Service & Market Scheduling Priorities Phase 2  
Transmission Exchange Agreement

### Independent 2024 Releases

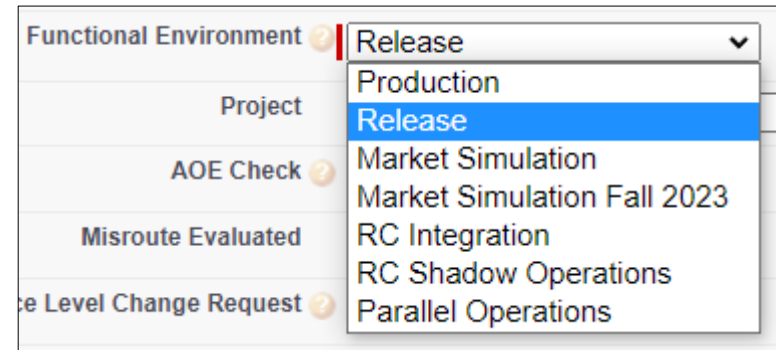
URL & IP Changes (& AUP Changes) – Application Delivery Resiliency: API ✓11/15/23 & 01/17/24; UI 01/18/24  
Transmission Register System Upgrade: Production 01/18/24  
WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 – Post HASP Curtailments: Activation 02/21/24  
Hybrid Resources Phase 2C – RIMS  
Congestion Revenue Rights System Upgrade  
CAISO Website Replacement  
FERC 881 – Managing Transmission Line Ratings Track 1  
FERC 881 – Managing Transmission Line Ratings Track 2

### Spring 2026 Release

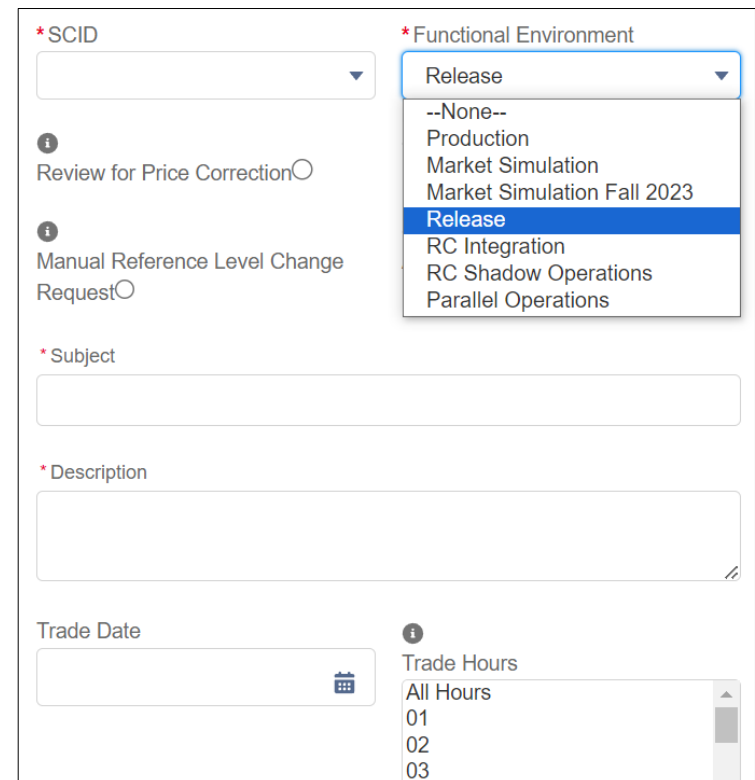
Day-Ahead Market Enhancements Activation  
EDAM ISO BAA Participation Rules Track A  
Extended Day-Ahead Market Activation  
EDAM Onboarding PacifiCorp  
WEIM BHE Montana

# Release Communication

- CIDI cases
  - **No Environment – Release:** (New option)
    - Inquiries that are related to releases, that are not directly related to Market Simulation issues.
    - Includes business requirements specifications (BRS) comments, implementation questions and feedback, etc.
  - **Market Simulation:**
    - Inquires that are related to the MAP-Stage environments (non-production).
  - **Market Simulation Fall 2023:**
    - Now that Fall 2023 Release is in Production, only the option of 'Market Simulation' remains as seasonal options are no longer applicable.
- Contact: [release@caiso.com](mailto:release@caiso.com)



A screenshot of a web form showing a dropdown menu for 'Functional Environment'. The menu is open, displaying several options: 'Release' (highlighted in blue), 'Production', 'Market Simulation', 'Market Simulation Fall 2023', 'RC Integration', 'RC Shadow Operations', and 'Parallel Operations'. The background shows parts of the form with labels like 'Project', 'AOE Check', 'Misroute Evaluated', and 'Level Change Request'.



A screenshot of the 'Release Communication' form. The form includes several fields and dropdown menus. The 'Functional Environment' dropdown is open, showing the same options as the first screenshot, with 'Release' selected. Other fields include 'SCID', 'Subject', 'Description', 'Trade Date', and 'Trade Hours'. There are also checkboxes for 'Review for Price Correction' and 'Manual Reference Level Change Request'.

# Summer 2024 Release

# Summer 2024 – Transmission Service & Market Scheduling Priorities

## Phase 2

Project Information	Details
<b>High Level Business Need</b>	Presents a long-term, durable framework to establish wheeling through scheduling priorities in the ISO markets that can further evolve with operational experience. It does not focus on, nor does it change, the processes for wheeling out or exporting from the ISO BAA.
<b>High Level Project Scope</b>	<p>The following are the key design elements of the proposed framework for establishing wheeling through scheduling priority across the ISO system:</p> <ul style="list-style-type: none"> <li>• Calculating Available Transfer Capability (ATC) in Monthly &amp; Daily Increments</li> <li>• Accessing and Reserving ATC</li> <li>• Transmission study and expansion process</li> <li>• Application of priorities in post-HASP process</li> <li>• Compensation framework for wheeling through scheduling priority</li> </ul>
<b>BPM Changes</b>	<ul style="list-style-type: none"> <li>• Market Instruments</li> <li>• Market Operations</li> <li>• Reliability Requirements</li> <li>• Settlements and Billing</li> <li>• Transmission Planning Process</li> <li>• Generator Interconnection and Deliverability Allocation Procedures</li> </ul>
<b>Tariff Changes</b>	<ul style="list-style-type: none"> <li>• §23.1, §23.2, §23.3, §23.4, §23.5, §23.6, §23.7</li> <li>• §26.1.4.5</li> <li>• §30.5.1</li> <li>• §34.12.3</li> <li>• §Appendix A</li> <li>• §Appendix L</li> </ul>
<b>Impacted Systems</b>	<ul style="list-style-type: none"> <li>• AIM</li> <li>• System for ATC calculation, access, and reservation</li> <li>• SIBR</li> <li>• RTM</li> <li>• Settlements</li> <li>• OASIS</li> <li>• ITS</li> </ul>

# Summer 2024 – Transmission Service & Market Scheduling Priorities Phase 2

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Feb 01, 2023	✓
External BRS	Post External BRS	TBD	
Settlements Config Guides	Post Draft Config Guides	Feb 12, 2024	
Tech Spec	Create ISO Interface Specifications	Yes	
Tariff	Filed ER23-2510 for Wheeling Through FERC Acceptance of ER 23-2510 (calculation of available transfer capability (ATC) and the process for establishing market scheduling priority for wheeling through the ISO transmission system)	Jul 28, 2023 Oct 30, 2023	✓ ✓
	Track 2 DTL Track 2 Revised DTL File Track 2 (study and expansion process for establishing wheel through priority on a long-term basis)	Jul 14, 2023 Oct 05, 2023 Q1 2024	✓ ✓
BPMs	Draft BPM changes – Market Instruments Draft BPM changes – Market Operations Draft BPM changes – Reliability Requirements Draft BPM changes – Settlements and Billing Draft BPM changes – Transmission Planning Process Draft BPM changes – Generator Interconnection and Deliverability Allocation Procedures	Yes	
Production Activation	Transmission Service & Market Scheduling Priorities Phase 2 – Activate daily and long-term increment calculations	Jun 01, 2023	

# Summer 2024 – Transmission Exchange Agreement

Project Information	Details/Date
<b>High Level Business Problem or Need</b>	The TEA is expiring in 2024 and absent WAPA's ability to resell their capacity on the Pacific AC Intertie ("PACI") #1 line which is owned and operated by WAPA-SNR and within the CAISO BAA they will move the line to the BANC BAA and the ISO will lose 1200 MW transfer capability at Malin.
<b>High Level Project Scope</b>	<ul style="list-style-type: none"><li>• WAPA needs functionality to sell their TOR (using ETC/TOR terminology instead of CRN) to other parties on their OASIS.</li><li>• If the TOR rights are sold then WAPA will notify the CAISO to provide the purchaser the hedging and scheduling priority opportunity provided all ETCs/TORs.</li><li>• The market and settlement systems need to be able to "move" the CRN from the WAPA CRN to the purchaser SCIDs so that the settlement to the purchaser SCID reverse the costs of transmission access charge and congestion (aka the perfect hedge) and the IFM and RTM provide a high scheduling priority.</li><li>• WAPA will not take on the obligation to settle with their purchaser.</li><li>• WAPA can sell any increments of MWs up to their 400 MW ownership rights. Therefore, the solution needs to be flexible enough to allow the "existing" TORs to vary the MWs capabilities. [Note: We can require restrictions, if required – e.g. no less than 5 MW increments]</li><li>• WAPA's functionality allows them to schedule between Malin and Round Mountain, and Malin and Tracy. This would be the source and sink that that functionality needs to provide.</li><li>• If there are outages on the line, the curtailment should be consistent with current practice.</li></ul>
<b>BPM Changes</b>	Settlements Configuration Guides
<b>Tariff Changes</b>	N/A
<b>Impacted Systems</b>	SIBR, DAM/RTM, Settlements, ITS, MF



# Summer 2024 – Transmission Exchange Agreement

Milestone Type	Milestone Name	Dates	Status
External BRS	Post External BRS	TBD	
Settlements Config Guides	Post Draft Config Guides	Feb 12, 2024	
Tech Spec	Create ISO Interface Specifications	Yes	
Tariff	NA	NA	
BPMs	Draft BPM changes – Settlements & Billing	Yes	
Production Activation	Transmission Exchange Agreement Renegotiation	Jun 01, 2024	

# Independent 2024 Releases

# UI & API URL & IP Changes (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

# UI & API URL & IP Changes (Application Delivery Resiliency)

**Current API Notice:** The California ISO implementation of the first phase of the Production Application Programming Interface (API) Web Service (WS) Uniform Resource Locator (URL) cutovers is now completed as of Nov. 15, 2023 and has made the new Production API WS URLs available. The next and final phase of the Production API WS URL cutovers is now scheduled for Jan. 17, 2024 and will move the existing Production API WS URLs to new infrastructure.

## Phase 1 – Nov. 15, 2023 **COMPLETE**

- No changes to existing API WS URLs: <https://ws.caiso.com/sst/<SYSTEM>/<SERVICE>>
- New API WS URLs are available: <https://ws.prod.caiso.com/sst/<SYSTEM>/<SERVICE>>
- Access to the new API WS URLs consist of the following that will require users to be configured per below:
  - **New IPs: Please open the entire 45.42.16.0/21 network on ports 80 & 443 for the new CAISO IP space**
  - **New Certificate Authority (was Verizon and is now Entrust): Please add the two Entrust certificates to your application trust stores on your servers**
  - **Global Rate Limit**
    - 30 per second across all the WS below combined per TCP source supported on the WS endpoint (1800 connections per minute); this includes submits and retrieves:
      - BAAOP/BSAP/CIRA/CMRI/DRRS/EIDE/ALFS (& FDR)/MF/PISOA/RCBSAP/RCSERVICES (RCEIDE)/SIBR/STLMT/OMS/ECIC
  - **Service-Level Acceptable Use Policy (AUP) for CMRI, DRRS, and MRI-S**
    - In addition to the Global Rate Limit above, these systems will have an additional layer of protection
    - CMRI
      - retrieves will leverage a 5-second period for enforcement
      - there are no CMRI submits
    - DRRS
      - Both submits and retrieves will leverage a 30-second period for enforcement
    - MRI-S (STLMT)
      - Retrieves of METER DATA will leverage a 30-second period for enforcement
      - submits will not have any additional layer of protection other than the Global Rate Limit above

## Phase 2 – Jan. 17, 2024

- No additional changes to the new API WS URLs made available in Phase 1: <https://ws.prod.caiso.com/sst/<SYSTEM>/<SERVICE>>
- The existing API WS URLs: <https://ws.caiso.com/sst/<SYSTEM>/<SERVICE>> will be cutover to new underlying infrastructure
- Access to the existing API WS URLs will now also require users to be configured per below (same as above):
  - New IPs
  - New Certificate Authority (was Verizon and is now Entrust)
  - Global Rate Limit
  - Service-Level Acceptable Use Policy (AUP) for CMRI, DRRS, and MRI-S

Customers are encouraged to contact Trang Vo at [tvo@caiso.com](mailto:tvo@caiso.com) or [release@caiso.com](mailto:release@caiso.com) and/or submit a CIDI case for any questions.

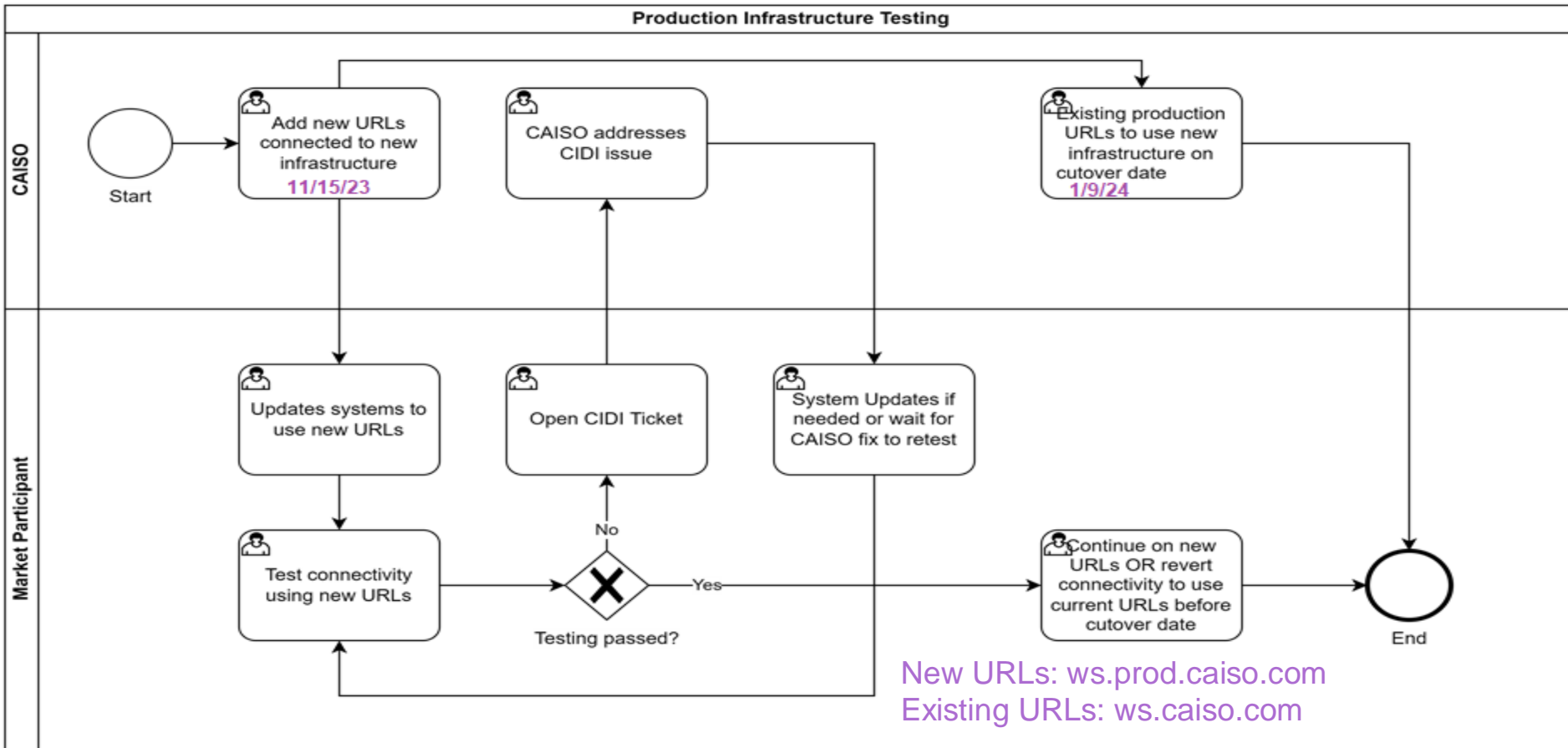
# UI & API URL & IP Changes (Application Delivery Resiliency)

## Production API Transition Plan – **Actions Necessary for API Users**

- **SOFT CUTOVER:** Production new temporary/transition API URLs (ws.prod.caiso) as of Nov 15, 2023 to transition
- **HARD CUTOVER:** Production current/existing (ws.caiso) API URLs cutover Jan 17, 2024
  - New infrastructure
  - New IPs
  - New Certificate Authority (Entrust)
  - Service-Level AUP for CMRI/DRRS/MRI-S
- ~~Production new temporary/transition API URLs to be deprecated at a future date~~
- **Production new API URLs (ws.prod.caiso) will remain available indefinitely; users can continue using the new URLs or repoint to the original API URLs (ws.caiso)**
- Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space to access new API URLs
- The Production transition and cut-over will be different than how MAP-STAGE occurred. The new APIs are available as of 11/15/23. There will be no changes to the Production existing API URLs until target 1/17/24.

# UI & API URL & IP Changes (Application Delivery Resiliency)

Customers should cut over to the new URLs [ws.prod.caiso.com](https://ws.prod.caiso.com) starting 11/15/23 and as soon as possible before 1/17/24.



# UI & API URL & IP Changes (Application Delivery Resiliency)

1. 1) Here are the API URL formats for non-Production & Production; note what is available/permanent

	Old URL & Infrastructure	New URL & Infrastructure	Existing URL to Move to New Infrastructure
MAPSTAGE	<p>Deprecated &amp; no longer available as of 9/21/23</p> <ul style="list-style-type: none"> <li><a href="https://wsmapi.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://wsmapi.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://wsmapi.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://wsmapi.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>	NA	<p>Available permanently since 5/18/23</p> <ul style="list-style-type: none"> <li><a href="https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>
PRODUCTION	<p>Available now on existing infrastructure</p> <ul style="list-style-type: none"> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>	<p>To be made available at a future date target 11/15/23 on new infrastructure to run in parallel with the left cell to support transition/testing, for a limited time</p> <ul style="list-style-type: none"> <li><a href="https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>	<p>Original URLs to be cut-over to new infrastructure at a future date target 1/17/24</p> <ul style="list-style-type: none"> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>

2. As mentioned on the call and shown above, there are URL/IP changes in flight now for the APIs

- Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space
- There is a new Certificate Authority for the new APIs (changed from Verizon to Entrust)
- API Acceptable Use Policy: In addition the existing global rate limit of 30 per second across all the apps combined supported on the WS endpoint (1800 connections per minute), here are additional protections within these apps on the new URLs
  - These will return a SOAP fault with AUP fails:
  - ```
<SOAP-ENV:Fault>
  <faultcode>SOAP-ENV:Server</faultcode>
  <faultstring xml:lang="en">429: CAISO Acceptable Use Policy Violation. Please retry your request after <n> seconds.</faultstring>
  <detail>
```
  - Apps
    - CMRI
    - DRRS
    - STLMT
- Impacted APIs on next slide

# UI & API URL & IP Changes (Application Delivery Resiliency)

|                     | Old URL & Infrastructure                                                                                                                                                                                                                                                                                                                                                                                         | New URL & Infrastructure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Existing URL to Move to New Infrastructure                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAPSTAGE            | <p>Deprecated &amp; no longer available as of 9/21/23</p> <ul style="list-style-type: none"> <li><a href="https://wsmap.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://wsmap.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://wsmap.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://wsmap.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul> | NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>Available permanently since 5/18/23</p> <ul style="list-style-type: none"> <li><a href="https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://mapstage-ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>            |
| PRODUCTION          | <p>Available now on existing infrastructure</p> <ul style="list-style-type: none"> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul>                       | <p>To be made available at a future date target 11/15/23 on new infrastructure to run in parallel with the left cell to support transition/testing, for a limited time</p> <ul style="list-style-type: none"> <li><a href="https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.prod.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul> | <p>Original URLs to be cut-over to new infrastructure at a future date target 1/17/24</p> <ul style="list-style-type: none"> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;</a></li> <li><a href="https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach">https://ws.caiso.com/sst/&lt;SYSTEM&gt;/&lt;SERVICE&gt;_DocAttach</a></li> </ul> |
| Production          | Existing Production API                                                                                                                                                                                                                                                                                                                                                                                          | New/Temporary for Transition Production API                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Existing/Original Production API URLs to be cut over to new infrastructure and IPs                                                                                                                                                                                                                                                                                                                                                   |
| BAAOP               | <a href="https://ws.caiso.com/sst/baaop">https://ws.caiso.com/sst/baaop</a>                                                                                                                                                                                                                                                                                                                                      | <a href="https://ws.prod.caiso.com/sst/baaop">https://ws.prod.caiso.com/sst/baaop</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <a href="https://ws.caiso.com/sst/baaop">https://ws.caiso.com/sst/baaop</a>                                                                                                                                                                                                                                                                                                                                                          |
| BSAP                | <a href="https://ws.caiso.com/sst/bsap">https://ws.caiso.com/sst/bsap</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/bsap">https://ws.prod.caiso.com/sst/bsap</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/bsap">https://ws.caiso.com/sst/bsap</a>                                                                                                                                                                                                                                                                                                                                                            |
| CIRA                | <a href="https://ws.caiso.com/sst/cira">https://ws.caiso.com/sst/cira</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/cira">https://ws.prod.caiso.com/sst/cira</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/cira">https://ws.caiso.com/sst/cira</a>                                                                                                                                                                                                                                                                                                                                                            |
| CMRI                | <a href="https://ws.caiso.com/sst/cmri">https://ws.caiso.com/sst/cmri</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/cmri">https://ws.prod.caiso.com/sst/cmri</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/cmri">https://ws.caiso.com/sst/cmri</a>                                                                                                                                                                                                                                                                                                                                                            |
| DRRS                | <a href="https://ws.caiso.com/sst/drrs">https://ws.caiso.com/sst/drrs</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/drrs">https://ws.prod.caiso.com/sst/drrs</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/drrs">https://ws.caiso.com/sst/drrs</a>                                                                                                                                                                                                                                                                                                                                                            |
| EIDE                | <a href="https://ws.caiso.com/sst/eide">https://ws.caiso.com/sst/eide</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/eide">https://ws.prod.caiso.com/sst/eide</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/eide">https://ws.caiso.com/sst/eide</a>                                                                                                                                                                                                                                                                                                                                                            |
| ALFS (& FDR)        | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/runtime.asvc">https://ws.prod.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                            |
| MF                  | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/runtime.asvc">https://ws.prod.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                            |
| PISOA               | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/runtime.asvc">https://ws.prod.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/runtime.asvc">https://ws.caiso.com/sst/runtime.asvc</a>                                                                                                                                                                                                                                                                                                                                            |
| RCBSAP              | <a href="https://ws.caiso.com/sst/rcbsap">https://ws.caiso.com/sst/rcbsap</a>                                                                                                                                                                                                                                                                                                                                    | <a href="https://ws.prod.caiso.com/sst/rcbsap">https://ws.prod.caiso.com/sst/rcbsap</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <a href="https://ws.caiso.com/sst/rcbsap">https://ws.caiso.com/sst/rcbsap</a>                                                                                                                                                                                                                                                                                                                                                        |
| RCSERVICES (RCEIDE) | <a href="https://ws.caiso.com/sst/rcservices">https://ws.caiso.com/sst/rcservices</a>                                                                                                                                                                                                                                                                                                                            | <a href="https://ws.prod.caiso.com/sst/rcservices">https://ws.prod.caiso.com/sst/rcservices</a>                                                                                                                                                                                                                                                                                                                                                                                                                                           | <a href="https://ws.caiso.com/sst/rcservices">https://ws.caiso.com/sst/rcservices</a>                                                                                                                                                                                                                                                                                                                                                |
| SIBR                | <a href="https://ws.caiso.com/sst/sibr">https://ws.caiso.com/sst/sibr</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/sibr">https://ws.prod.caiso.com/sst/sibr</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/sibr">https://ws.caiso.com/sst/sibr</a>                                                                                                                                                                                                                                                                                                                                                            |
| STLMT               | <a href="https://ws.caiso.com/sst/stlmt">https://ws.caiso.com/sst/stlmt</a>                                                                                                                                                                                                                                                                                                                                      | <a href="https://ws.prod.caiso.com/sst/stlmt">https://ws.prod.caiso.com/sst/stlmt</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <a href="https://ws.caiso.com/sst/stlmt">https://ws.caiso.com/sst/stlmt</a>                                                                                                                                                                                                                                                                                                                                                          |
| OMS                 | <a href="https://ws.caiso.com/sst/weboms">https://ws.caiso.com/sst/weboms</a>                                                                                                                                                                                                                                                                                                                                    | <a href="https://ws.prod.caiso.com/sst/weboms">https://ws.prod.caiso.com/sst/weboms</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <a href="https://ws.caiso.com/sst/weboms">https://ws.caiso.com/sst/weboms</a>                                                                                                                                                                                                                                                                                                                                                        |
| ECIC                | <a href="https://ws.caiso.com/sst/ecic">https://ws.caiso.com/sst/ecic</a>                                                                                                                                                                                                                                                                                                                                        | <a href="https://ws.prod.caiso.com/sst/ecic">https://ws.prod.caiso.com/sst/ecic</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="https://ws.caiso.com/sst/ecic">https://ws.caiso.com/sst/ecic</a>                                                                                                                                                                                                                                                                                                                                                            |



# UI & API URL & IP Changes (Application Delivery Resiliency) – Certification Authority

- New Certificate Authority
  - There is a new certificate authority for the new API URL infrastructure: It was Verizon and is now Entrust
  - Please add the two certificates to your application trust stores on your servers to access the new API URL infrastructure
  - The new Production API URLs and existing Production API URLs after cutover have a different Root and Intermediate certificate:
    - Entrust Root Certification Authority – G2
    - Entrust Certification Authority – L1M

# UI & API URL & IP Changes (Application Delivery Resiliency) – Certification Authority

The screenshot shows a web browser window with the address bar displaying `ws.prod.caiso.com/sst/cmri/RetrieveMarketAwards_CMRIv4_AP`. The main content area displays an XML error message: "This XML file does not appear to have any style information associated with it". Below the message, the XML structure is visible, showing a SOAP fault with the message: "SECURITY: The security contract requires the document to be signed by the issuer".

Overlaid on the browser window is a "Certificate Viewer: ws.prod.caiso.com" dialog box. The dialog has two tabs: "General" and "Details". The "Details" tab is active, showing the following information:

- Certificate Hierarchy:**
  - Entrust Root Certification Authority - G2
  - Entrust Certification Authority - L1M
  - ws.prod.caiso.com
- Certificate Fields:**
  - Authority Information Access
  - CRL Distribution Points
  - Certificate Subject Alternative Name
  - Certificate Key Usage
  - Extended Key Usage
  - Certificate Policies
  - Signed Certificate Timestamp List
  - Certificate Signature Algorithm
- Field Value:**
  - Not Critical
  - DNS Name: ws.prod.caiso.com
  - DNS Name: ws.caiso.com
  - DNS Name: ws.prod.ecn.wepex.net
  - DNS Name: ws.ecn.wepex.net

An "Export..." button is located at the bottom right of the dialog.

# UI & API URL & IP Changes (Application Delivery Resiliency) – Certification Authority Questions

What do API customers need to do to access new URLs and maintain access to existing URLs after the cutover?

- Add the two Entrust certificates to your application trust stores on your servers (see image on previous slide)

Will customers be able to access the current Production API URLs (pre-cutover) after adding the two Entrust certificates?

- Yes, this is an addition of the two Entrust certificates to your trust store, but the existing Verizon certificates will still be there and work for the current Production API URLs pre-cutover

When should customers add the two Entrust certificates to their Production server application trust stores?

- This can be done now without impacting Production API access (see above), and should be done prior to 11/9 to access the new Production API URLs (ws.prod.caiso, and should be done NLT 12/20 to avoid impacts to Production API access on the existing API URLs (ws.caiso)

How will user certificates be impacted?

- No changes needed to user certificates for the Production API URL cutover
- User certificates are also changing from Verizon to Entrust as they expire and are renewed, but do not need to be on Entrust prior to the Production API URL cutover
- For example, if a user has an existing Verizon user certificate that expires mid-2024, that Verizon user certificate will still be able to access the new Production API URL infrastructure (11/9/23 onwards for new URLs, and 12/21/23 onwards for existing URLs)

# UI & API URL & IP Changes (Application Delivery Resiliency) - New Certification Authority

## References

- Entrust L1M Certificate Authority: [http://web.entrust.com/subca-certificates/L1M-G2-Xcert\\_20141215.cer?\\_gl=1\\*1pabf82\\*\\_ga\\*MTk2NDQzNTE0LjE2ODc0NjQ1NjA.\\*\\_ga\\_6QRW66BW5T\\*MTY4NzQ2NDU1OS4xLjEuMTY4NzQ2NDU4MS4zOC4wLjA.&\\_ga=2.121940939.1908197984.1687464560-196443514.1687464560](http://web.entrust.com/subca-certificates/L1M-G2-Xcert_20141215.cer?_gl=1*1pabf82*_ga*MTk2NDQzNTE0LjE2ODc0NjQ1NjA.*_ga_6QRW66BW5T*MTY4NzQ2NDU1OS4xLjEuMTY4NzQ2NDU4MS4zOC4wLjA.&_ga=2.121940939.1908197984.1687464560-196443514.1687464560)
- Entrust Root Certificate Authority: [https://web.entrust.com/root-certificates/entrust\\_g2\\_ca.cer?\\_gl=1\\*1t3efhy\\*\\_ga\\*MTk2NDQzNTE0LjE2ODc0NjQ1NjA.\\*\\_ga\\_6QRW66BW5T\\*MTY4NzQ2NDU1OS4xLjEuMTY4NzQ2NDgxMy41NS4wLjA.&\\_ga=2.127397581.1908197984.1687464560-196443514.1687464560](https://web.entrust.com/root-certificates/entrust_g2_ca.cer?_gl=1*1t3efhy*_ga*MTk2NDQzNTE0LjE2ODc0NjQ1NjA.*_ga_6QRW66BW5T*MTY4NzQ2NDU1OS4xLjEuMTY4NzQ2NDgxMy41NS4wLjA.&_ga=2.127397581.1908197984.1687464560-196443514.1687464560)
- Parent pages these came from:
  - <https://www.entrust.com/knowledgebase/ssl/entrust-certificate-services-subordinate-cas>
  - <https://www.entrust.com/resources/certificate-solutions/tools/root-certificate-downloads>

# UI & API URL & IP Changes

## Phase 1: Deployment for new API URLs

- CAISO previously sent communications on the soft cutover for the new API URLs in the MAP Stage environment. Market Participants are required to validate access and transition to the new API URLs before August 15, 2023. **The old API URLs in MAP Stage are no longer available as of September 1, 2023.** For Production, there are no changes to the current/existing API URLs; however, the IP addresses and infrastructure will be changed.

## Phase 2: Deployment for new UI URLs

- Starting on July, 27, 2023, some of the ISO applications will be available for testing starting in the MAP Stage environment and then Production. Application access is based on the user's provisioning. No application down time is expected. We will send additional communication for the remaining UI URLs once they are ready for validation.

## Action requested:

- Market Participants can begin accessing the new UI URLs in parallel with the current UI URLs for a window of time.
- The timeline to validate access and transition to the new UI URLs for each environment is shorter than the API timeline; therefore, action is needed sooner.
- Once the new UI URLs are deployed into Production, Market Participants have until Thursday, January 18, 2024 to validate and transition to the new UI URLs.

| Applications & Environments                                                                        | Deployment Start Dates | New User Interface (UI) URLs                                                                                                             | Deprecation of Old URL |
|----------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Balancing Area Authority Operations Portal (BAAOP)</b>                                          |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Fri 7/28/23            | <a href="https://mapstage-baaop.caiso.com">https://mapstage-baaop.caiso.com</a>                                                          | Fri 12/8/23            |
| Production                                                                                         | Wed 9/20/23            | <a href="https://baaop.caiso.com">https://baaop.caiso.com</a>                                                                            | Thu 1/18/24            |
| <b>Base Schedule Aggregation Portal (BSAP)</b>                                                     |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Fri 7/28/23            | <a href="https://mapstage-bsap.caiso.com">https://mapstage-bsap.caiso.com</a>                                                            | Fri 12/8/23            |
| Production                                                                                         | Mon 10/16/23           | <a href="https://bsap.caiso.com">https://bsap.caiso.com</a>                                                                              | Thu 1/18/24            |
| <b>Reliability Coordinator Base Schedule Aggregation Portal (RCBSAP)</b>                           |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Fri 7/28/23            | <a href="https://mapstage-rcbsap.caiso.com">https://mapstage-rcbsap.caiso.com</a>                                                        | Fri 12/8/23            |
| Production                                                                                         | Tue 10/26/23           | <a href="https://rcbsap.caiso.com">https://rcbsap.caiso.com</a>                                                                          | Thu 1/18/24            |
| <b>Schedule Infrastructure &amp; Business Rules (SIBR)</b>                                         |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Fri 7/28/23            | <a href="https://mapstage-sibr.caiso.com">https://mapstage-sibr.caiso.com</a>                                                            | Fri 12/8/23            |
| Production                                                                                         | Mon 10/16/23           | <a href="https://sibr.caiso.com">https://sibr.caiso.com</a>                                                                              | Thu 1/18/24            |
| <b>Reporting (Includes SIBR Reports, Transmission Registry, RIMS, Master File, and FSP folder)</b> |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Mon 7/31/23            | <a href="https://mapstage-reporting.caiso.com">https://mapstage-reporting.caiso.com</a>                                                  | Fri 12/8/23            |
| Production                                                                                         | Tue 12/5/23            | <a href="https://reporting.caiso.com">https://reporting.caiso.com</a>                                                                    | Thu 1/18/24            |
| <b>Market Participant Portal (MPP)</b>                                                             |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Thu 12/14/23           | <a href="https://mapstage-mpp.caiso.com">https://mapstage-mpp.caiso.com</a>                                                              |                        |
| Production                                                                                         | Tue 12/19/23           | <a href="https://mpp.caiso.com">https://mpp.caiso.com</a>                                                                                | Thu 1/18/24            |
| <b>Customer Market Results Interface (CMRI)</b>                                                    |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Thu 8/3/23             | <a href="https://mapstage-cmri.caiso.com">https://mapstage-cmri.caiso.com</a>                                                            | Fri 12/8/23            |
| Production                                                                                         | Thu 10/19/23           | <a href="https://cmri.caiso.com">https://cmri.caiso.com</a>                                                                              | Thu 1/18/24            |
| <b>Congestion Revenue Rights (CRR)</b>                                                             |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Mon 8/7/23             | <a href="https://mapstage-crr.caiso.com">https://mapstage-crr.caiso.com</a>                                                              | Fri 12/8/23            |
| Production                                                                                         | Thu 10/19/23           | <a href="https://crr.caiso.com">https://crr.caiso.com</a>                                                                                | Thu 1/18/24            |
| <b>WEIM Portal</b>                                                                                 |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Done                   | <a href="https://mapstage-weim.caiso.com">https://mapstage-weim.caiso.com</a>                                                            | Fri 12/8/23            |
| Production                                                                                         | Done                   | <a href="https://weim.caiso.com">https://weim.caiso.com</a>                                                                              | Thu 1/18/24            |
| <b>Master File (MF)</b>                                                                            |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Wed 8/9/23             | <a href="https://mapstage-mf.caiso.com">https://mapstage-mf.caiso.com</a>                                                                | Fri 12/8/23            |
| Production                                                                                         | Thu 10/19/23           | <a href="https://mf.caiso.com">https://mf.caiso.com</a>                                                                                  | Thu 1/18/24            |
| <b>Transmission Registry (TR)</b>                                                                  |                        |                                                                                                                                          |                        |
| MAP Stage                                                                                          | Tue 9/5/23             | <a href="https://mapstage-tr.caiso.com/">https://mapstage-tr.caiso.com/</a>                                                              | Fri 12/8/23            |
| Production                                                                                         | TBD                    | <a href="https://tr.caiso.com">https://tr.caiso.com</a>                                                                                  | Thu 1/18/24            |
| <b>Path Limit Calculator (PLC)</b>                                                                 |                        |                                                                                                                                          |                        |
| Production                                                                                         | Thu 10/19/23           | <a href="https://plc.caiso.com/">https://plc.caiso.com/</a>                                                                              | Thu 1/18/24            |
| <b>Hosted Advanced Network Applications (HANA) Base / HANA Study</b>                               |                        |                                                                                                                                          |                        |
| Production                                                                                         | Tue 10/26/23           | <a href="https://hana.caiso.com/">https://hana.caiso.com/</a><br><a href="https://hanastudy.caiso.com/">https://hanastudy.caiso.com/</a> | Thu 1/18/24            |

# 2024 – Transmission Register System Upgrade

| Project Information      | Details/Date                                                |
|--------------------------|-------------------------------------------------------------|
| High Level Project Scope | TR Framework Upgrade and corresponding provisioning changes |
| Impacted Systems         | TR, AIM                                                     |

| Milestone Type | Milestone Name                                                                                                                                                                                                                                                                                                                                                                                              | Dates                                                        | Status           |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------------|
| BRS            | BRS                                                                                                                                                                                                                                                                                                                                                                                                         | NA                                                           | NA               |
| User Guides    | <a href="http://www.caiso.com/participate/Pages/ApplicationAccess/Default.aspx">http://www.caiso.com/participate/Pages/ApplicationAccess/Default.aspx</a><br>Updated Transmission Register PTO Administrator User Manual<br>Updated Transmission Register Component Linking Manual<br>Updated Transmission Register Autoloader User Manual<br>Updated Transmission Register CAISO & PTO General User Manual | Nov 20, 2023<br>Nov 20, 2023<br>Nov 20, 2023<br>Nov 20, 2023 | ✓<br>✓<br>✓<br>✓ |
| Training       | Training                                                                                                                                                                                                                                                                                                                                                                                                    | Nov 15, 2023                                                 | ✓                |
| Market Sim     | Market Sim Window                                                                                                                                                                                                                                                                                                                                                                                           | Nov 27, 2023 – Jan 05, 2024                                  |                  |
| Production     | Production                                                                                                                                                                                                                                                                                                                                                                                                  | Jan 19, 2024                                                 |                  |

# Feb 2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2

## Track 2

| Project Information      | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High Level Project Scope | <ul style="list-style-type: none"> <li>• <b>Track-2</b> <ul style="list-style-type: none"> <li>• Item2A – Clarification of Post-HASP Block Hour Low-Priority Export                             <ul style="list-style-type: none"> <li>• Operator-Driven Low-Priority Export Curtailment                                     <ul style="list-style-type: none"> <li>• CAISO operator's ability to initiate pro-rata curtailment based on identified MW, given the following priority order:                                             <ul style="list-style-type: none"> <li>• RTECON (RT economic hourly block export schedules that clear HASP).</li> <li>• RTLPT (RT Self-Schedule hourly block export schedules not backed by Generation from non-RA Capacity and cleared HASP).</li> <li>• 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)]</li> </ul> </li> <li>• CAISO operator's ability to identify/filter exports by market priority types as well as "Firm Provisional Energy (G-FP)" eTag identifier.</li> <li>• Publish resource-specific market priority types and their associated MW data to ADS.</li> </ul> </li> </ul> </li> <li>• 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)</li> </ul> </li> </ul> |
| BPM Changes              | WEIM, Market Instruments, Market Operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Tariff Changes           | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Impacted Systems         | MF, Market, ITS, ADS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |



# Feb 2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2

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



# Feb 2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2

| Milestone Type               | Milestone Name                                                               | Dates                       | Status |
|------------------------------|------------------------------------------------------------------------------|-----------------------------|--------|
| Board Approval               | Obtain Board of Governors Approval<br>WEIM Governing Board Approval          | Dec 14, 2022                | ✓      |
| External BRS                 | Post External BRS                                                            | Mar 10, 2023                | ✓      |
|                              | Post External BRS v1.1                                                       | Mar 31, 2023                | ✓      |
|                              | Post External BRS v1.2                                                       | Jun 27, 2023                | ✓      |
|                              | Post External BRS v1.3                                                       | Sep 05, 2023                | ✓      |
|                              | Post External BRS v1.4                                                       | Sep 20, 2023                | ✓      |
|                              | Post External BRS v1.41                                                      | Sep 21, 2023                | ✓      |
| Settlements<br>Config Guides | NA                                                                           | NA                          |        |
| Tech Spec                    | ADS                                                                          | Aug 10, 2023                | ✓      |
|                              | CMRI                                                                         | Aug 10, 2023                | ✓      |
|                              | MFRDT Tech Spec                                                              | Aug 10, 2023                | ✓      |
|                              | MFRDT File Draft                                                             | Aug 22, 2023                | ✓      |
|                              | RDT Definitions Draft                                                        | Aug 29, 2023                | ✓      |
| Tariff                       | Tariff (NA, and NA for activation change from Fall 2023 Release to Feb 2023) | NA                          |        |
| BPMs                         | Draft BPM changes – Market Instruments PRR 1531                              | Aug 23, 2023                | ✓      |
|                              | Draft BPM changes – WEIM PRR 1532                                            | Aug 24, 2023                | ✓      |
|                              | Draft BPM changes – Market Operations PRR 1533                               | Aug 24, 2023                | ✓      |
|                              | Draft BPM changes – Market Instruments PRR 1537                              | Aug 25, 2023                | ✓      |
|                              | Draft BPM changes – Market Operations PRR 1536                               | Aug 24, 2023                | ✓      |
| Training                     | Training                                                                     | Sep 13, 2023                | ✓      |
| Market Sim Scenarios         | Market Sim Scenarios                                                         | Jul 28, 2023                | ✓      |
|                              |                                                                              | Aug 23, 2023                | ✓      |
|                              |                                                                              | Sep 08, 2023                | ✓      |
| Market Sim                   | Market Sim Window                                                            | Sep 25, 2023 – Oct 13, 2023 | ✓      |
|                              | Market Sim – Pro Rata Curtailment                                            | Jan 08, 2024 – Jan 31, 2024 |        |
| Production Activation        | Resource Sufficiency Evaluation Enhancements Phase 2 Track 2                 | Feb 21, 2024                |        |

# 2024 – Hybrid Resources 2C RIMS

| Project Information                        | Details/Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Level Business Problem or Need</b> | <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> |
| <b>High Level Project Scope</b>            | <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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>BPM Changes</b>                         | Settlements & Billing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Impacted Systems</b>                    | <p>Summer 2023: Settlements</p> <p>Fall 2023: Metered Quantities for Hybrids</p> <p><b>Independent 2024: RIMS</b></p> <p>Completed: Today's Outlook, ISO Today Mobile Application, Reports</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Requirements</b>                        | <a href="http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf">http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

# 2024 – Hybrid Resources 2C RIMS

| Milestone Type               | Milestone Name                                     | Dates        | Status |
|------------------------------|----------------------------------------------------|--------------|--------|
| External BRS                 | Publish External BRS                               | Jan 31, 2023 | ✓      |
| Settlements<br>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                         | Q3/Q4 2024   |        |

# 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><b>Congestion Revenue Rights (CRR) system replacement project scope is the roll-out of a:</b></p> <ul style="list-style-type: none"> <li>• 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</li> <li>• Set of application-programming interfaces (APIs) to enable integration between ISO and market participant systems</li> </ul> <p><b>Overall, to support the following in one consolidated CRR external-facing system:</b></p> <ul style="list-style-type: none"> <li>• Annual/Monthly Auction and Allocation market participant bid submission and results retrieval</li> <li>• Load data submission by CRR LSEs, CEC</li> <li>• Load migration data submission by CRR UDCs</li> <li>• Secured "Congestion Revenue Rights Full Network Model" information access</li> <li>• Private and public access of CRR market input and output information</li> </ul> |
| BPM Changes              | <p>Congestion Revenue Rights</p> <ul style="list-style-type: none"> <li>• Enhancements made to the new CRR product.</li> <li>• Automatic publishing of CRR market results.</li> <li>• Automatic CRR notification.</li> <li>• New CRR schedule calendar.</li> <li>• New CRR FNM access.</li> <li>• New CRR data submission and download interface UI/API.</li> <li>• New CRR market results interface.</li> <li>• Load Migration</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Tariff Change            | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Impacted Systems         | CRR, AIM, CMRI, OASIS, CTS, Market Clearing, EMMS, IFM/RTN, MQS, Master File, MPP, Settlements, WebOMS, ETCC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

# 2024 - Congestion Revenue Rights (CRR) Upgrade

| System      | High Level Changes                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CRR         | Significant system upgrade including: <ul style="list-style-type: none"><li>• Enhancements made to the new CRR application.</li><li>• Automatic publishing of CRR market results.</li><li>• Automatic CRR notification.</li><li>• New CRR schedule calendar.</li><li>• New CRR FNM access.</li><li>• New CRR data submission and download interface UI/API.</li><li>• Other TBDs identified through BRS development.</li></ul>                            |
| AIM         | <ul style="list-style-type: none"><li>• New users and roles to support new CRR functionality</li></ul>                                                                                                                                                                                                                                                                                                                                                    |
| CMRI        | <ul style="list-style-type: none"><li>• Full and incremental Payload publishing</li><li>• Publish CRR Awards payload on event-driven, ad-hoc or scheduled basis</li><li>• Publish CRR Awards payload on event-driven, ad-hoc or scheduled basis</li></ul>                                                                                                                                                                                                 |
| OASIS       | <ul style="list-style-type: none"><li>• Publish CRR Calendar, and all available CRR market names, and credit margin information, 3 year historical expected value..</li><li>• Allow authorized users to publish CRR inventory payloads</li><li>• 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,</li></ul> |
| CTS         | <ul style="list-style-type: none"><li>• Broadcast</li></ul>                                                                                                                                                                                                                                                                                                                                                                                               |
| EMMS        | <ul style="list-style-type: none"><li>• CRR will consume data from EMMS</li></ul>                                                                                                                                                                                                                                                                                                                                                                         |
| IFM/RTN     | <ul style="list-style-type: none"><li>• CRR will consume data from IFM/RTN</li></ul>                                                                                                                                                                                                                                                                                                                                                                      |
| MQS         | <ul style="list-style-type: none"><li>• MQS will consume and process SCID in a new format</li><li>• MQS will consume ownership payload in bulk</li></ul>                                                                                                                                                                                                                                                                                                  |
| Master File | <ul style="list-style-type: none"><li>• Master File will be modified as needed to support the new CRR functionality</li></ul>                                                                                                                                                                                                                                                                                                                             |
| MPP         | <ul style="list-style-type: none"><li>• CRR will provide pre-configured external reports</li></ul>                                                                                                                                                                                                                                                                                                                                                        |
| Settlement  | <ul style="list-style-type: none"><li>• Settlements will be modified as needed to support the new CRR functionality</li></ul>                                                                                                                                                                                                                                                                                                                             |
| WebOMS      | <ul style="list-style-type: none"><li>• CRR will consume data from WebOMS</li></ul>                                                                                                                                                                                                                                                                                                                                                                       |
| ETCC        | <ul style="list-style-type: none"><li>• CRR will consume data from ETCC</li></ul>                                                                                                                                                                                                                                                                                                                                                                         |

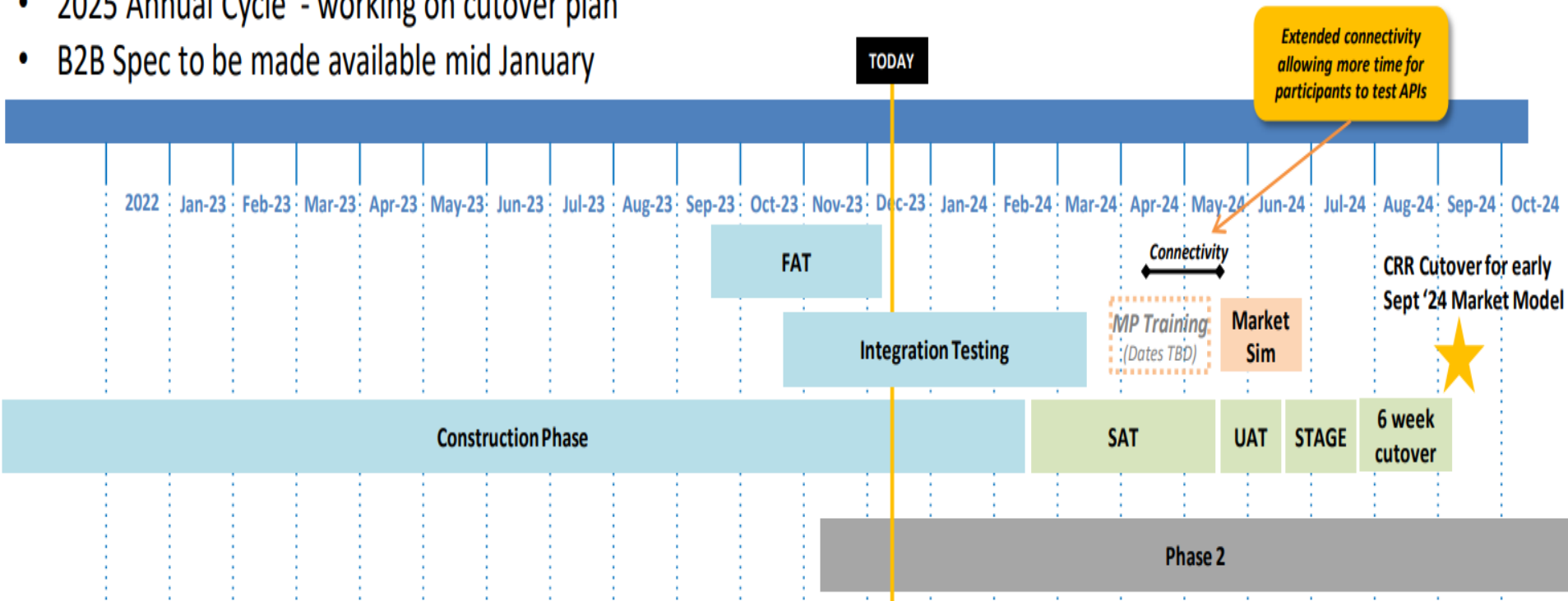
## 2024 - Congestion Revenue Rights (CRR) Upgrade

| Milestone Type             | Milestone Name                                                                                            | Dates                        | Status |
|----------------------------|-----------------------------------------------------------------------------------------------------------|------------------------------|--------|
| Board Approval             | Obtain Board of Governors Approval                                                                        | NA                           |        |
| External BRS               | Publish External BRS<br>BRS Revision v1.3                                                                 | Nov 16, 2022<br>Mar 29, 2023 | ✓<br>✓ |
| 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                                                                                                | May 2024 – Jun 2024          |        |
| Go Live                    | Go Live to start 6-week cutover<br><br>- August 2024 monthly allocation and auction markets on new system | Jul 23, 2024                 |        |
| Customer Partnership Group | <a href="#">Last CPG</a>                                                                                  | Dec 13, 2023                 | ✓      |
|                            | Next CPG                                                                                                  | Jan 2024                     |        |

# 2024 - Congestion Revenue Rights (CRR) Upgrade

Updated December 2023

- Factory Acceptance Testing (FAT) completed
- Integration testing in progress and on-track for April Connectivity Testing
- Start of functional testing (Site Acceptance Testing - SAT) and other items shifted
- Target go live in July 23<sup>rd</sup> to start 6 week cutover
  - August 2024, monthly allocation and auction markets on new system
- 2025 Annual Cycle - working on cutover plan
- B2B Spec to be made available mid January



# 2024 - 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](http://www.caiso.com)
    - Meeting details and presentation materials are available on the CAISO Developer site at [www.developer.caiso.com](http://www.developer.caiso.com) , which requires an account to be setup for access
  - **CRR Customer Partnership Group**
    - **Last CPG 12/13; [recording available](#)**
    - **Next CPG meeting is Jan 2024**
    - Monthly
    - Meetings available on the CAISO calendar on [www.caiso.com](http://www.caiso.com)
    - Meeting details and presentation materials are available on [www.caiso.com](http://www.caiso.com) > Stay Informed > Meetings & Events > Customer Partnership Groups



# 2024 – FERC 881 – Managing Transmission Line Ratings

| Project Information             | Details/Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Level Project Scope</b> | <p>This initiative will address the California ISO's compliance with FERC Order No. 881 in establishing new transmission line rating requirements</p> <p>Order No. 881 establishes new transmission line rating requirements for public utility transmission providers</p> <ul style="list-style-type: none"> <li>Establish and use ambient-adjusted ratings and seasonal ratings for all transmission lines unless excepted                             <ul style="list-style-type: none"> <li>Use AARs for near-term transmission service requests</li> <li>Use seasonal rating for long-term transmission service requests</li> </ul> </li> <li>RTOs/ISOs must implement systems and procedures to allow transmission owners to electronically update transmission line ratings at least hourly</li> <li>Use uniquely determined emergency ratings for contingency analysis in the operations horizon and in post-contingency simulations of constraints</li> <li>Implement transparency reform</li> </ul> |

| Milestone Type | Milestone Name                | Dates        | Status |
|----------------|-------------------------------|--------------|--------|
| Tariff         | Draft Tariff Language         | May 20, 2022 | ✓      |
|                | Revised Draft Tariff Language | Jun 23, 2022 | ✓      |
|                | FERC Filing ER22-2362         | Jul 12, 2022 | ✓      |
|                | FERC Acceptance ER22-2362     | Apr 20, 2023 | ✓      |
| Production     | Production                    | 2024         |        |

# Spring 2026 Release

# Day Ahead Market Enhancements

| Project Information                        | Details/Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Level Business Problem or Need</b> | <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 real-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> |
| <b>High Level Project Scope</b>            | <p>Enhance the California ISO's (CAISO's) day-ahead market by:</p> <ul style="list-style-type: none"> <li>• Introducing an imbalance reserve (IRU/IRD) product to provide flexible capacity to account for real-time ramping needs</li> <li>• Enhancing the residual unit commitment process to also ensure there is sufficient downward dispatch capability (RCU/RCD)</li> <li>• Enhancing the day-ahead market to maximize benefits of greater West-wide diversity in the day-ahead optimization for Western Energy Imbalance Market participants</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>BPM Changes</b>                         | Settlements and Billing, Market Instruments & Market Operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Tariff Changes</b>                      | Sections 27, 31, 34, 39                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Impacted Systems</b>                    | MF, SIBR, DAM, OASIS, CMRI, Settlements & Internal Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

# Day Ahead Market Enhancements

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

# Day Ahead Market Enhancements

| Milestone Type                | Milestone Name                                                                                                                                                                                                                                                                            | Dates                       | Status |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------|
| Board Approval                | Board briefing/approval                                                                                                                                                                                                                                                                   | May 17, 2023                | ✓      |
| External BRS                  | Publish External BRS v1.0                                                                                                                                                                                                                                                                 | Jul 25, 2023                | ✓      |
|                               | Publish External BRS v1.1 <ul style="list-style-type: none"> <li>Clarify, correct typos and clean up the document.</li> <li>Move some requirements from DAME BRS to EDAM BRS and vice versa.</li> <li>Update business requirement to match filed Tariff and/or clarify policy.</li> </ul> | Dec 22, 2023                |        |
| Settlements Config Guides     | Post Draft Config Guides - First set of charge codes                                                                                                                                                                                                                                      | Jan 16, 2024                |        |
|                               | Post Draft Config Guides - Second set of charge codes                                                                                                                                                                                                                                     | Mar 26, 2024                |        |
|                               | Post Draft Config Guides - Third set of charge codes                                                                                                                                                                                                                                      | Aug 26, 2024                |        |
| Tech Spec                     | Publish Technical Specifications - OASIS                                                                                                                                                                                                                                                  | Nov 09, 2023                | ✓      |
|                               | Publish Technical Specifications – MF<br>Publish MF GRDT v19.0 DRAFT                                                                                                                                                                                                                      | Nov 21, 2023                | ✓      |
|                               | Publish Technical Specifications - SIBR                                                                                                                                                                                                                                                   | Nov 28, 2023                | ✓      |
|                               | Publish Technical Specifications - CMRI                                                                                                                                                                                                                                                   | Dec 15, 2023                | ✓      |
| Tariff                        | First Draft Tariff Posting                                                                                                                                                                                                                                                                | Jun 02, 2023                | ✓      |
|                               | Second Draft Tariff Posting                                                                                                                                                                                                                                                               | Jul 11, 2023                | ✓      |
|                               | FERC Filing                                                                                                                                                                                                                                                                               | Aug 22, 2023                | ✓      |
|                               | Receive FERC order                                                                                                                                                                                                                                                                        | Dec 21, 2023                |        |
| BPMs                          | Post Draft BPM – Market Instruments                                                                                                                                                                                                                                                       | TBD                         |        |
|                               | Post Draft BPM – Market Operations                                                                                                                                                                                                                                                        | TBD                         |        |
|                               | Post Draft BPM – Settlements and Billing                                                                                                                                                                                                                                                  | TBD                         |        |
|                               | Post Draft BPM – Definitions and Acronyms                                                                                                                                                                                                                                                 | TBD                         |        |
| Implementation Working Groups | Implementation Working Groups                                                                                                                                                                                                                                                             | Start Fall 2024             |        |
| External Training             | External User Training                                                                                                                                                                                                                                                                    | May 08, 2025                |        |
| Market Sim                    | Market Sim Scenarios                                                                                                                                                                                                                                                                      | Aug 04, 2023                | ✓      |
|                               | Market Sim Window                                                                                                                                                                                                                                                                         | Jun 02, 2025 - Aug 22, 2025 |        |
| Production Deployment         | Day Ahead Market Enhancements (Inactive)                                                                                                                                                                                                                                                  | Oct 01, 2025                |        |
| Production Activation         | Day Ahead Market Enhancements (Financially Binding)                                                                                                                                                                                                                                       | May 01, 2026                |        |

# Spring 2026 – Day Ahead Market Enhancements

- Upcoming BRS v1.1 to publish 12/22/23
- Revisions Preview:
  - Clarified, corrected typos and cleaned up the document.
  - Moved some requirements from DAME BRS to EDAM BRS and vice versa.
  - Updated business requirement to match filed Tariff and/or clarified policy.
    - Restored back Reliability Capacity Up/Down (RCU/RCD) bid caps to \$250.
    - Set Metered Sub-System (MSS)-specific annual Reliability Unit Commitment (RUC) participation flag to always Opt-In.
    - Netted RCU/RCD Overlapping Resource Adequacy (RA) Capacity from RUC Bid Cost Recovery (BCR) calculations.
    - Updated for not assessing Resource Adequacy Availability Incentive Mechanism (RAAIM) to Imbalance Reserve (IR) and Reliability Capacity (RC) awards for generic and Flex RA.
    - Extended the Day-Ahead (DA) and Base Schedule Forecast Movement to virtual supply and demand resources.
    - Extended the Fifteen-Minute Market (FMM) deviation settlements to virtual supply and demand resources.
    - Accounted for virtual Forecast Movement (FM) in allocation of residual FM Settlements.
    - Made the Load-Serving Entity (LSE)-Resource Pair True-Up flag on LSE-Resource Pair instead of LSE-only and updated its logic and submission system from Master File to Customer Interface for Resource Adequacy (CIRA).
    - Set Upper Economic Limit (UEL) to 0 for System Resources, if e-tag validation fails.
    - Required that resources with RCU Award that submitted a DA Energy Bid to export outside the EDAM Area must provide a decremental Real-Time (RT) Energy Bid to dispatch down the export schedule in the FMM.
    - Updated for not mitigating RCU Bids that are submitted on behalf of imports from outside the EDAM Area.
    - Published Imbalance Reserve Up/Down (IRU/IRD) and RCU/RCD Overlapping RA Capacity in Customer Market Results Interface (CMRI) reports.
    - Changed calculation of ramp rate segment for IRU and IRD to correspond to Day-Ahead Energy Schedule (DAES) instead of DAES+IRU Award and DAES-IRD Award.
    - Removed the requirement of intertie congestion components being included in RCU/RCD marginal prices.
    - Updated Ancillary Service State of Charge (ASSOC) constraints formulation.
    - Accounted for IR Surplus in market optimization, Settlements and reporting.
    - Allowed bid daily min energy limit positive or negative in SIBR, consistent with market.
    - Expand IR Requirement input model to cover Trading Day+1, +2, and +3 for market and reporting.
    - Deleted the RC Constraint Open Access Same-time information System (OASIS) reports.

# Extended Day Ahead Market (EDAM) Implementation

| Project Information                        | Details/Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Level Business Problem or Need</b> | The purpose of this initiative is to create a comprehensive extended day-ahead market that extends over multiple balancing authority areas (BAAs) participating in the Western Energy Imbalance Market (WEIM). EDAM is a voluntary day-ahead electricity market with the potential to deliver significant economic, environmental, and reliability benefits for participants across the West. EDAM will more efficiently and effectively integrate renewable resources and address the significant operational challenges presented by a rapidly changing resource mix, emerging technologies, and the impacts of climate change. EDAM will enable procurement of robust supply and flexible capacity that will position EDAM participants to effectively address changes in conditions from day-ahead to real-time, improving their response to potential reliability challenges. EDAM builds upon the proven ability of the WEIM to increase regional coordination, support state policy goals, and cost effectively meet demand. |
| <b>High Level Project Scope</b>            | The EDAM design leverages existing features of the ISO day-ahead market that are common in other day-ahead markets across the country. The design also considers enhancements proposed in contemporaneous stakeholder initiatives that will harness flexibility across the larger footprint by incorporating an imbalance reserve product that will enhance price formation. EDAM introduces new products, imbalance reserve and reliability capacity, as well as new penalties, and a Resource Sufficiency Evaluation (RSE) surcharge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>BPM Changes</b>                         | Definitions and Acronyms<br>Energy Imbalance Market (EIM)<br>Market Instruments<br>Market Operations<br>Settlements and Billing<br>EDAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Impacted Systems</b>                    | MF, ALFS, ALFS-SOA, SIBR, RTSI, RTBS, BSAP, DAM (IFM and RUC), DA-RSE (new), RTM (RTPD and RTD), STUC, MPM, ITS, BARC, GHG Pass (new), Settlements, CMRI, OASIS, ADS, WebOMS, Internal ISO Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Requirements</b>                        | Published Aug 02, 2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

# Extended Day Ahead Market (EDAM) Implementation

| Milestone Type               | Milestone Name                                                                            | Dates                       | Status |
|------------------------------|-------------------------------------------------------------------------------------------|-----------------------------|--------|
| External BRS                 | Publish External BRS v1.0                                                                 | Aug 02, 2023                | ✓      |
|                              | Publish External BRS v1.1                                                                 | Dec 29, 2023                |        |
| Tariff                       | Draft Tariff Language                                                                     | Mar 30, 2023                | ✓      |
|                              | Revised Draft Tariff Language                                                             | Jun 08, 2023                | ✓      |
|                              | Updated Revised Draft Tariff Language                                                     | Jul 25, 2023                | ✓      |
|                              | FERC Filing                                                                               | Aug 22, 2023                | ✓      |
|                              | FERC Response requested by                                                                | Dec 21, 2023                | ✓      |
|                              | Requested effective date for tariff changes for EDAM agreements and onboarding provisions | Dec 21, 2023                |        |
| Settlements<br>Config Guides | Post Draft Config Guides - First set of charge codes                                      | Jan 16, 2024                |        |
|                              | Post Draft Config Guides - Second set of charge codes                                     | Mar 26, 2024                |        |
|                              | Post Draft Config Guides - Third set of charge codes                                      | Aug 26, 2024                |        |
| Tech Spec                    | Publish Technical Specifications – RTSI                                                   | 12/6/23                     | ✓      |
|                              | Publish Technical Specifications – SIBR                                                   | 12/15/23                    |        |
|                              | Publish Technical Specifications – MF                                                     | Q1 2024                     |        |
|                              | Publish MF GRDT DRAFT                                                                     | Q1 2024                     |        |
|                              | Publish Technical Specifications – OASIS                                                  | Q1 2024                     |        |
|                              | Publish Technical Specifications – ALFS                                                   | Q1 2024                     |        |
|                              | Publish Technical Specifications – CMRI                                                   | Q1 2024                     |        |
|                              | Publish Technical Specifications – OMS                                                    | Q1 2024                     |        |
| BPMs                         | Publish Technical Specifications – PLC                                                    | Q1 2024                     |        |
|                              | Post Draft BPM – Energy Imbalance Market (EIM)                                            | TBD                         |        |
|                              | Post Draft BPM – Market Instruments                                                       |                             |        |
|                              | Post Draft BPM – Market Operations                                                        |                             |        |
|                              | Post Draft BPM – Settlements and Billing                                                  |                             |        |
|                              | Post Draft BPM – EDAM                                                                     |                             |        |
| External Training            | Post Draft BPM – Definitions and Acronyms                                                 |                             |        |
|                              | Training                                                                                  | TBD                         |        |
| Market Sim                   | EDAM Onboarding Market Sim                                                                | Sep 01, 2025 – Jan 16, 2026 |        |
| Production                   | EDAM Production Deployment - Inactive                                                     | Oct 01, 2025                |        |
|                              | EDAM Onboarding (Financially Binding) & Activation (Pacifcorp)                            | May 01, 2026                |        |



# Spring 2026 – EDAM ISO BAA Participation Rules Track A

| ➤ Project Information      | ➤ Details/Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ➤ High Level Project Scope | <ul style="list-style-type: none"> <li>➤ Through this initiative, the ISO will address ISO Balancing Authority Area (BAA)-specific elements required for Extended Day-Ahead Market (EDAM) participation, including how to allocate ISO BAA EDAM resource sufficiency evaluation (RSE) failure surcharges and revenues, and options for curing ISO BAA EDAM advisory RSE shortfalls.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| ➤ Tariff Changes           | <ul style="list-style-type: none"> <li>➤ First, the CAISO proposes tariff revisions to allow for the settlement of all Transfer System Resources in the CAISO BA.</li> <li>➤ Second, the CAISO proposes tariff revisions to allow for the settlement of EDAM Transfer revenue allocated to the CAISO BA, inclusive of EDAM Transfer revenue and EIM Transfer revenue.</li> <li>➤ Third, the CAISO proposes tariff revisions to allow the CAISO to distribute all CAISO BA revenues and surcharges for the EDAM RSE Failure Surcharge.</li> <li>➤ Fourth, the CAISO proposes tariff revisions to set forth the calculations for the EDAM Historical Revenue Recovery amounts for transmission owners in the CAISO BA.</li> <li>➤ Fifth, the CAISO proposes tariff revisions to allow the CAISO BA to enable the Net EDAM Export Transfer Constraint, a voluntary, and optional, mechanism that each EDAM Balancing Authority may enable to preserve sufficient supply to meet its projected needs, while managing reliability based on conditions and circumstances anticipated within its balancing area.</li> </ul> |

| Milestone Type | Milestone Name                | Dates        | Status |
|----------------|-------------------------------|--------------|--------|
| Board Approval | Board approval                | Sep 21, 2023 | ✓      |
| Tariff         | Draft Tariff Language         | Aug 25, 2023 | ✓      |
|                | Revised Draft Tariff Language | Oct 11, 2023 | ✓      |
|                | FERC Filing ER24-379          | Nov 13, 2023 | ✓      |
|                | FERC Response Requested By    | Feb 15, 2024 |        |
| Production     | Effective Date                | Spring 2026  |        |

# Spring 2026 – WEIM BHE Montana

| Project Info                 | Details/Date                                                                                                                                                                 |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Application Software Changes | System modifications as needed to accommodate any unique Berkshire Hathaway Energy Montana needs to support their WEIM onboarding.                                           |
| BPM Changes                  | WEIM BPM will be updated if needed to reflect changes identified during the onboarding and as required to reflect the unique processes of Berkshire Hathaway Energy Montana. |
| Market Simulation            | December 2025 thru January 2026                                                                                                                                              |
| Parallel Operations          | February 2026 thru March 2026                                                                                                                                                |

| Milestone Type      | Milestone Name               | Dates                  |
|---------------------|------------------------------|------------------------|
| Market Sim          | Market Sim Window            | Dec 2025 thru Jan 2026 |
| Parallel Operations | Parallel Operations          | Feb 2026 thru Mar 2026 |
| Tariff              | File Readiness Certification | Mar 2026               |
| Production          | Activation                   | May 2026               |

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

Market Sim

Market Sim

Release Users Group  
(RUG)

# RUG Calendar 2023

RUG 12/26/23 cancellation; Next RUG 01/09/24



2023

Release User Group Meetings

Note: dates subject to change; for the latest information please visit the Calendar on [www.caiso.com](http://www.caiso.com)

| January |    |    |    |    |    |    |
|---------|----|----|----|----|----|----|
| Su      | Mo | Tu | We | Th | Fr | Sa |
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| 28      | 29 | 30 | 31 |    |    |    |

| February |    |    |    |    |    |    |
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| March |    |    |    |    |    |    |
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| April |    |    |    |    |    |    |
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| May |    |    |    |    |    |    |
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| June |    |    |    |    |    |    |
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| July |    |    |    |    |    |    |
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| August |    |    |    |    |    |    |
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| September |    |    |    |    |    |    |
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| October |    |    |    |    |    |    |
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| November |    |    |    |    |    |    |
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| December |    |    |    |    |    |    |
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| 24       | 25 | 26 | 27 | 28 | 29 | 30 |
| 31       |    |    |    |    |    |    |

Meeting

Holiday

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CAISO PUBLIC

# RUG Calendar 2024



2024

Release User Group Meetings

Note: dates subject to change; for the latest information please visit the Calendar on [www.caiso.com](http://www.caiso.com)

| January |    |    |    |    |    |    |
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| February |    |    |    |    |    |    |
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| March |    |    |    |    |    |    |
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| April |    |    |    |    |    |    |
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| May |    |    |    |    |    |    |
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| June |    |    |    |    |    |    |
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| July |    |    |    |    |    |    |
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| August |    |    |    |    |    |    |
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| 18     | 19 | 20 | 21 | 22 | 23 | 24 |
| 25     | 26 | 27 | 28 | 29 | 30 | 31 |

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

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

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

Meeting

Holiday

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CAISO PUBLIC

# User Groups Calendar - 2023



2023

Settlement User Group Meetings

*Note: dates subject to change; for the latest information please visit the Calendar on [www.aiso.com](http://www.aiso.com)*

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

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

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



2023

Technical User Group Meetings

*Note: dates subject to change; for the latest information please visit the Calendar on [www.aiso.com](http://www.aiso.com)*

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

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

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



# Marker Performance Report Update



# CAISO Overview – July 2023 Emergency Events Treatment of Export and Wheeling Transactions

# As a Balancing Authority, the ISO adheres to these requirements to balance supply and demand



- All Balancing Authorities (BAs) must adhere to NERC and FERC rules regarding exports, firmness of transmission and load management
- Energy transfer transactions are prioritized between BAs during strained grid conditions
- Similar to all other BAs the ISO will clear low priority transactions once it has served its own native load and there is sufficient supply

The California ISO is one of 39 Balancing Authorities in the Western Interconnection

# Important distinction between low priority and high priority exports

## Low Priority

Considered opportunity sales sourced from the ISO's pool of resources that the ISO can support once it has met its own load requirements

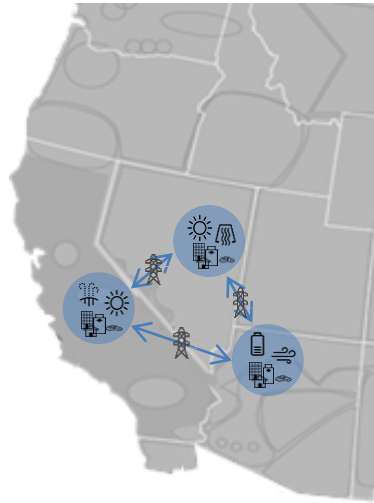
## High Priority

Supply from the ISO that is not already contractually committed to serve ISO load

Low priority exports may not be feasible during strained grid conditions

# Treatment of wheel through transactions on the ISO system

ISO provides low and high priority wheel-through service to allow entities to transfer energy through the ISO's transmission system from one BAA to another



## High priority wheels

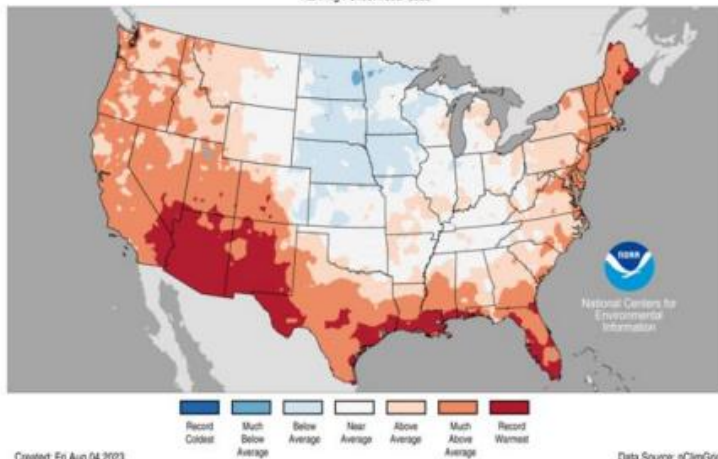
- Requires demonstration of need to wheel through the ISO system based on external contractual commitment at least 45-days in advance of the month
- Receive treatment equal to the ISO's native load

Without required registration the wheel is considered low priority

# Summer 2023, extreme heat conditions in the desert southwest

Mean temperature percentiles for July 2023

Ranking Period: 1895-2023

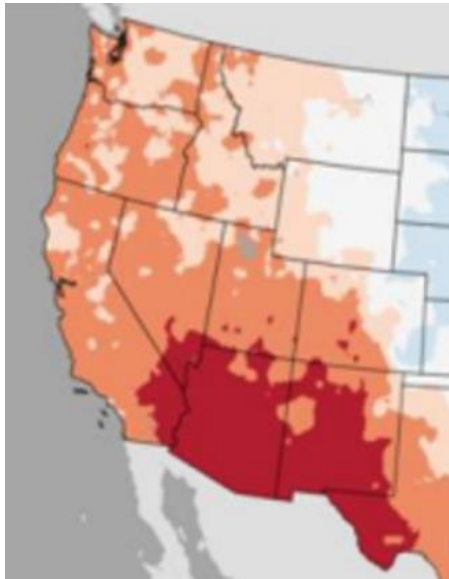


- Record heat in the DSW
- Unprecedented demand outside CA
- Western energy supply stretched thin

- Transmission Congestion
- Challenges for Grid Operators

Despite improved supply conditions from prior years, extreme heat put a strain on the grid in the month of July

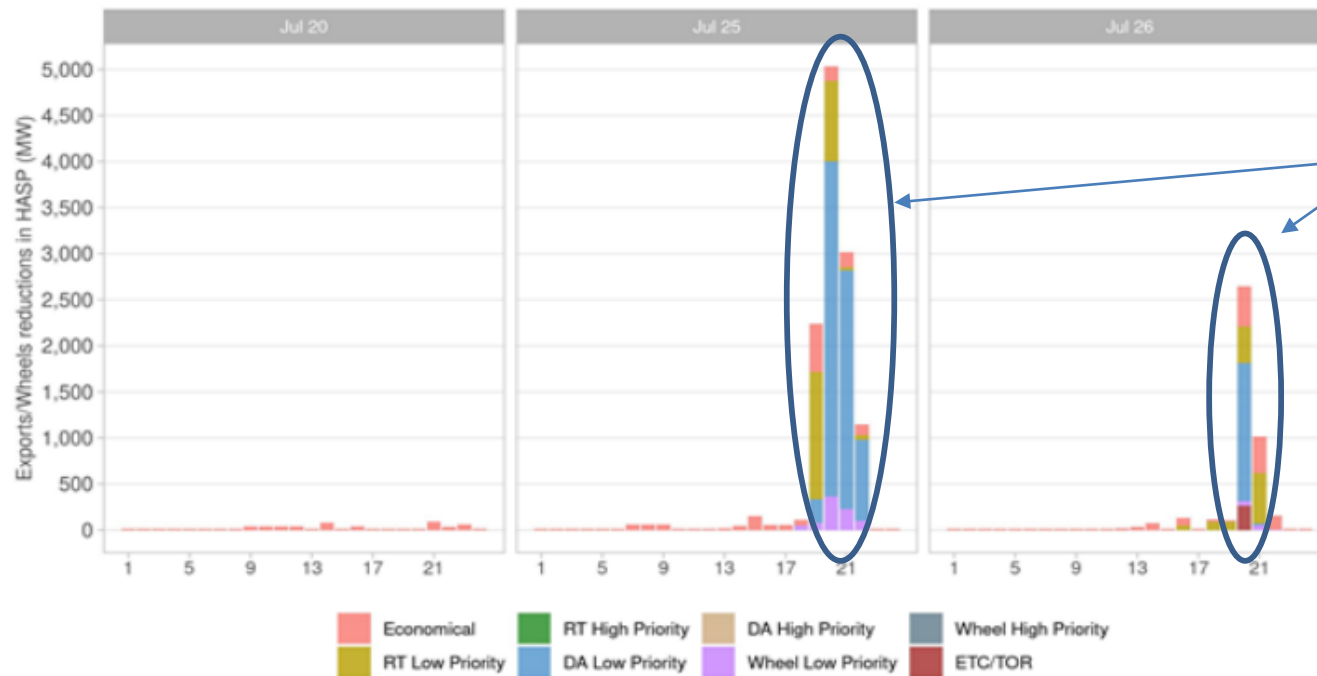
# Emergency declarations and actions taken in July 2023 during high demand conditions



- July 20 - An Energy Emergency Alert 1 (EEA1) was declared for the ISO BAA on the evening of July 20 resulting in a demand response event
- July 25 – An Energy Emergency Watch was declared as solar power diminished
- July 26 – An Energy Emergency Watch was declared due to similar system conditions as July 25

The ISO honored all high-priority exports and wheels during each of the emergency events

Due to tight supply conditions, the RT Market could not clear all low priority transactions



Low priority and economic transactions that could not clear the hourly market in hours 19 - 22

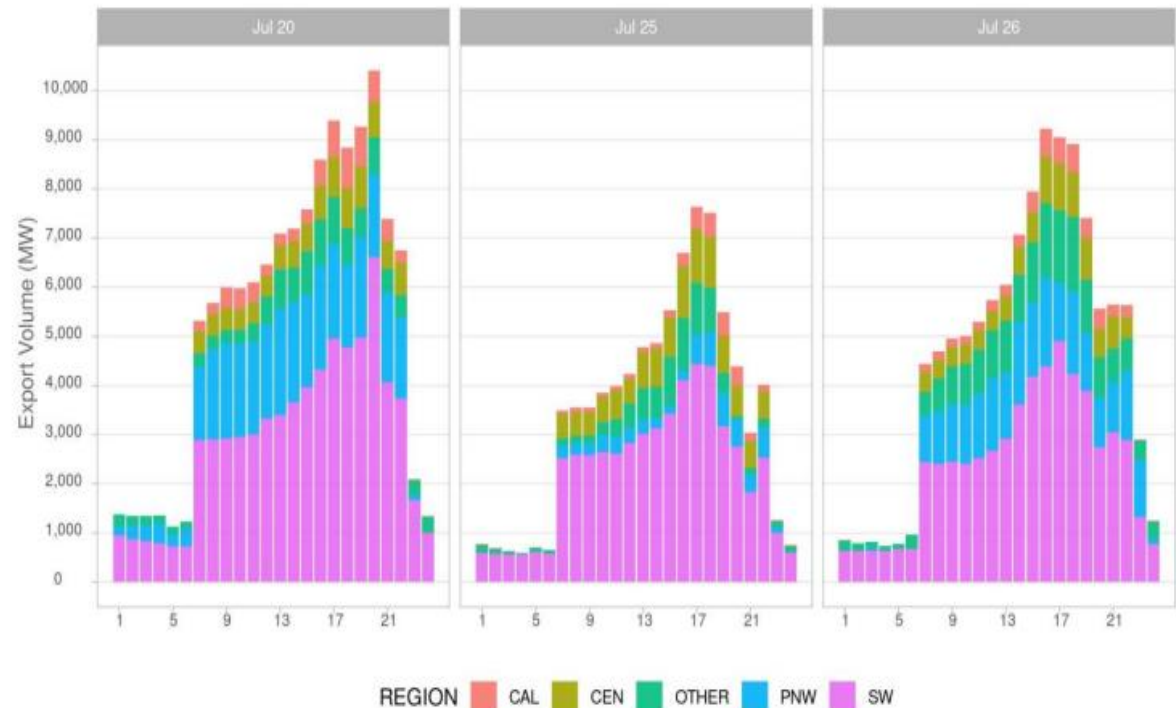
All high priority exports and wheel-through transactions were honored



# The ISO was able to support a large volume of exports and wheels

Unprecedented high volume of exports cleared in July

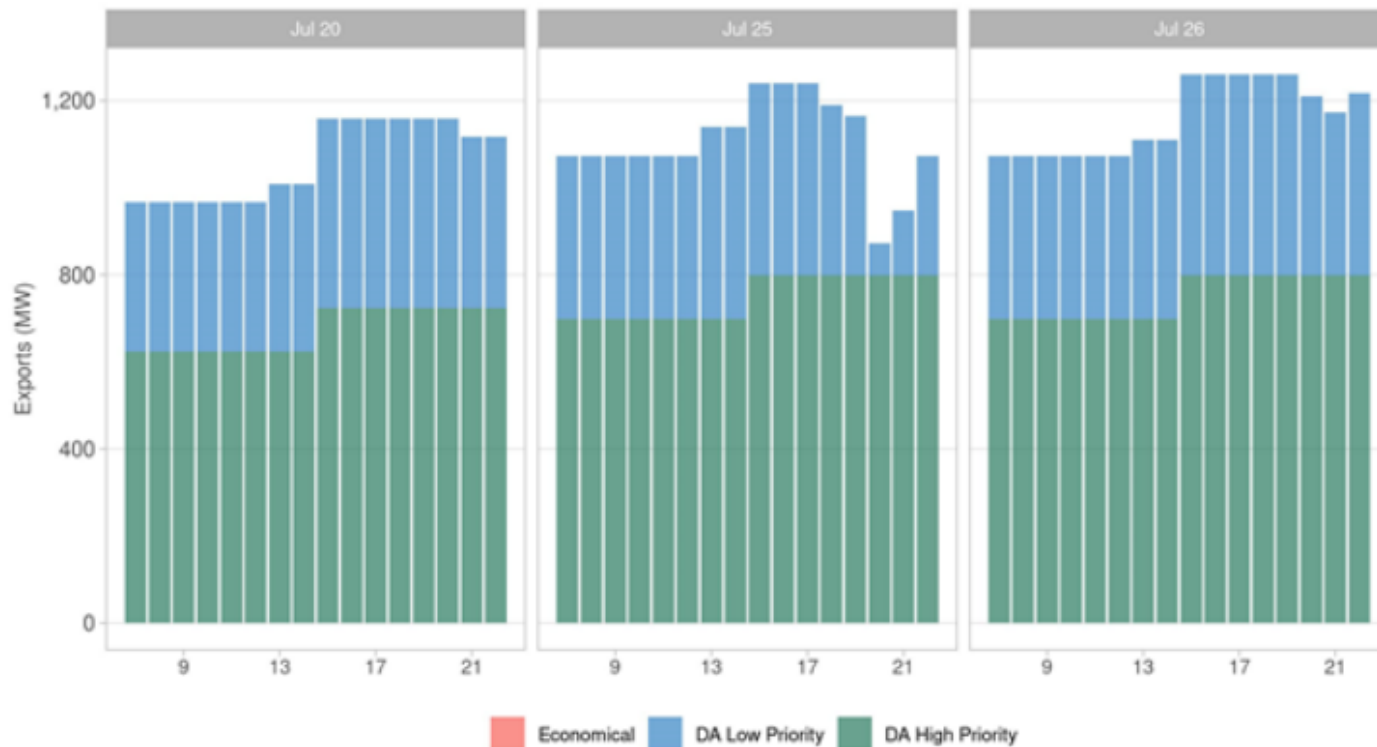
Exports during peak hours were double of those in summers of 2021 & 2022 during strained system conditions



Breakdown of ISO exports by sinking BAA July 20, 25 & 26

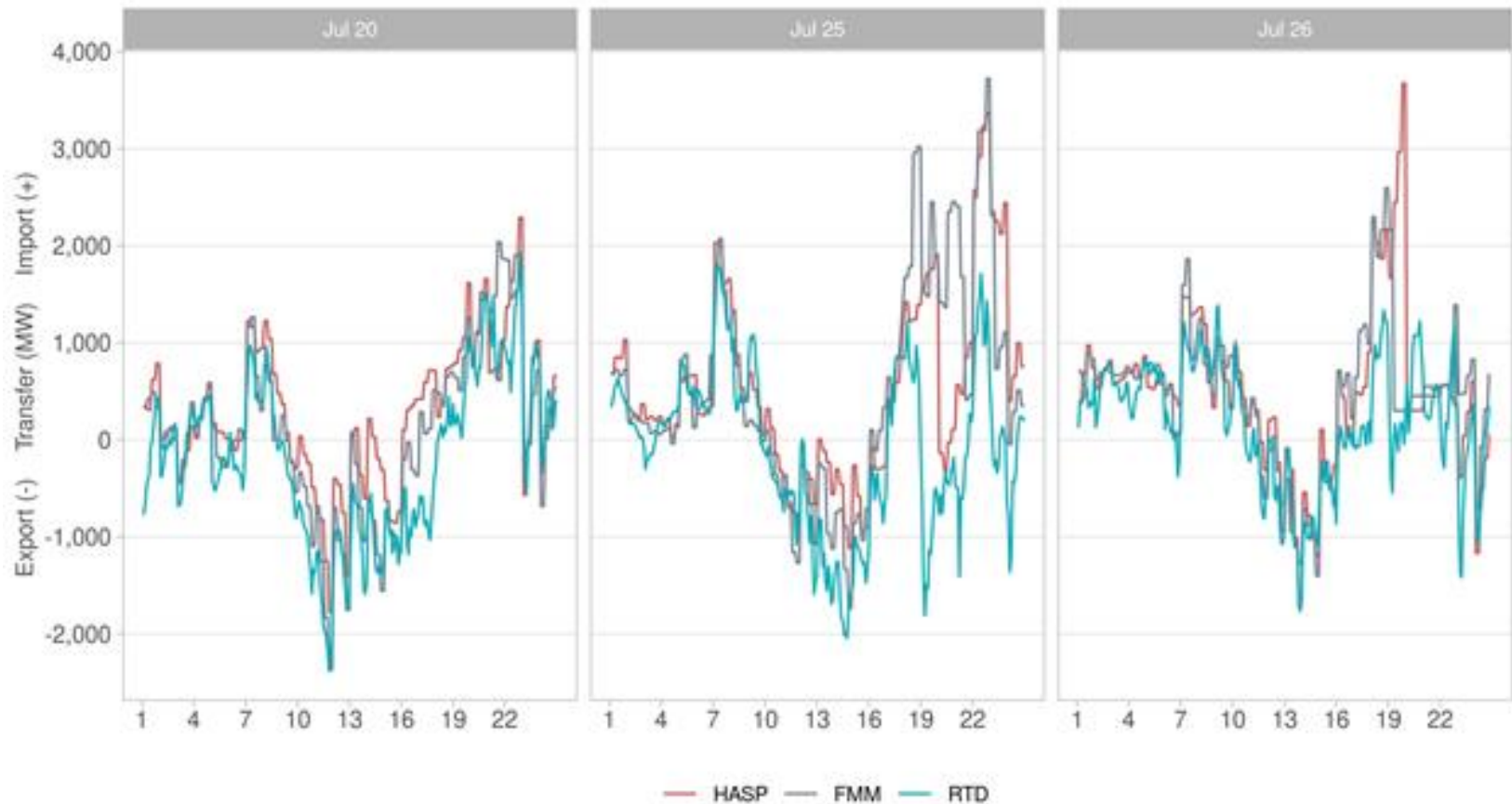
Market cleared an unprecedented 9,000 MW of exports at various times in July

During this critical time period, the ISO was still able to clear up to 1,200 MW of wheel-through transactions



Significant volume of low priority transactions were supported

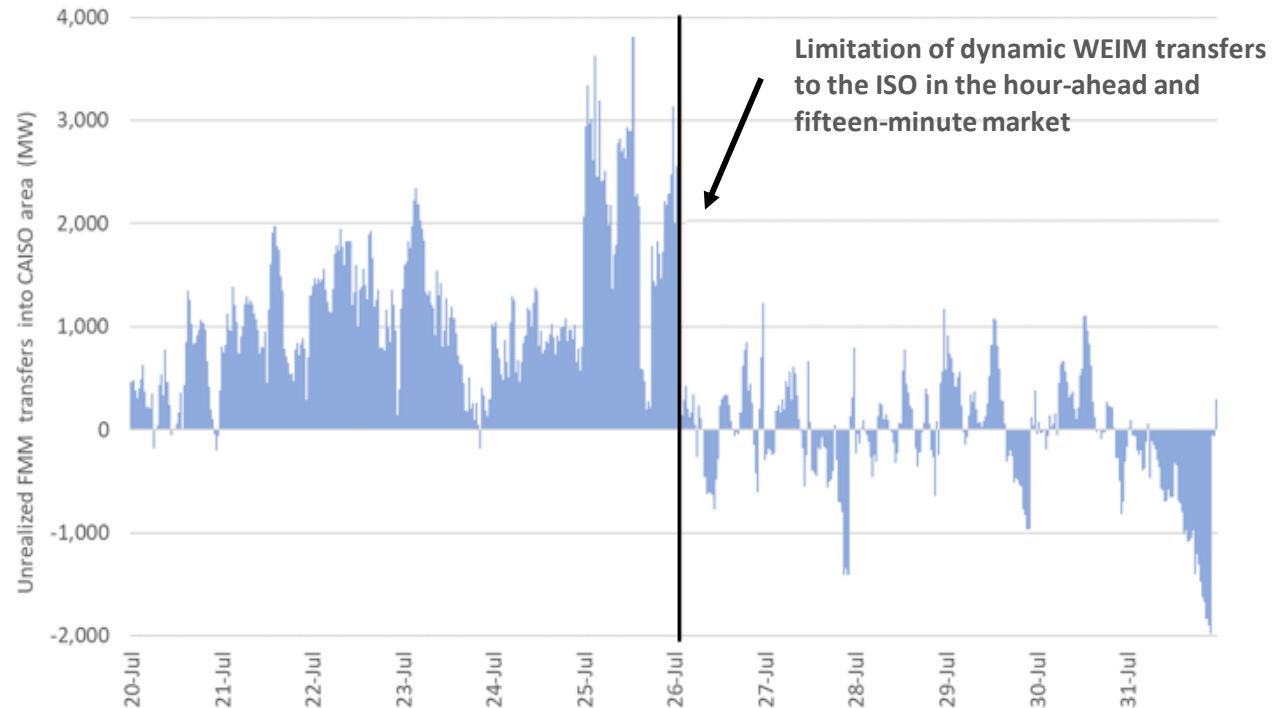
# Energy Transfer Trends for CAISO area across markets



Advisory transfers in HASP and FMM were much higher than materialized transfers in RTD

# Starting on July 26, the ISO limited reliance on imports from the WEIM

Reliance on WEIM transfers into the ISO BAA were limited to minimize the risk of supply not materializing starting on July 26



# Energy Storage Performance after Fall Enhancements

## Energy storage enhancements Track 2 was activated on November 1, 2023

- The original state of charge equation

$$SOC_{i,t} = SOC_{i,t-1} - \left( EN_{i,t}^{(+)} + \eta_i EN_{i,t}^{(-)} \right) \frac{\Delta T}{T_{60}}$$

$$\underline{SOC}_{i,t} \leq SOC_{i,t} \leq \overline{SOC}_{i,t}$$

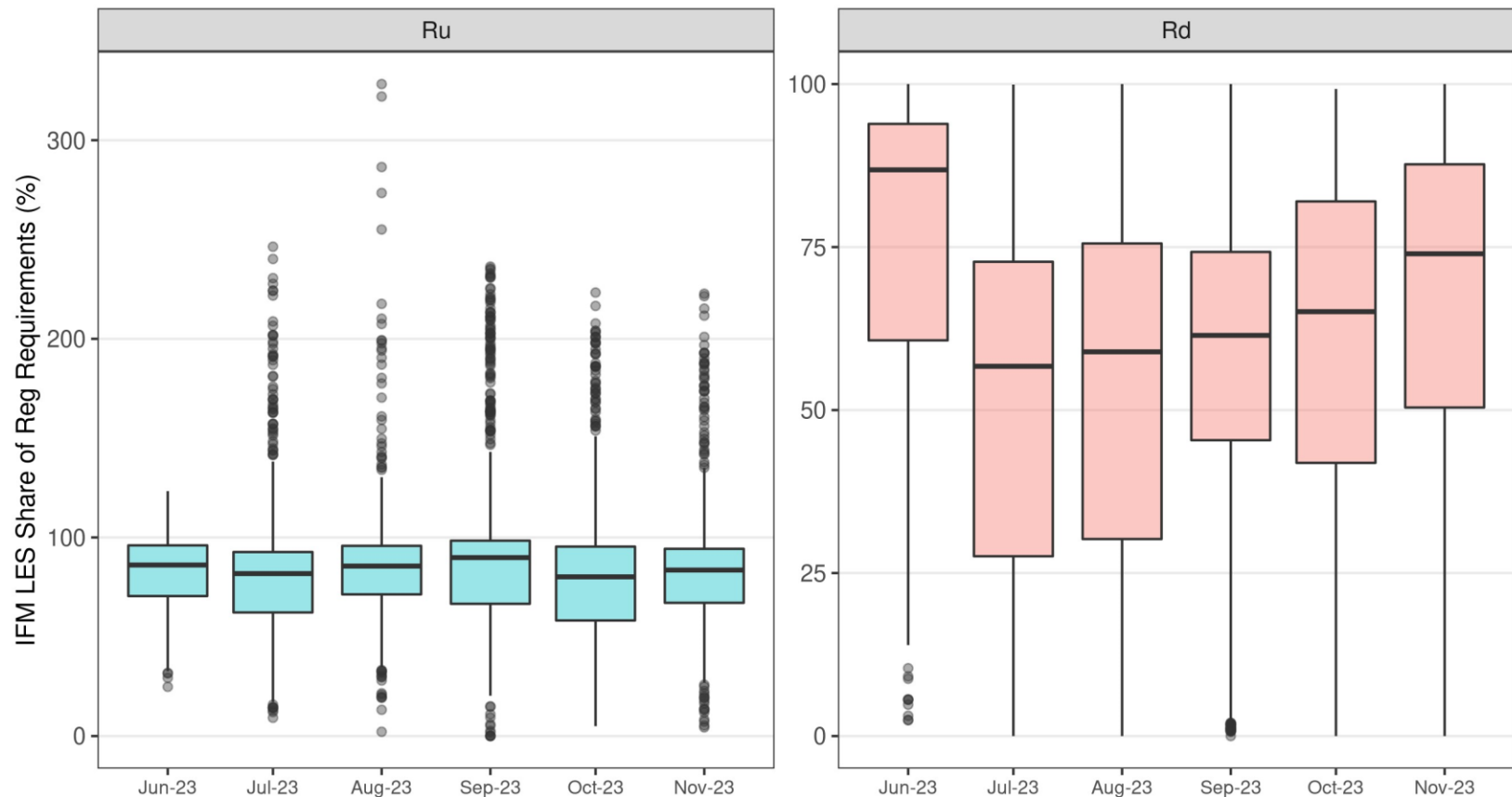
(SOC: original SOC with energy impact only)

- A new set of constraints is introduced

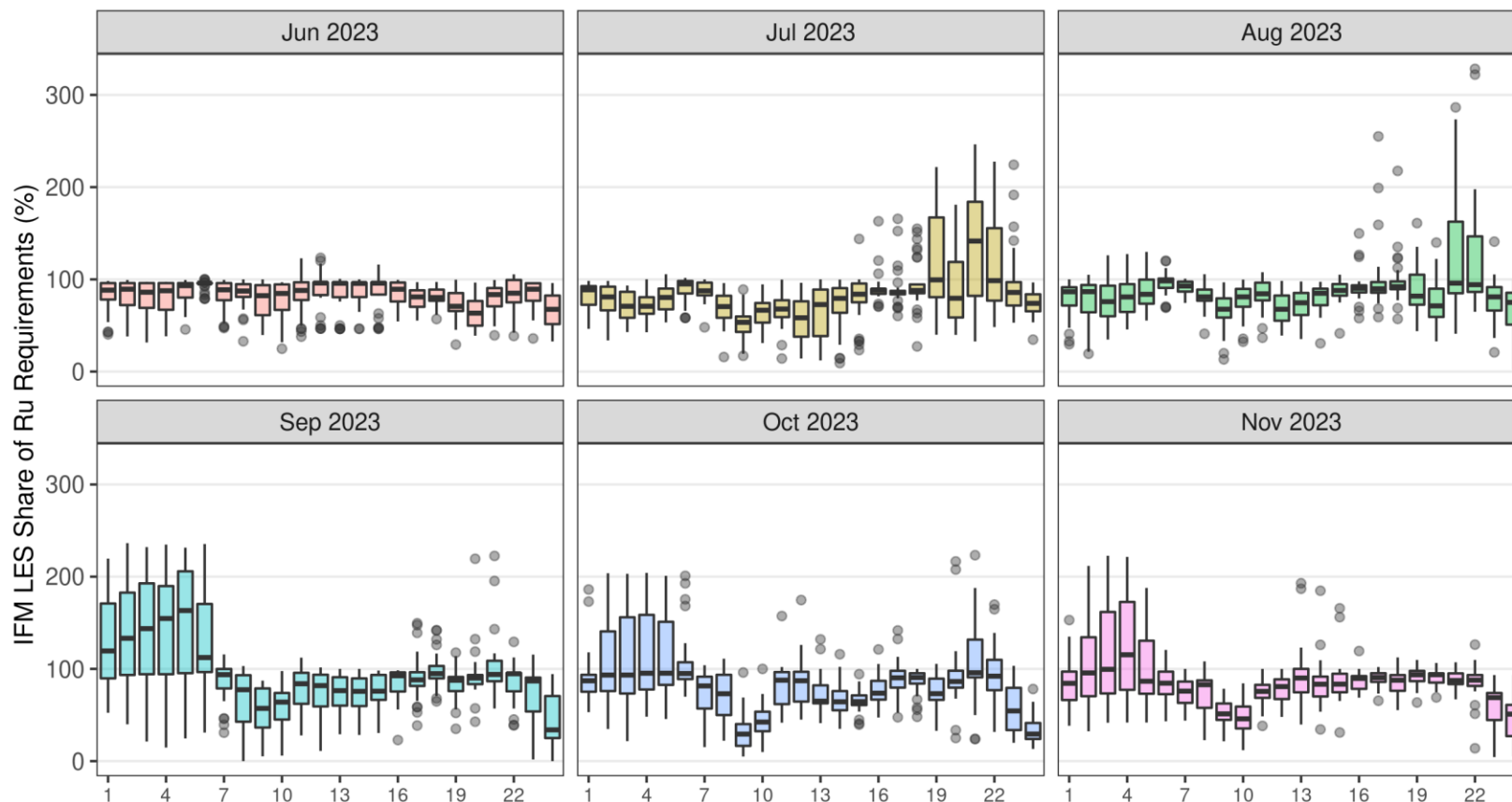
$$SOC_{i,t}^{AT} = SOC_{i,t-1}^{AT} - \left( EN_{i,t}^{(+)} + \eta_i EN_{i,t}^{(-)} + \textcolor{red}{ATRU}_t RU_{i,t} - \textcolor{red}{ATRD}_t \eta_i RD_{i,t} \right) \frac{\Delta T}{T_{60}}$$

( $SOC^{AT}$  : SOC with attenuation factors)

# There is no material change in the share of regulation requirement supported by storage resources

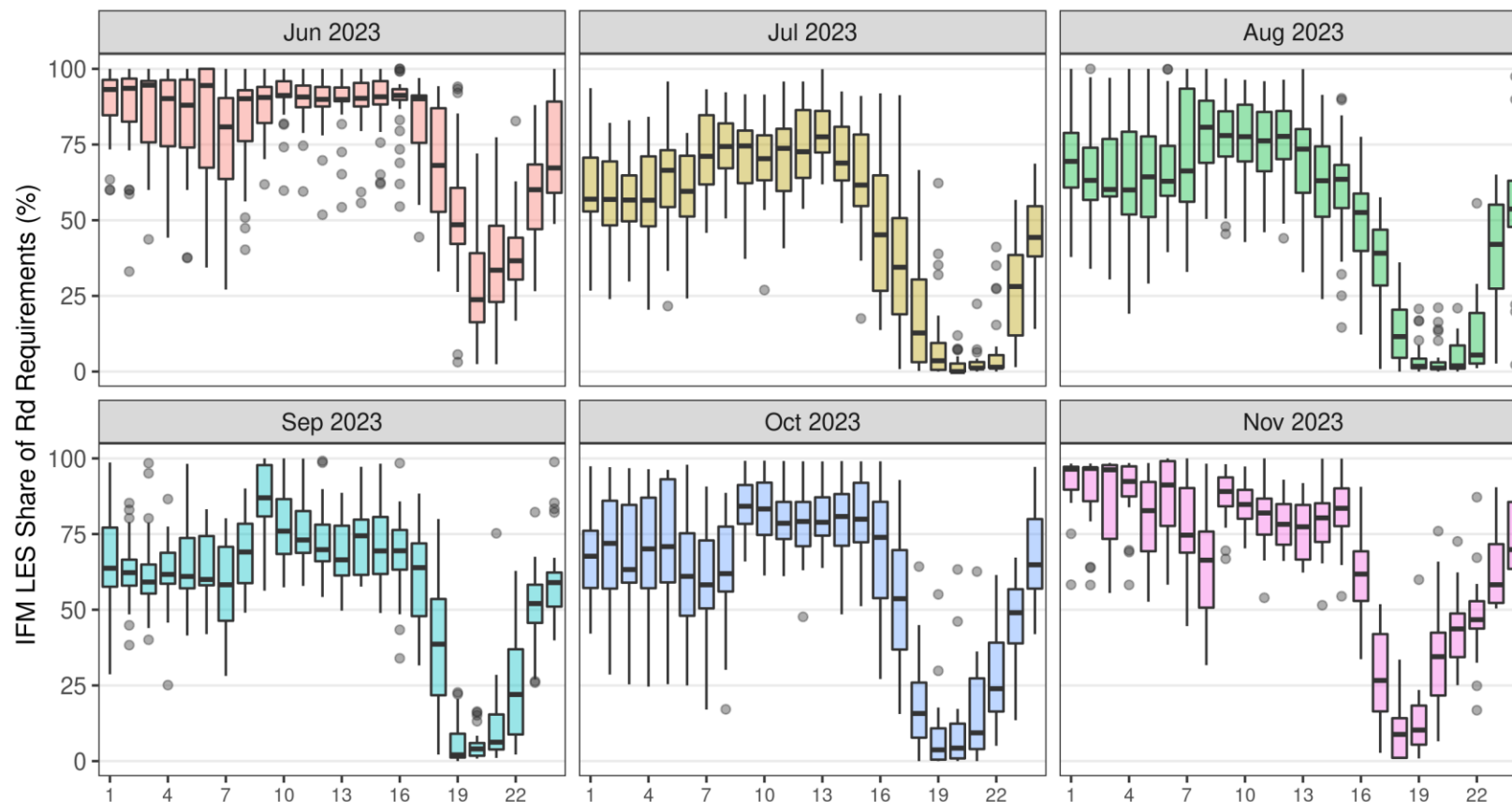


# No material change in the hourly profile of the LESR percentage share of the Ru requirement after implementation of enhancements

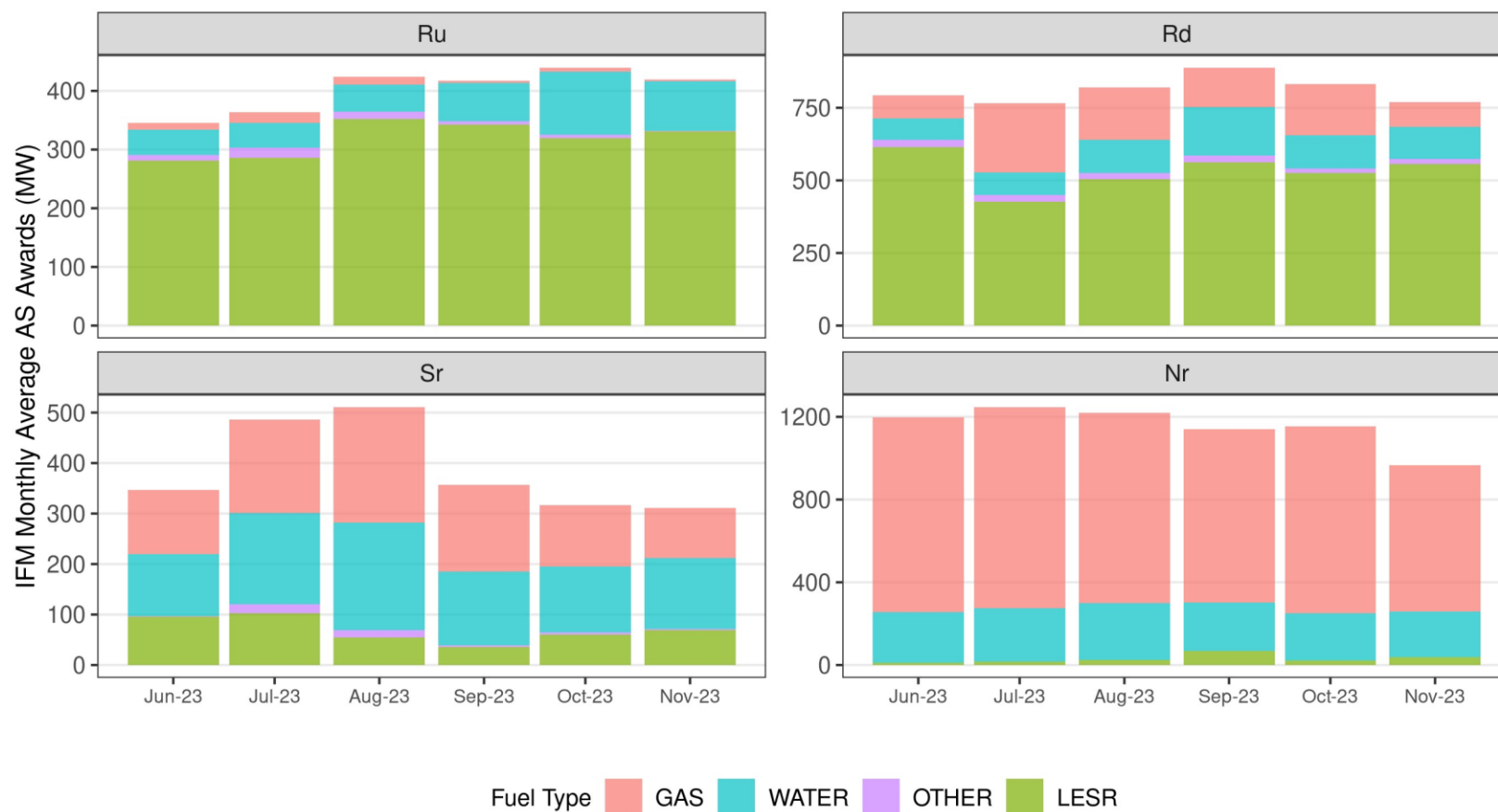




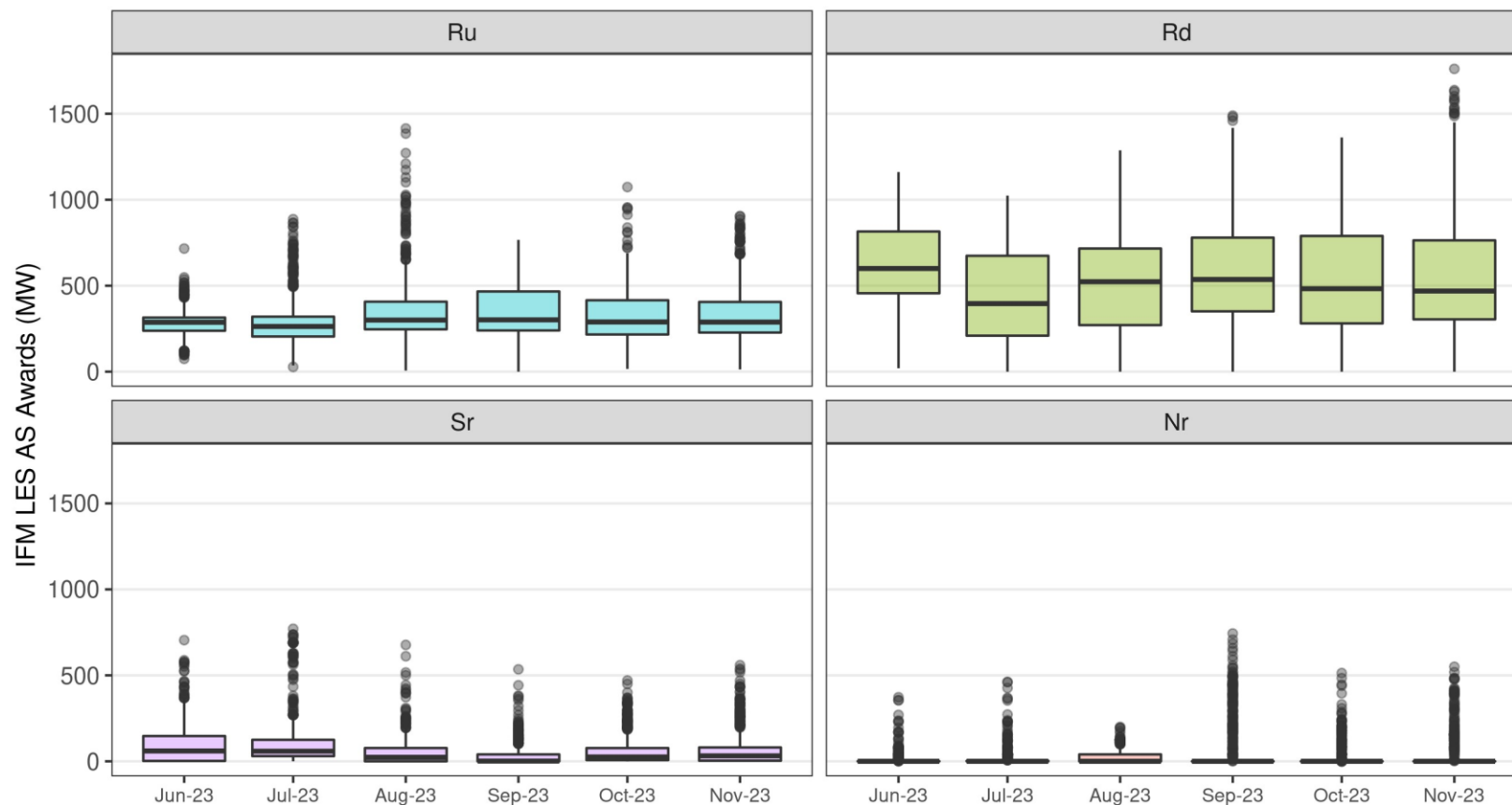
# No material change in the hourly profile of the LESR percentage share of the Rd requirement



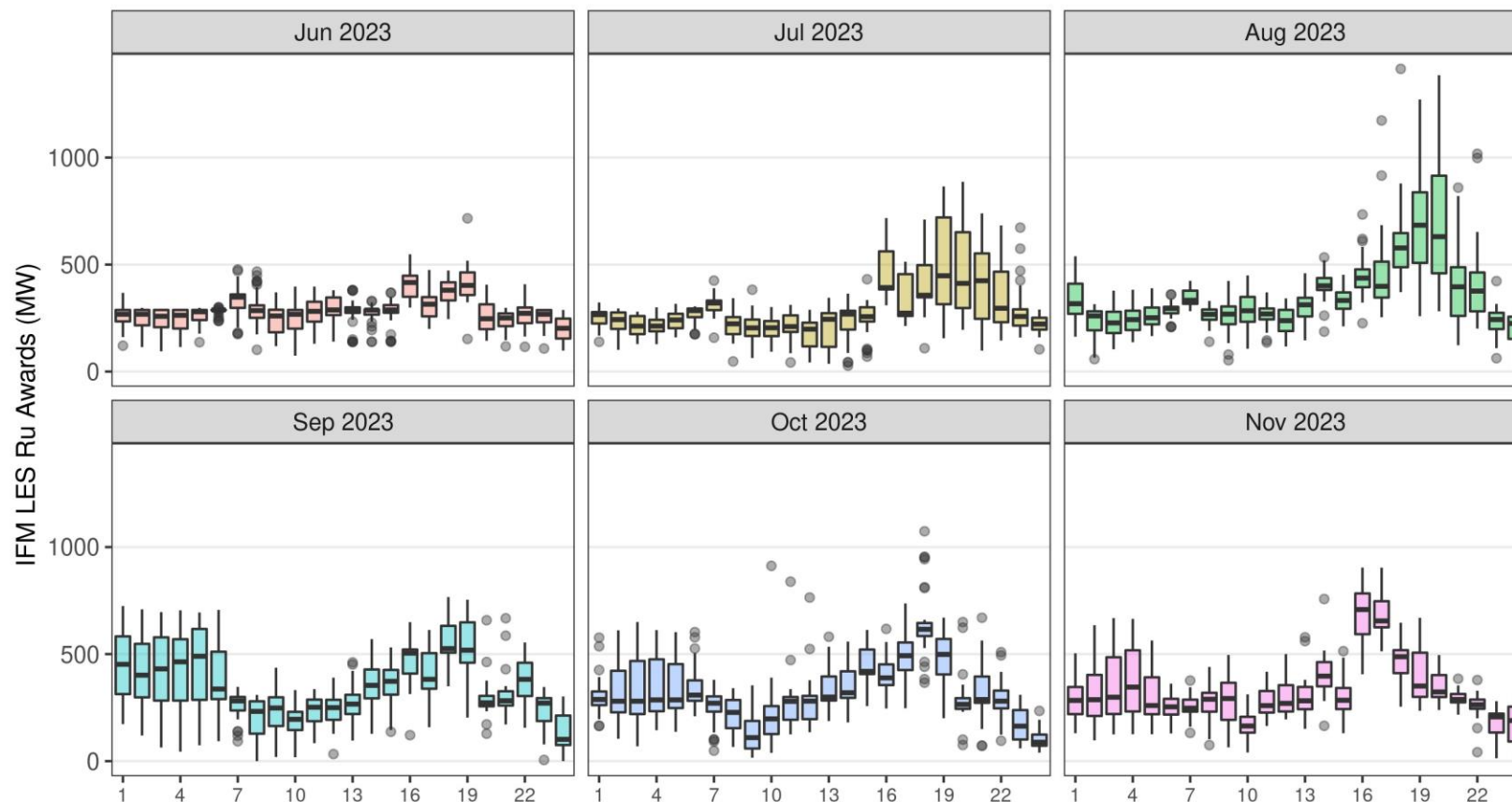
# Monthly average IFM AS awards shows no significant change in pattern



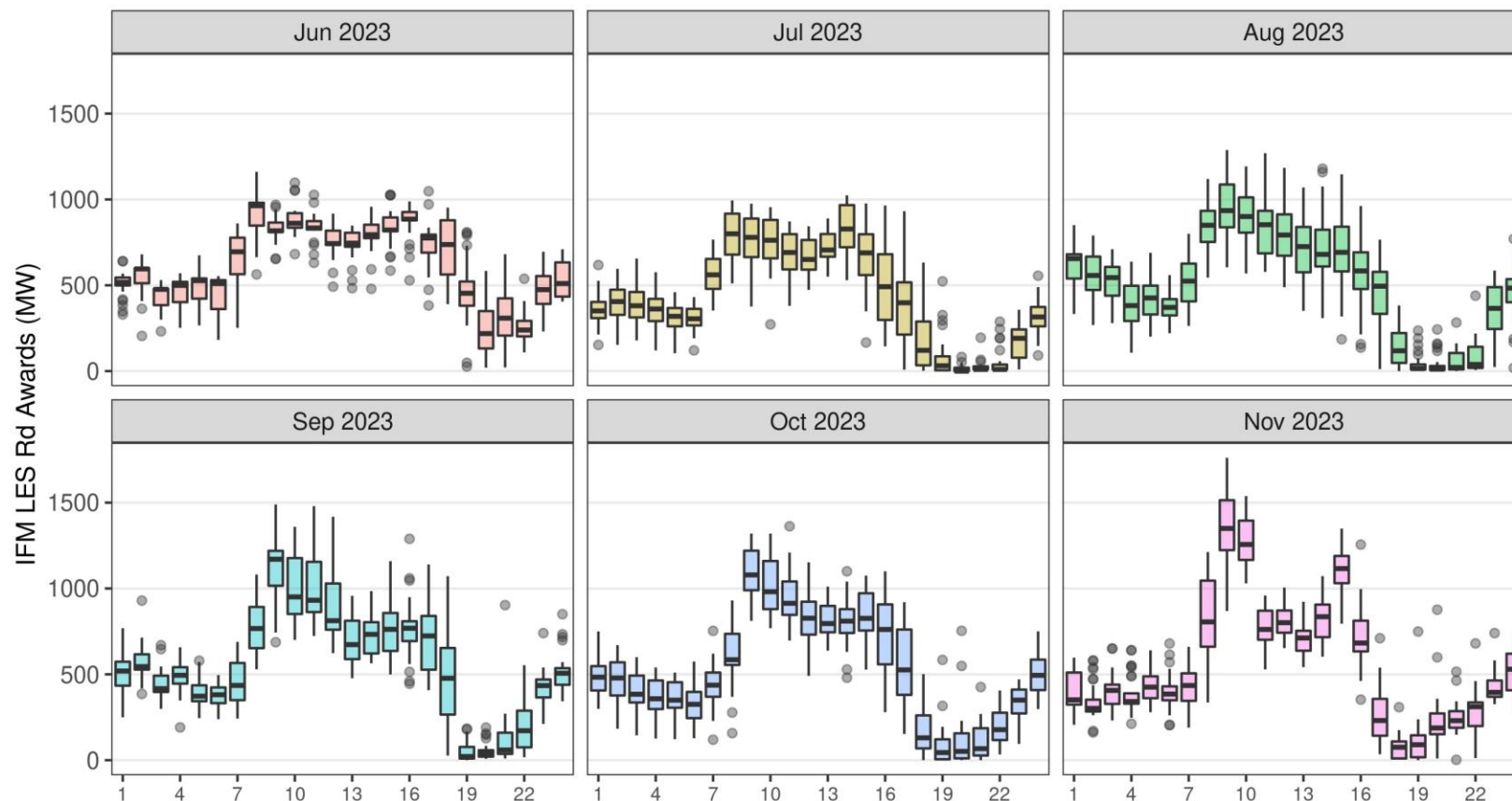
# Monthly IFM AS market awards show no significant change in pattern



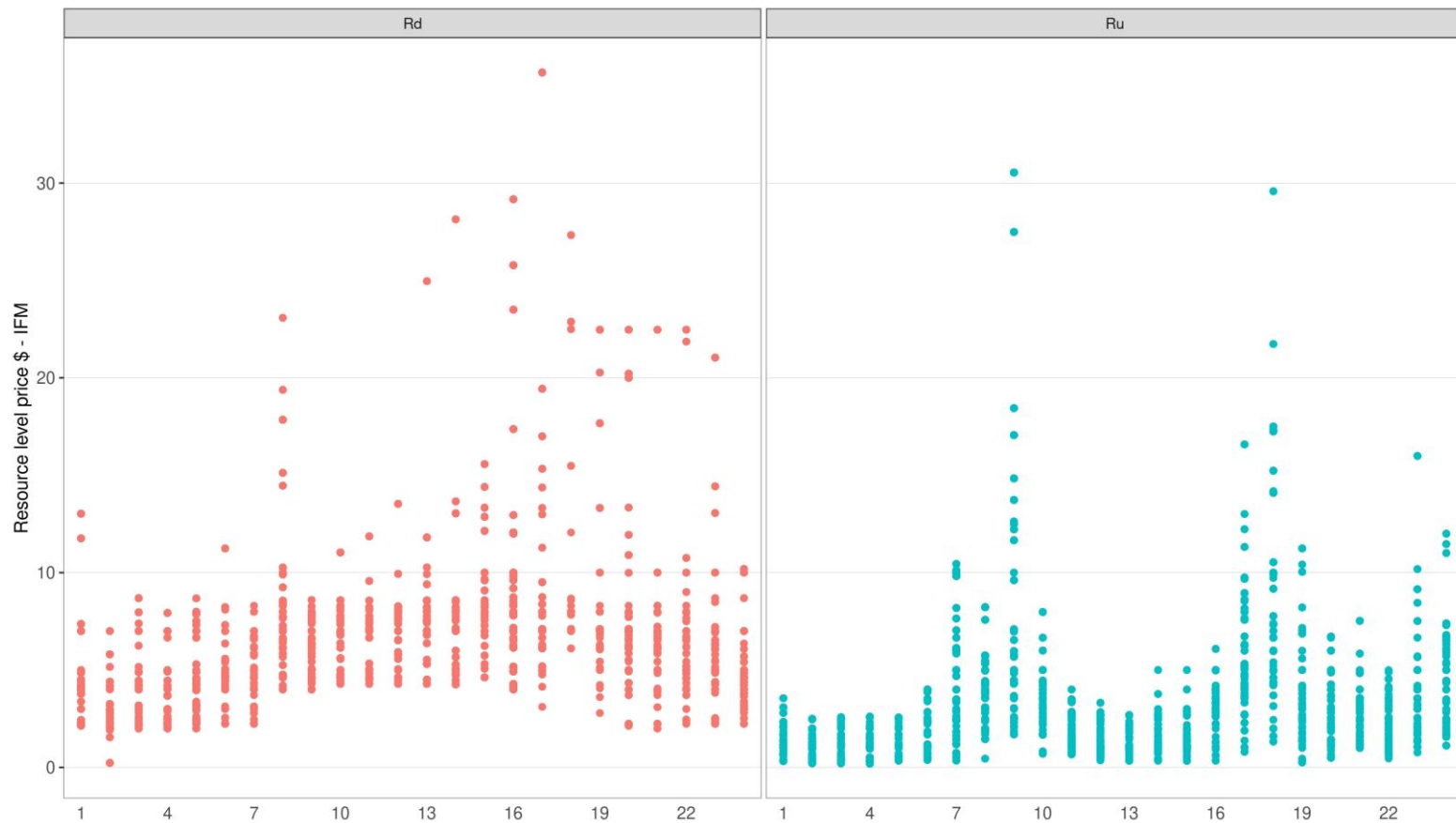
# Regulation up awards in the day-ahead market have not seen a material change in trend



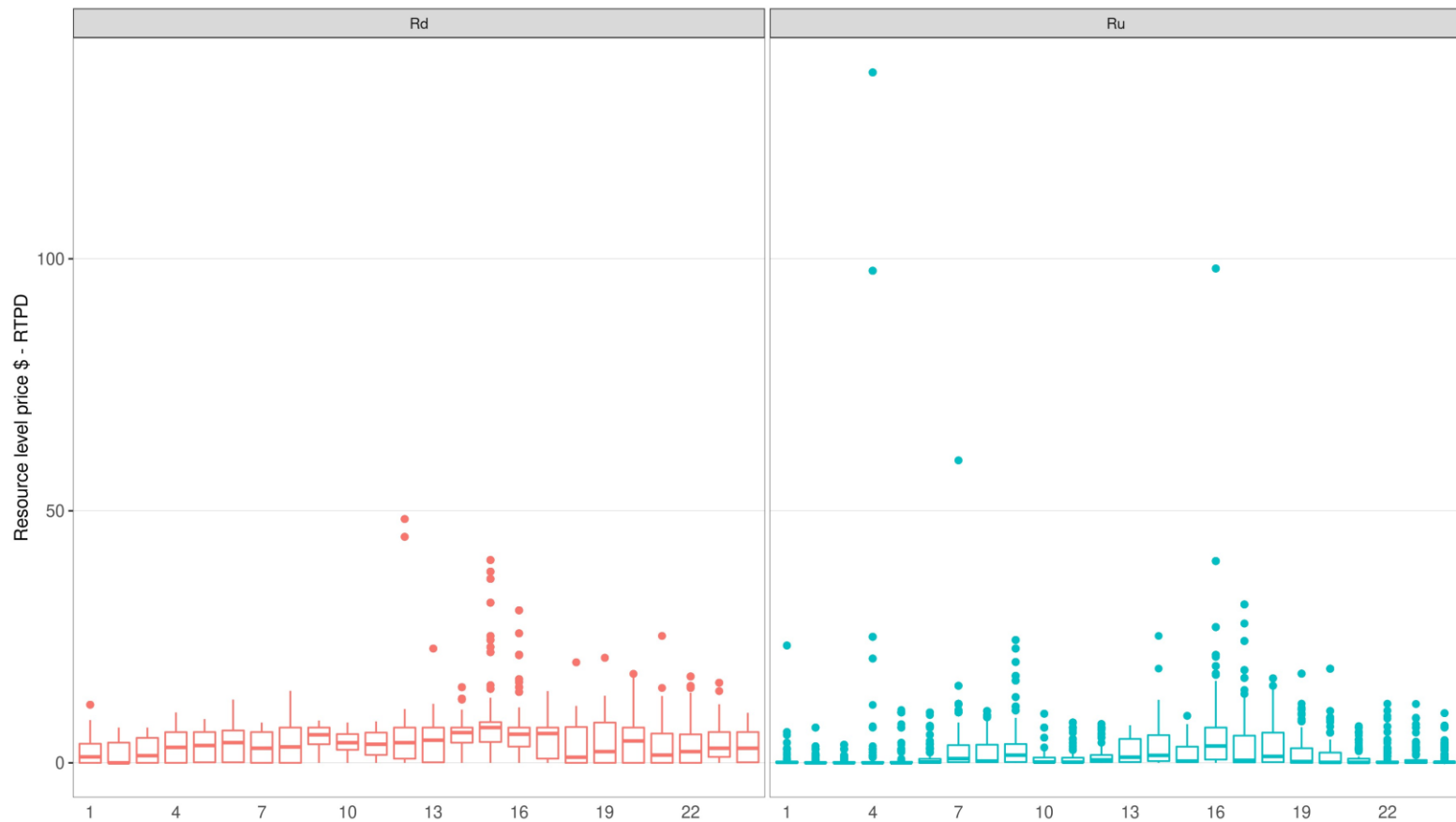
# Regulation down awards in the day-ahead market have not seen a material change in trend



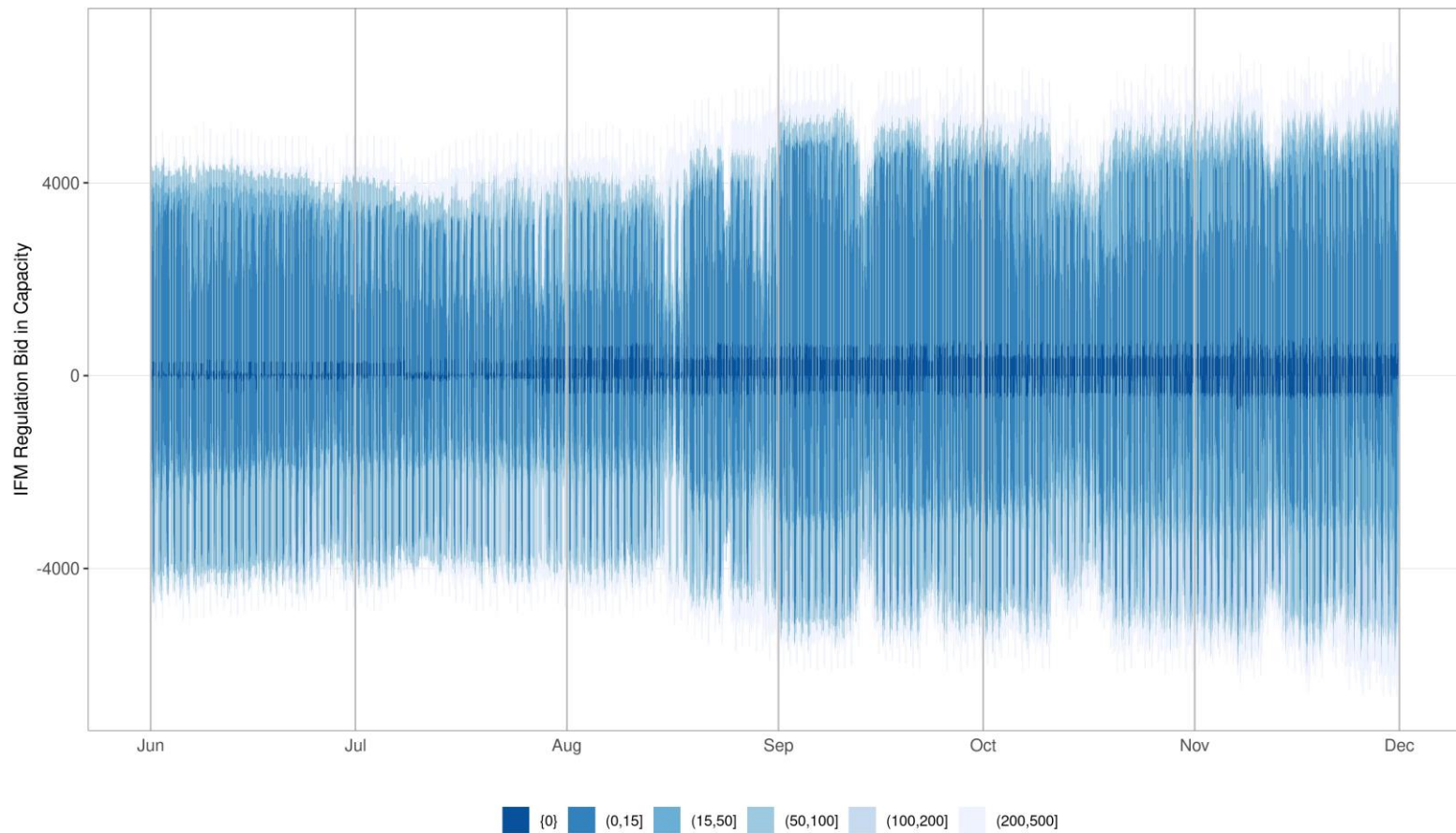
IFM Resource level regulation prices have not seen negative prices since the implementation of the enhancements



Real-time resource level regulation prices have not seen negative prices since the implementation of the enhancements

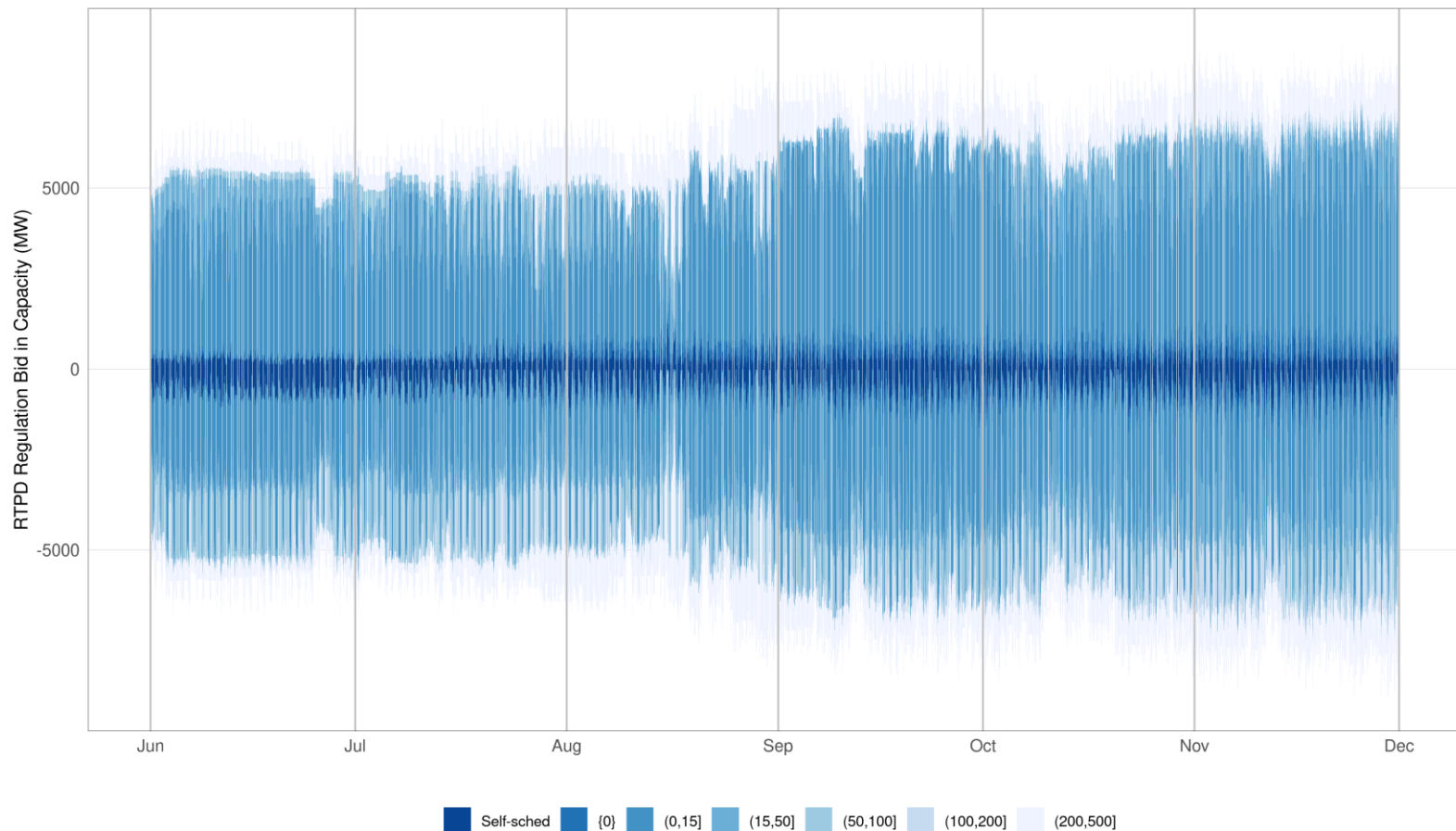


# IFM regulation bid in capacity show no significant change after the implementation of enhancements





# Real-time regulation bid-in capacity shows no significant change after the implementation of enhancements

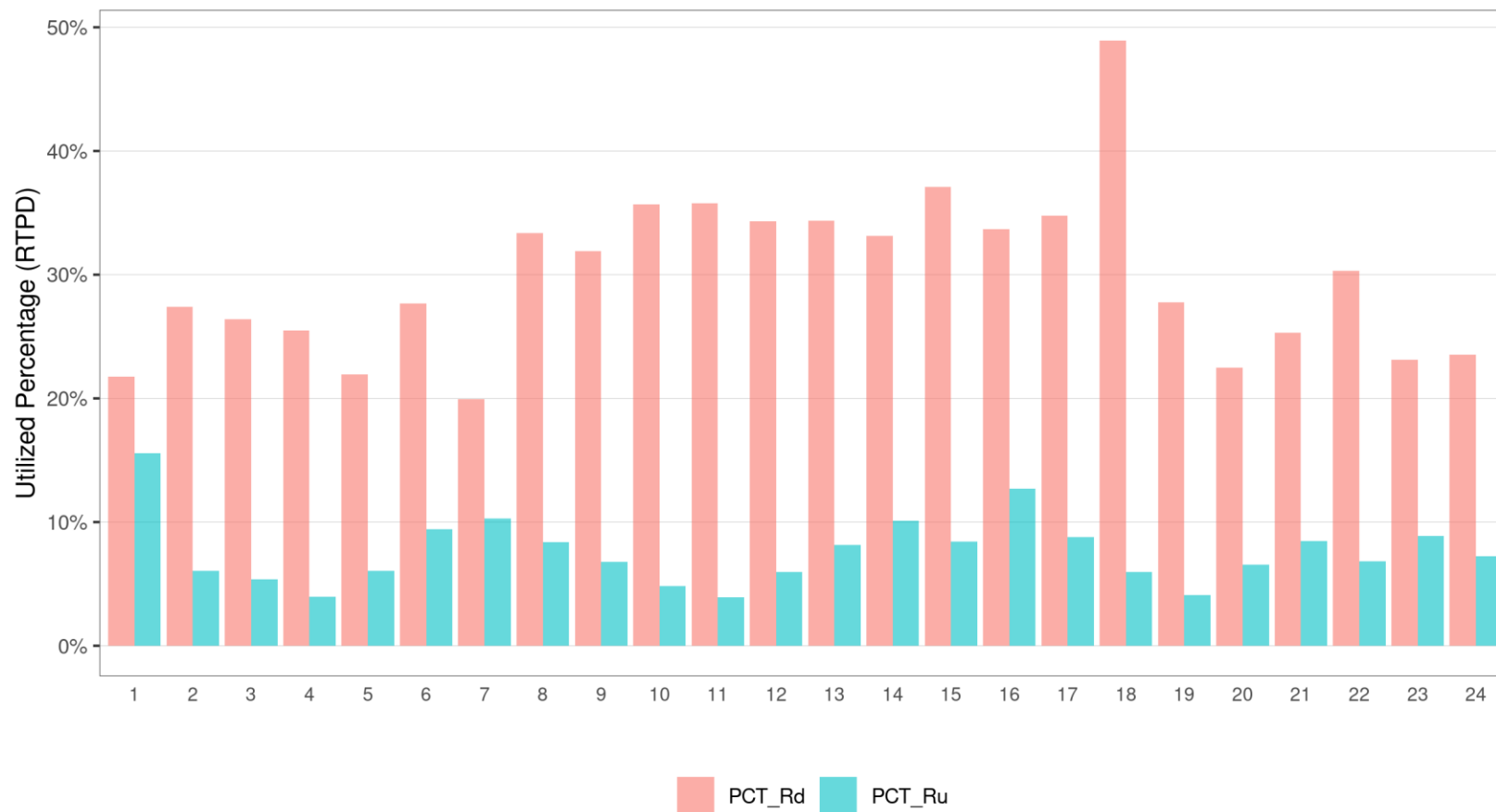


As part of the storage enhancements, CAISO estimates attenuation factors for each calendar season

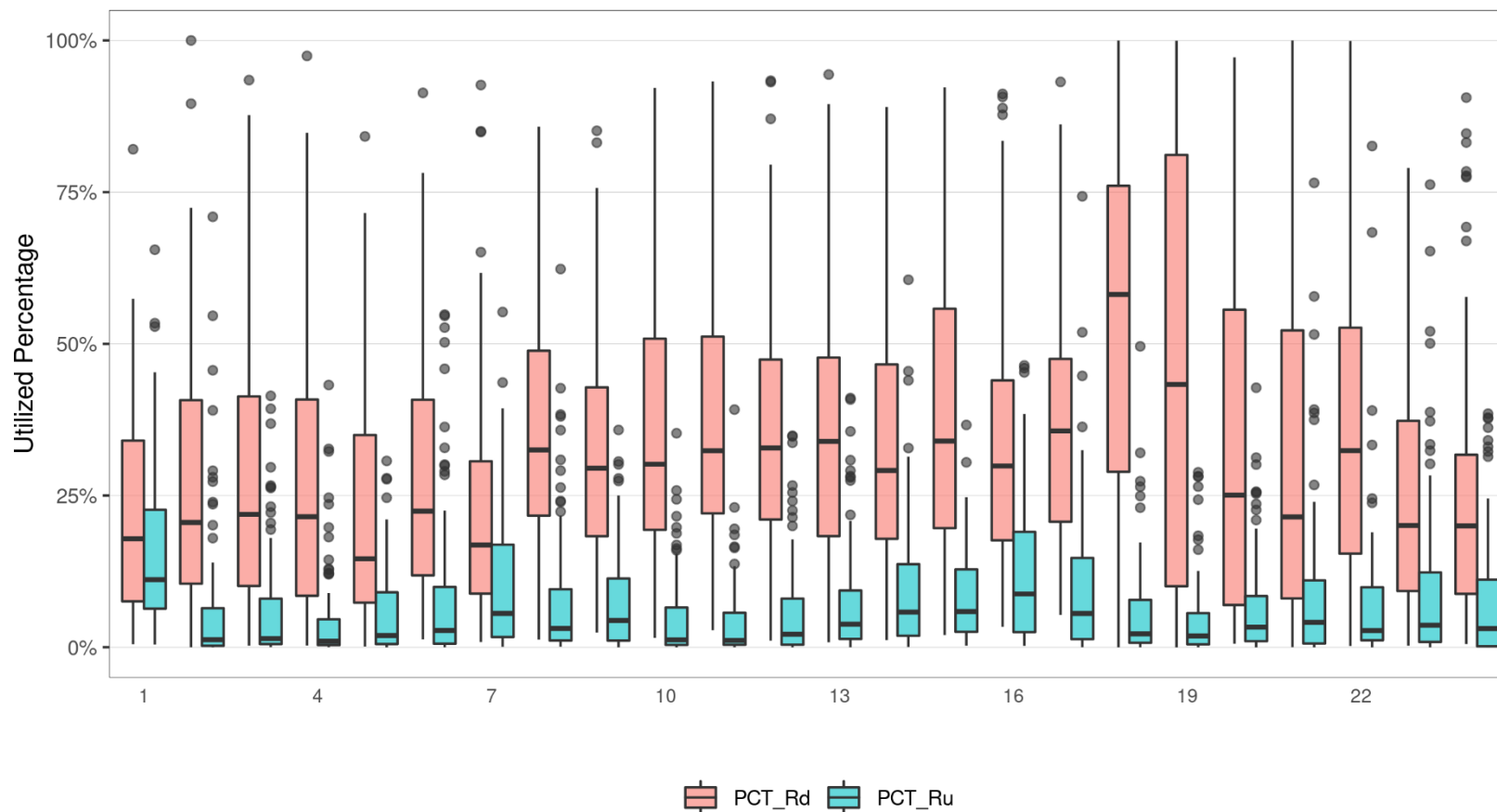
- Estimating the actual utilization of regulation
- Data range: 2022 Q4
- Metric:
  - a) Data source: resource level AGC setpoint vs. DOP
  - b) Reference: RTPD regulation awards
  - c) System aggregated percentages

$$\text{Percentage utilization } Ru(Rd) = \frac{\text{Total utilized } Ru(Rd)}{\text{Total } Ru(Rd) \text{ awards}}$$

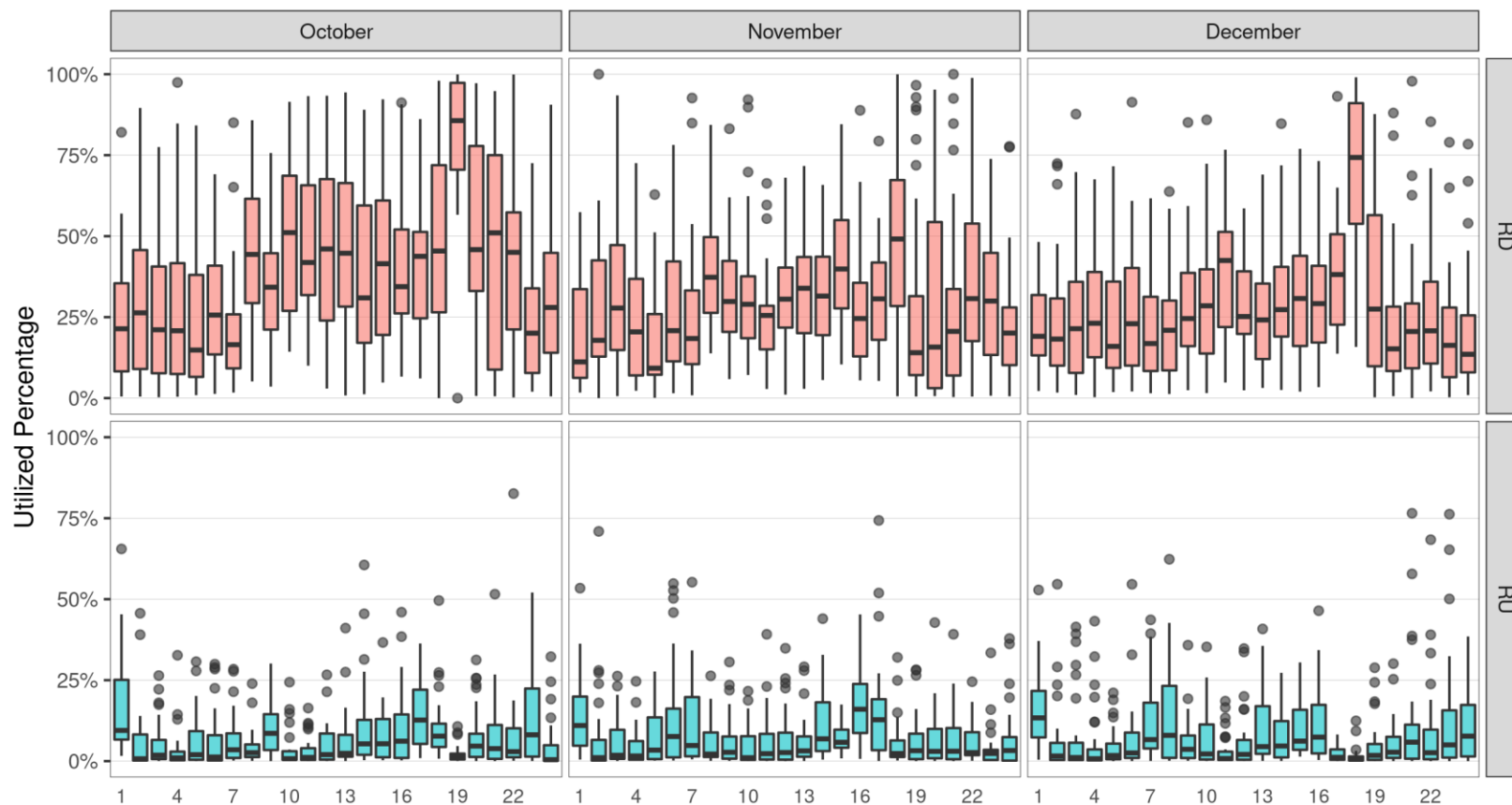
# Percentage of regulation utilized during Q4 2022 shows higher use for regulation down



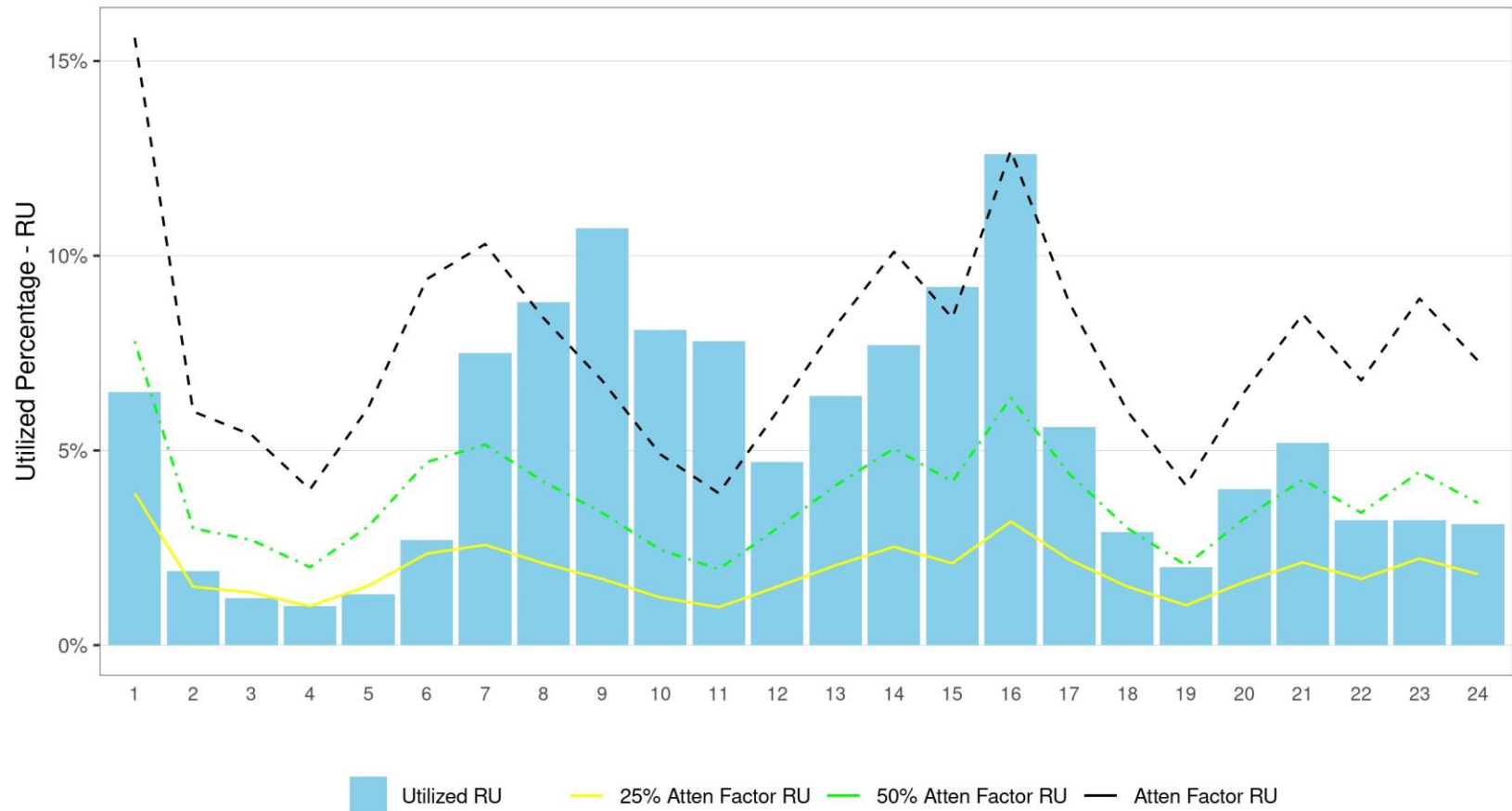
# Rd utilization in hour ending 18 and 19 show higher medians with wider spreads



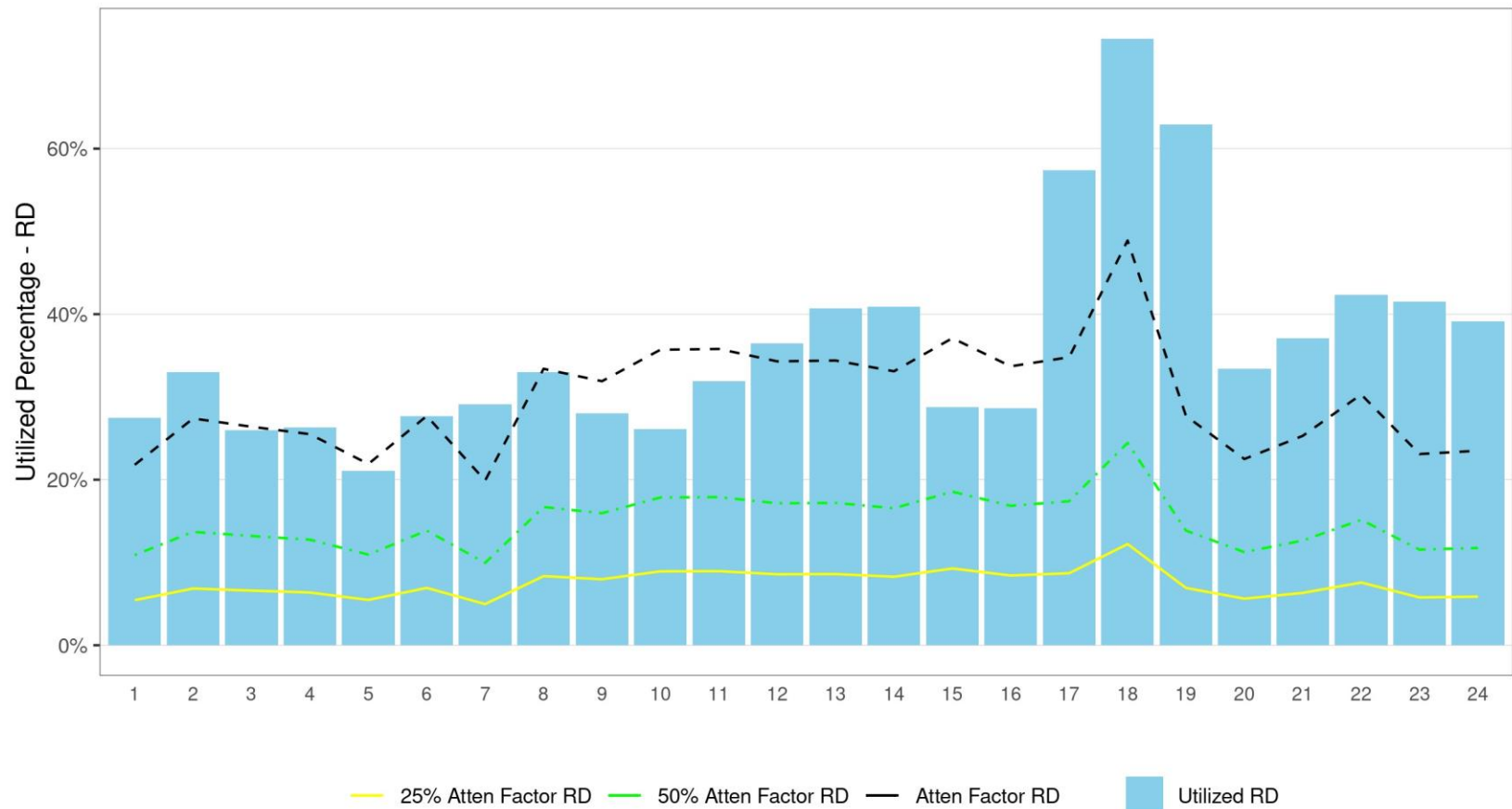
# Ru utilization remains low



With the implementation of the enhancements, CAISO introduced the use of attenuation factors gradually in steps of 25%. Regulation Up



With the implementation of the enhancements, CAISO introduced the use of attenuation factors gradually in steps of 25%. Regulation Down



# Attenuation factors comparison – Regulation up 2023 Q4 vs. 2024 Q1



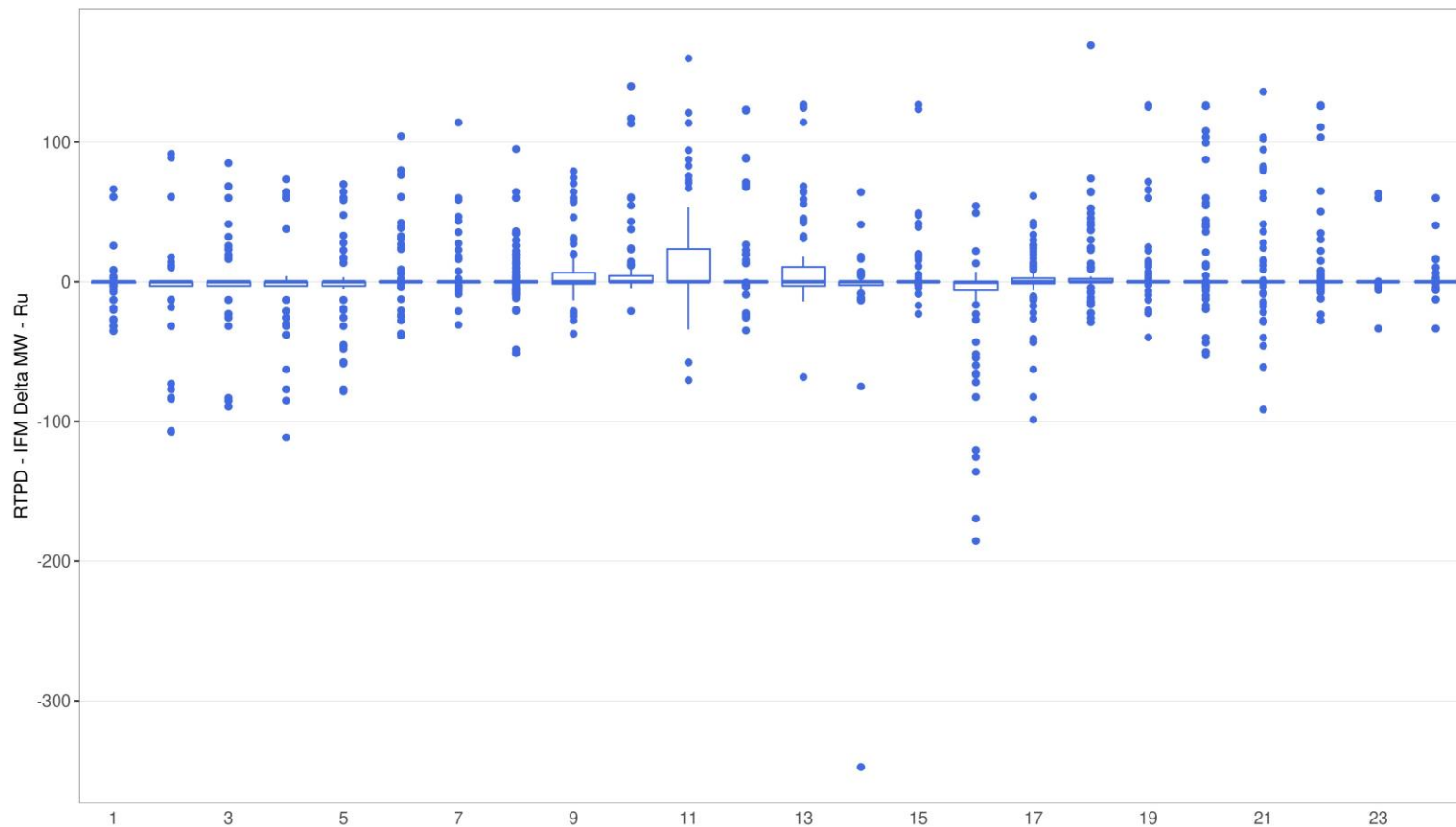


# Attenuation factors comparison – Regulation down 2023 Q4 vs. 2024 Q1

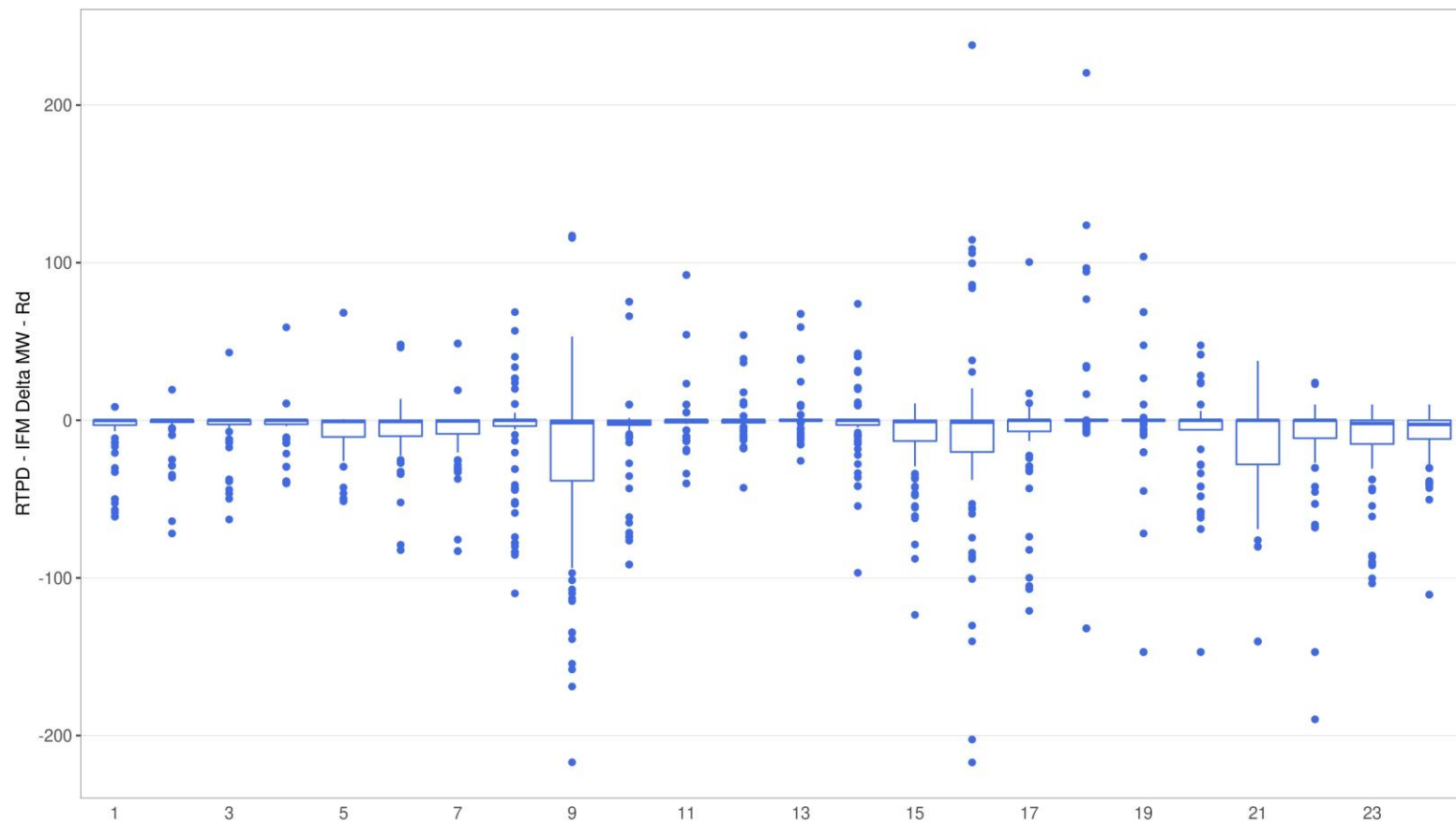


# Delta awards (RTPD – IFM) from LESR – Ru

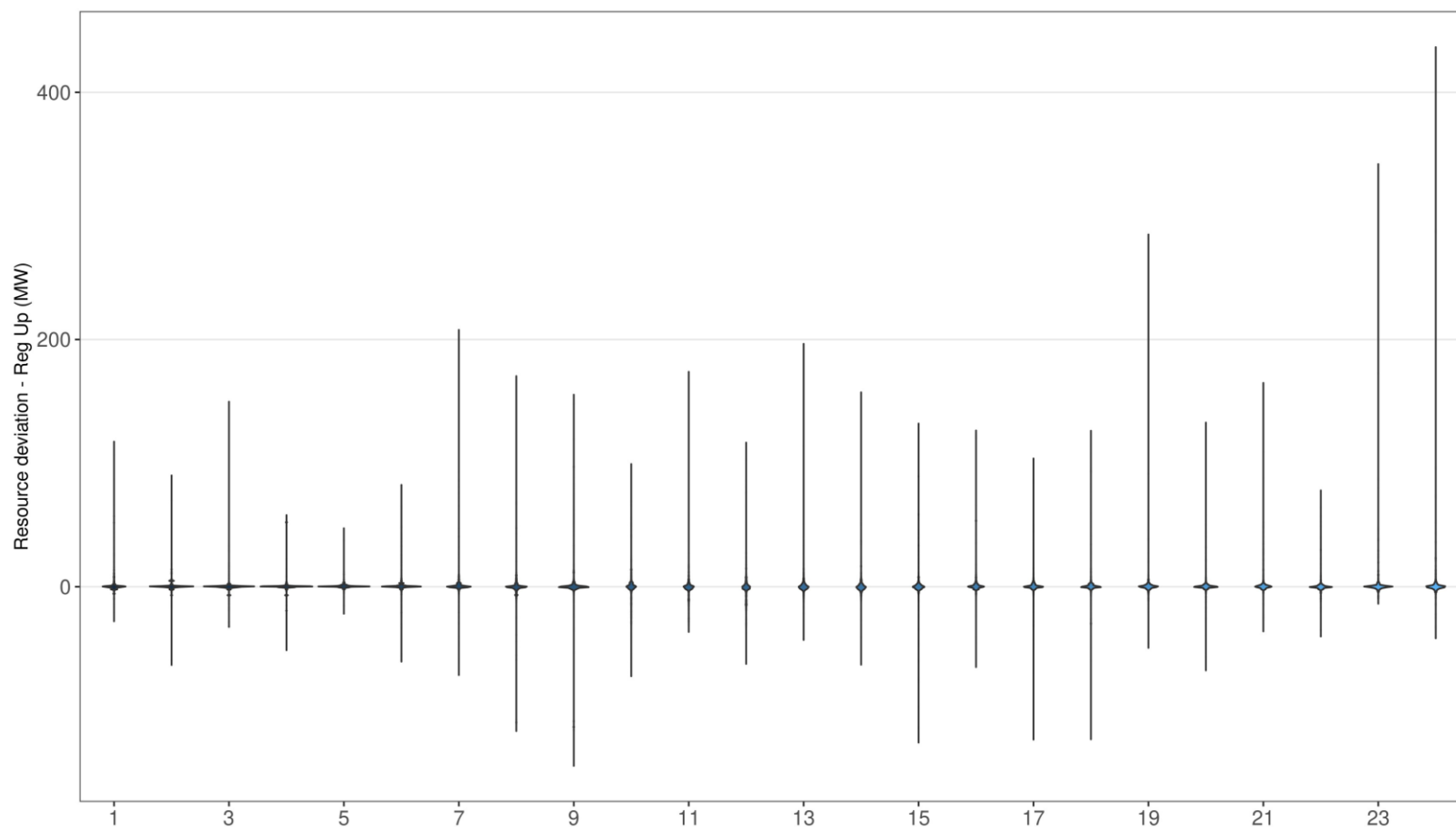
## November 2023



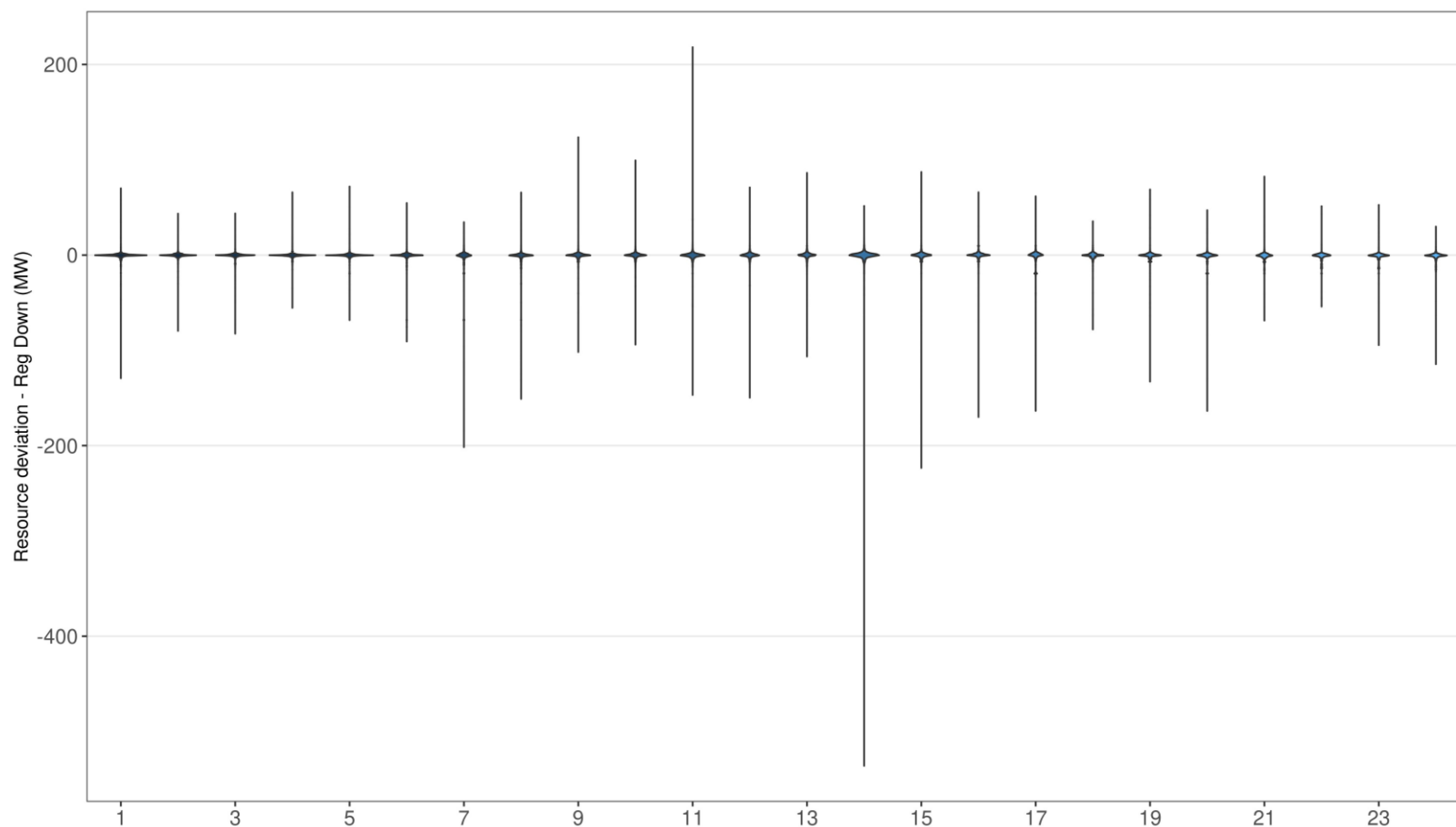
# Delta awards (RTPD – IFM) from LESR – Rd November 2023



# Resource deviation when Ru was dispatched November 2023

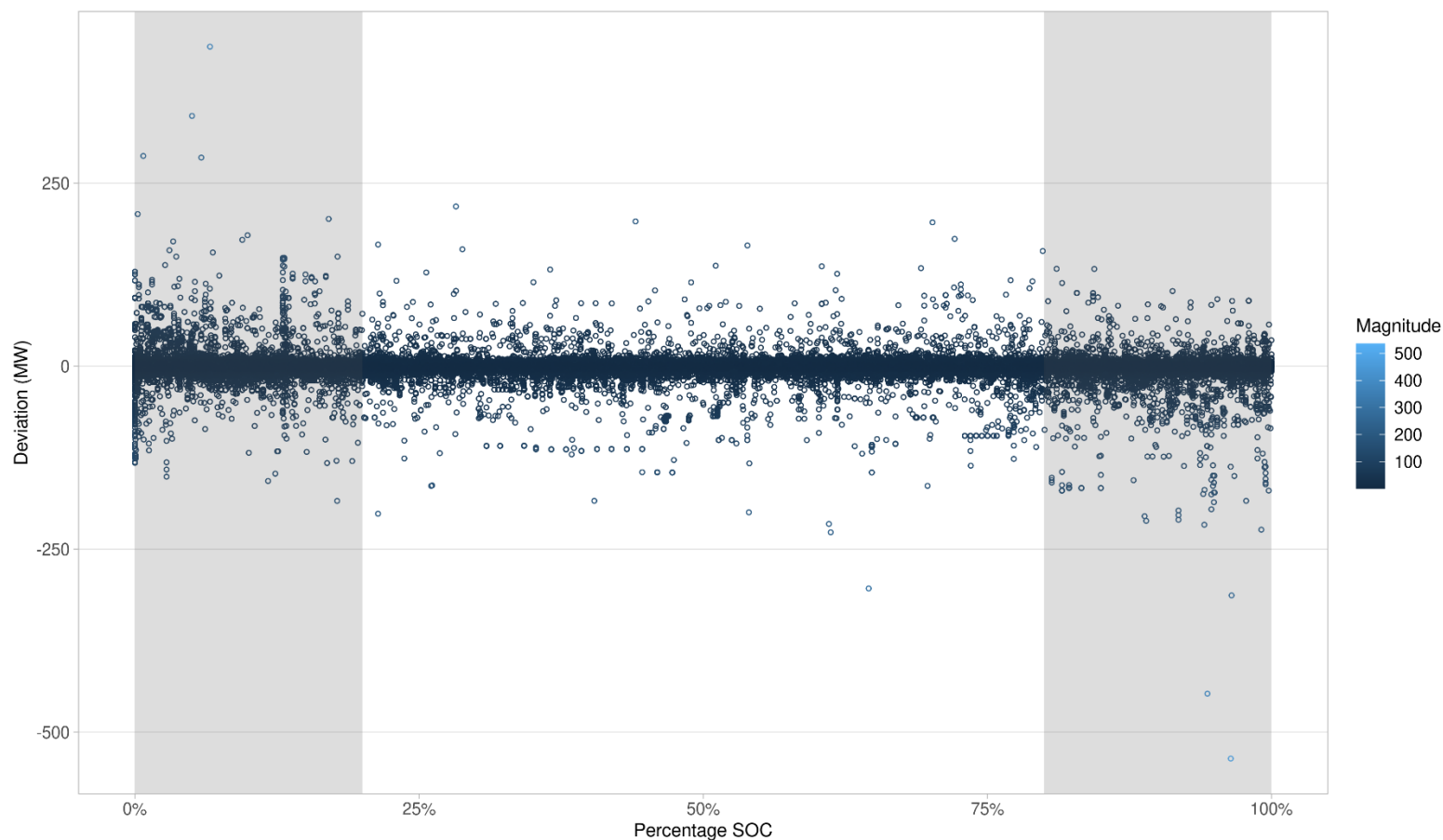


# Resource deviation when Rd was dispatched November 2023

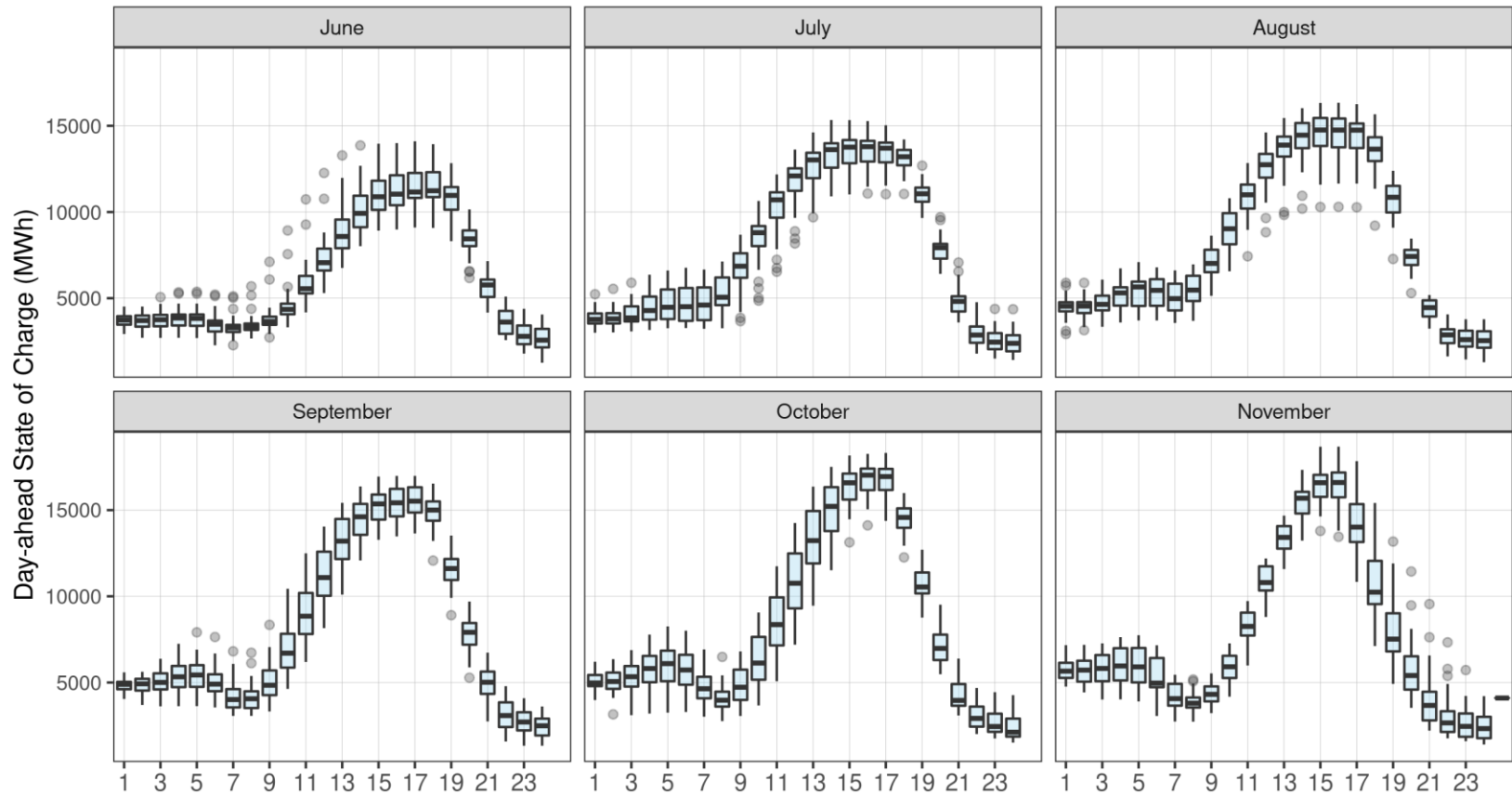


# Resource deviation vs. SOC percentage

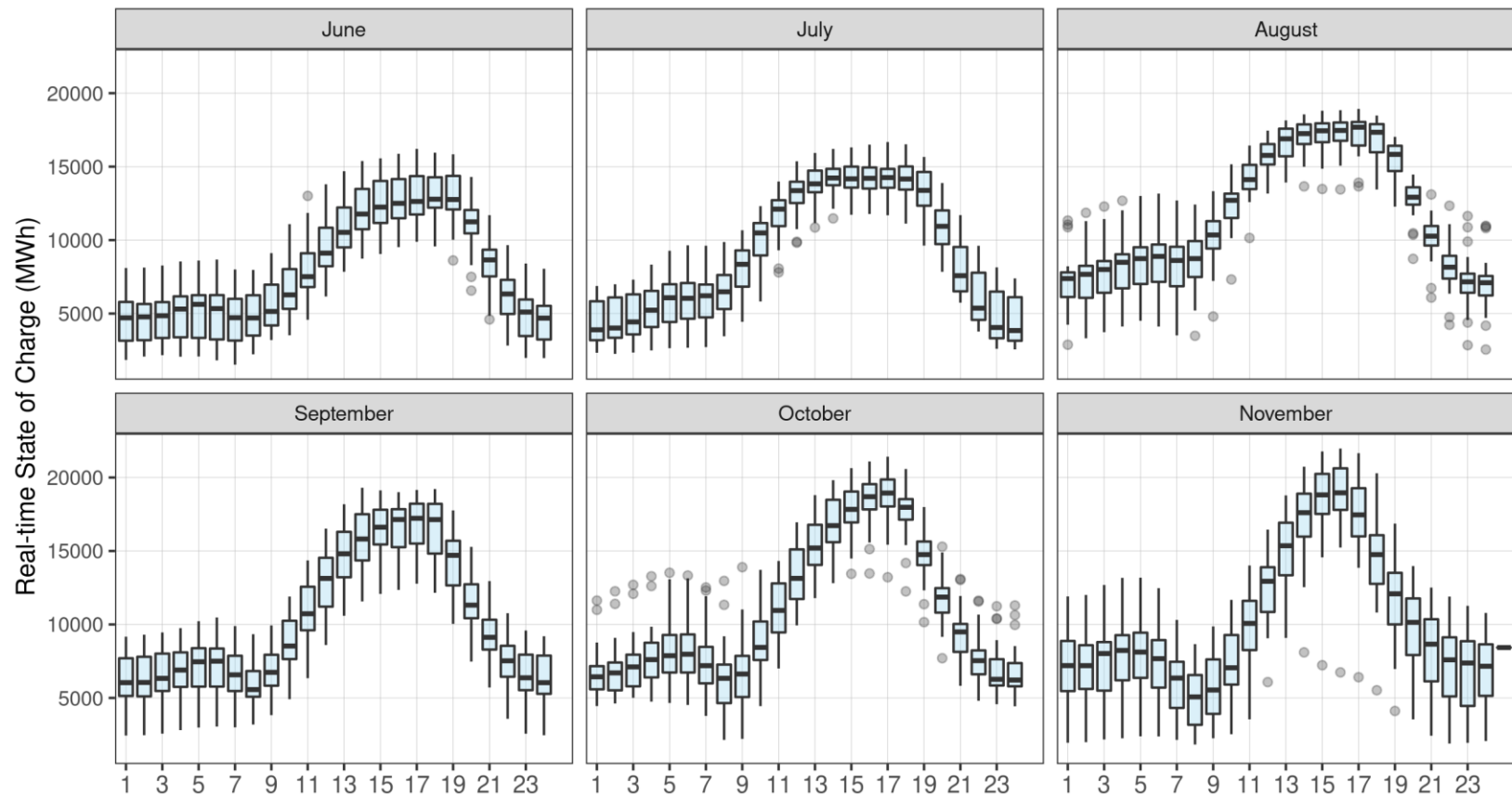
## November 2023



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

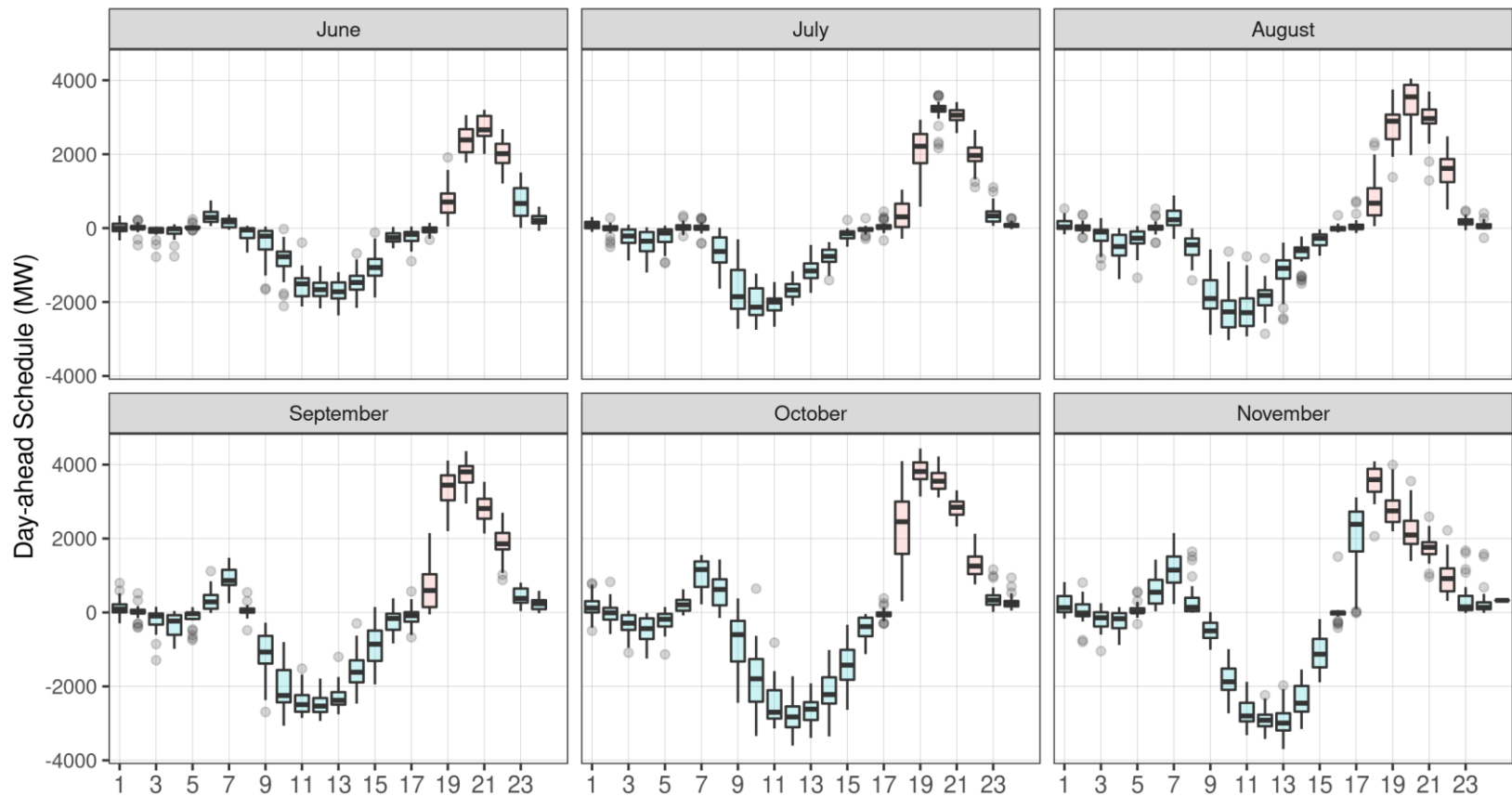


# Real-Time State of charge for storage resources was in line with the day-ahead state of charge

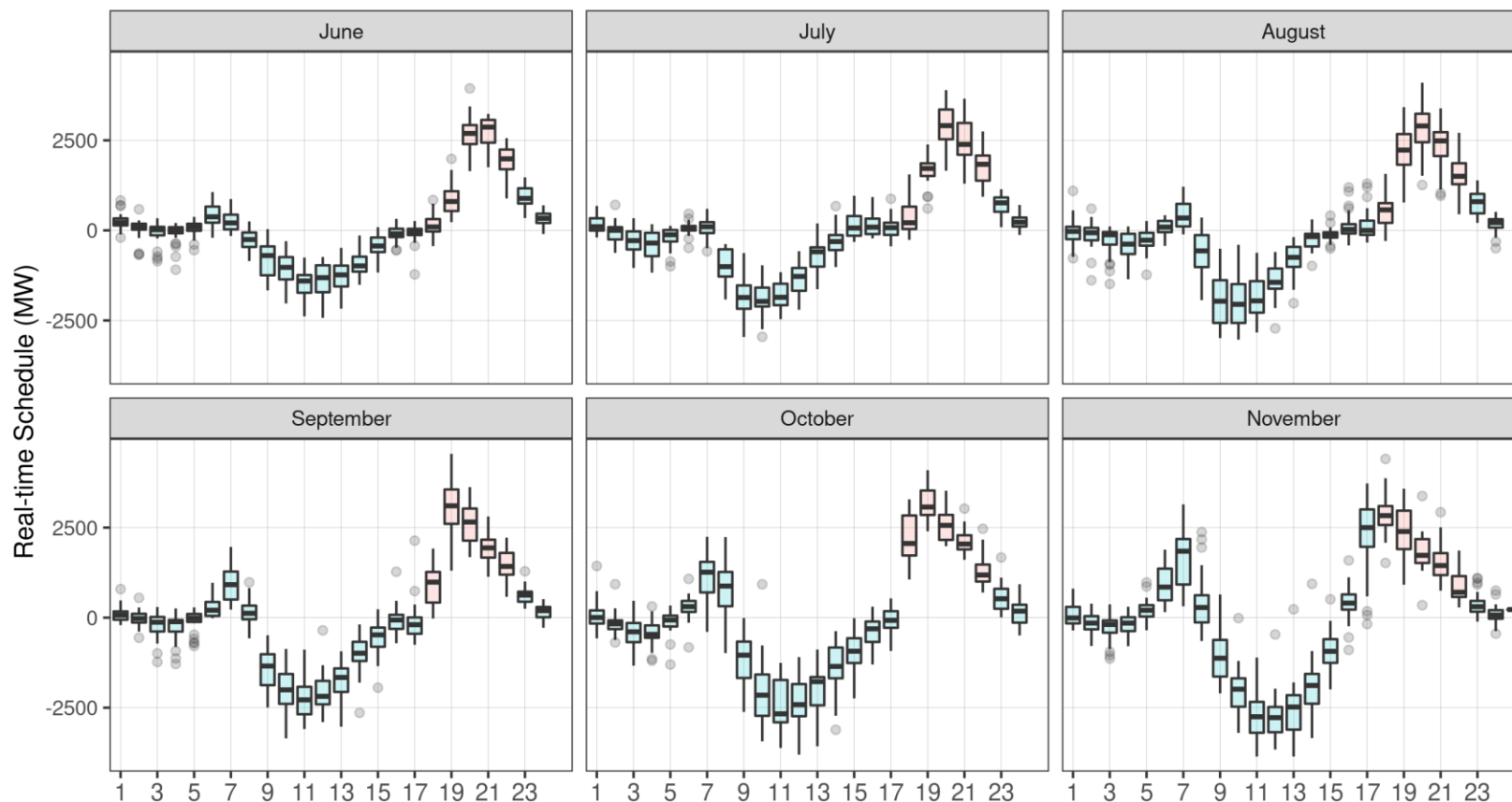




# Storage resources were consistently charging during solar hours and discharging during net load peaks



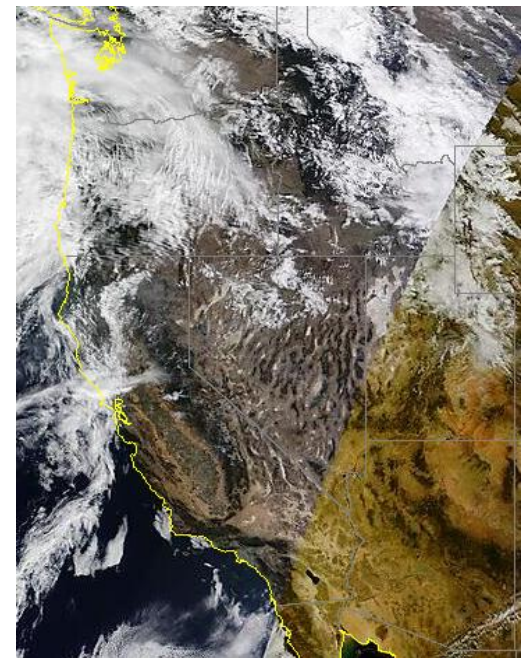
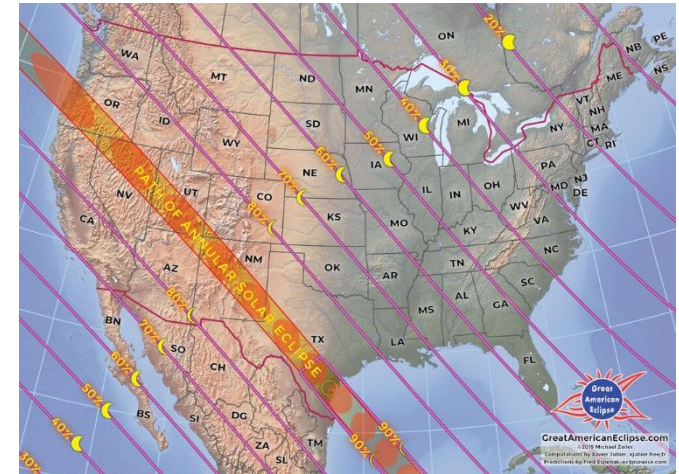
# Storage resources were consistently charging during solar hours and discharging during net load peaks



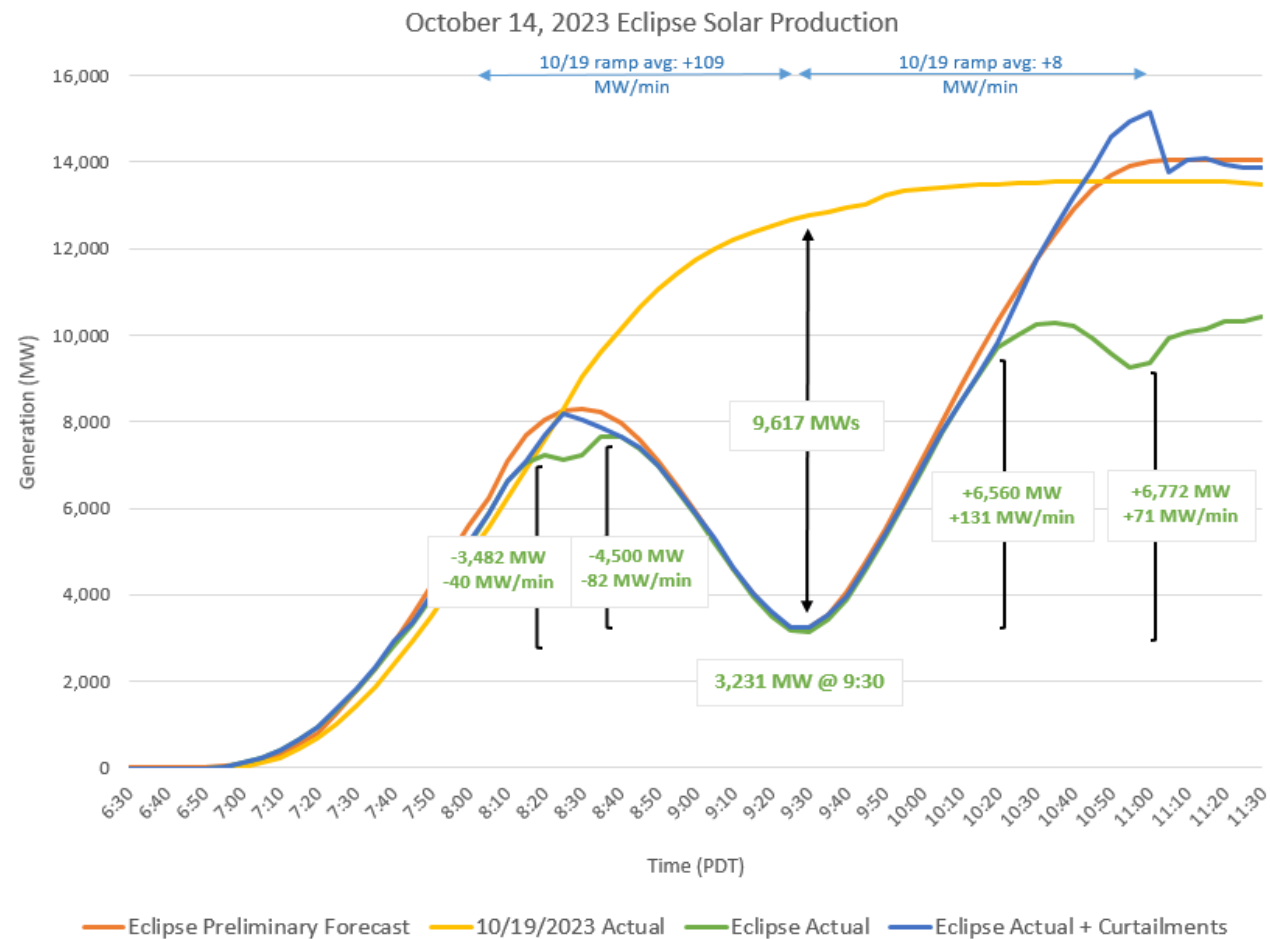
# Solar Eclipse

# Eclipse Overview

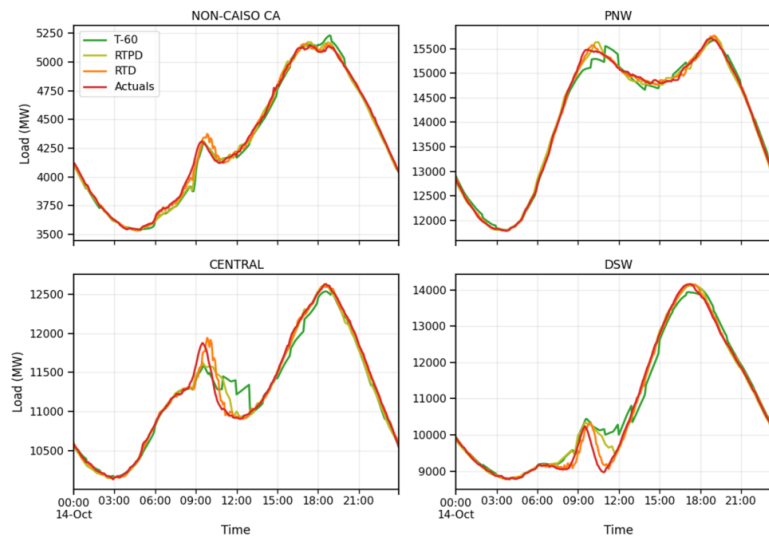
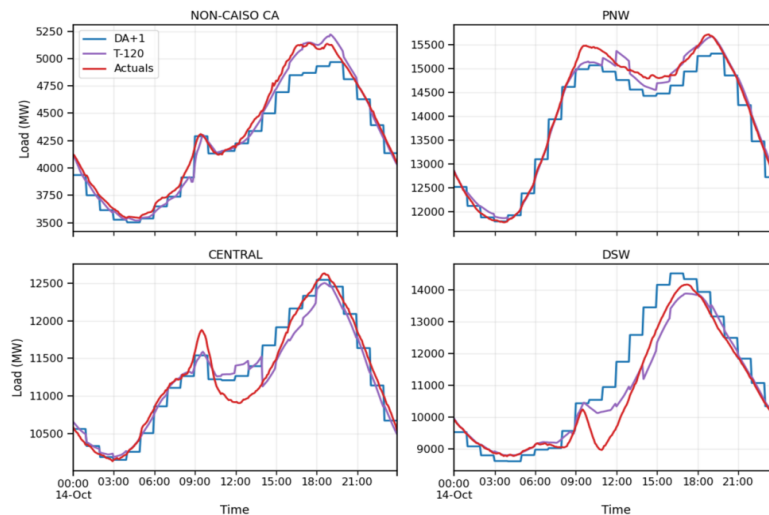
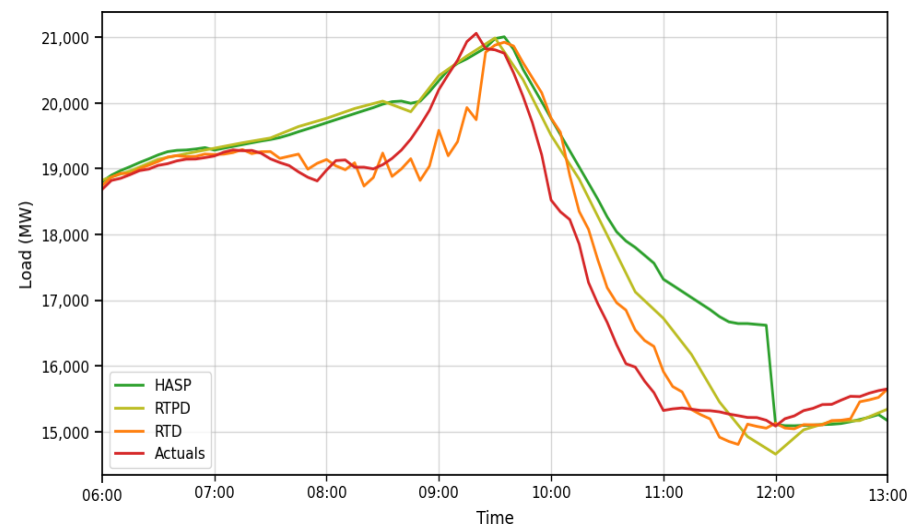
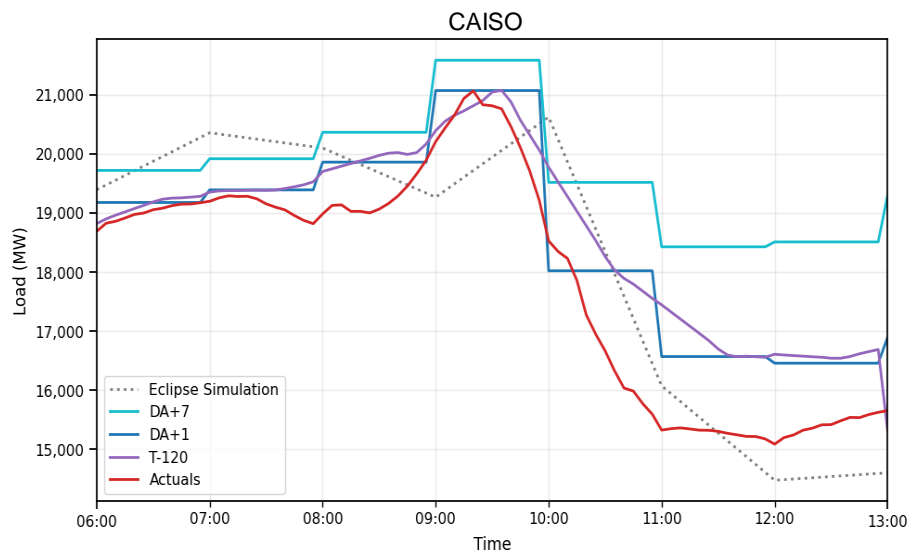
- Saturday, October 14, 2023 from 8 a.m. – 11 a.m. with largest impact around 9:30 a.m.
- Cloud cover across Pac NW and parts of northern California during the eclipse
- Impacts across CAISO and WEIM to grid-scale solar, behind-the-meter solar, load and net load



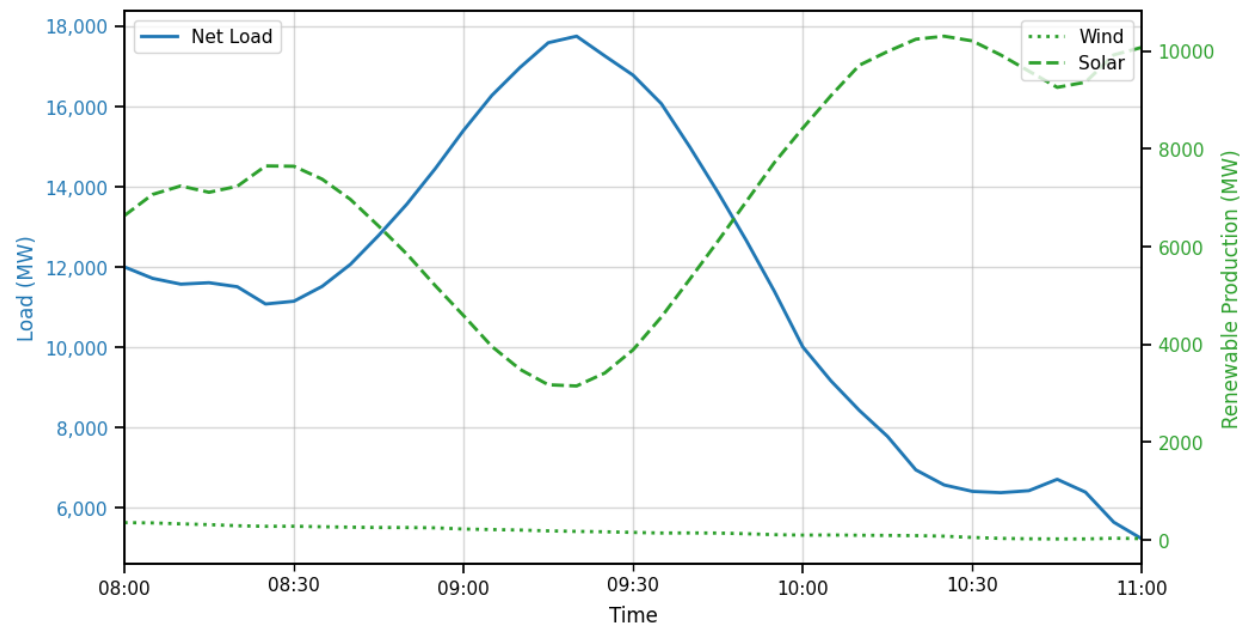
# CAISO Solar Production



# CAISO and WEIM Load



# CAISO Net Load Ramp



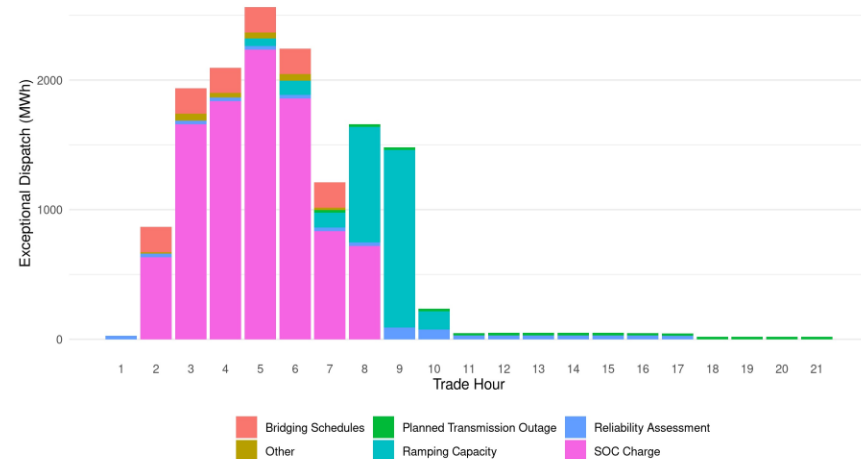
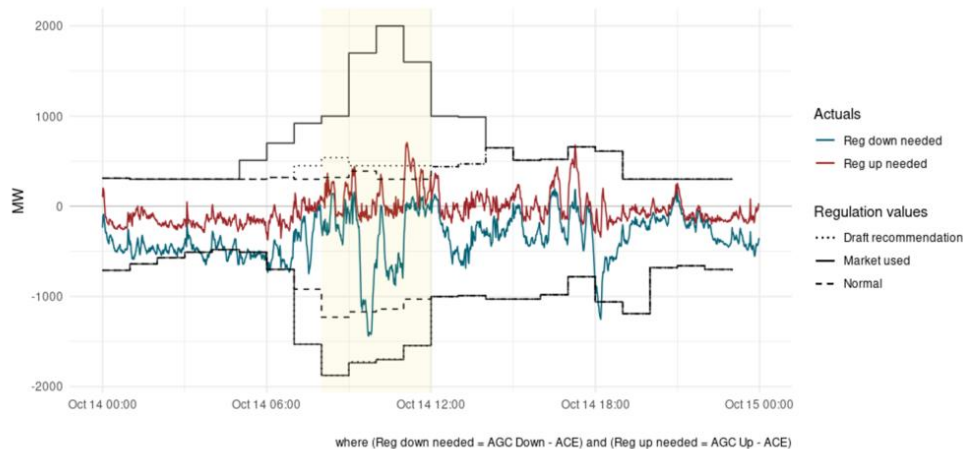
|           | Start | End   | Load Start | Load End | Total Ramp (MW) | Average Ramp (MW/min) | Max Ramp (MW/min) | Typical Ramp (MW/min) |
|-----------|-------|-------|------------|----------|-----------------|-----------------------|-------------------|-----------------------|
| Ramp Up   | 8:15  | 9:15  | 11,607     | 17,582   | 5,975           | 100                   | 190               | -96                   |
| Ramp Down | 9:15  | 11:00 | 17,582     | 5,227    | -12,355         | -118                  | -267              | -33                   |

|           | Start | End   | Load Start | Load End | Total Ramp (%) | Average 15 Min Ramp (%) | Max 15 Min Ramp (%) | Typical 15 Min Ramp (%) |
|-----------|-------|-------|------------|----------|----------------|-------------------------|---------------------|-------------------------|
| Ramp Up   | 8:15  | 9:15  | 11,607     | 17,582   | 51.5%          | 12.9%                   | 24.5%               | -11.0%                  |
| Ramp Down | 9:15  | 11:00 | 17,582     | 5,227    | -70.3%         | -10.0%                  | -22.6%              | -6.0%                   |



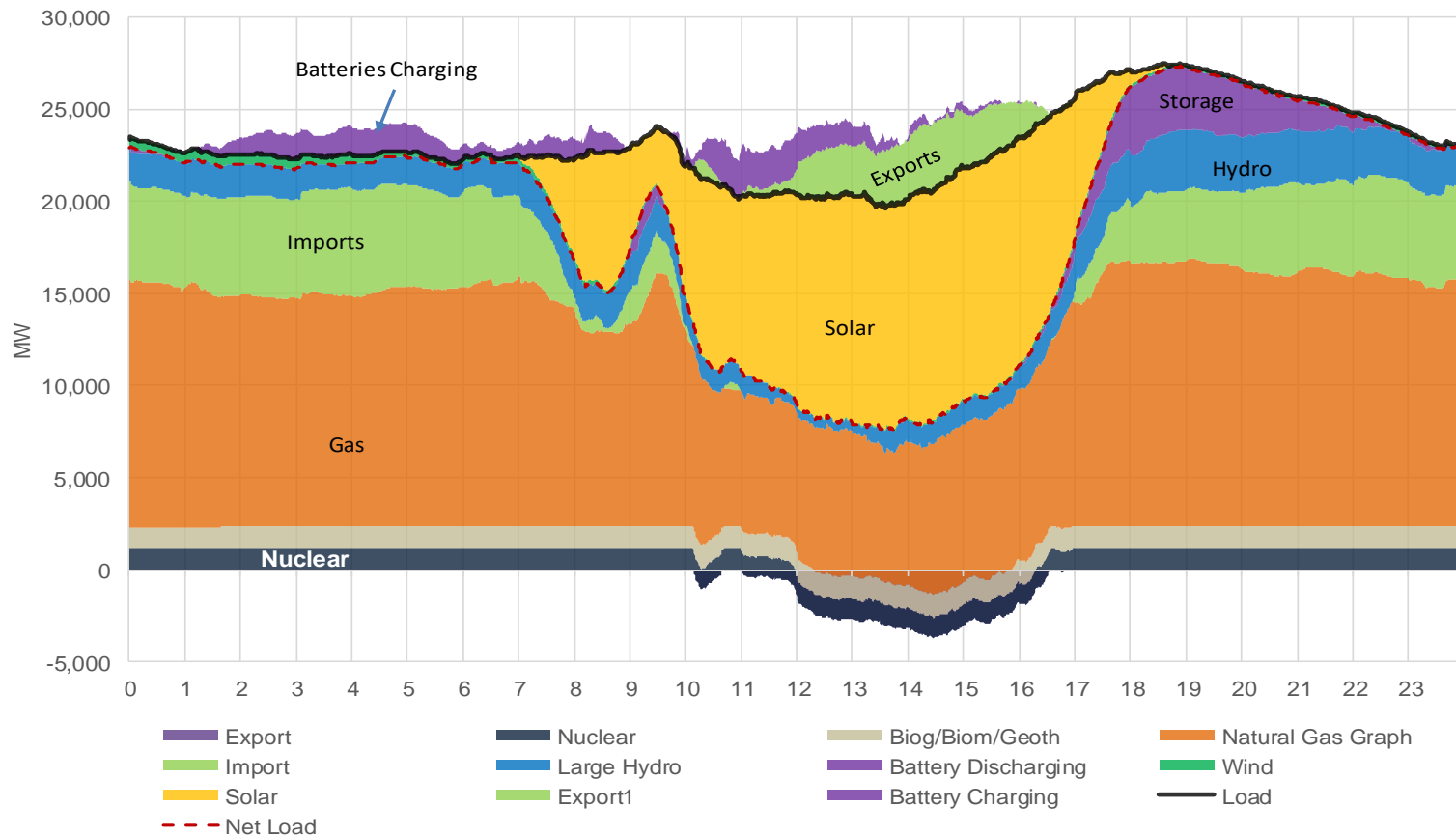
# In coordination with entities in the West, CAISO took proactive measures to manage the Eclipse conditions

- Utilized RUC adjustments to secure capacity from the day-ahead market
- Increased procurement of regulation to account for the unique conditions of the eclipse
- Charged in advance storage resources to be readily available during the eclipse period
- Implemented tighter control bands to balance the system

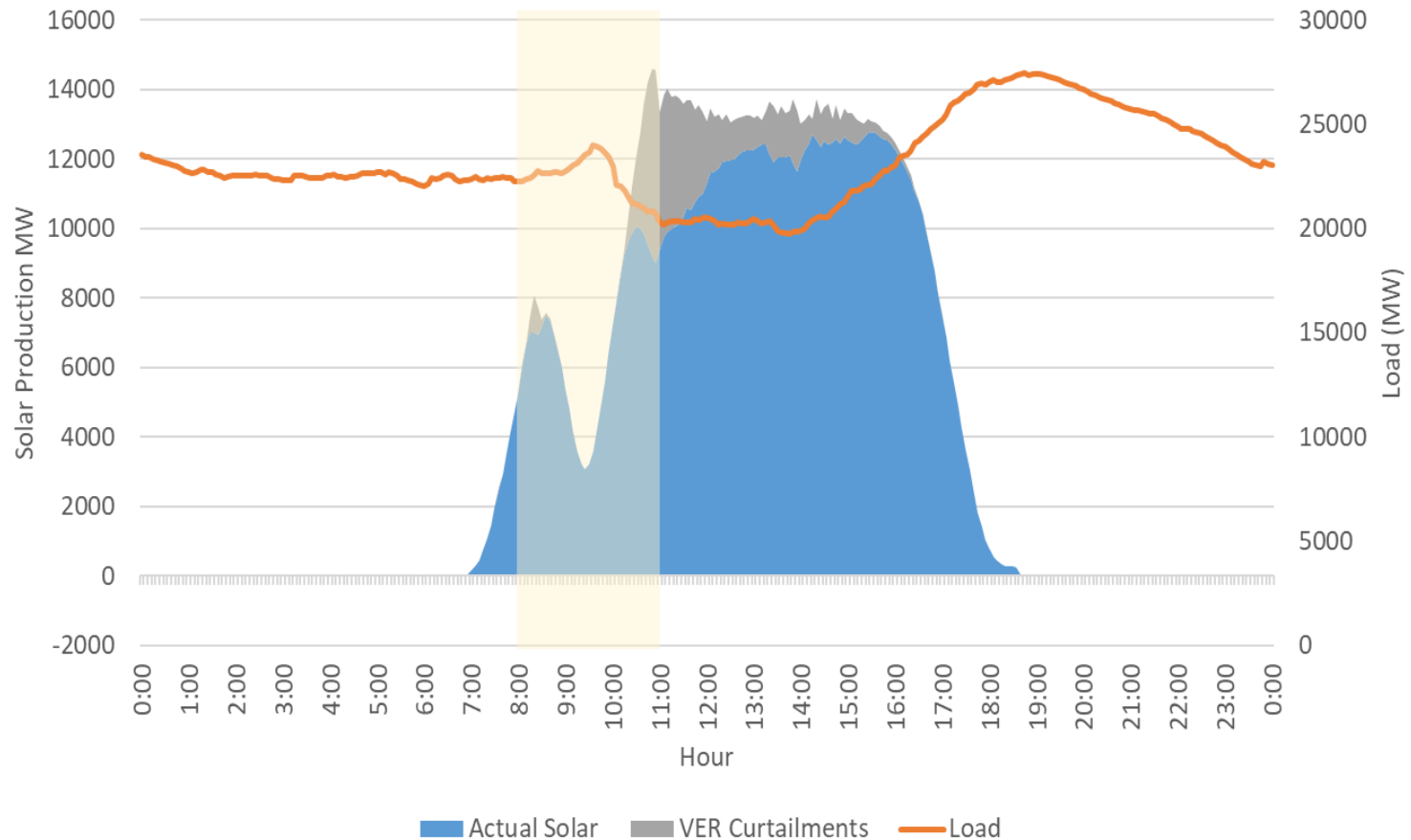




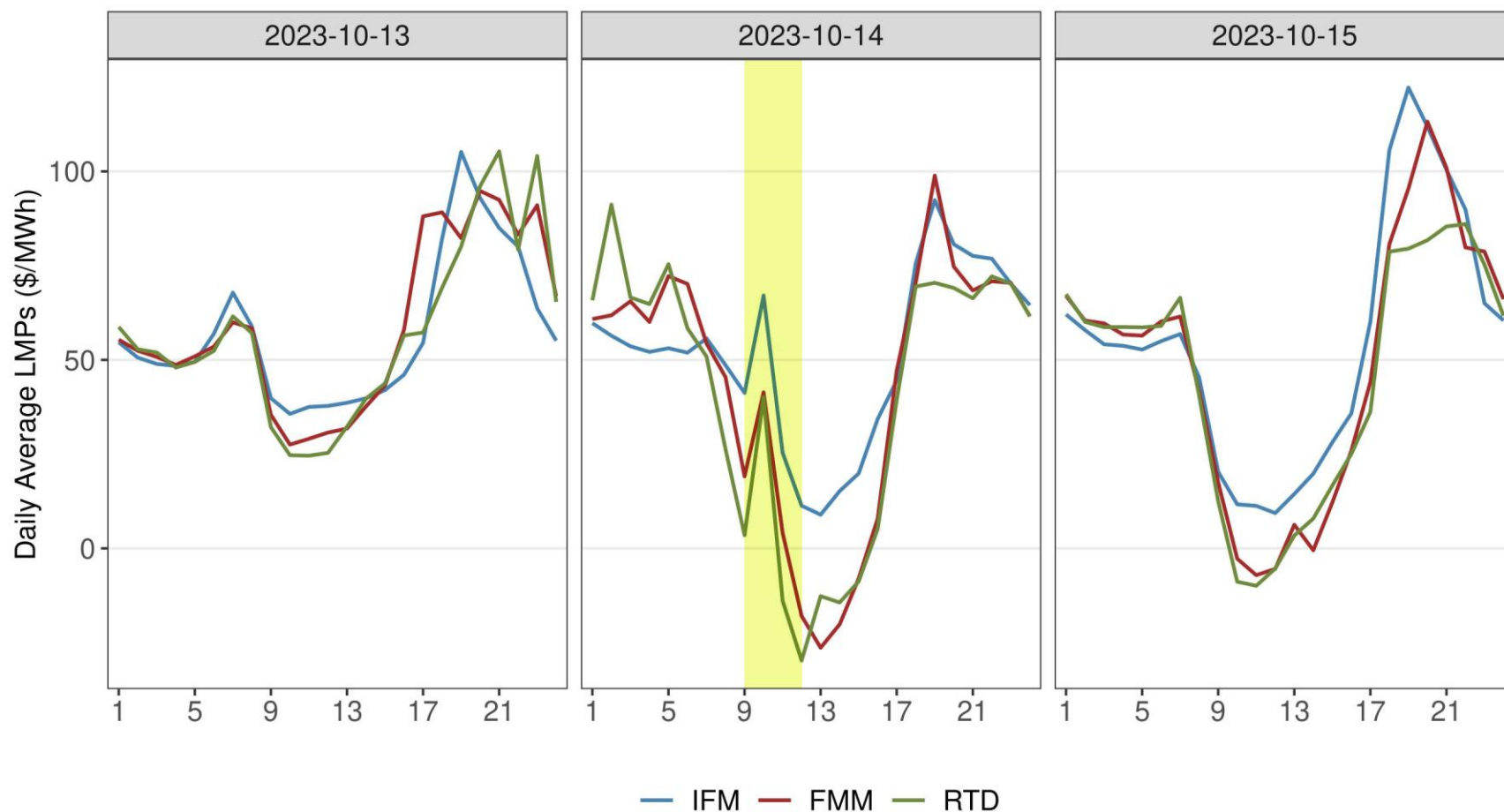
# The changes of solar production were offset by production changes of other types of supply



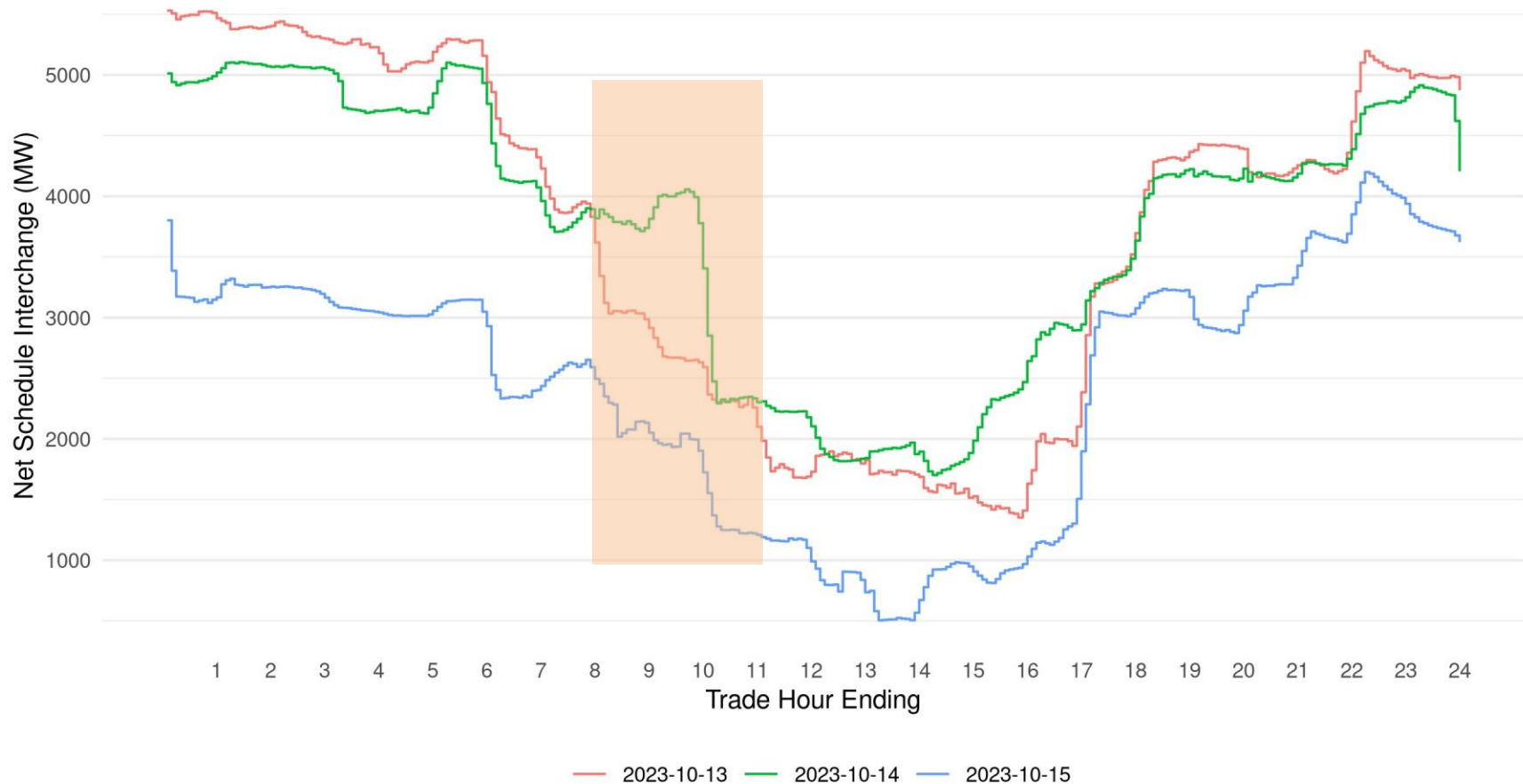
Solar production was directly impacted by the Eclipse and the market leveraged on renewable curtailments to manage the speed of solar returning to full production



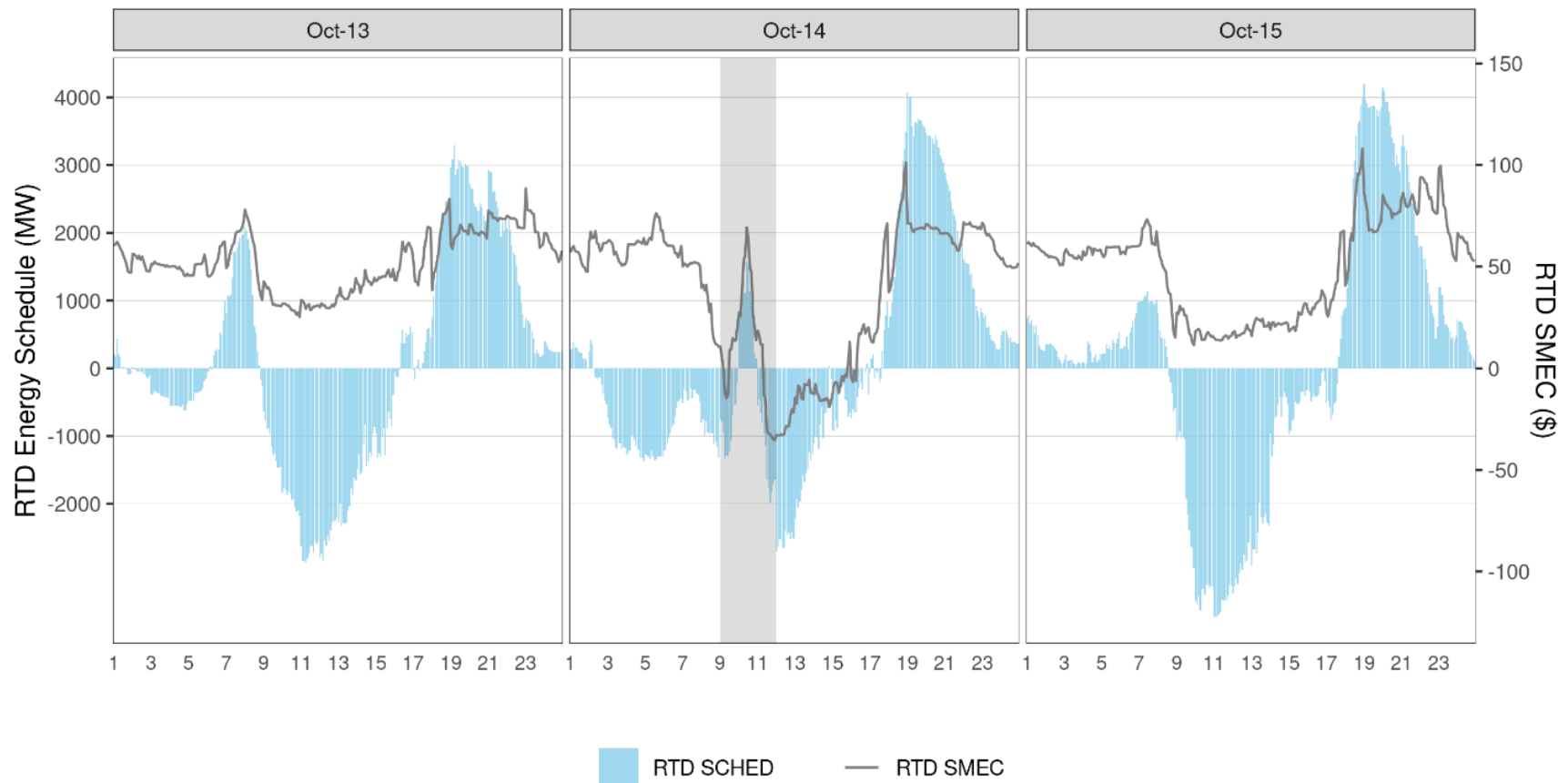
# Prices reacted accordingly to the conditions of the eclipse, increasing during reduced solar production



# Net schedule interchange increased during the time of solar production decline



# Storage resources increased generation to offset loss of solar production

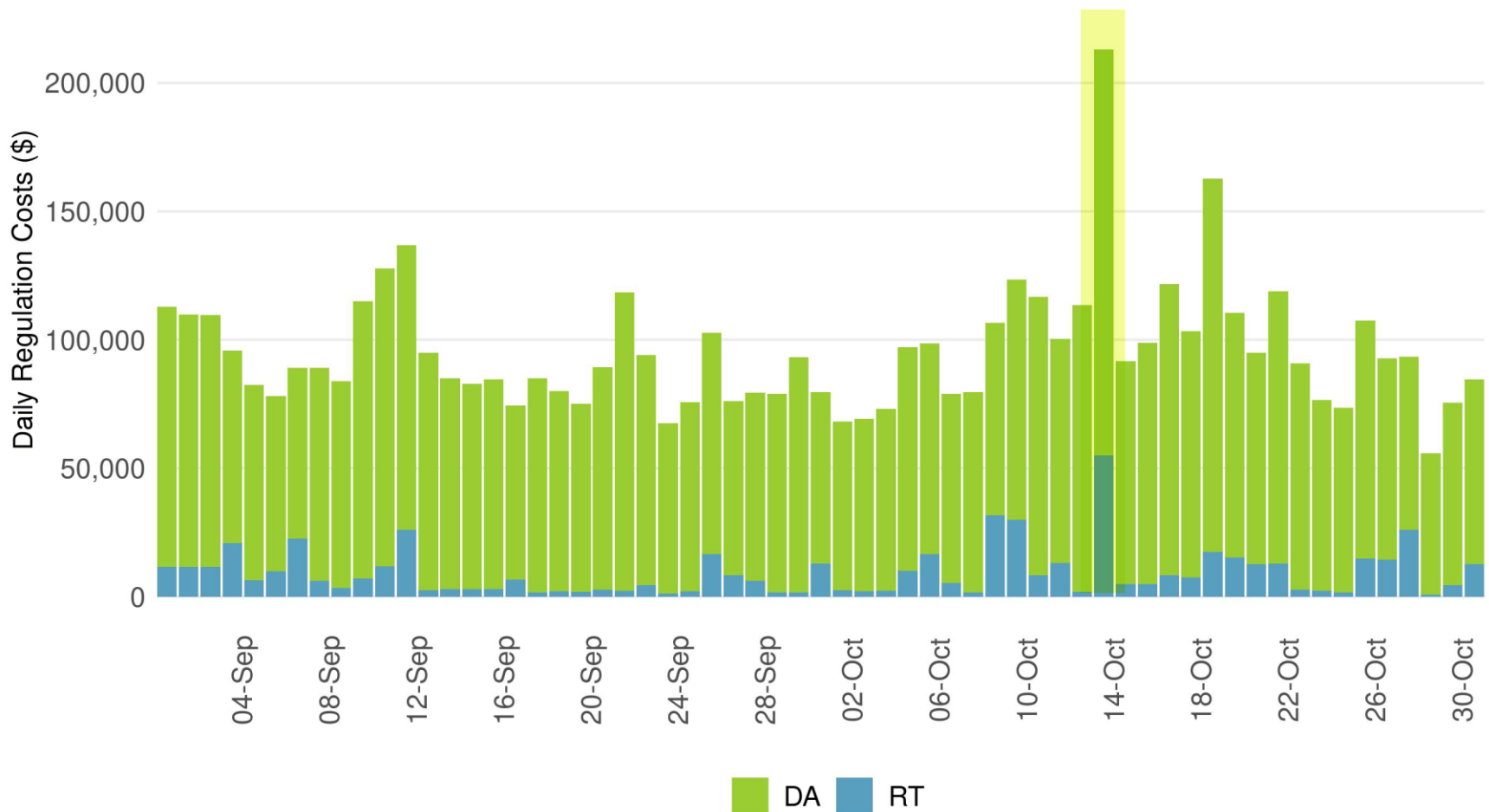


# The WEIM market was an effective tool to dispatch supply and balance demand across the wider footprint



Transfers for CAISO moved accordingly to compensate for the solar production changes

# Regulation costs shows an increase for October 14 as compared to other days



# Load Conformance

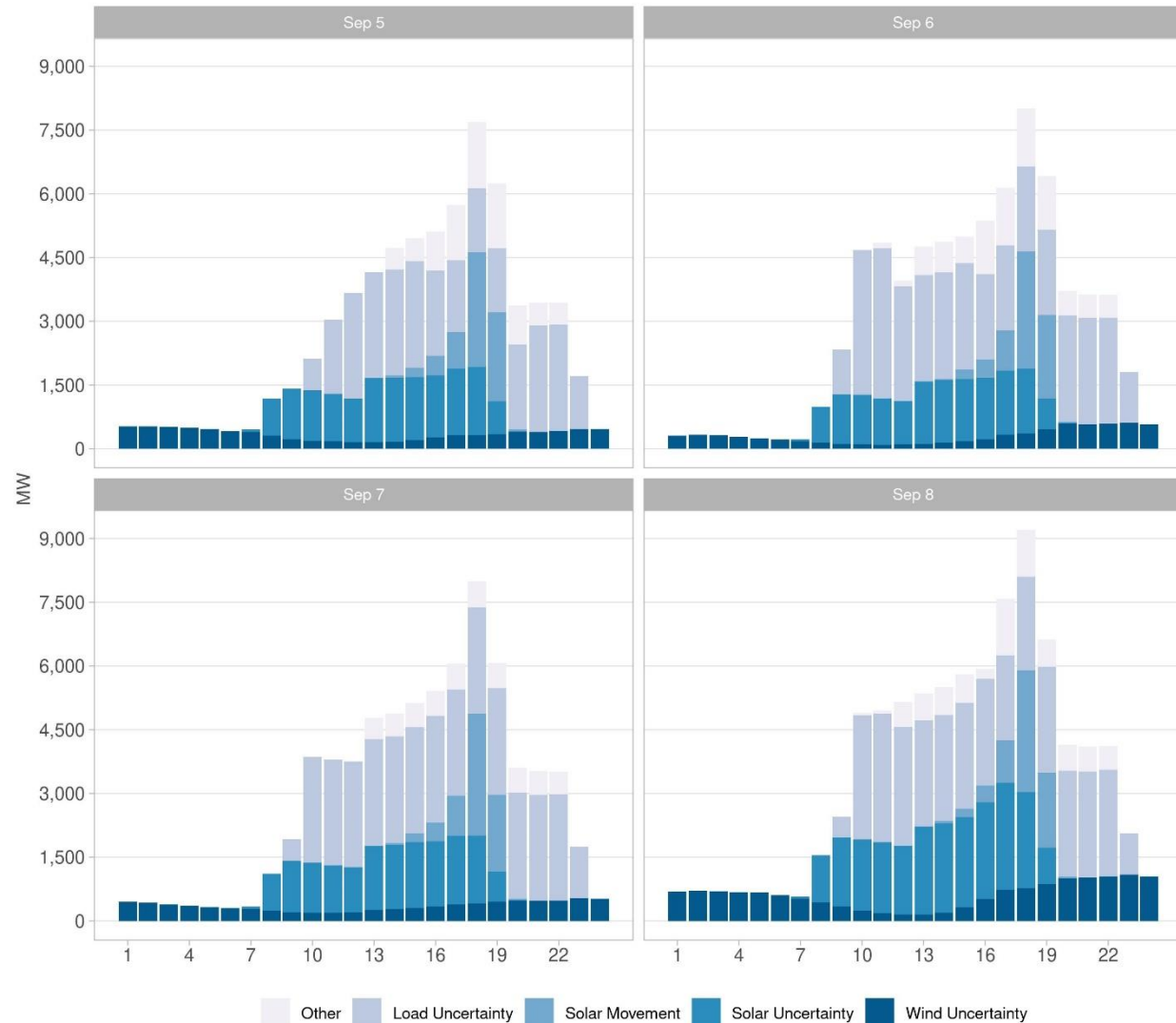


# From the Summer 2022 performance, CAISO committed to further assess the need and use of load conformance across markets

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

The different uncertainty components had been added together to derive the RUC adjustment and resulted in excessive adjustments

Load conformance in HASP market was also used heavily with values of up to 5,000MW



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

- Based on the performance of September 2022, CAISO committed to
  - Enhance the guiding logic for RUC adjustments by using a logic similar to the proposed Imbalance Reserve. Assess the use of load conformance in real-time markets
- CAISO implemented a change to the logic for guiding the RUC adjustments for weather-based uncertainty on July 2023
- CAISO has been running a pilot program to assess the overall implications of load conformance
- CAISO continues to assess the performance and impacts of load conformance used in the various markets

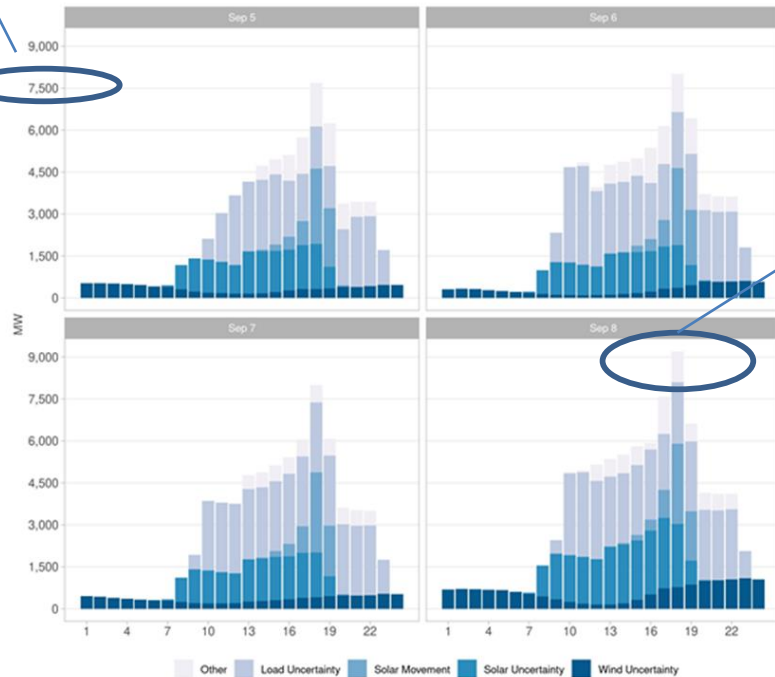
# Change of methodology for guiding RUC adjustments

- Review actual performance of RUC guiding from Summer 2022
- Review metrics to analyze performance of probabilistic uncertainty forecasting
- Introduce methodology for RUC recommendation to parallel Imbalance-Reserve and Flexible Ramp requirements
- Review simulated performance for new methodology, selected time periods centered around Summer 2022 (Prior to Summer 2023)
- Review actual Summer (July/August) 2023 performance of “Imbalance Reserve”-like product

Additive approach resulted in **extra requirement** at peak and **poor coverage** off-peak

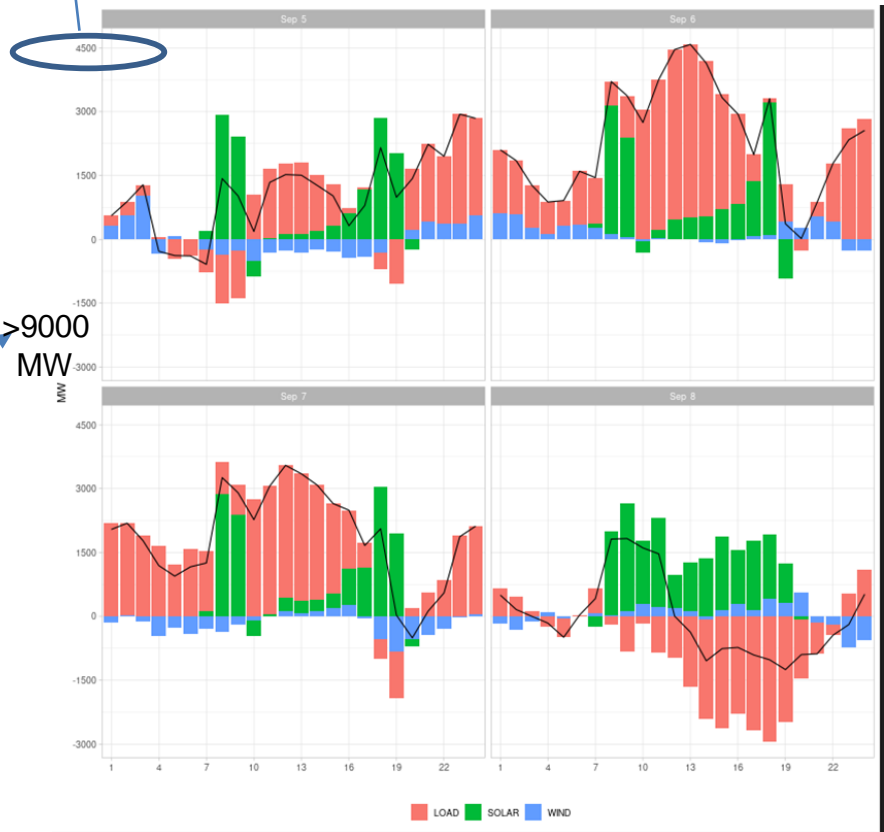
## RUC Requirement Utilized

7500 MW



## Realized Uncertainty Observed

4500 MW

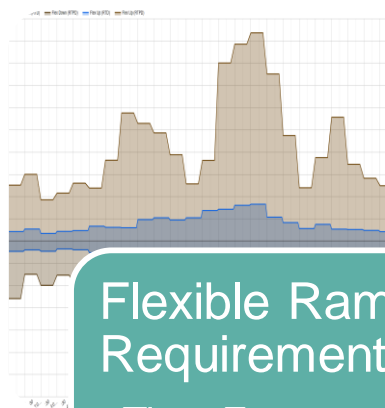


# Products to assist with Net-Load Uncertainty



## Imbalance Requirements

- Time Frame: DA to FMM
- Method: Quantile Regression



## Flexible Ramp Requirements

- Time Frame: FMM to RTD
- Method: Quantile Regression



## Regulation Requirements

- Time Frame: RTD to Actual
- Method: Combination

# How do we assess the performance of probabilistic forecasts?

- Four criteria in measurements
  - Coverage: This is used to check the validity of a model, and is the coverage of observed uncertainty against the estimate requirement. The uncertainty requirement is targeted for 95%, which is achieved with 97.5% for upward and 2.5% for downward requirement.
  - Requirement: This is the average of the estimated requirement over a period of time.
  - Closeness: This is defined as the average distance between the observed uncertainty and the estimated requirement.
  - Exceeding: this is the average MW difference when the observed uncertainty is exceeding the estimated requirement.

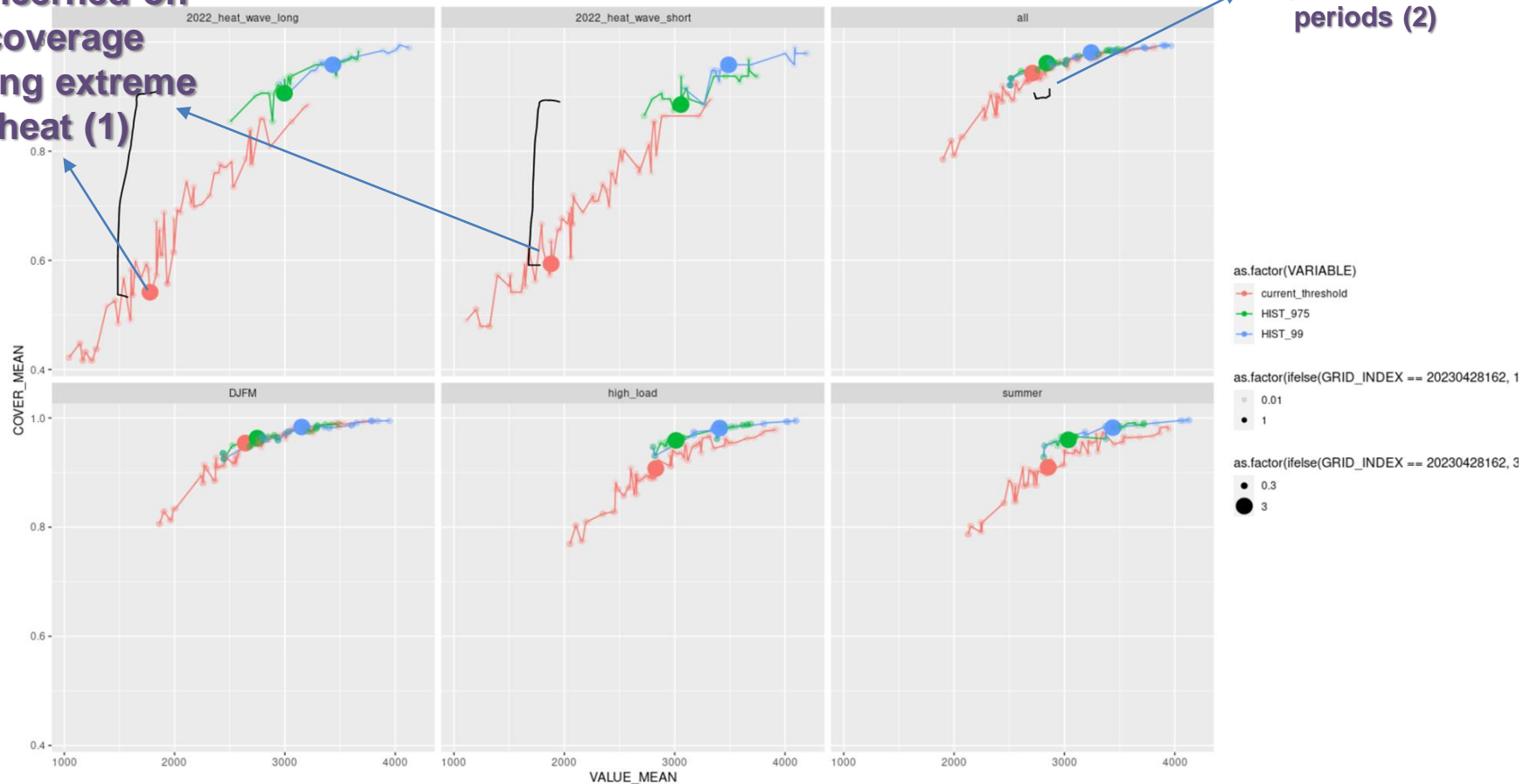
## Summer 2023: Utilize Imbalance Requirements (*similar* to DAME approved design)

- Simulation of performance over the last ~500 days, with highlighted periods (e.g., 2022 heat wave, Summer, >35,000 MW days)
- Trialed Methodologies
  - Mosaic methodology
  - 97.5% Net Load Histogram
  - 99% Net Load Histogram

# Trialing Multiple Options: *All results binned by time period or total load forecast*

Concerned on coverage during extreme heat (1)

Generally lower requirement for all specified time periods (2)





## Trialing Multiple Options: Broad takeaways

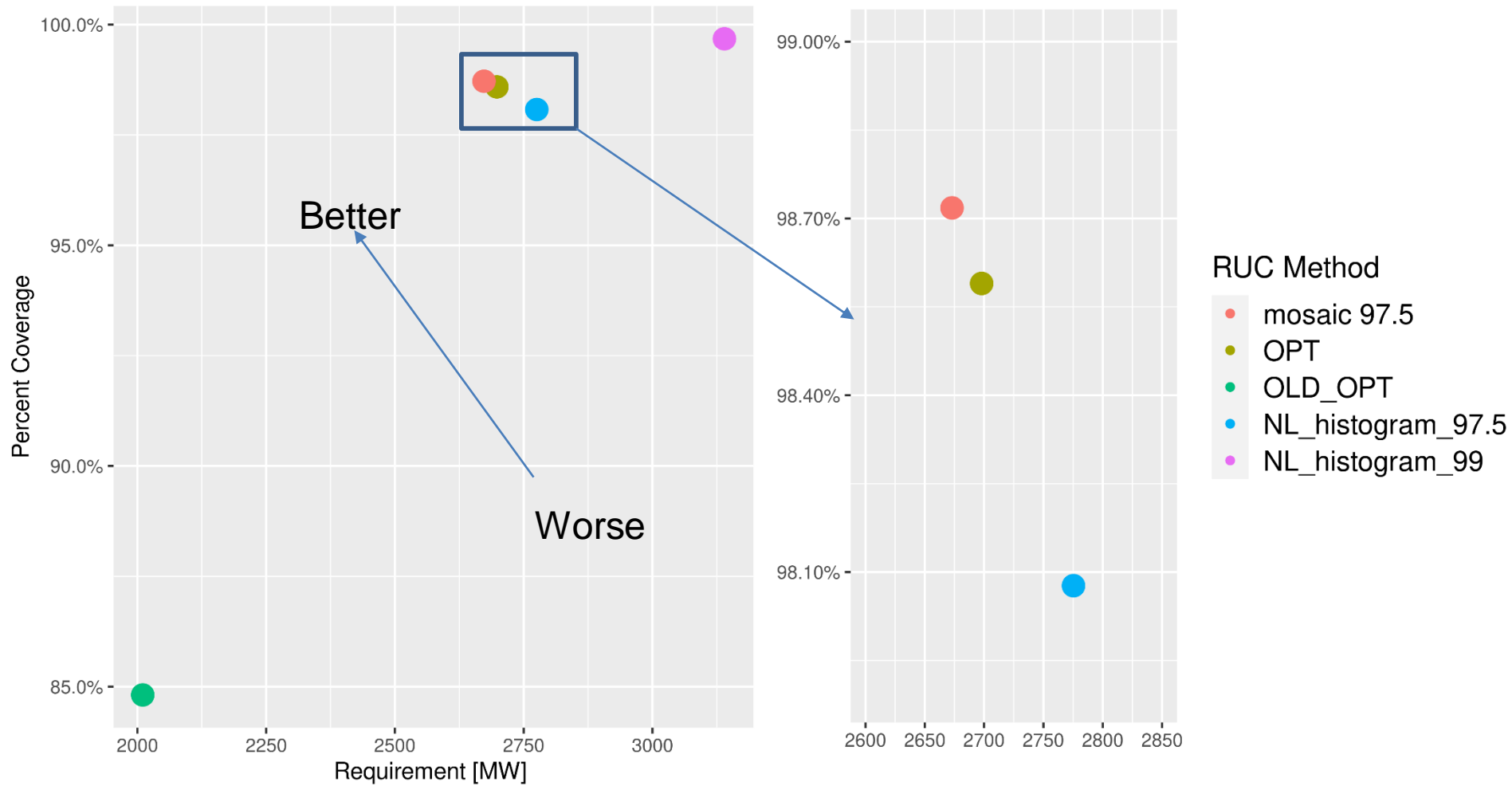
- When considering the most extreme 2022 (supply-constrained) days, a large departure in coverage between mosaic and histogram is evident
- When considering broader periods of time, mosaic has comparable coverage with a lower average requirement

# RUC Net Load Uncertainty Evaluation: July and August, 2023

- Starting on July 1<sup>st</sup>, 2023, the CAISO started utilizing an “Imbalance Reserve”-like methodology to inform the RUC adjustments for net load uncertainty.
  - Look to improve performance of previous RUC forecasting recommendation
  - Leverage mosaic methodology (from existing FRP and proposed IBR)
  - Assess the need to adapt recommendation when approaching weather extremes

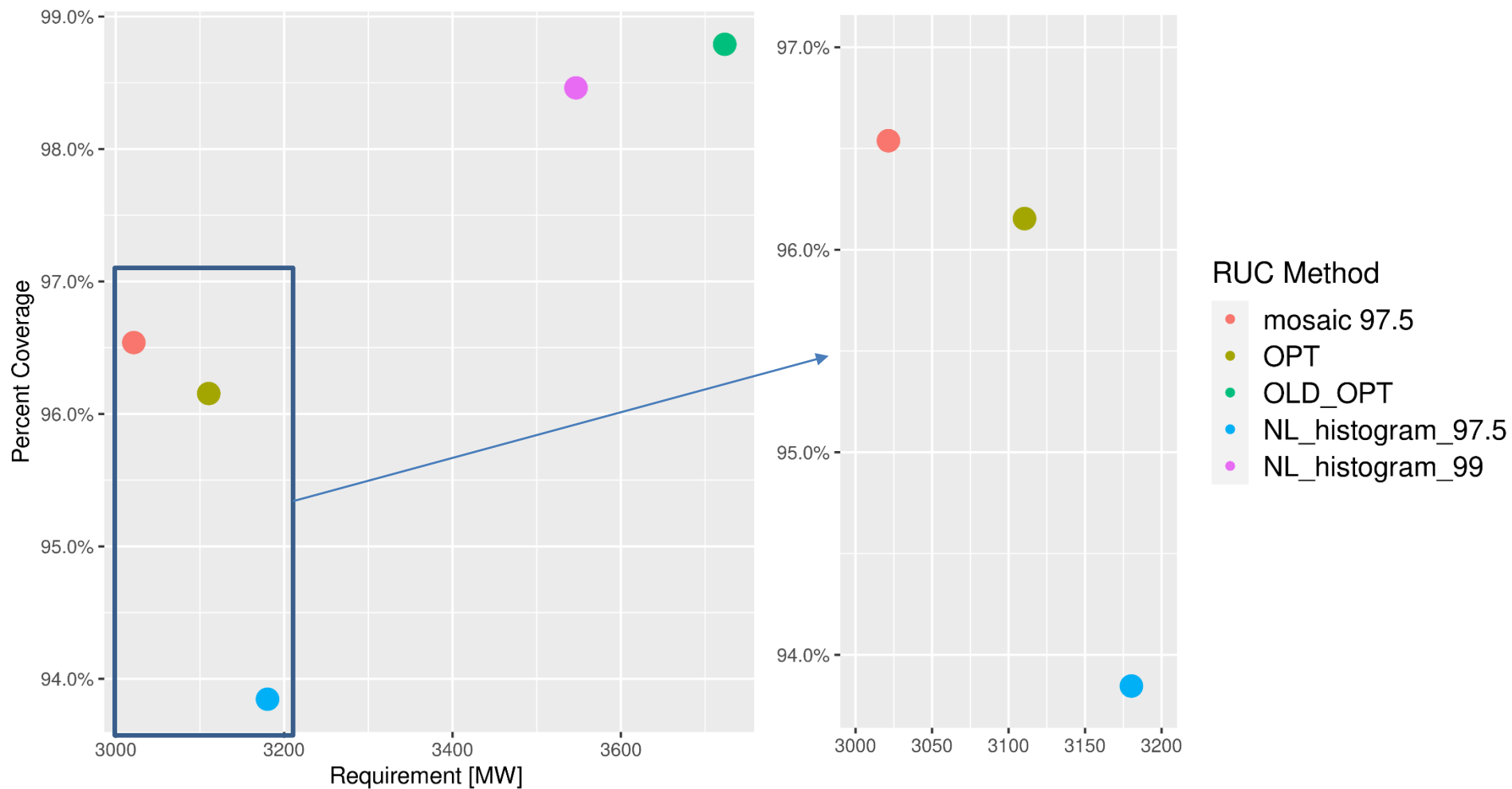
## Requirement vs. Coverage All Hours (Period Mean)

All Methods: New Method (gold), Old Method (green)



## Requirement vs. Coverage HE 18-21 (Period Mean)

All Methods: New Method (gold), Old Method (green)

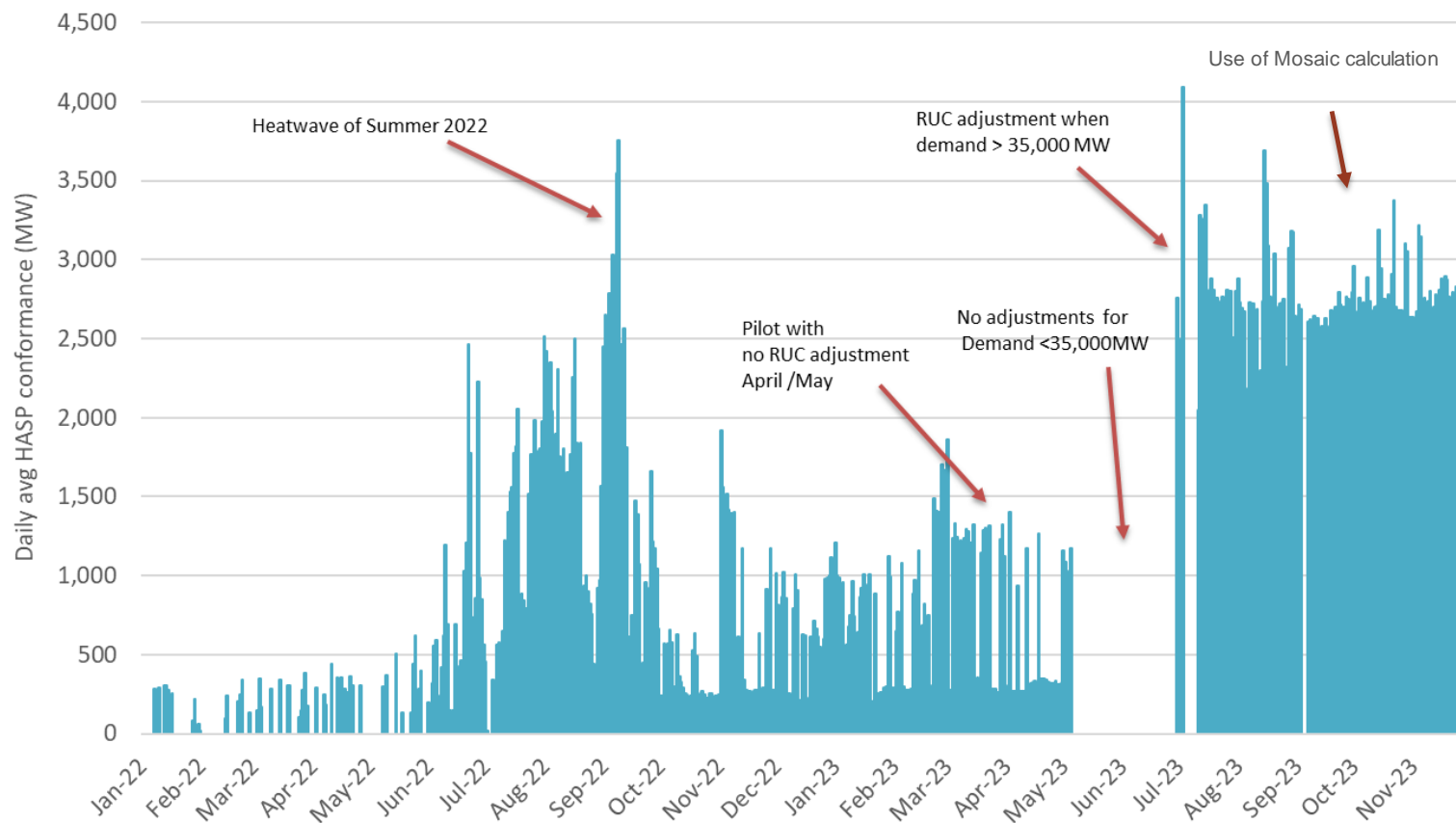


Analysis from: 2023-07-01 to 2023-09-01

## RUC Net Load Uncertainty Takeaways July 1<sup>st</sup> – Sept 1<sup>st</sup>, 2023

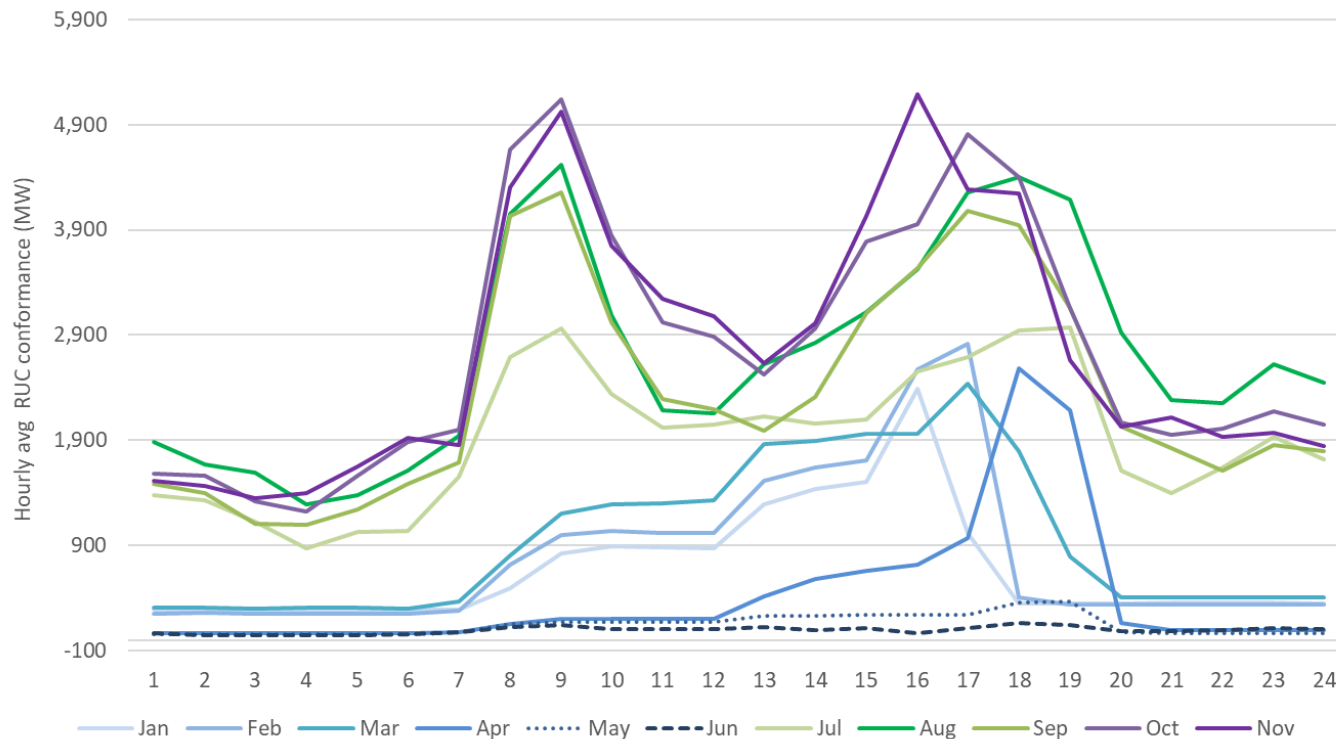
- New RUC approach provided **higher coverage (98.6%)** than net load histogram approach (**98.1%**). When just considering HE 18-21 this gap increases to  $> 2\%$
- New RUC approach maintained **lower average requirement (2697 MW)** than net load histogram approach (**2775 MW**).
- 2023 Results for Old RUC approach confirm the same general conclusions for lack of all hours coverage (**84.8%**) and too much requirement at peak (**3723 MW**)
- Switching criteria offered comparable coverage/requirement to mosaic but CAISO had moderate summer

As part of the pilot program, CAISO reduced the use of RUC adjustments. For most of June, RUC adjustments were 0 MW when load forecast < 35,000MW



With the use of Mosaic calculation, the RUC adjustments have been consistently high

# Hourly profile of RUC adjustments saw a steep increase with the use of Mosaic calculation

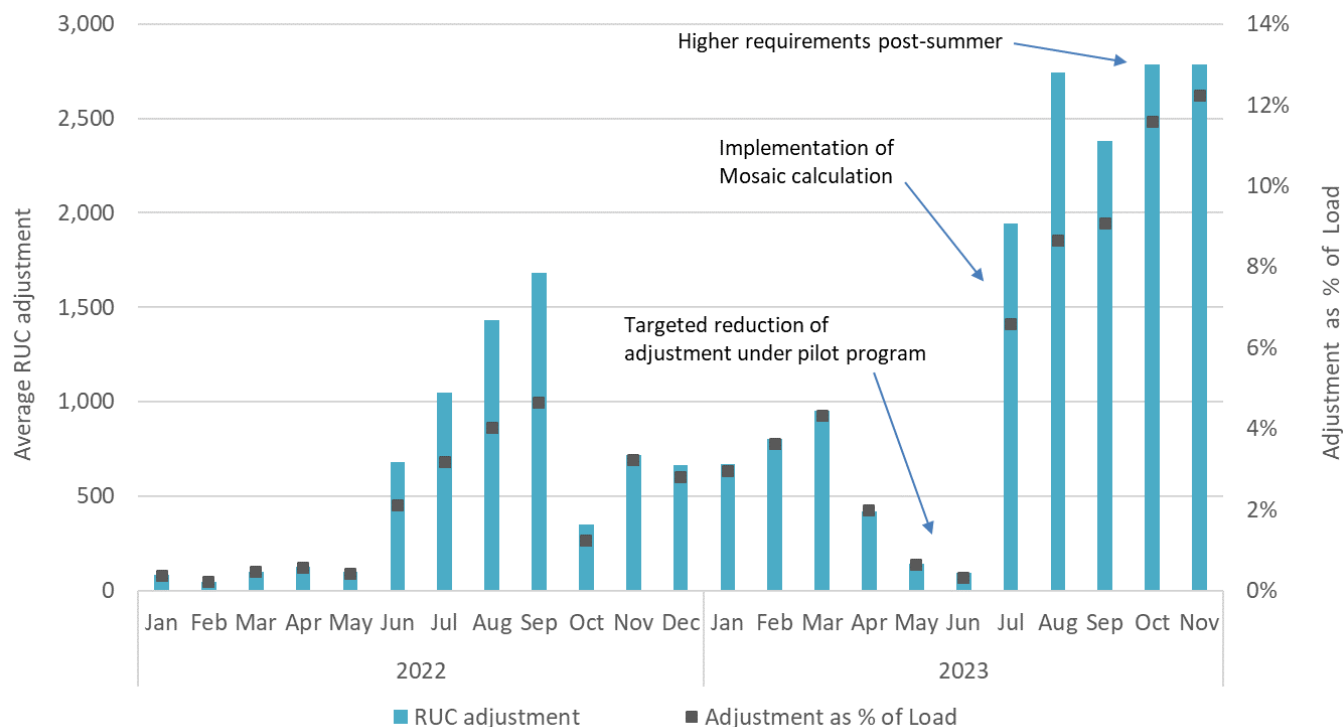


Profiles for July-November were based on Mosaic-like calculations

RUC adjustments have been even higher after summer conditions

The new calculation has increased steeply the requirements for morning hours and midday hours

# The use of the Mosaic calculation for RUC adjustments has resulted in sustained higher RUC adjustments



The RUC adjustments used in post-summer months have been higher than those used in summer and represent much higher percentages of the load adjusted

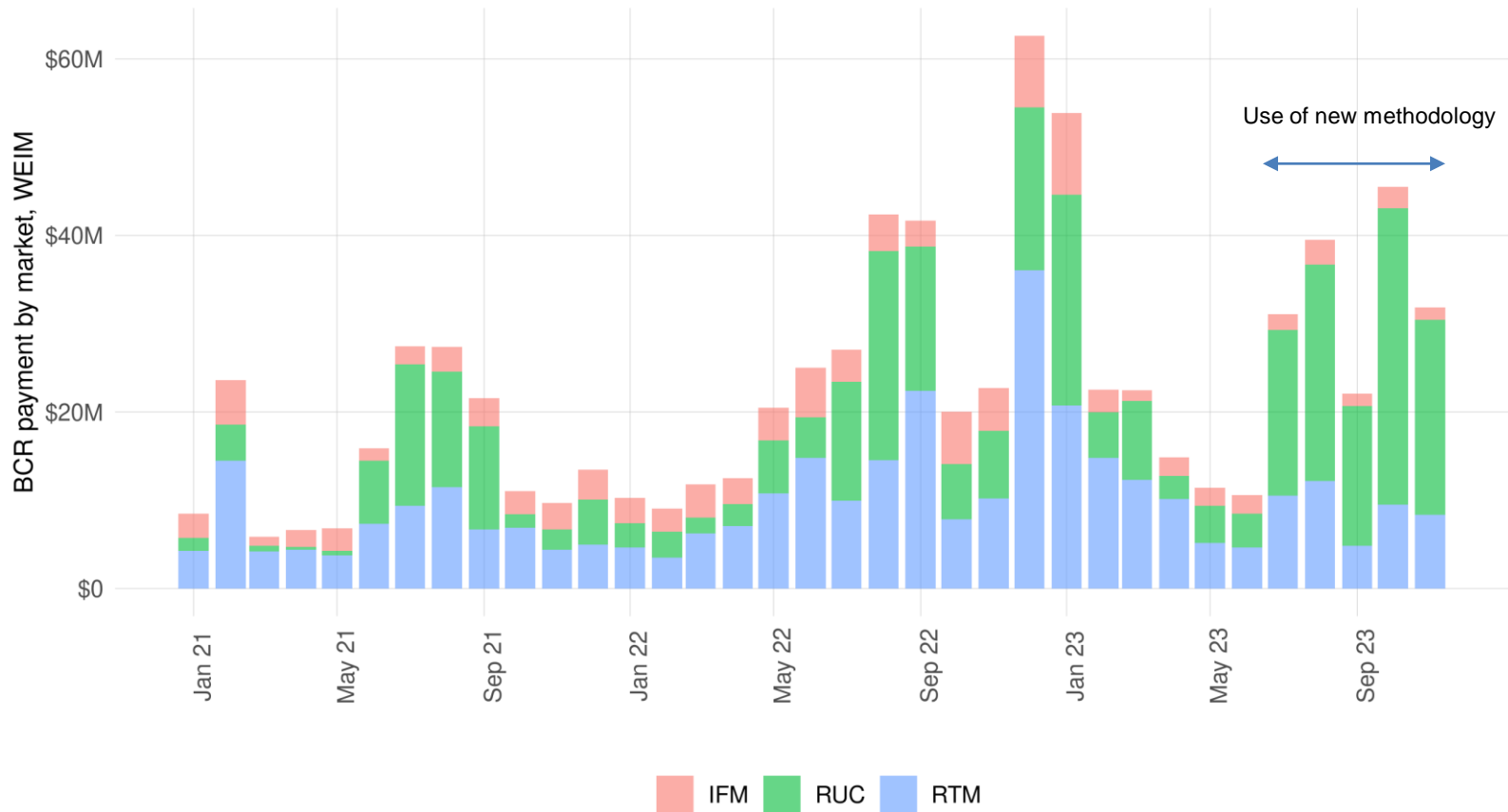
RUC adjustments used in October and November were about five times higher than those used in same months of 2022



## The use of high RUC adjustments has different implications in the market and system

- It has led to commit more long-start generation
- It has resulted in additional bid cost recovery for resources dispatched uneconomically
- It has increased generation available in midday hours resulting in additional oversupply conditions and reduction of renewable resources
- It may suppress real-time prices with the commitment of additional generation

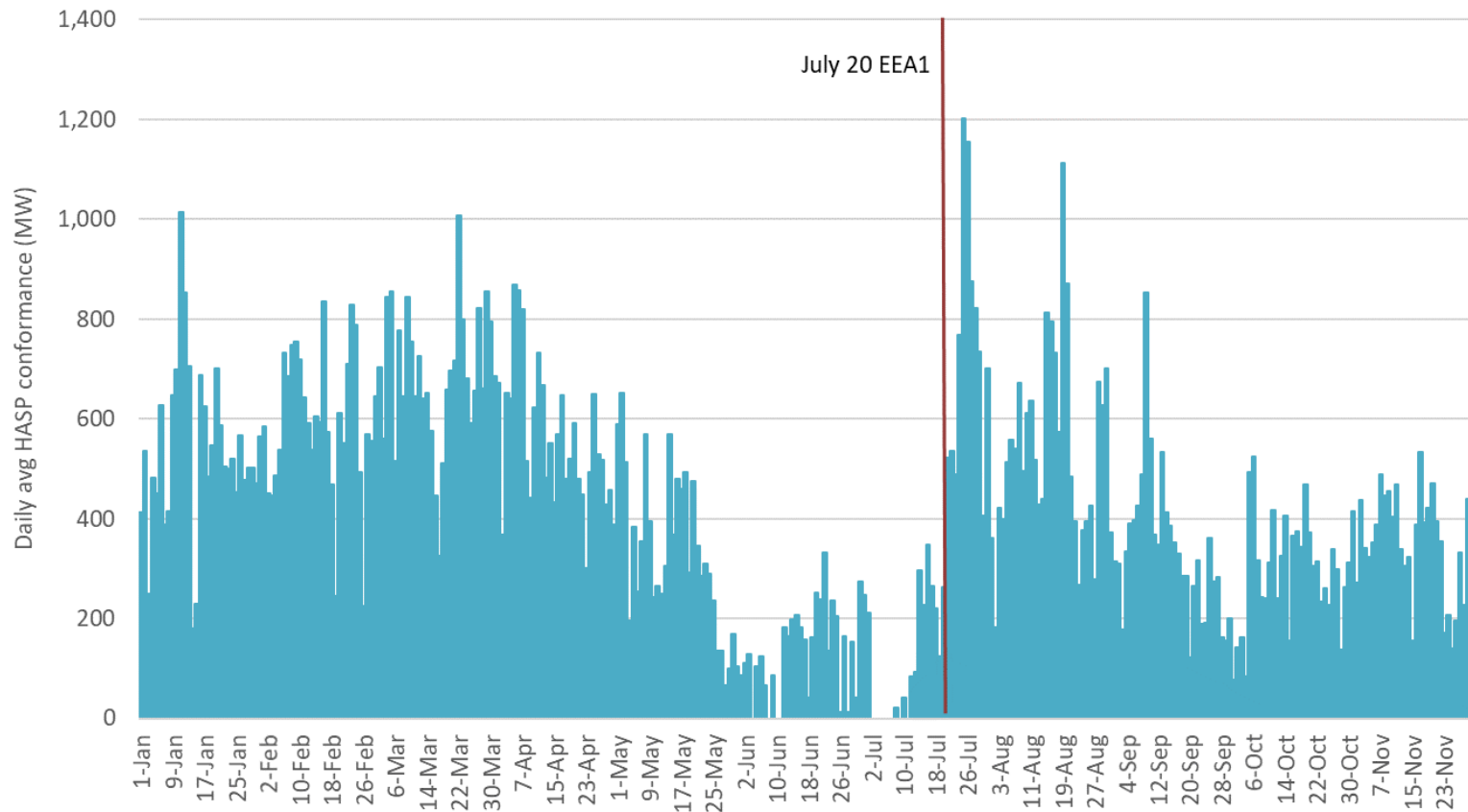
# The higher RUC adjustments has resulted in committing more generation uneconomically leading to additional bid cost recovery



# Implications of use of RUC adjustments

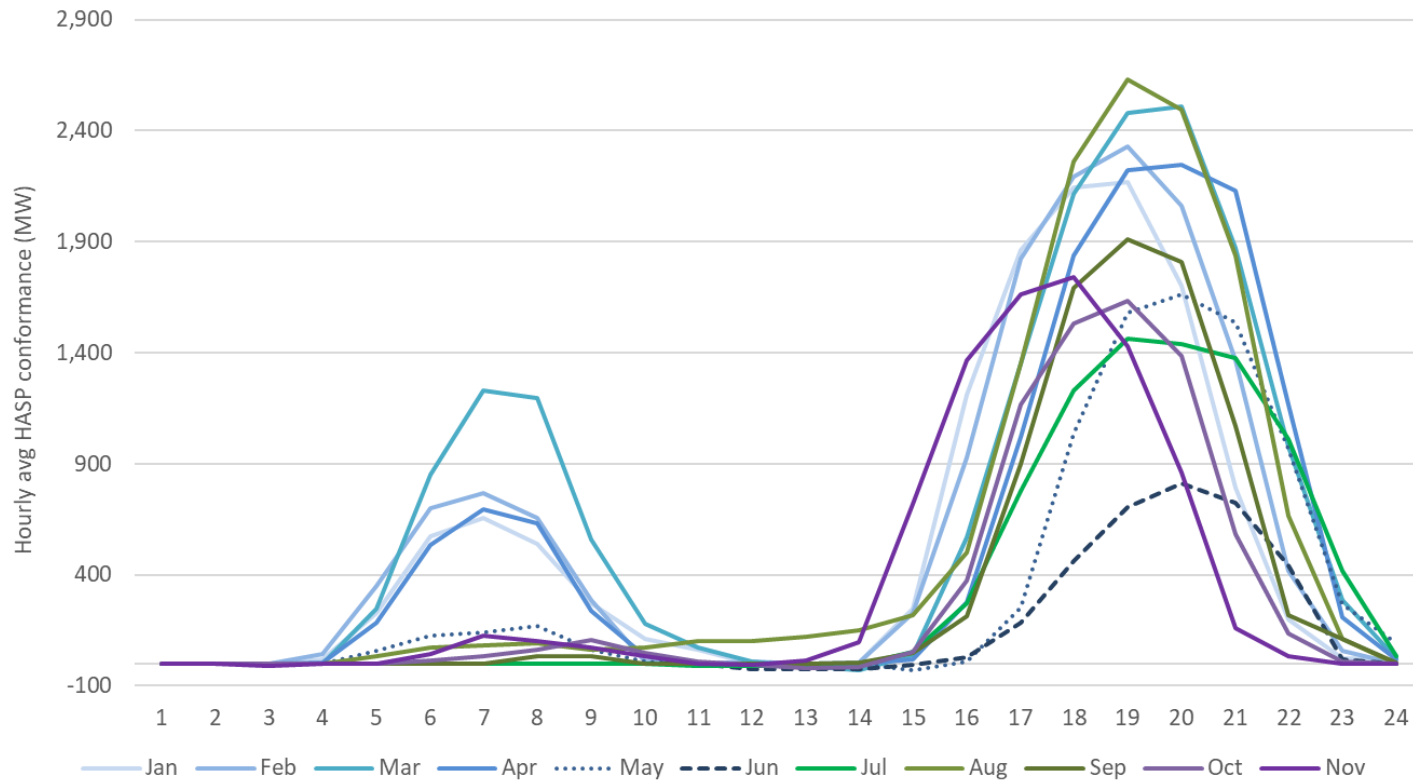
- The intent of start using similar methodology to imbalance reserve was to consistently generate estimates of net load uncertainty
- The current calculation relies on a more conservative approach than the one from imbalance reserves
- CAISO is adjusting the current methodology to align with the standard methodology for imbalance reserves, which will result in lower requirements
- Additionally, the ISO is assessing the varying level of risk of net load uncertainty for non-summer months, which will potentially further reduce the estimated requirements
- CAISO expects to effectuate these changes in the week of December 18

CAISO's explicit effort to assess the use and need of load conformance is reflected in the downward trend in the first half of 2023 in the HASP market



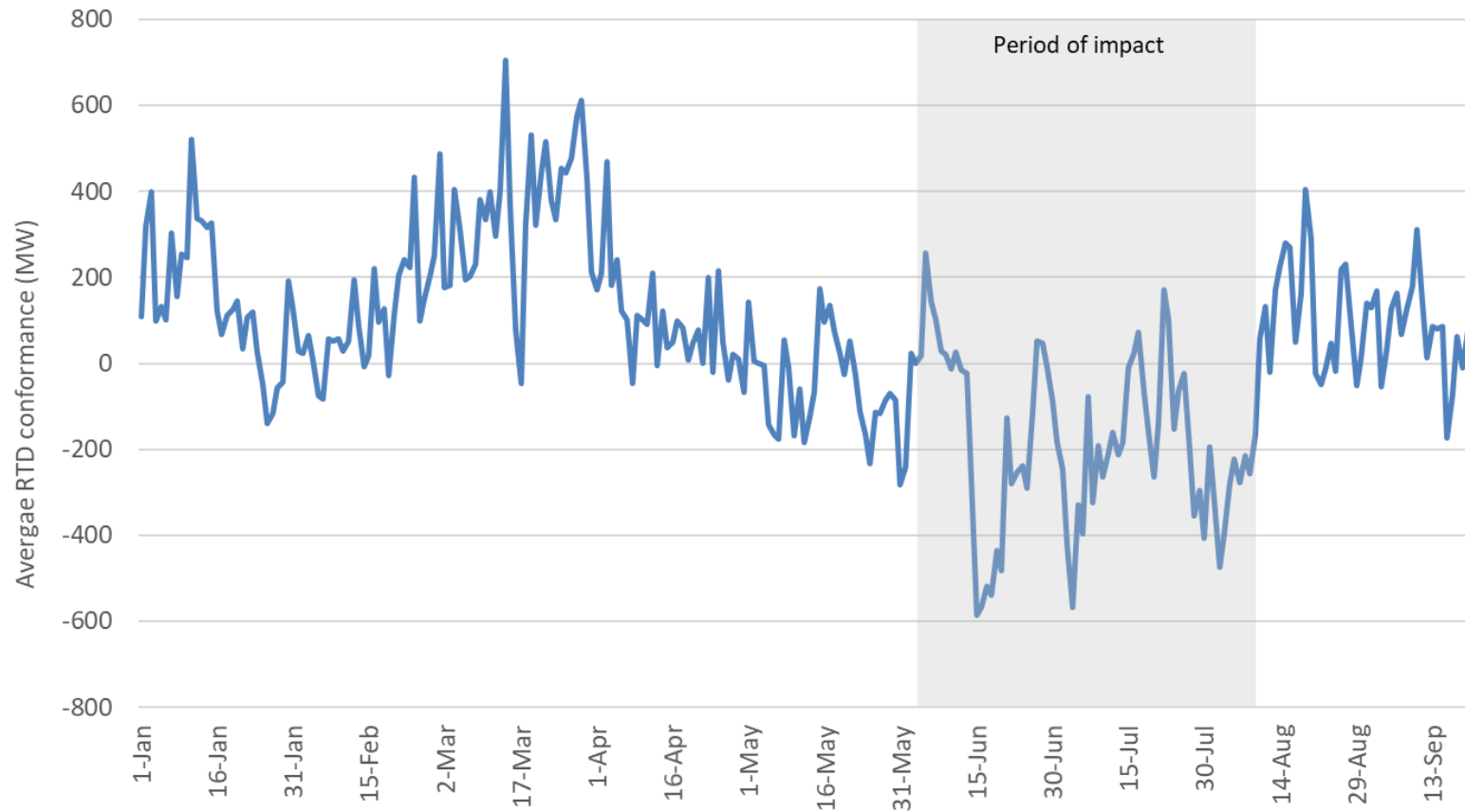
After the first summer emergency developed, the ISO reconsidered the practice of load conformance. More details can be found in the July summer performance report

# With the pilot program, HASP conformance was assessed and reduced through mid July



With the July events, the program was paused and HASP conformance returned to typical levels

In June, an incorrect set up of telemetry for certain resources resulted in more frequent use of five-minute load conformance



This issue was addressed on August 10

# Assistance Energy Transfer

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

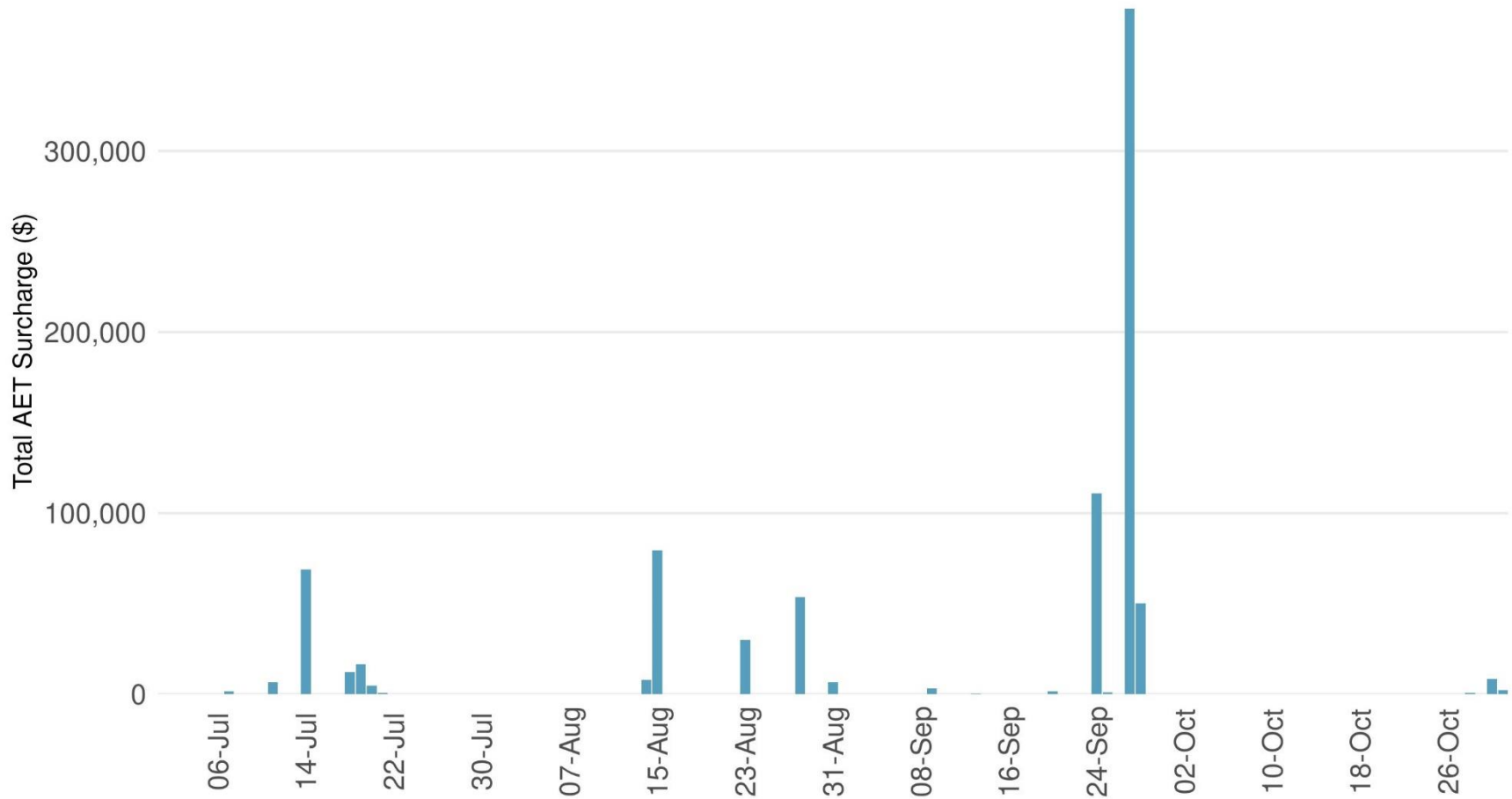
- Assistance energy transfers allow the WEIM to provide reliability benefits to balancing authority areas (BAAs) deficient in capacity or flexibility
- Designation requests must be submitted by 11am Pacific Time at least 5 business days in advance of the effective start date
- Designation requests must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



# A total of five BAAs opted into AET between July 2023 and October 2023, including CAISO



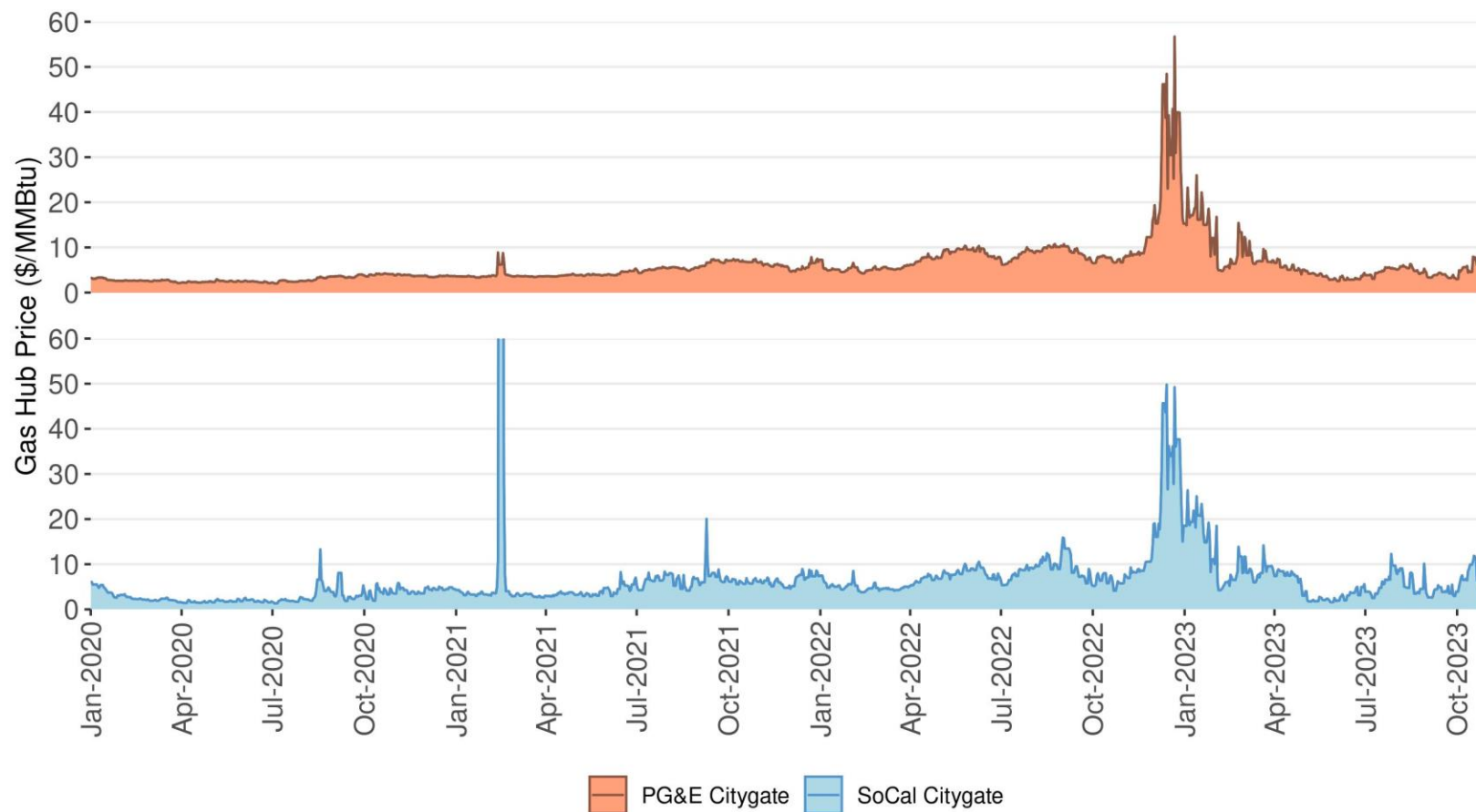
The highest total monthly amount of AET surcharge to-date was assessed in September 2023, peaking on September 27 due to forced outage in one BAA



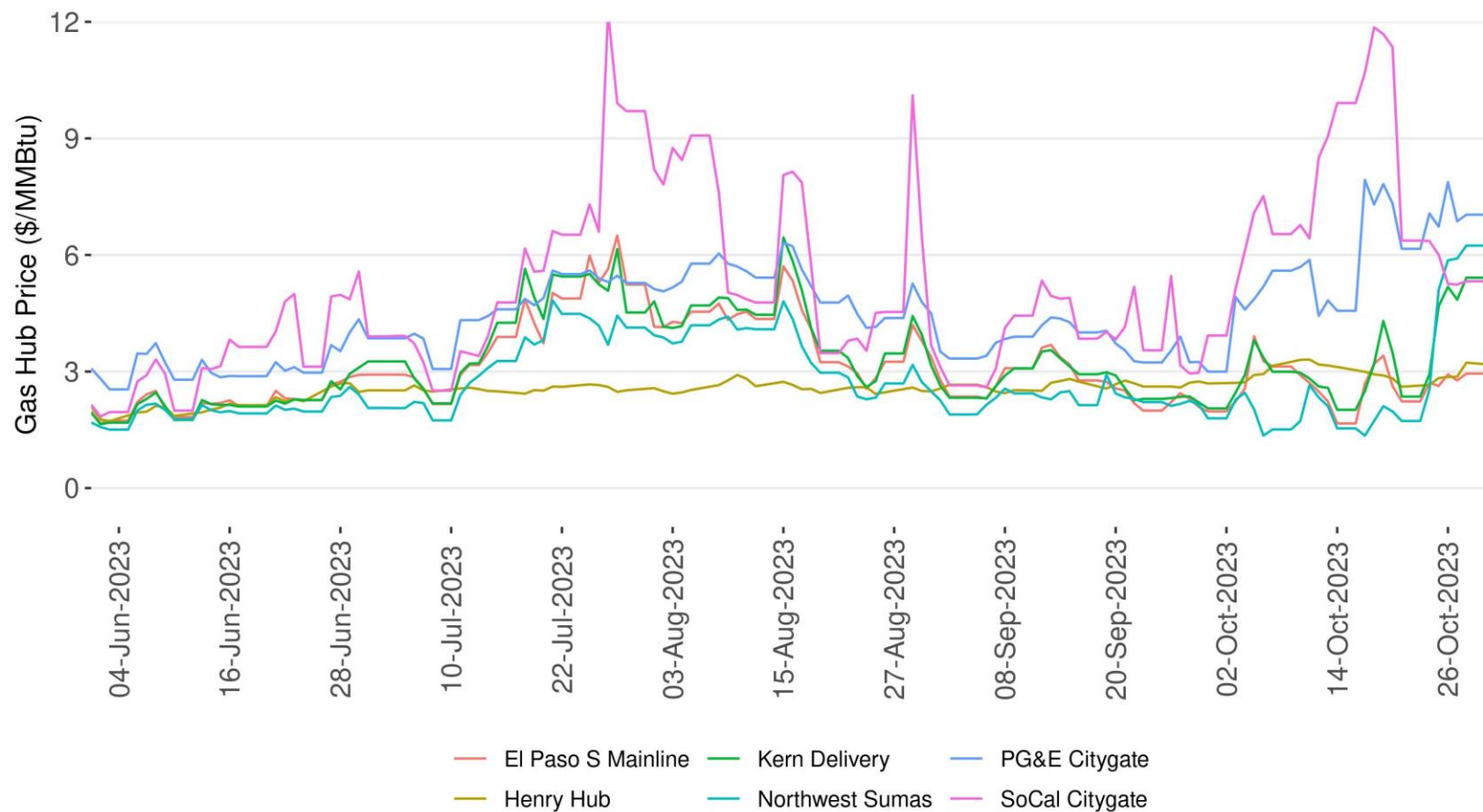
# Gas and Power Index Prices

## CAISO Market Costs

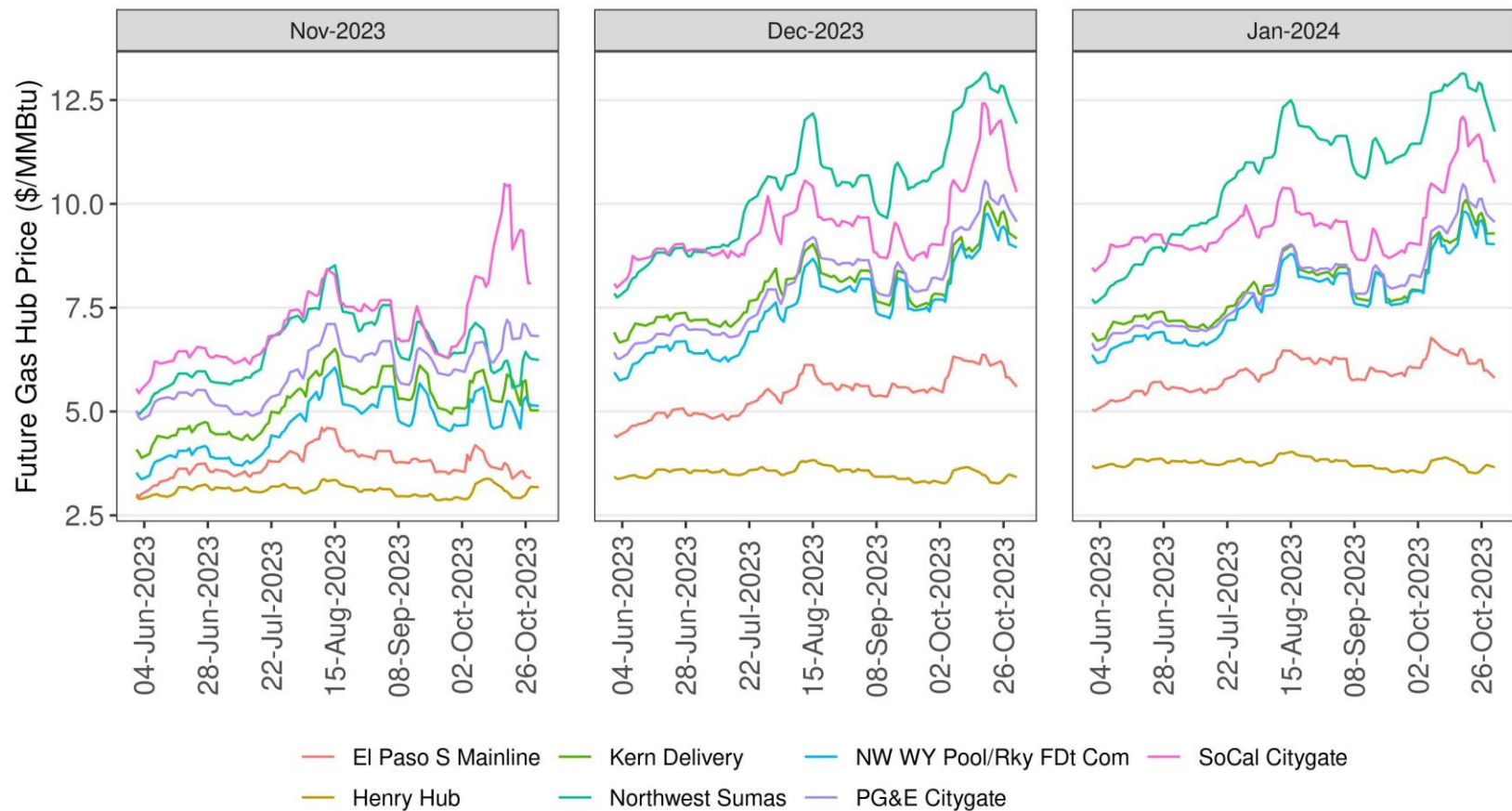
# California next-day gas prices saw lower levels in fall 2023 trading compared to summer 2022



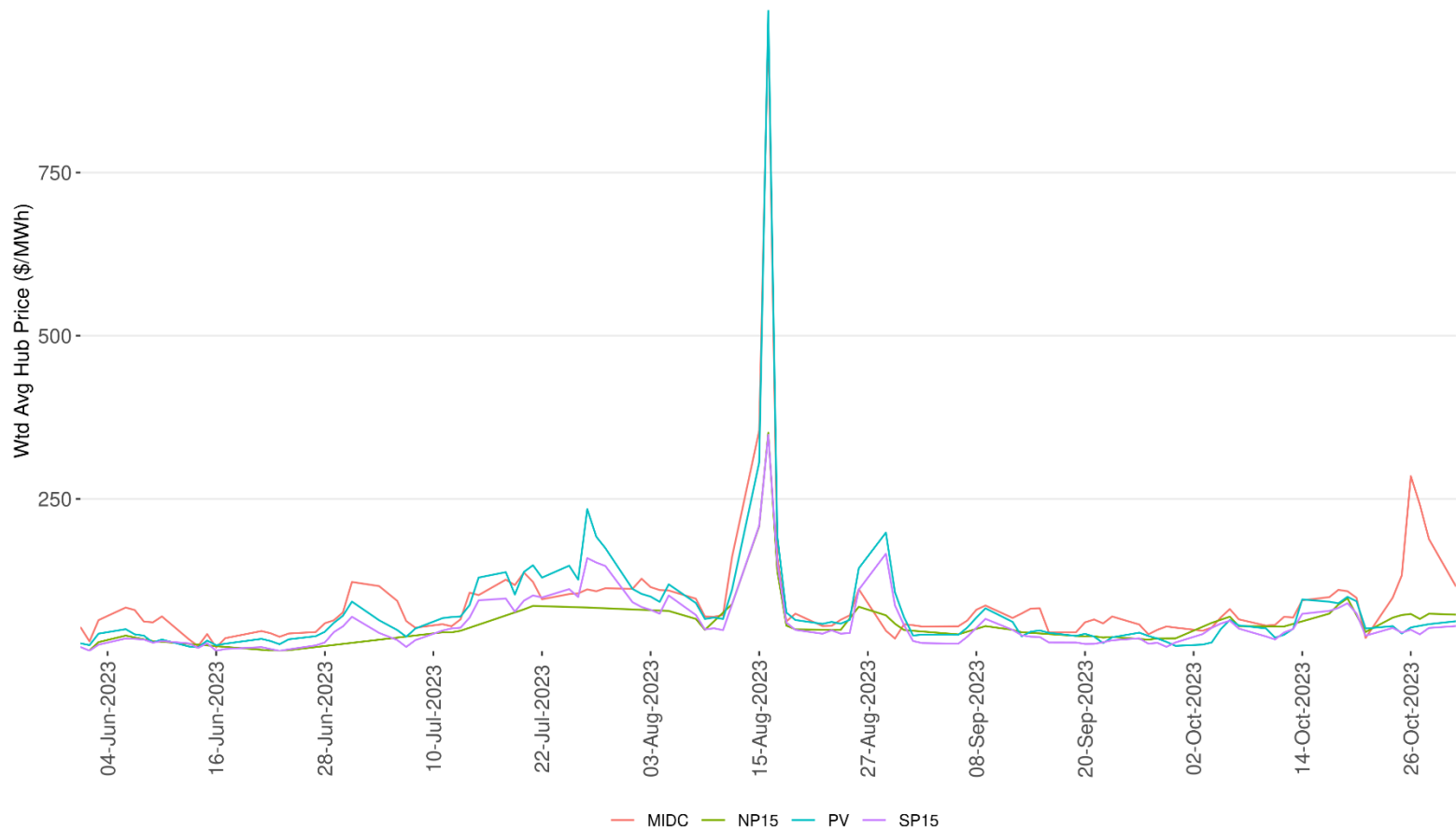
# California gas prices reached elevated levels in October 2023 on par with summer levels



# Future gas prices for winter 2023 rose steadily throughout summer trading and spiked modestly during October trading

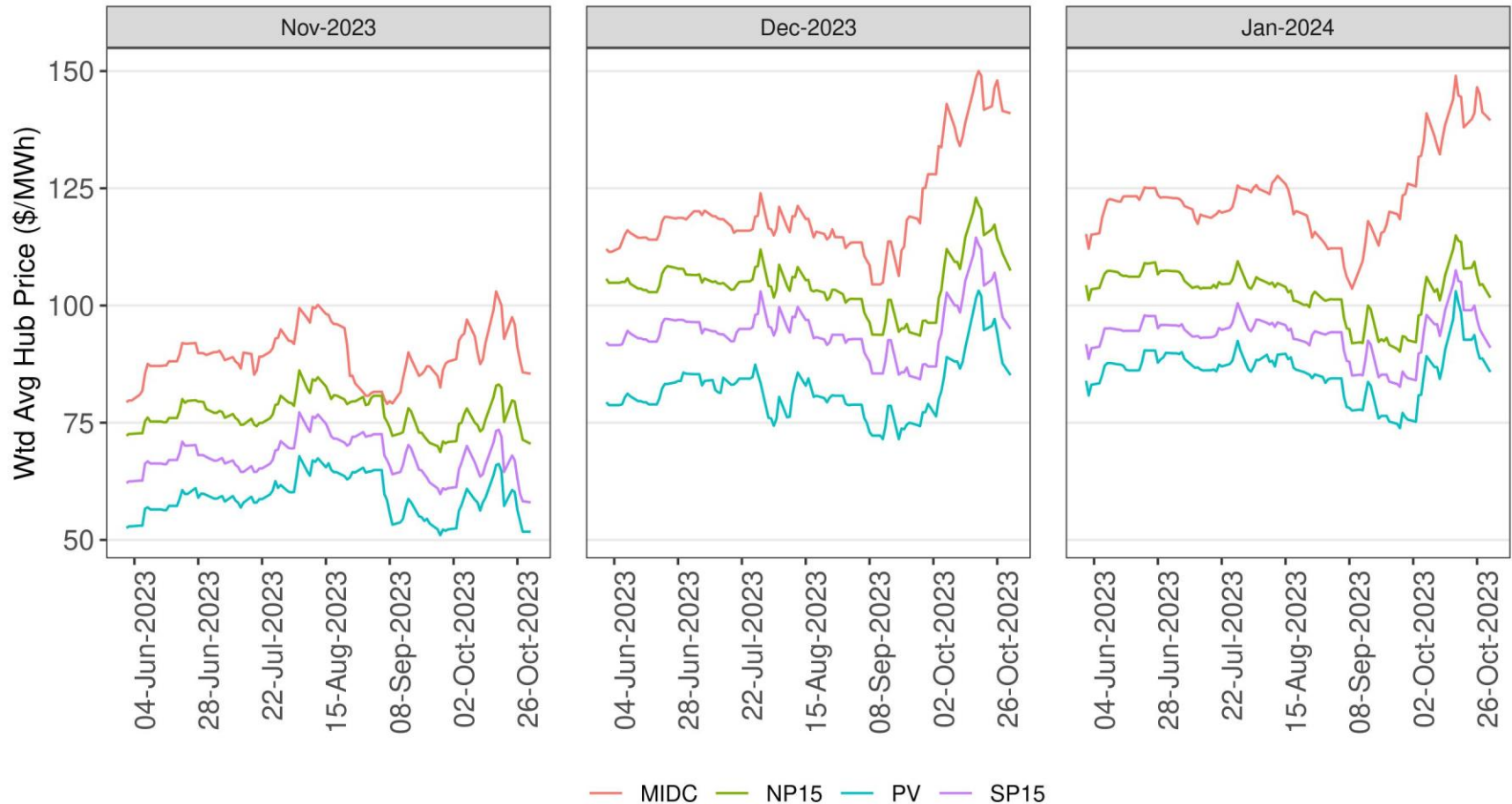


Next-day on-peak bilateral power prices traded lower than mid-August peak for the remainder of summer, with one Mid-C price spike in recent trading



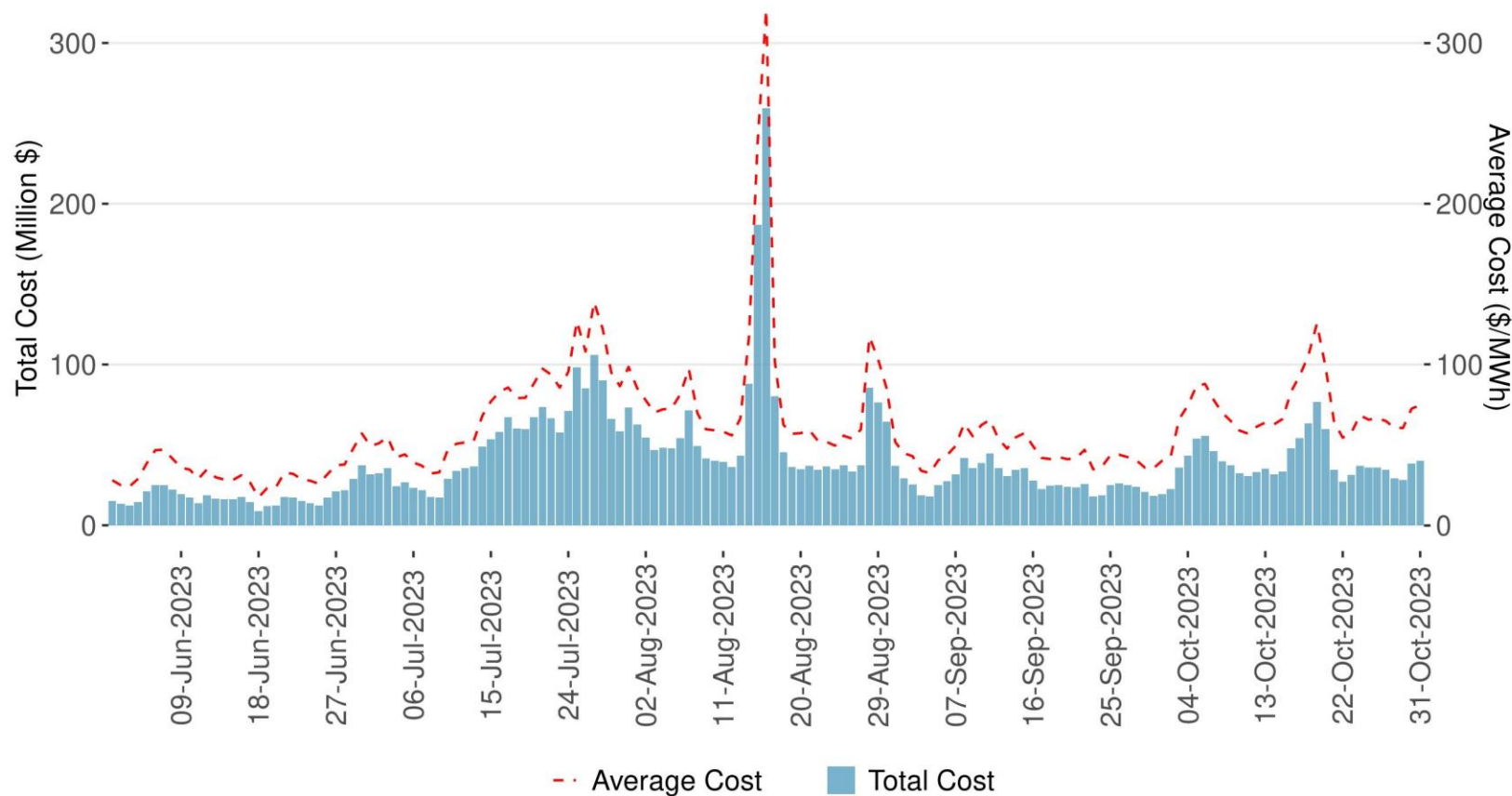


# Future on-peak bilateral power prices for December 2023 and January 2024 have climbed above \$100/MWh since late summer trading

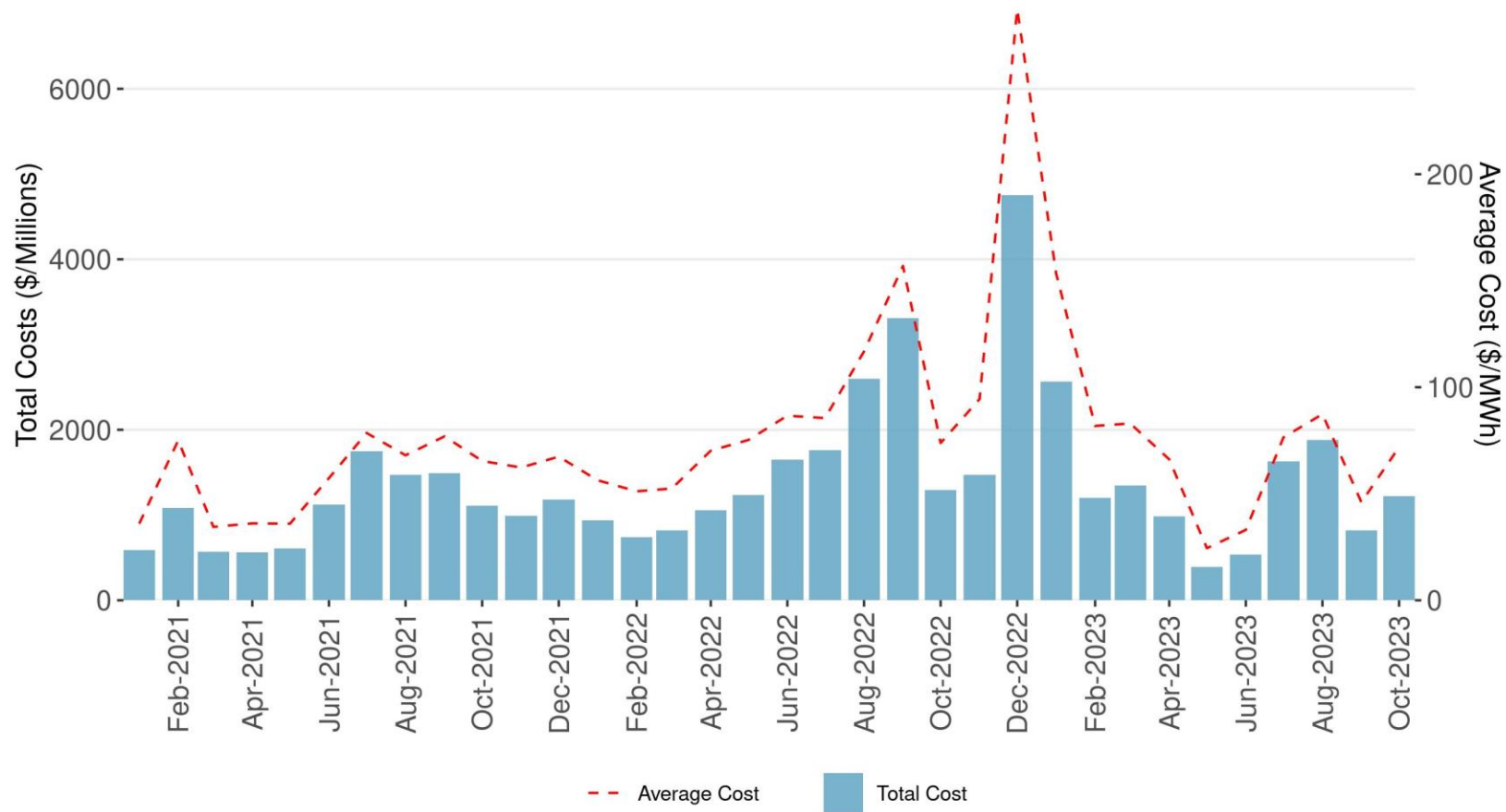




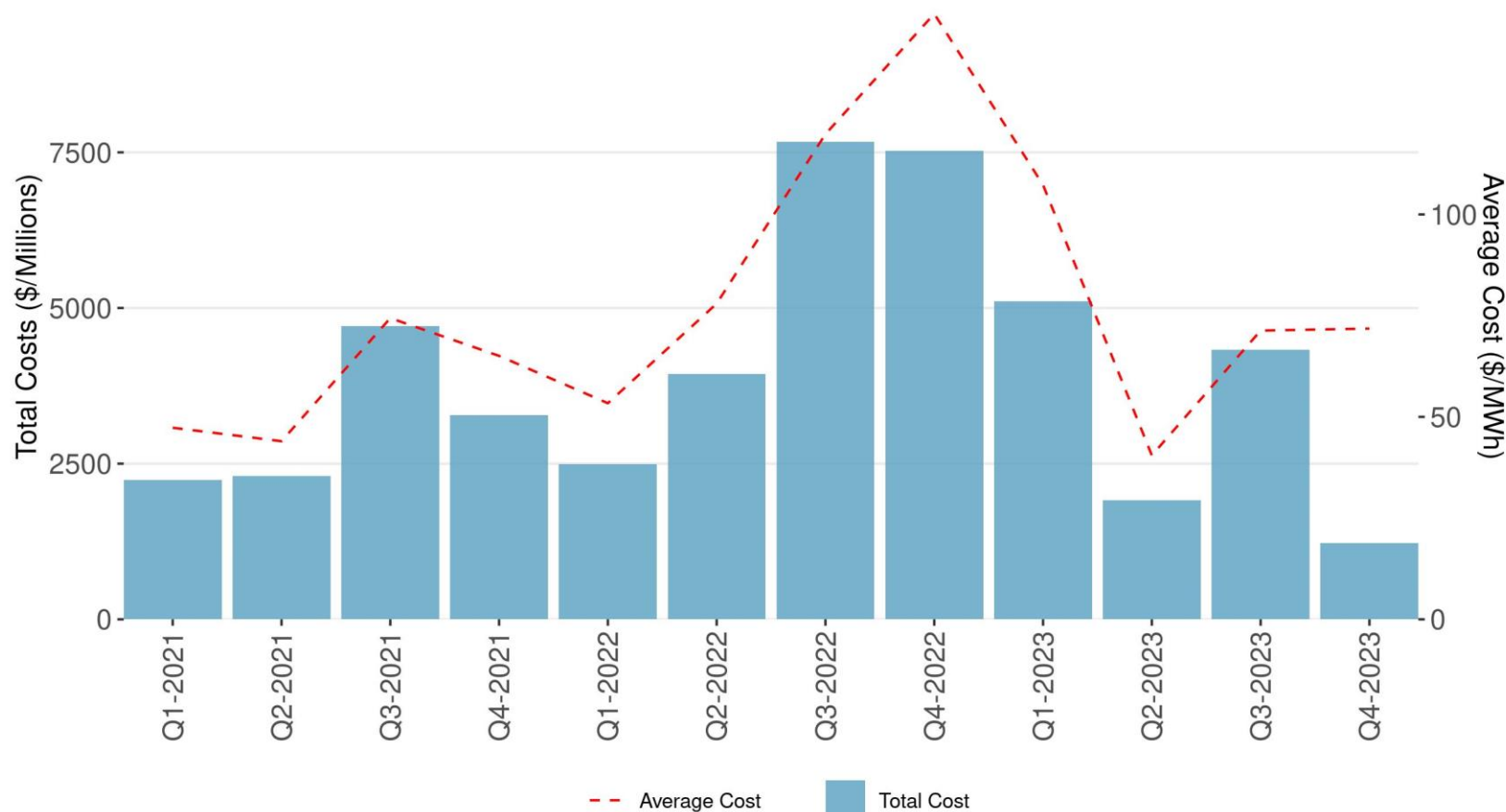
Daily market costs were lower following August 15-16 spike but average cost remains in line with early summer averages



# Monthly totals for summer 2023 remained low compared to summer 2022 and December 2022

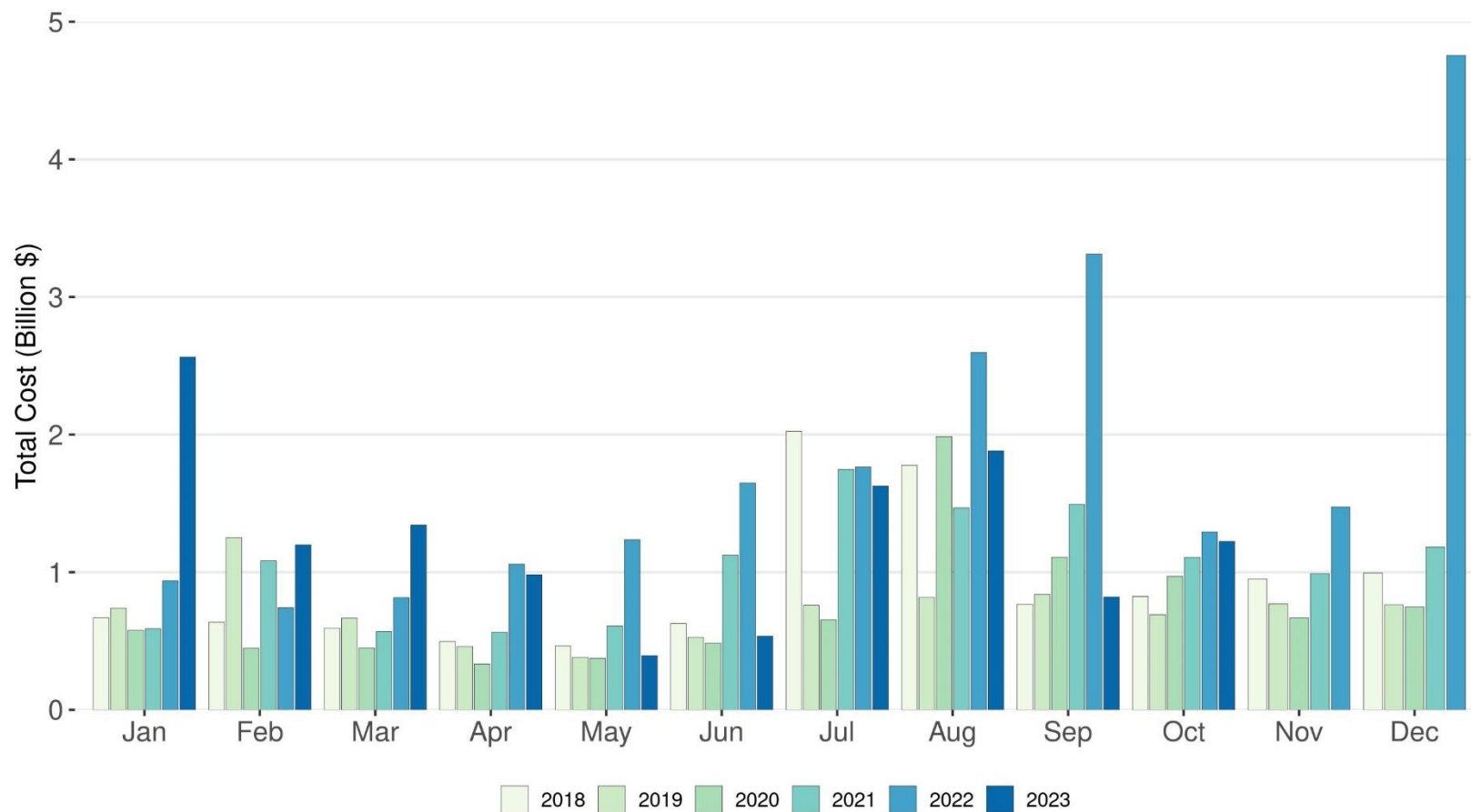


Q3 2023 total costs are \$3B lower than Q3 2022 total costs, or \$48.55/MWh lower on average



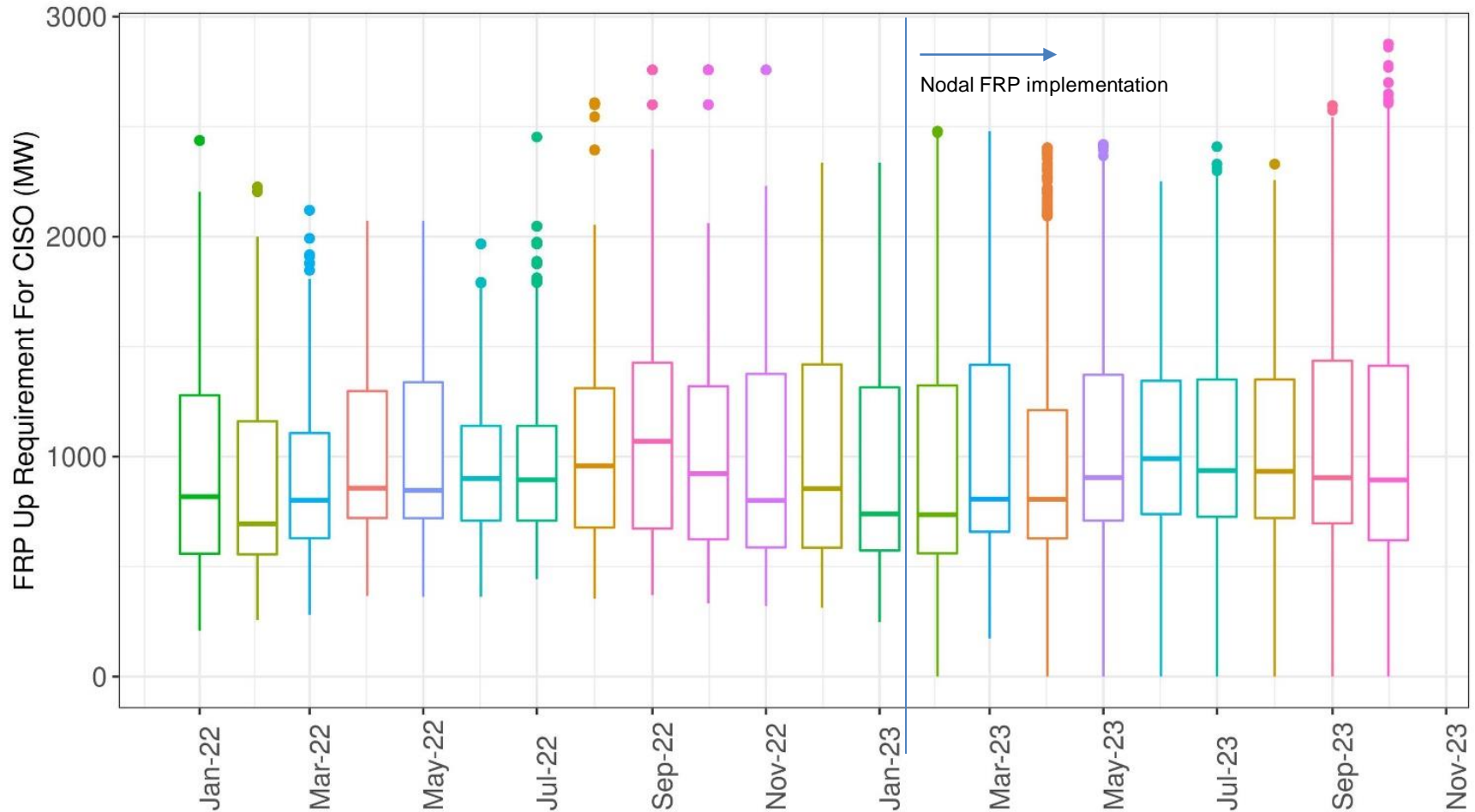
Note: Q4 2023 includes data for October only

# Monthly totals for summer 2023 months remained lower than monthly totals from the previous year

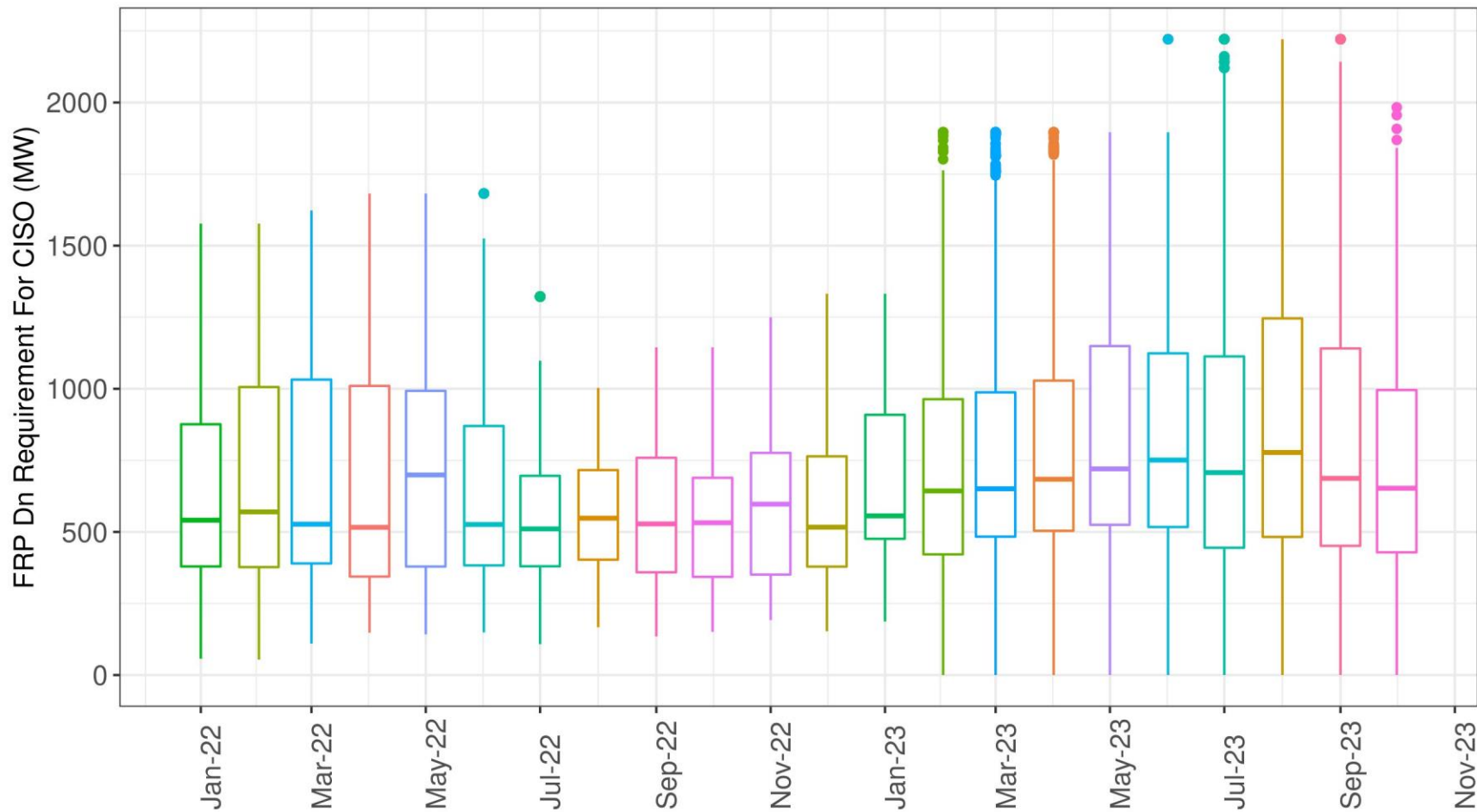


# FRP Update

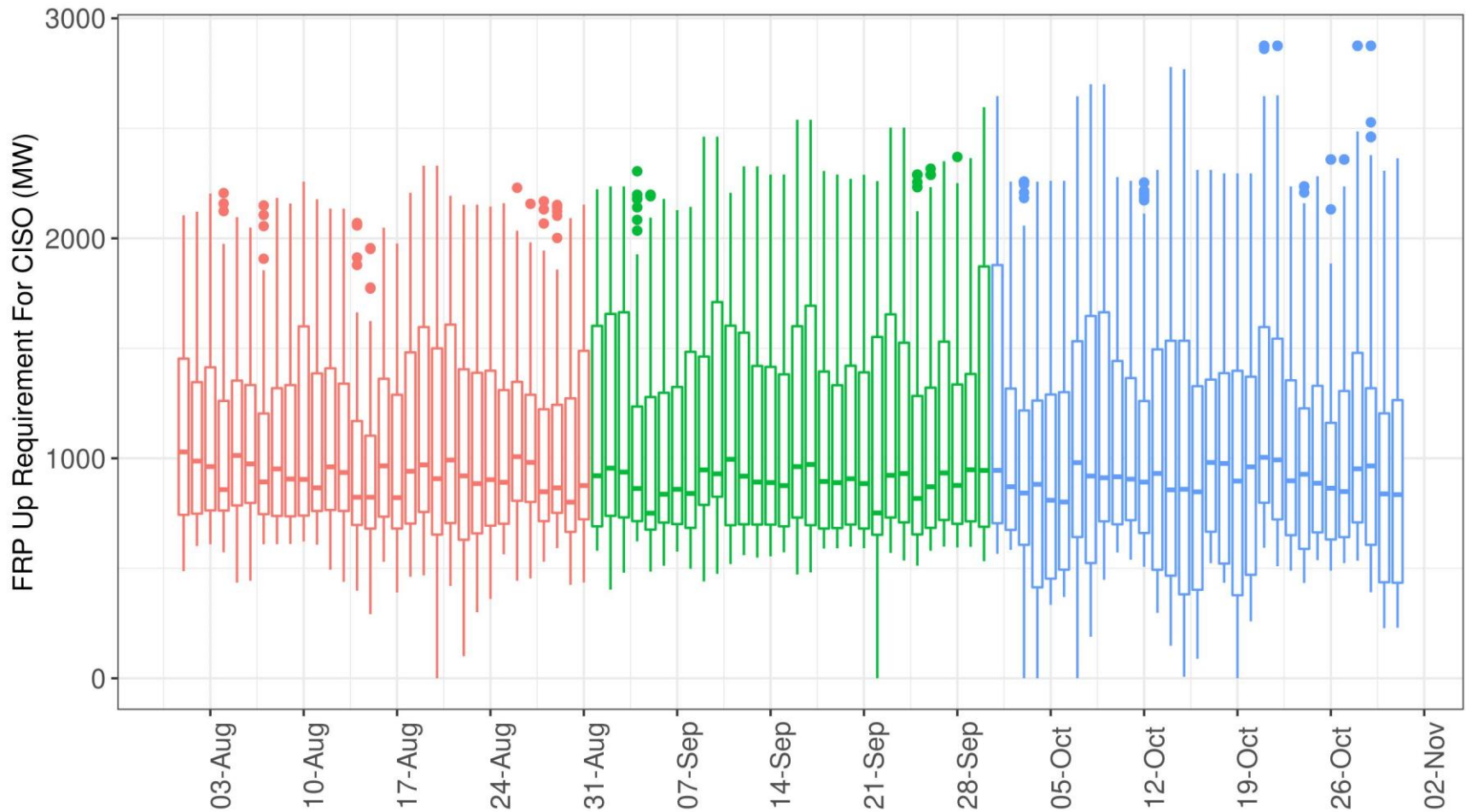
# FRP Up Requirement for CAISO area remain within typical ranges



# FRP Down Requirement for CAISO area remain within typical ranges

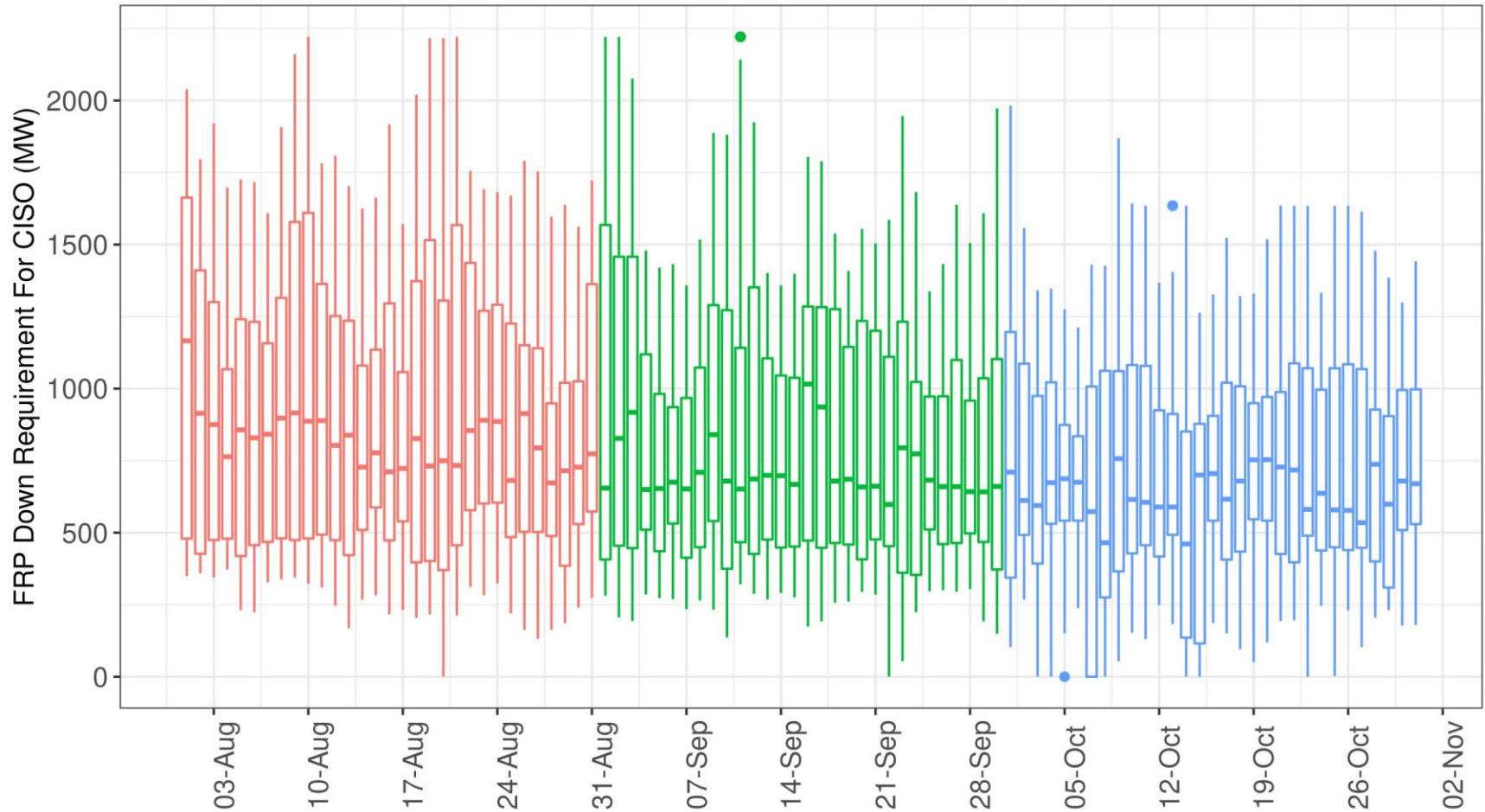


# The daily distribution of FRP Up requirement in the last 3 months for CAISO area exhibit a steady trend

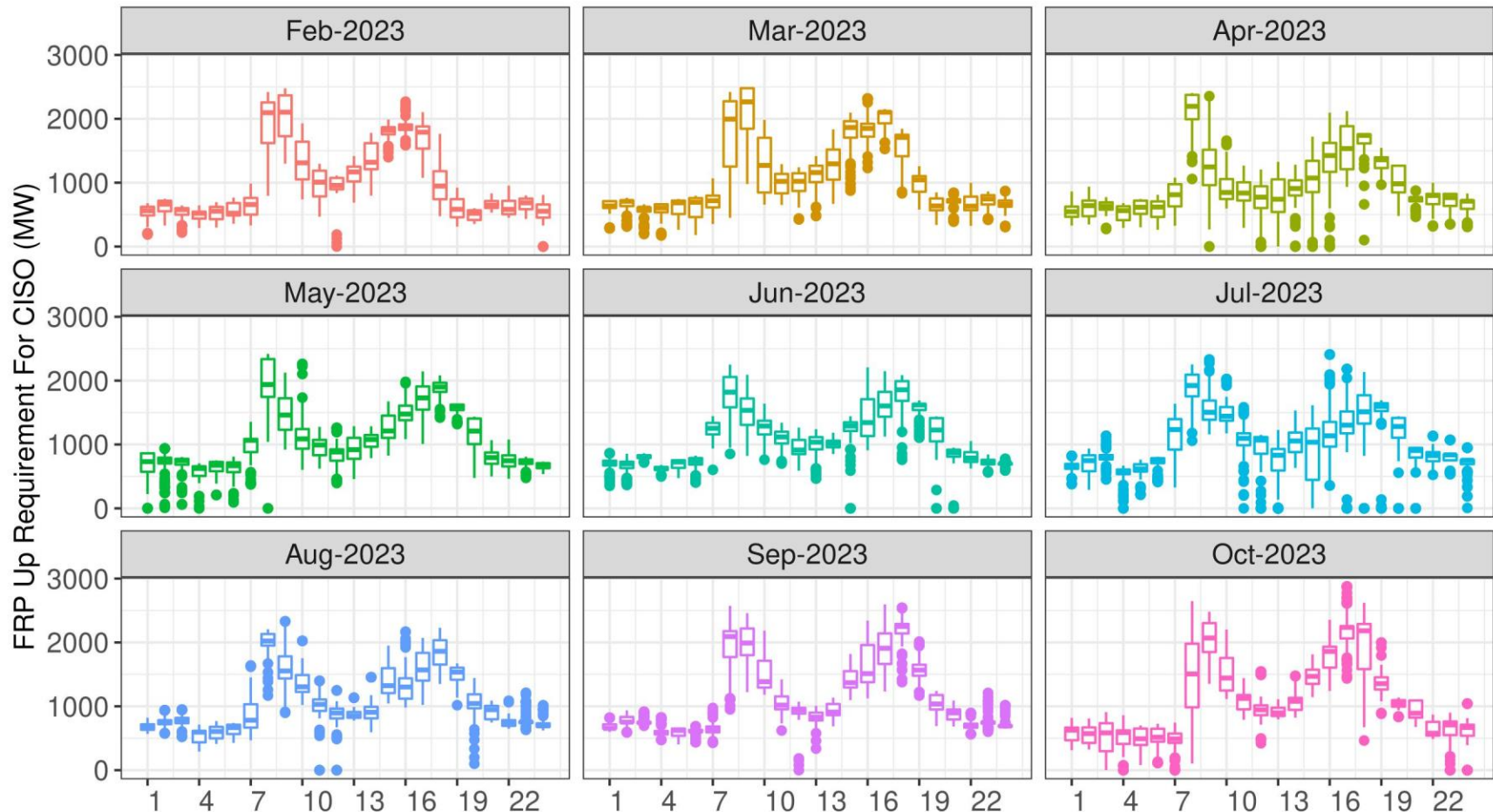




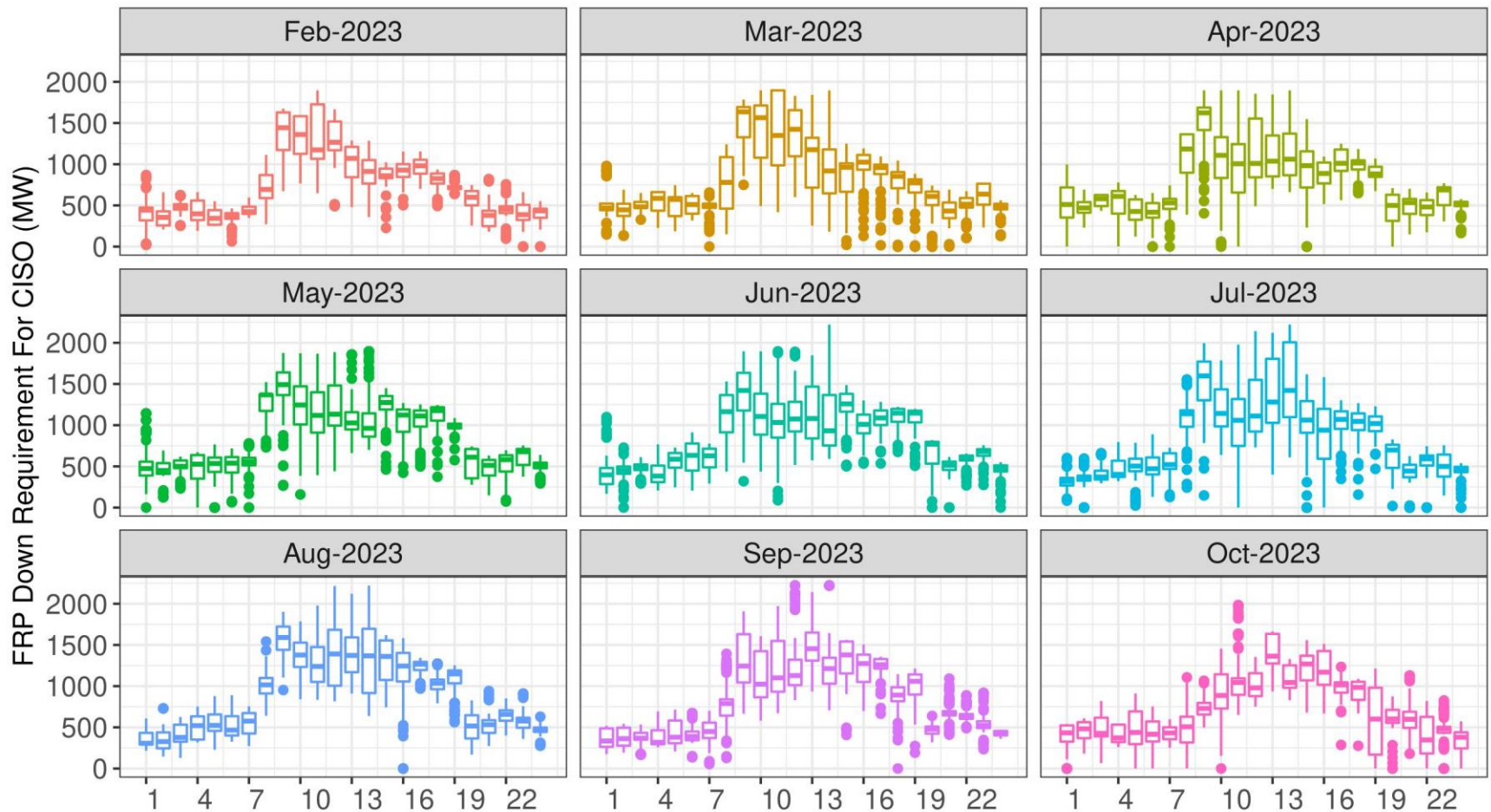
# The daily distribution of FRP Down requirement in the last 3 months for CAISO area exhibit a steady trend



# The hourly profile of upward FRP tends to follow a pattern of morning and evening peaks



The hourly profile of downward FRP tends to follow a complementary pattern to the upward FRP, with higher values in midday hours



# FRP Coverage

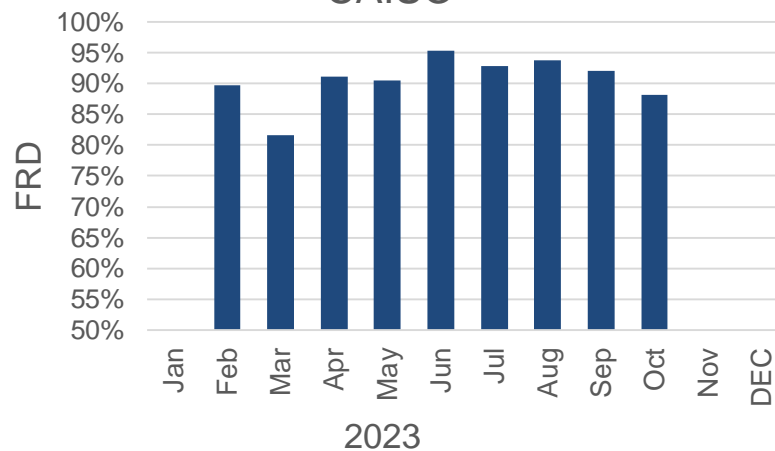
## CAISO



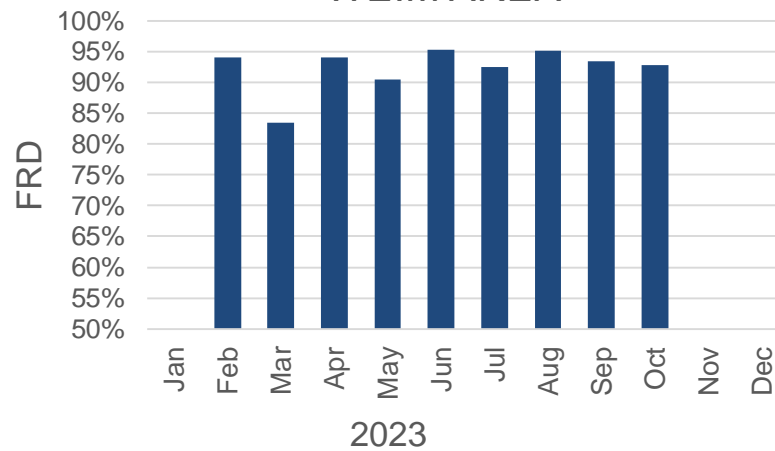
## WEIM AREA



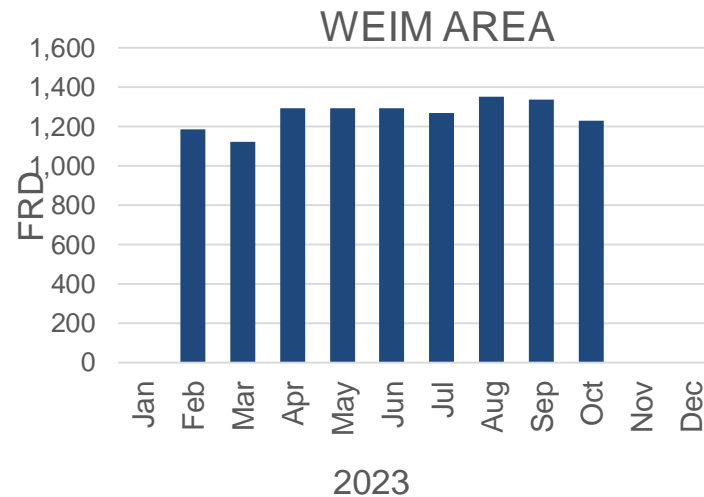
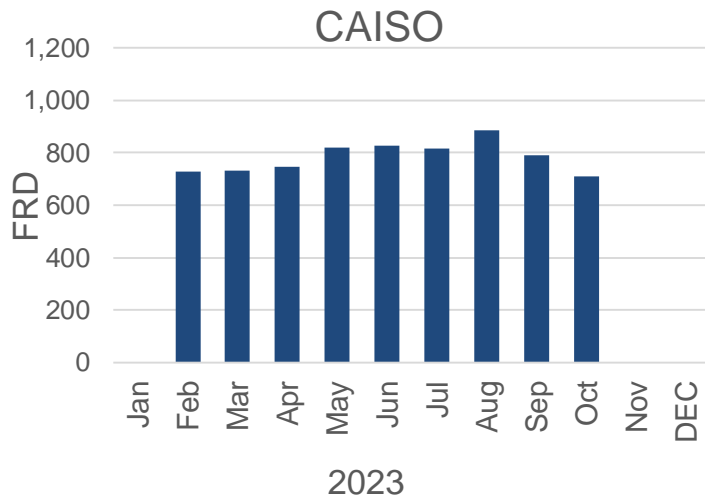
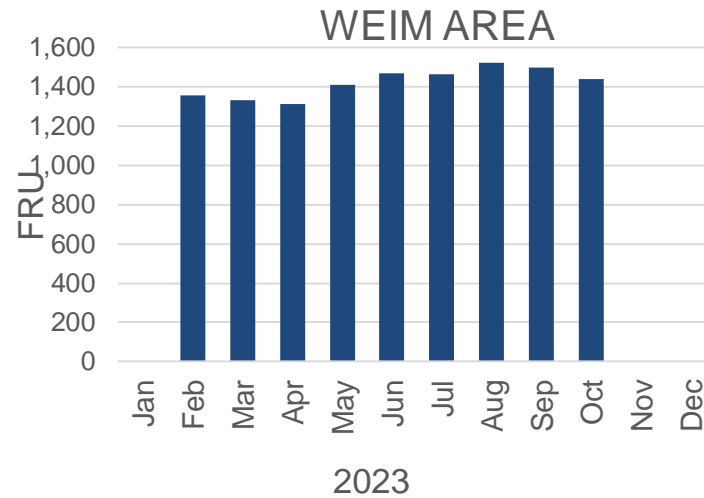
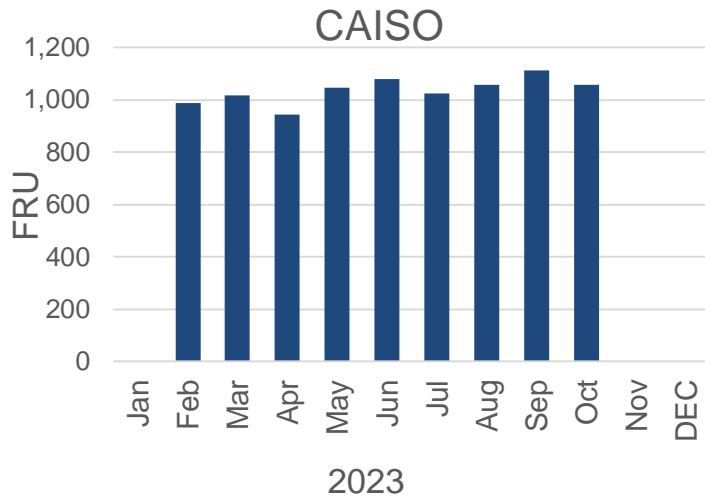
## CAISO



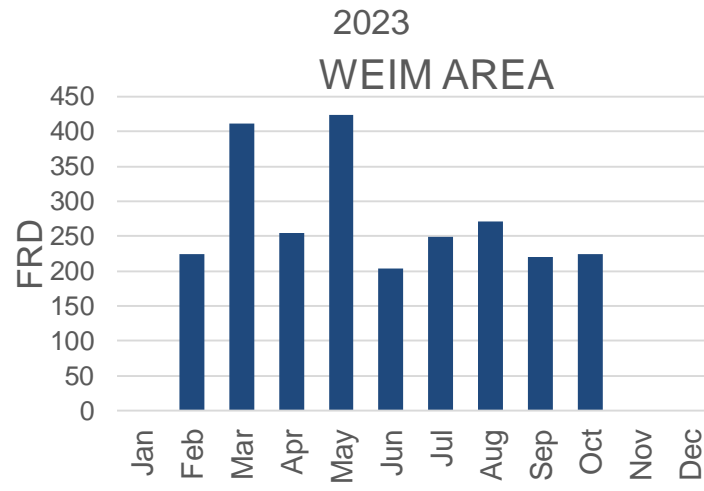
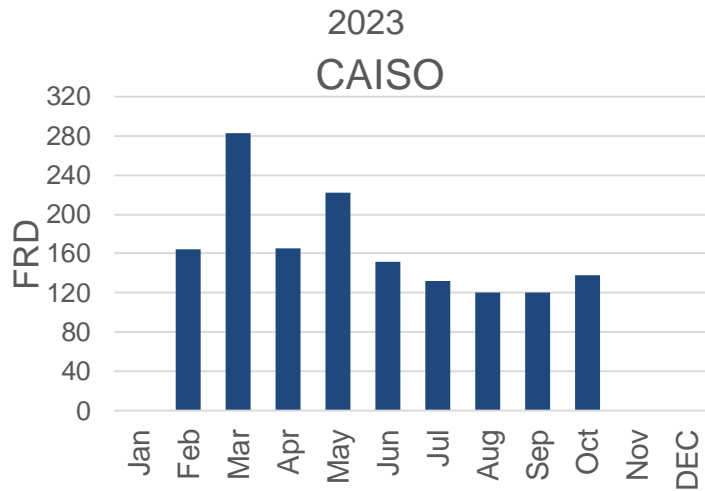
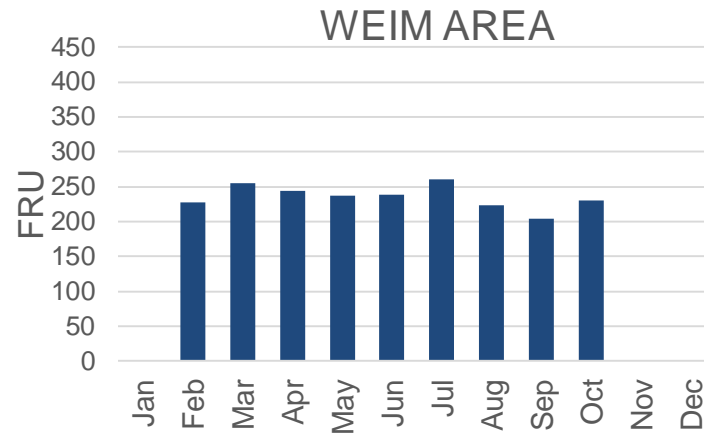
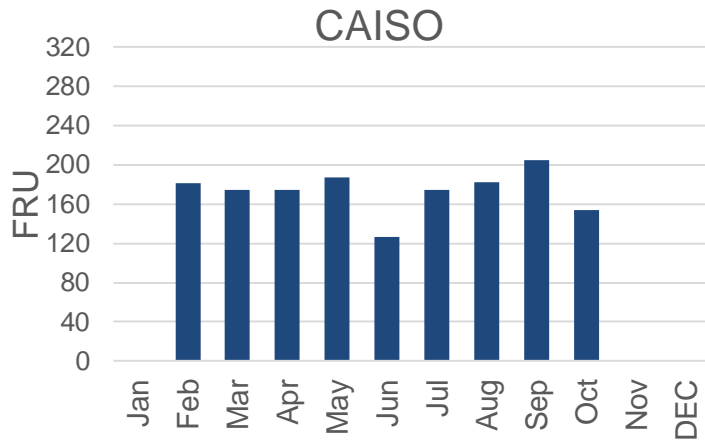
## WEIM AREA



# FRP Requirement



# FRP Exceedance



The ISO working to update the tracking metrics as discussed in the November 29th, MSC.

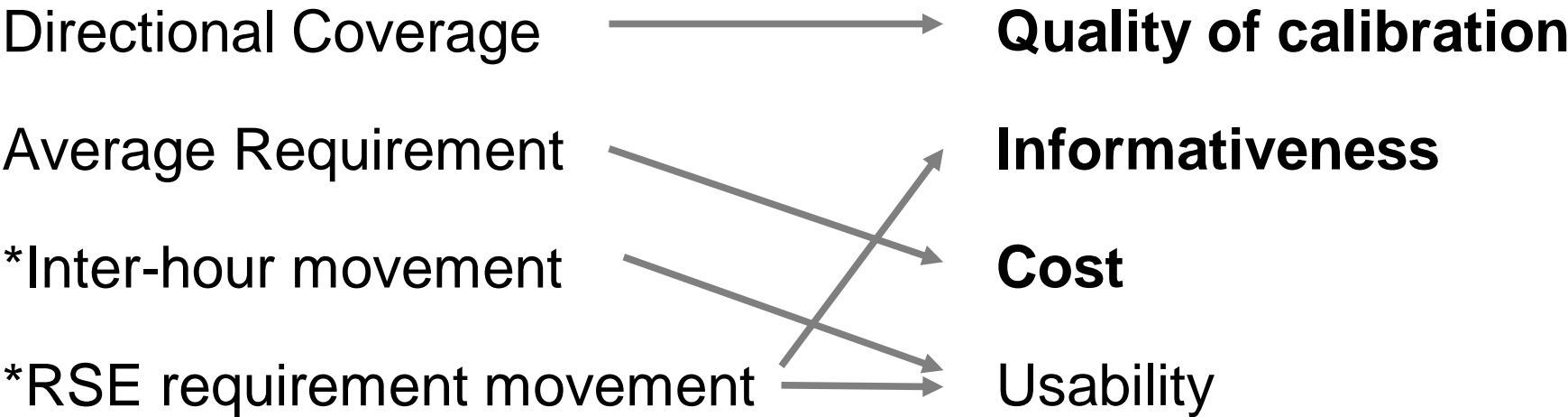


# Performance metrics mapped to key items

How to assess  
requirement  
performance

## Current Performance Metrics:

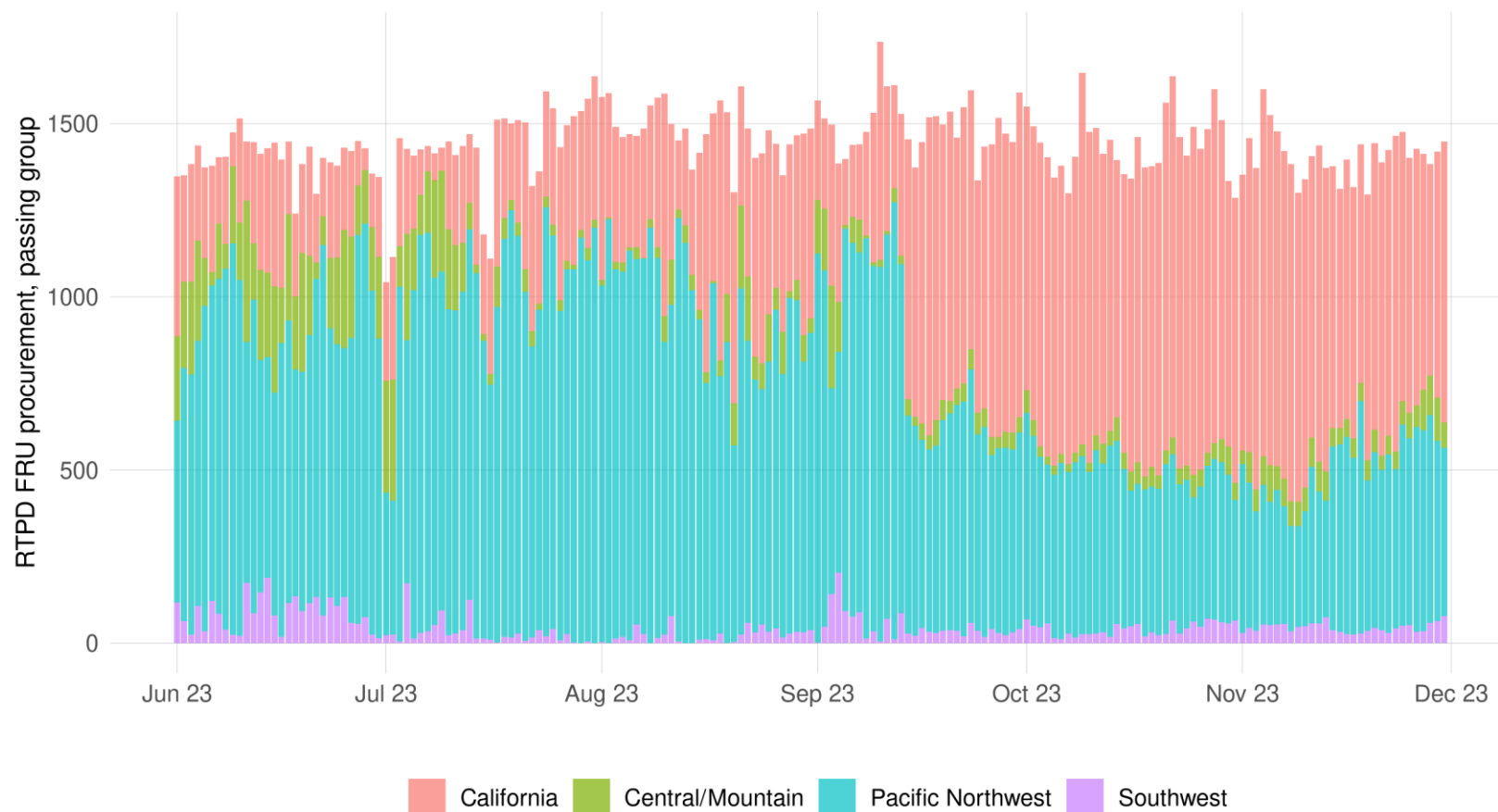
## Key Items:



\*denotes new performance metric

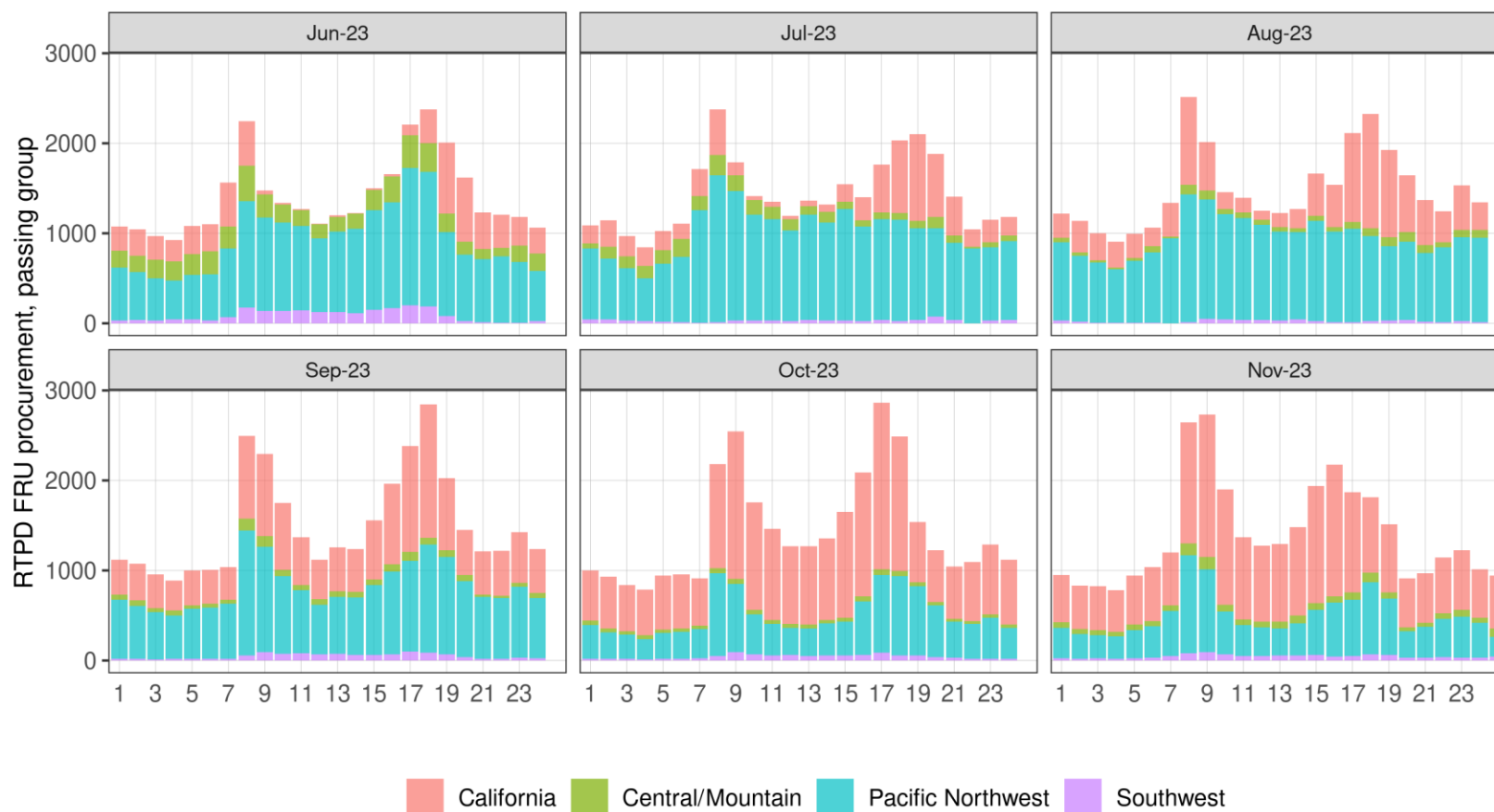
The ISO will work to update performance metrics utilized to analyze FRP requirements in 2024 based off the design presented in the November Market Surveillance Committee meeting.

# Upward FRP is largely procured from areas in the southwest and California

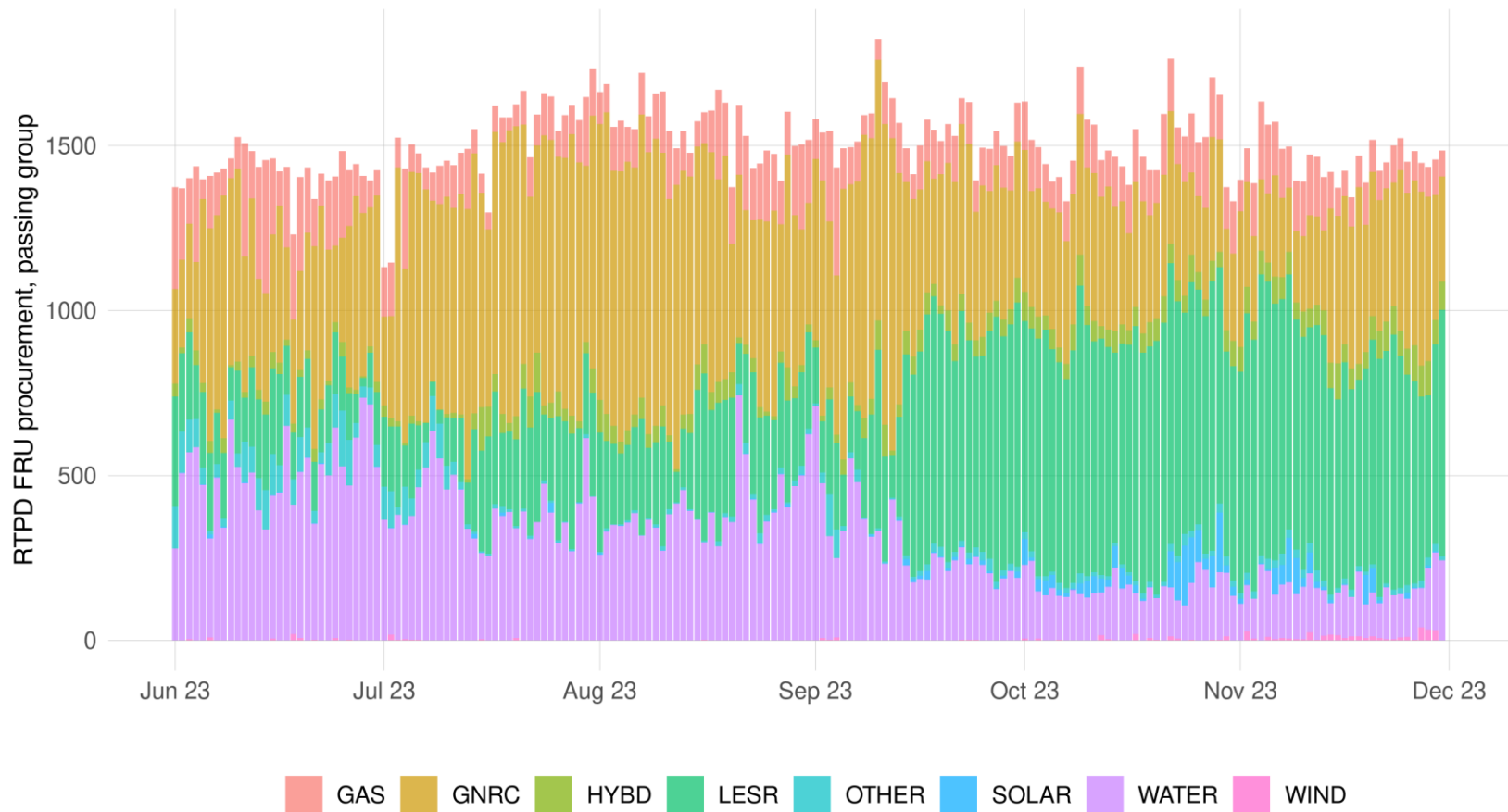




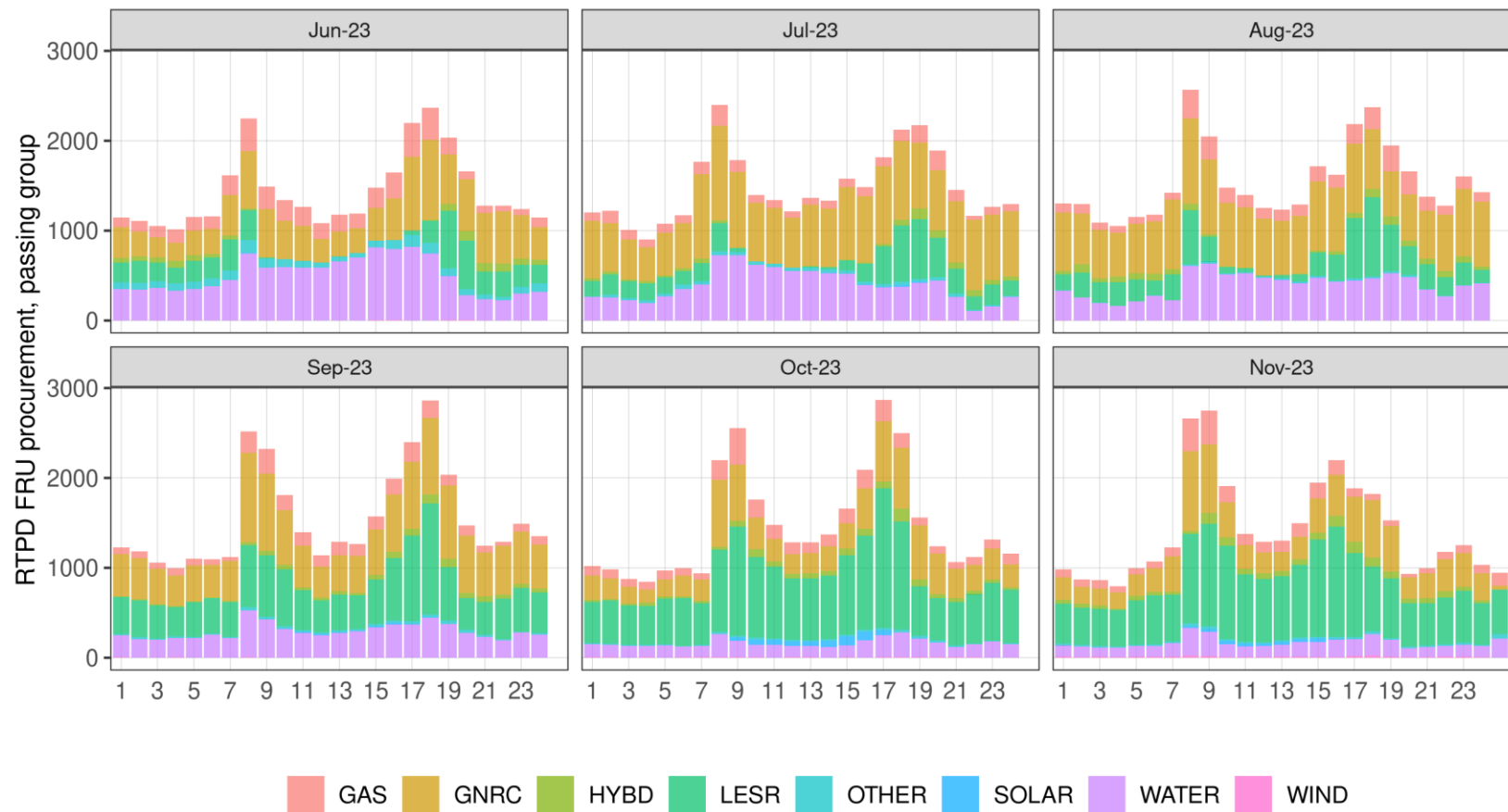
Upward FRP procurement from CAISO area is largely occurring in midday hours when solar production is plentiful and months with modest demand level



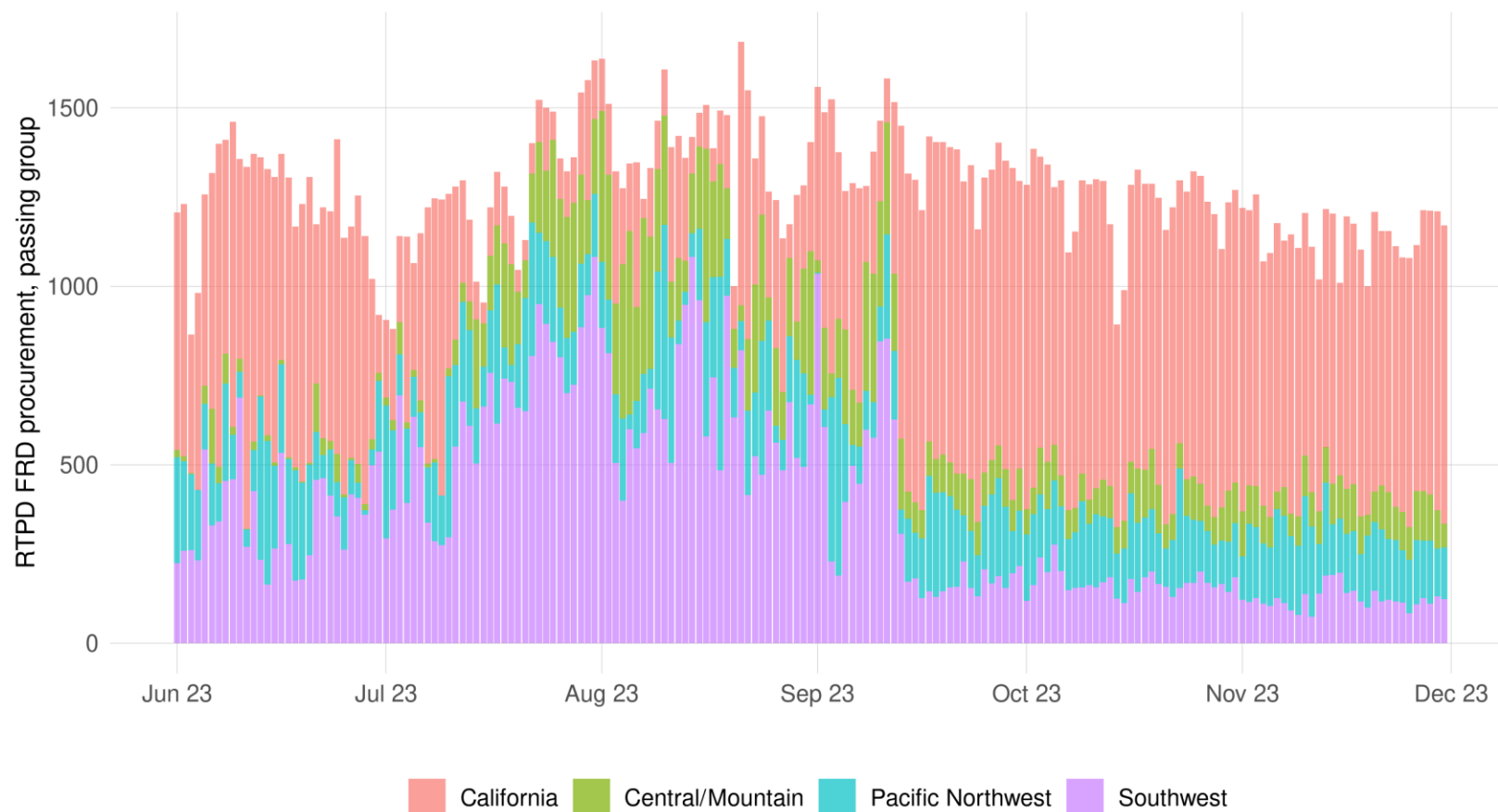
# Upward FRP procurement is supported by various types of technologies



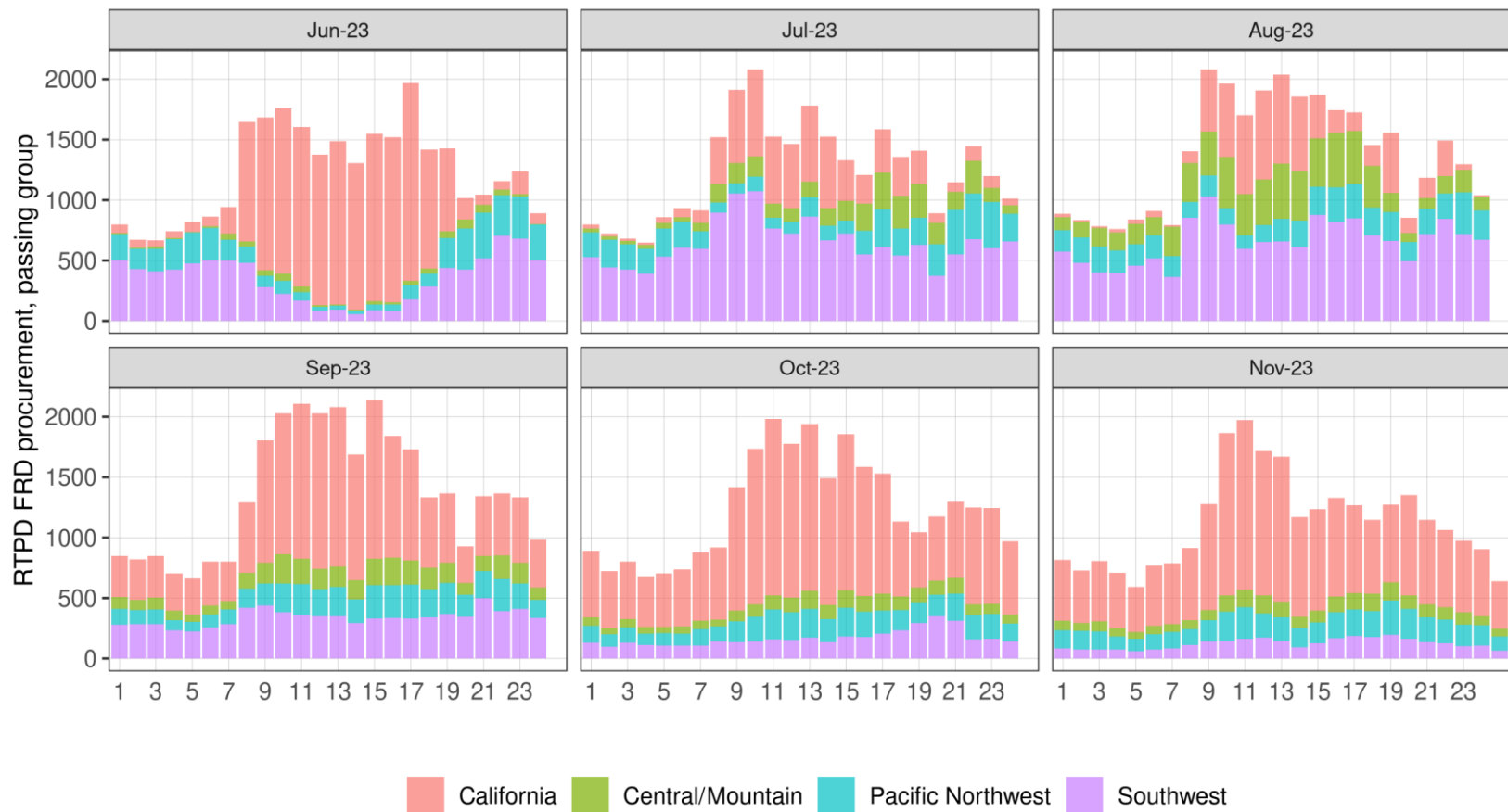
# Storage resources tend to support upward FRP procurement for evening ramping hours



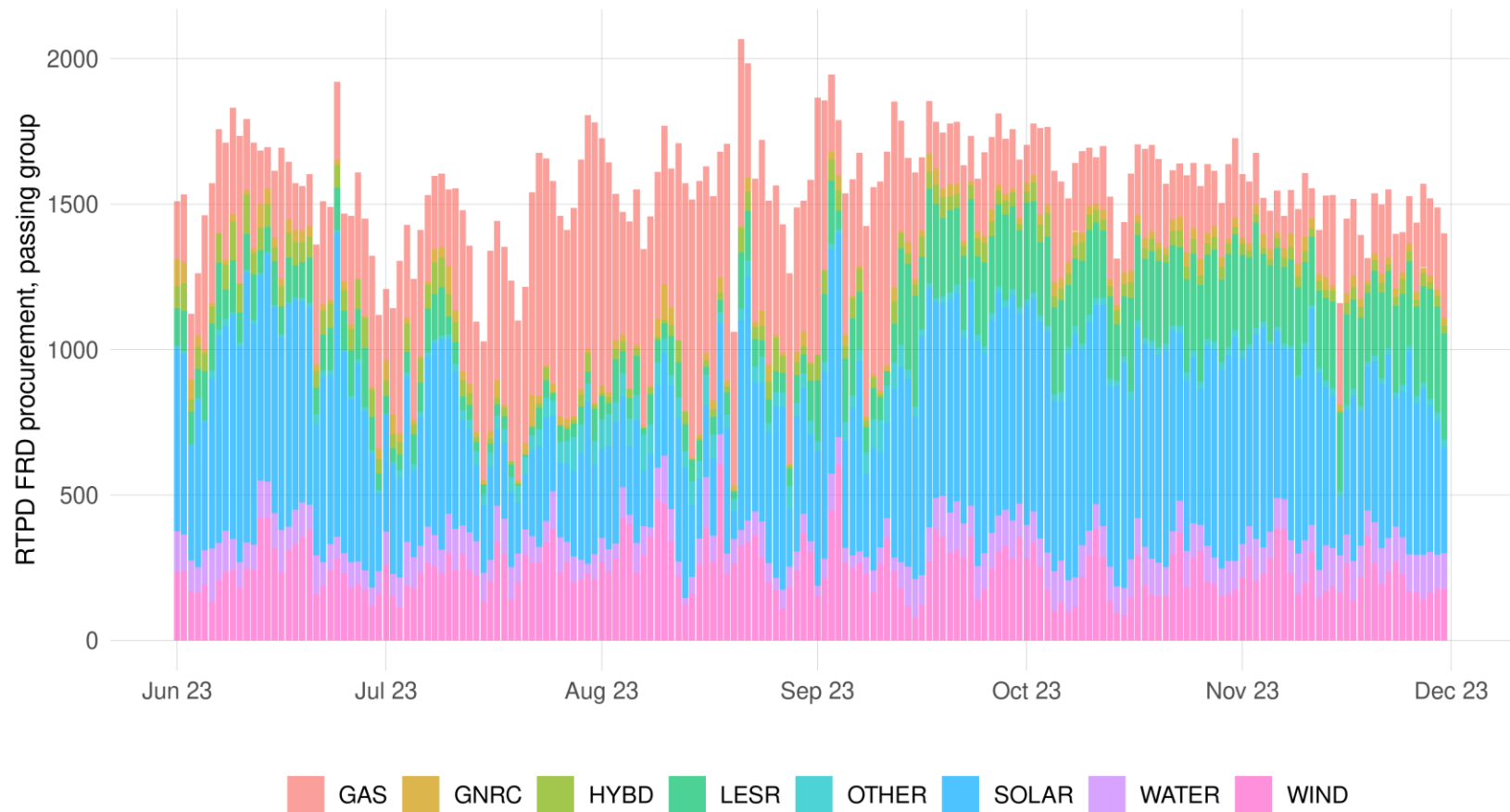
# Downward FRP is largely procured from areas in the southwest, California, and Pacific Northwest



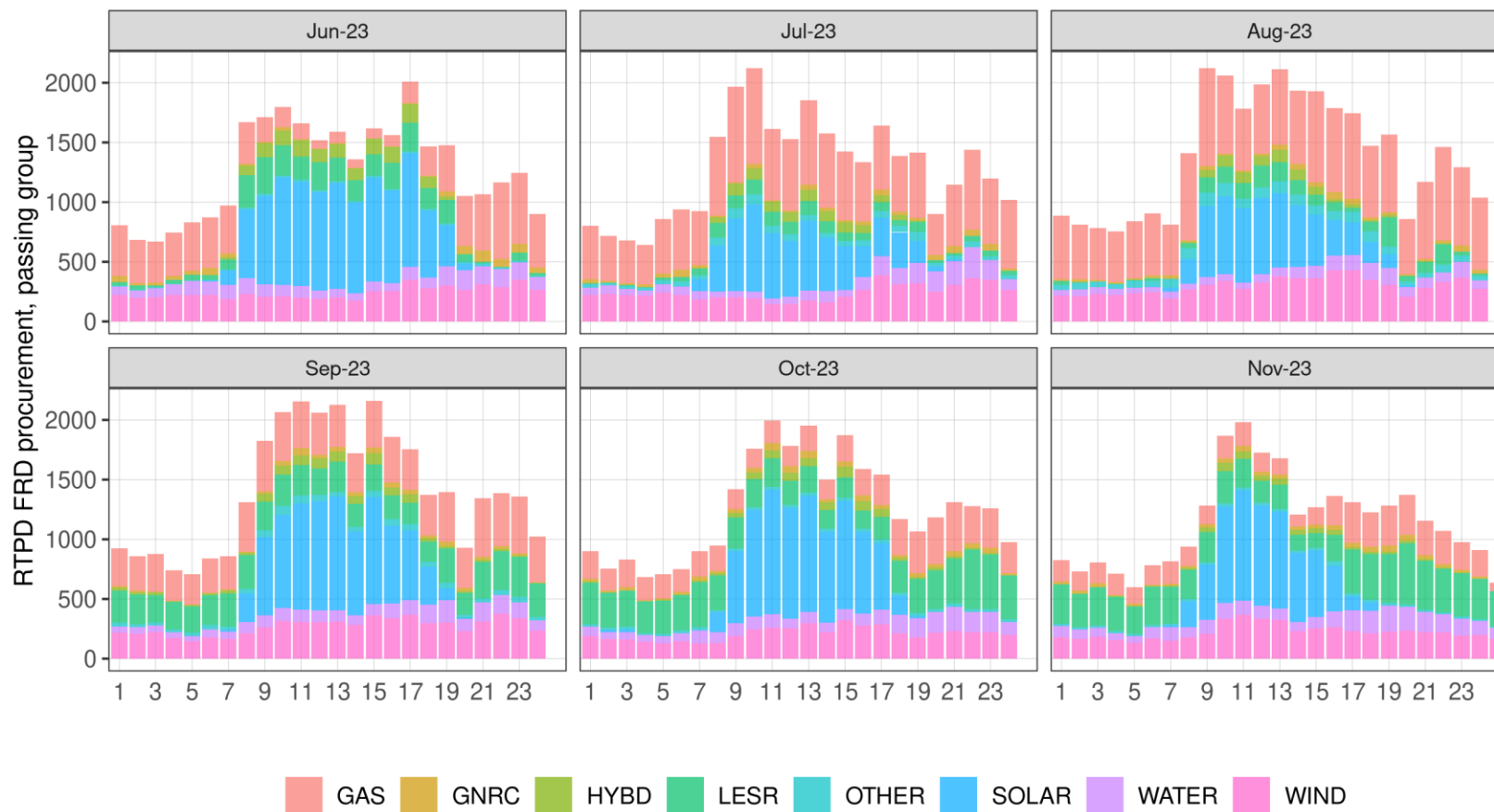
# California tends to support midday hours in the downward direction



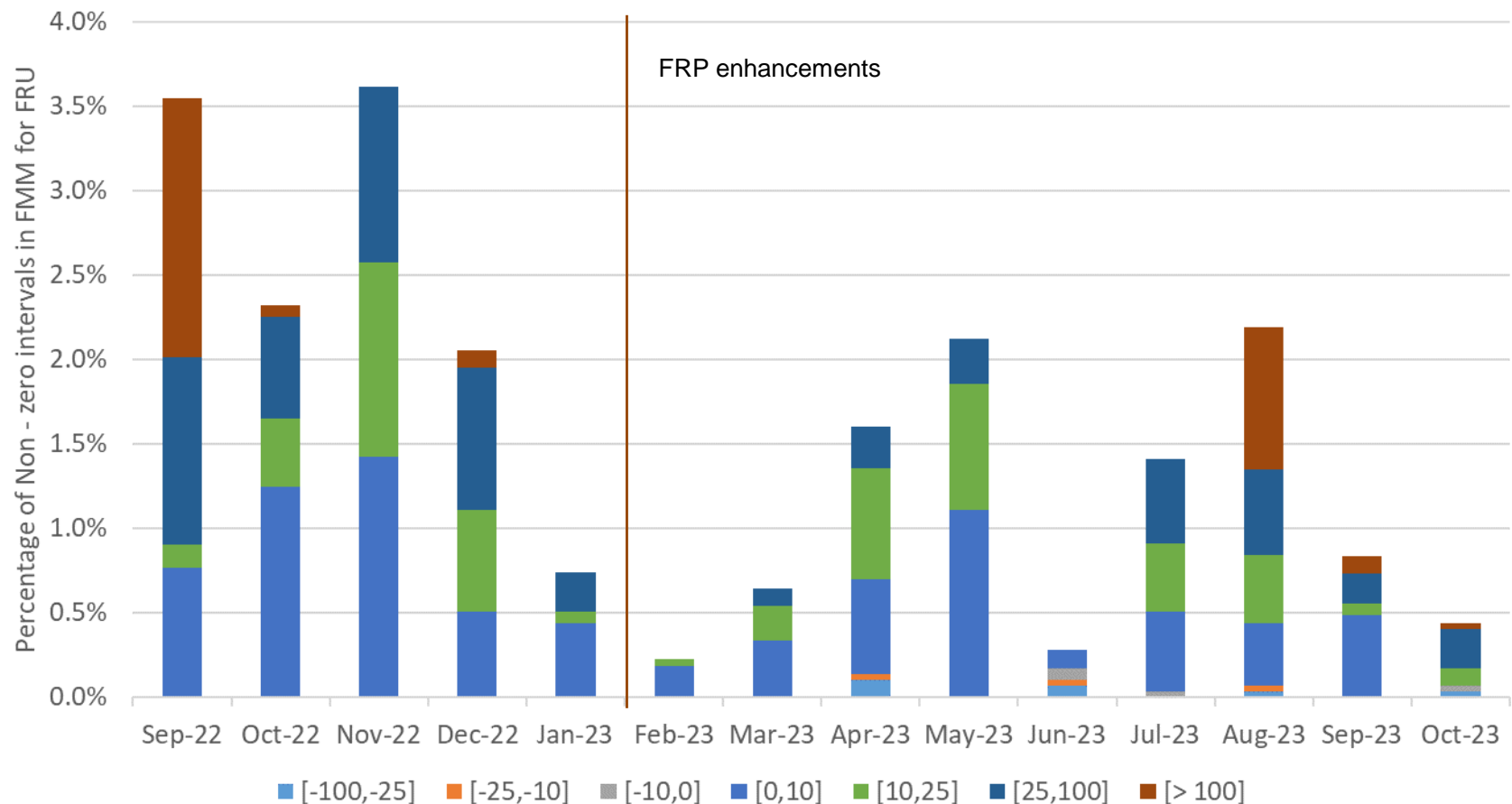
# Downward FRP procurement is supported by various types of technologies



# Solar resources tend to support midday hours in the downward direction

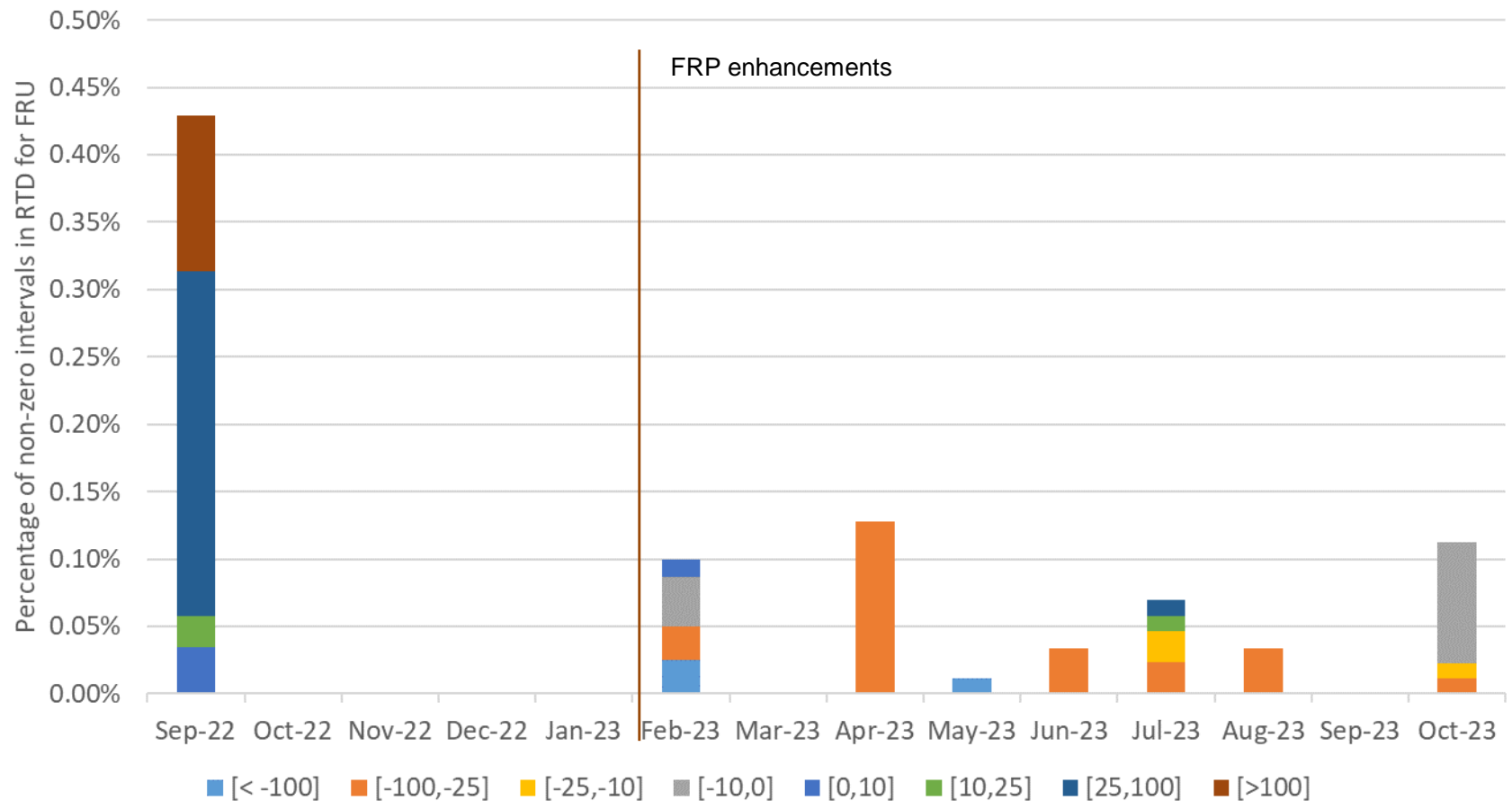


# Frequency of intervals with non-zero FMM prices for upward FMM continues to be low after nodal implementation



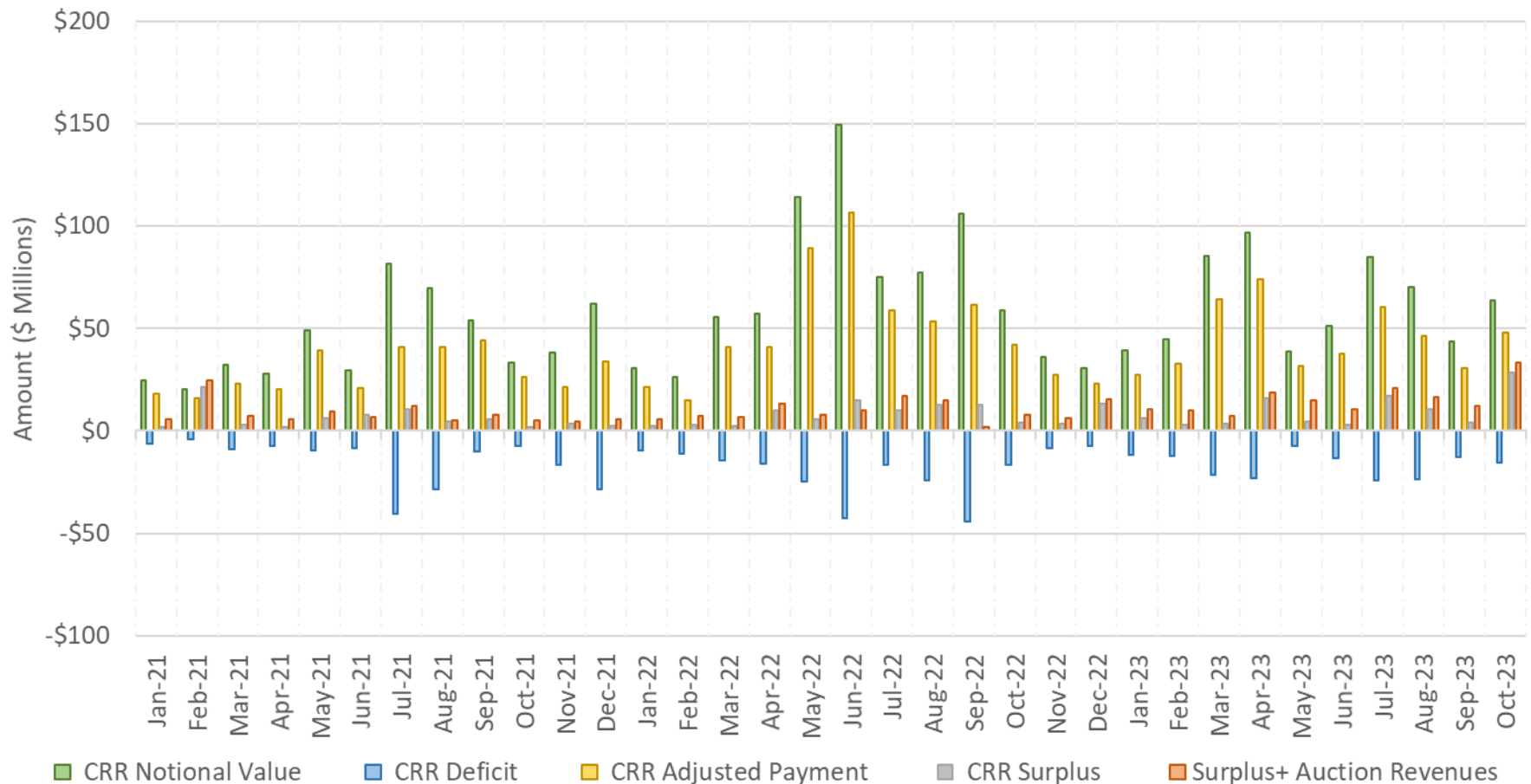


# Frequency of intervals with non-zero RTD prices for upward FRP continues to be low after nodal implementation

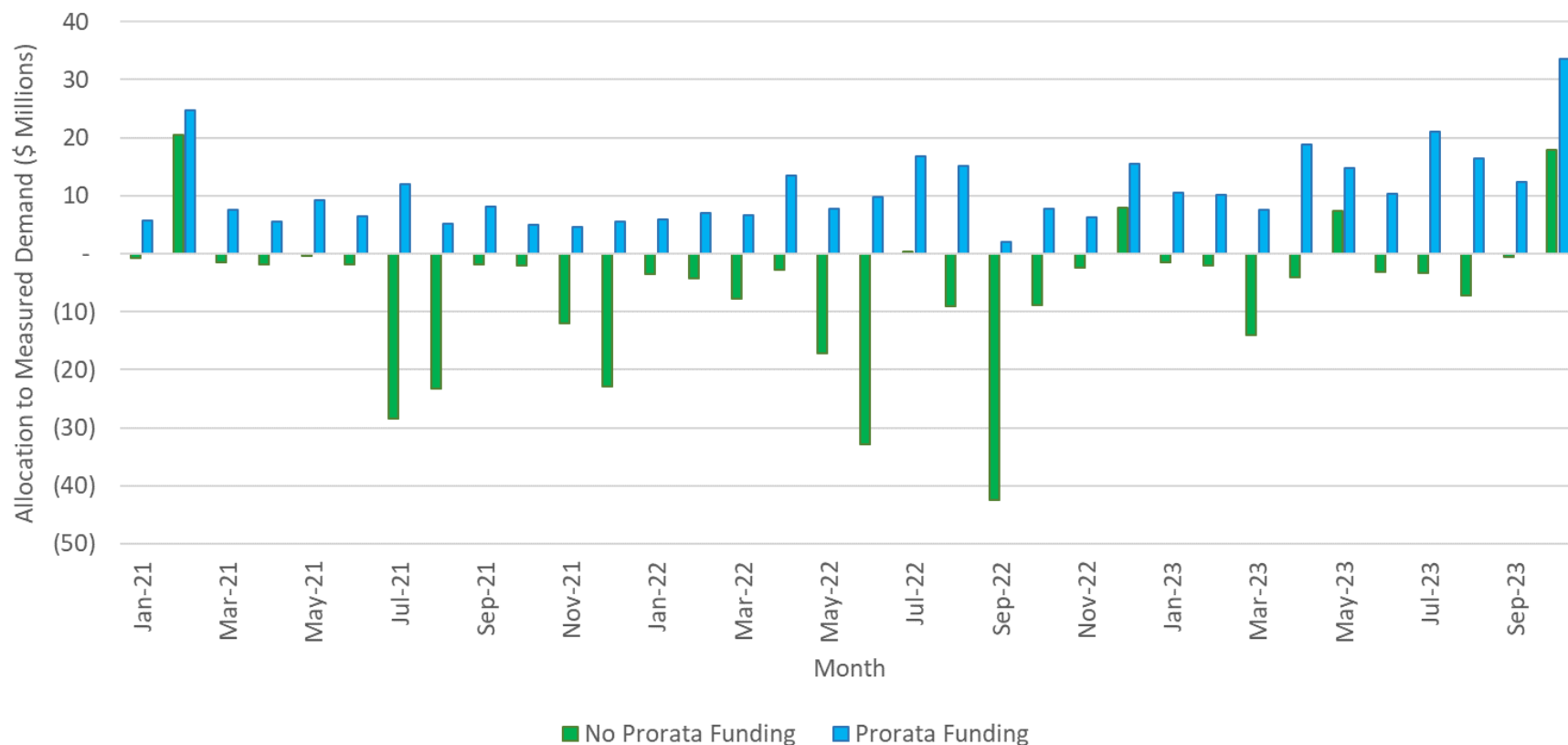


# CRR Update

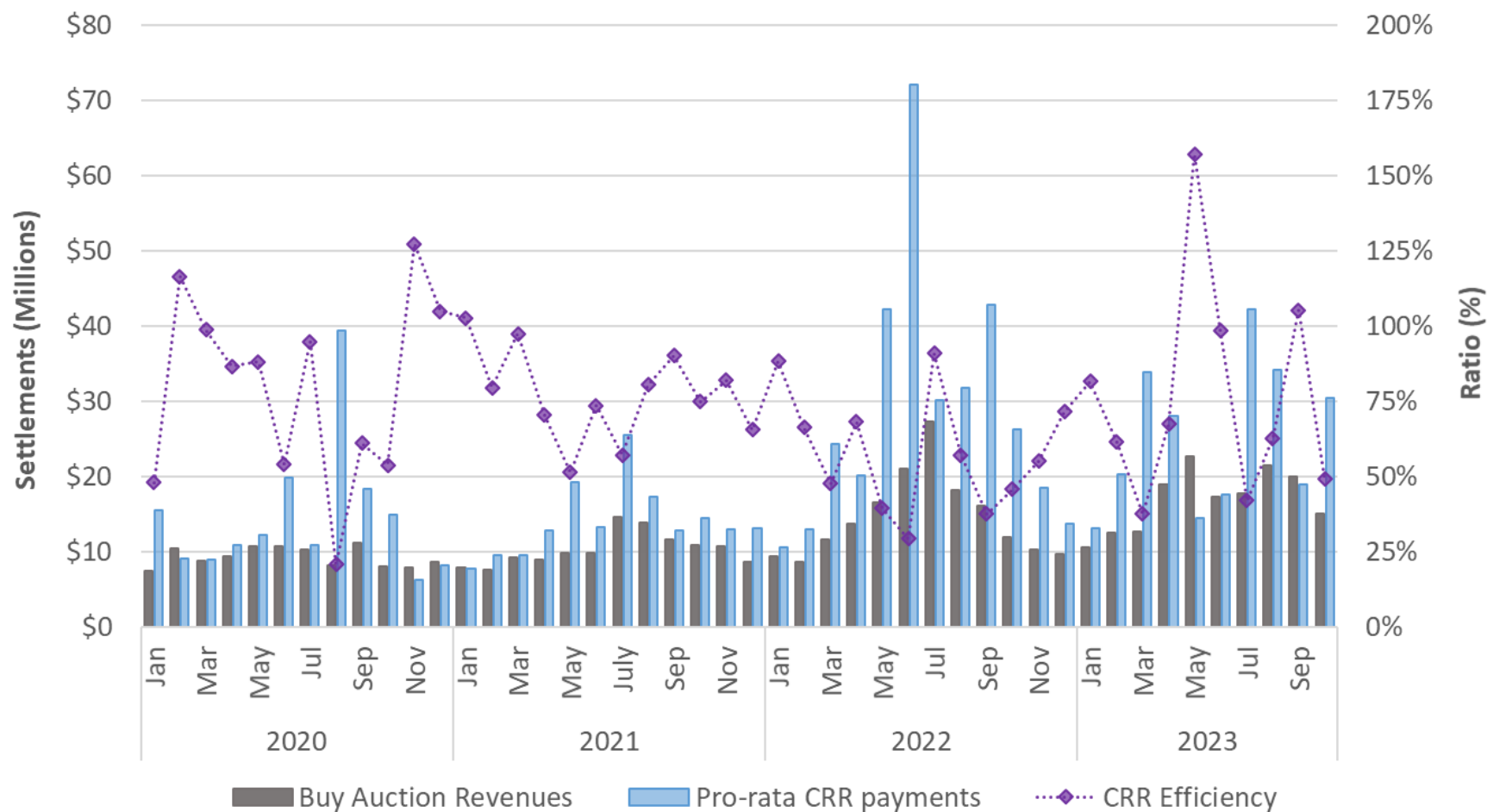
# The magnitude of the overall CRR settlements has decreased after summer



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

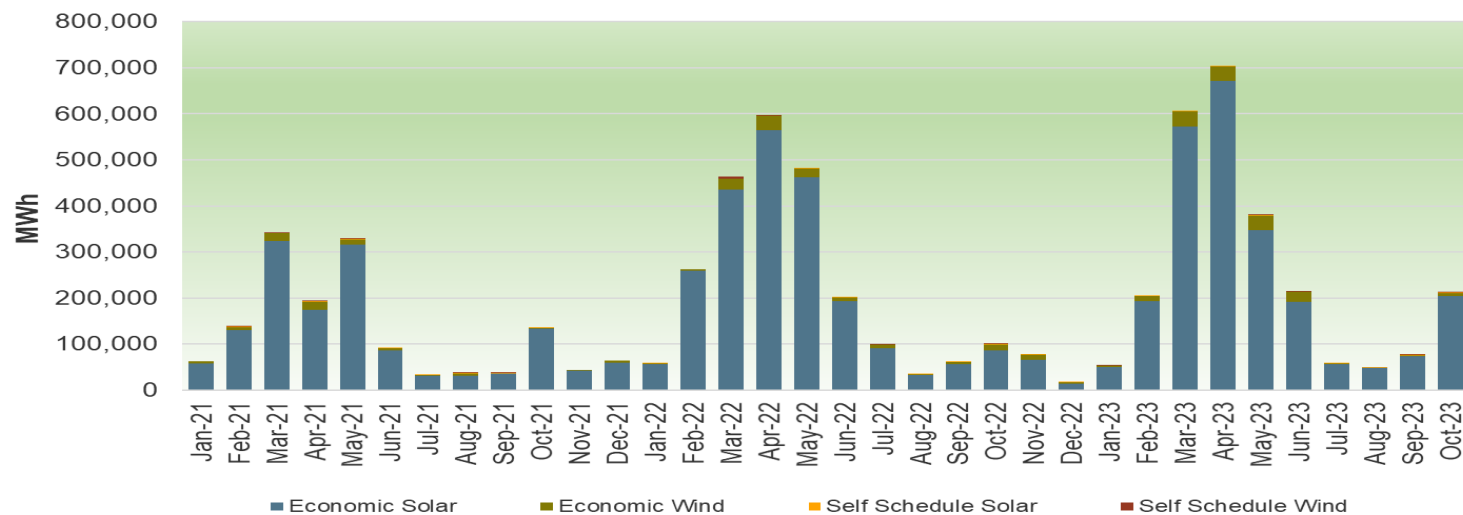
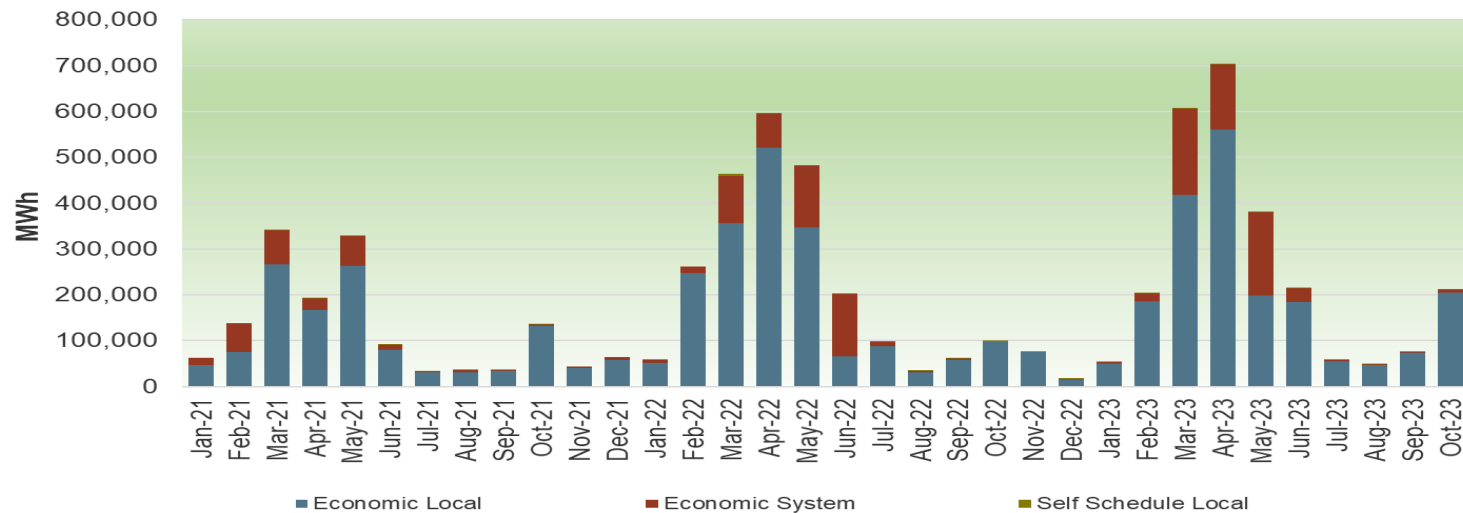


# Auction efficiency has been fairly variable based on level of congestion observed

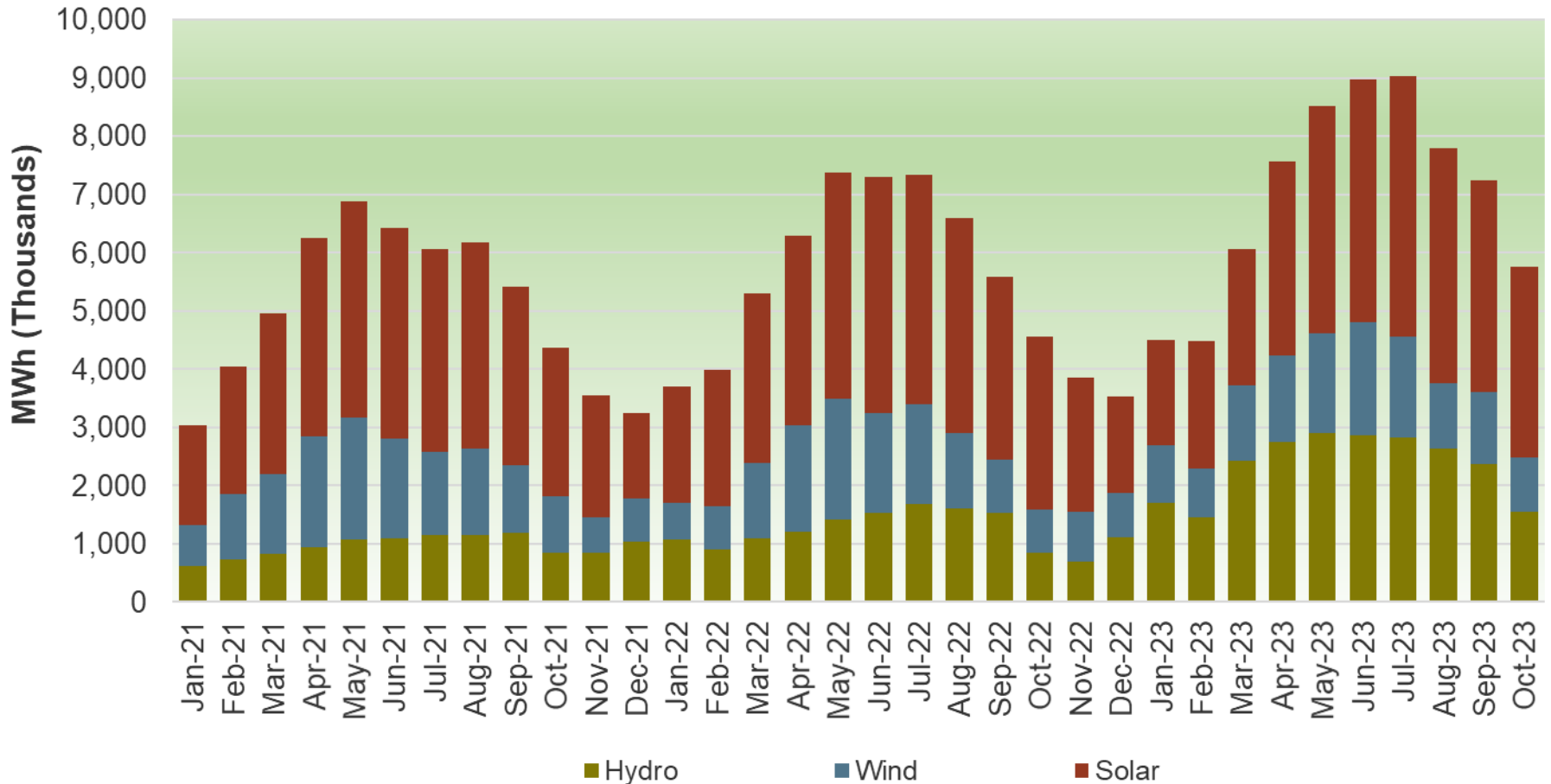


# Market Performance Metrics

# RTD renewable (VERs) curtailment rose in October

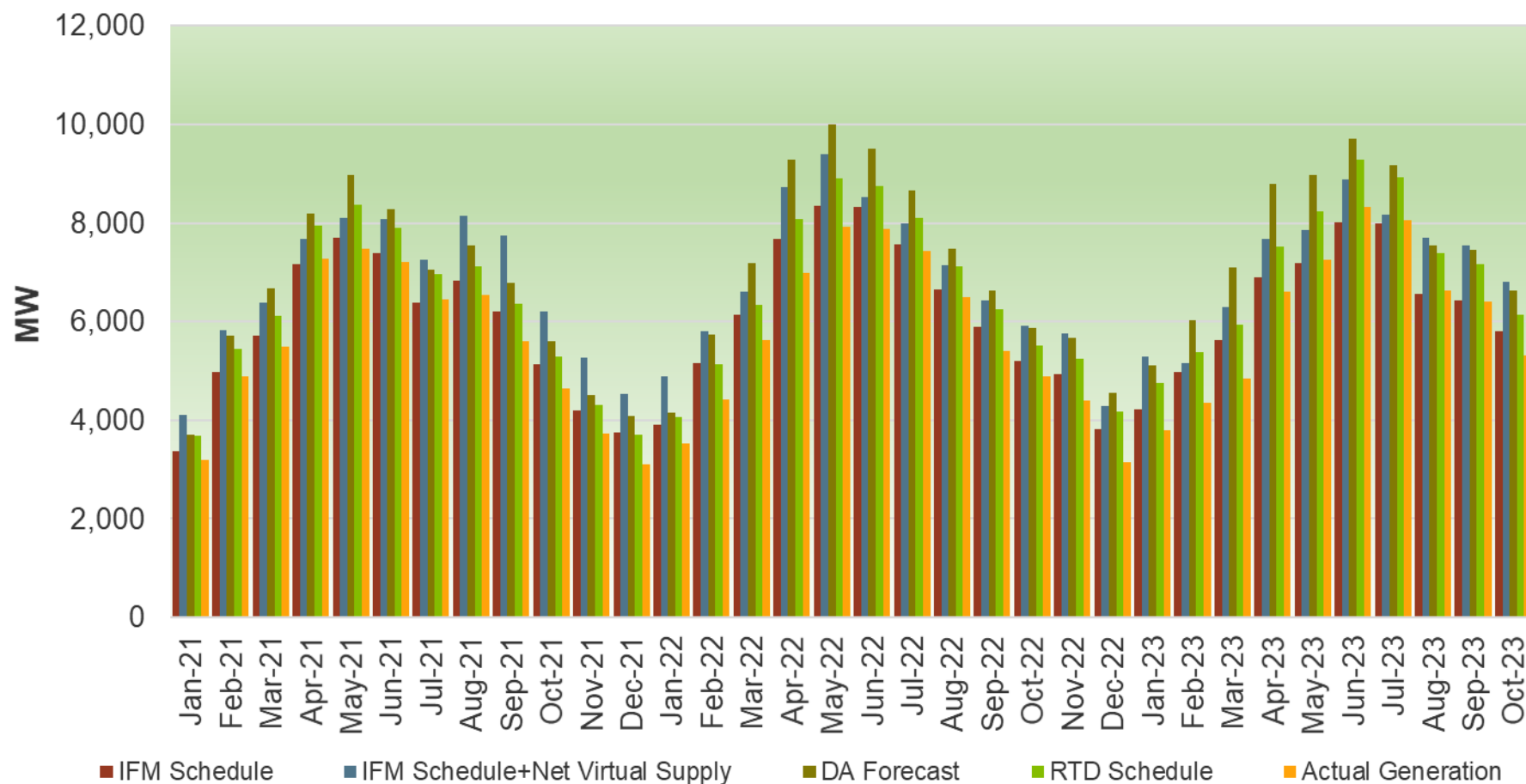


# Hydro production higher than previous years

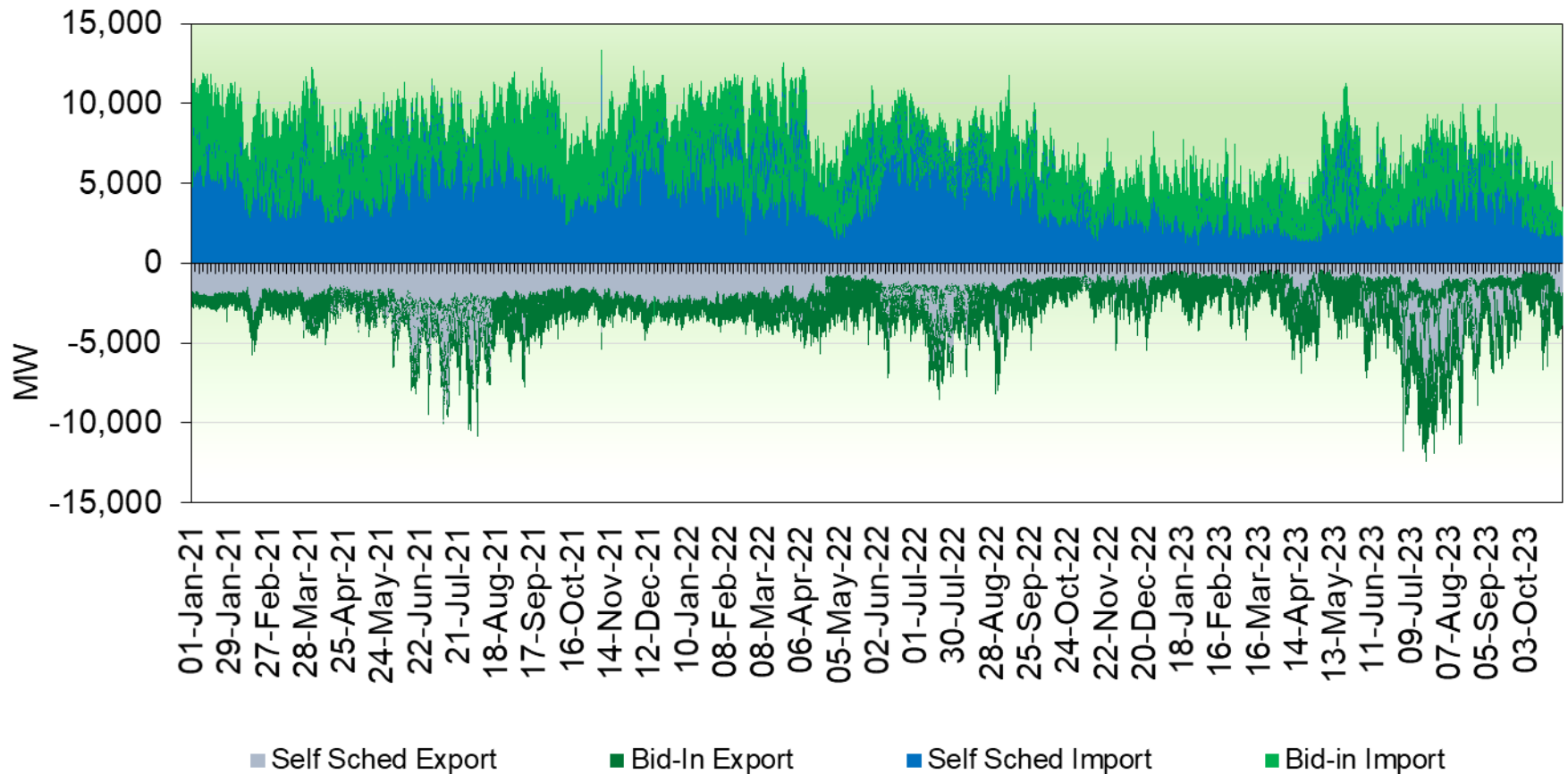




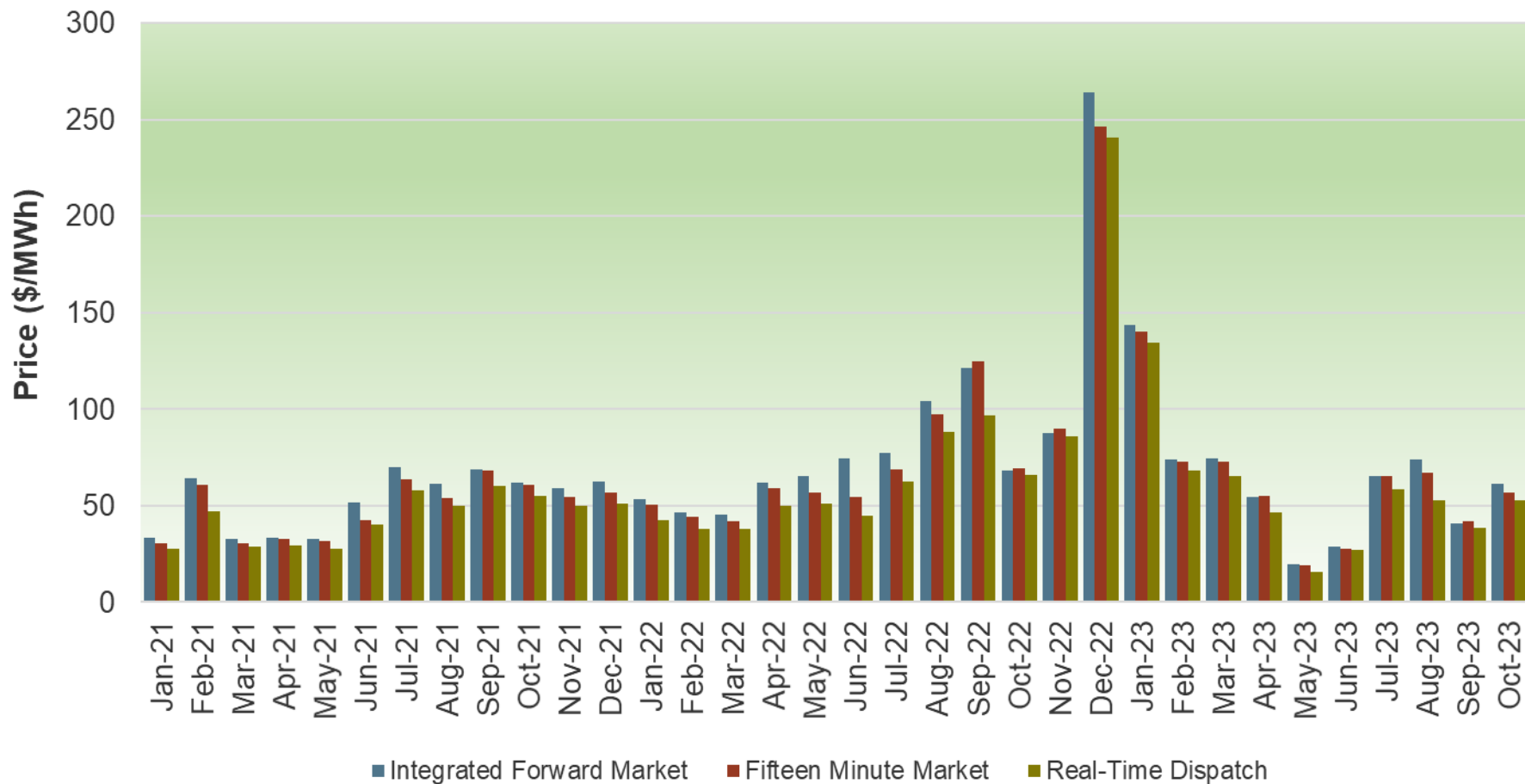
# ISO total monthly VERS schedules and forecasts compared to actuals



# Self scheduled exports fell in October

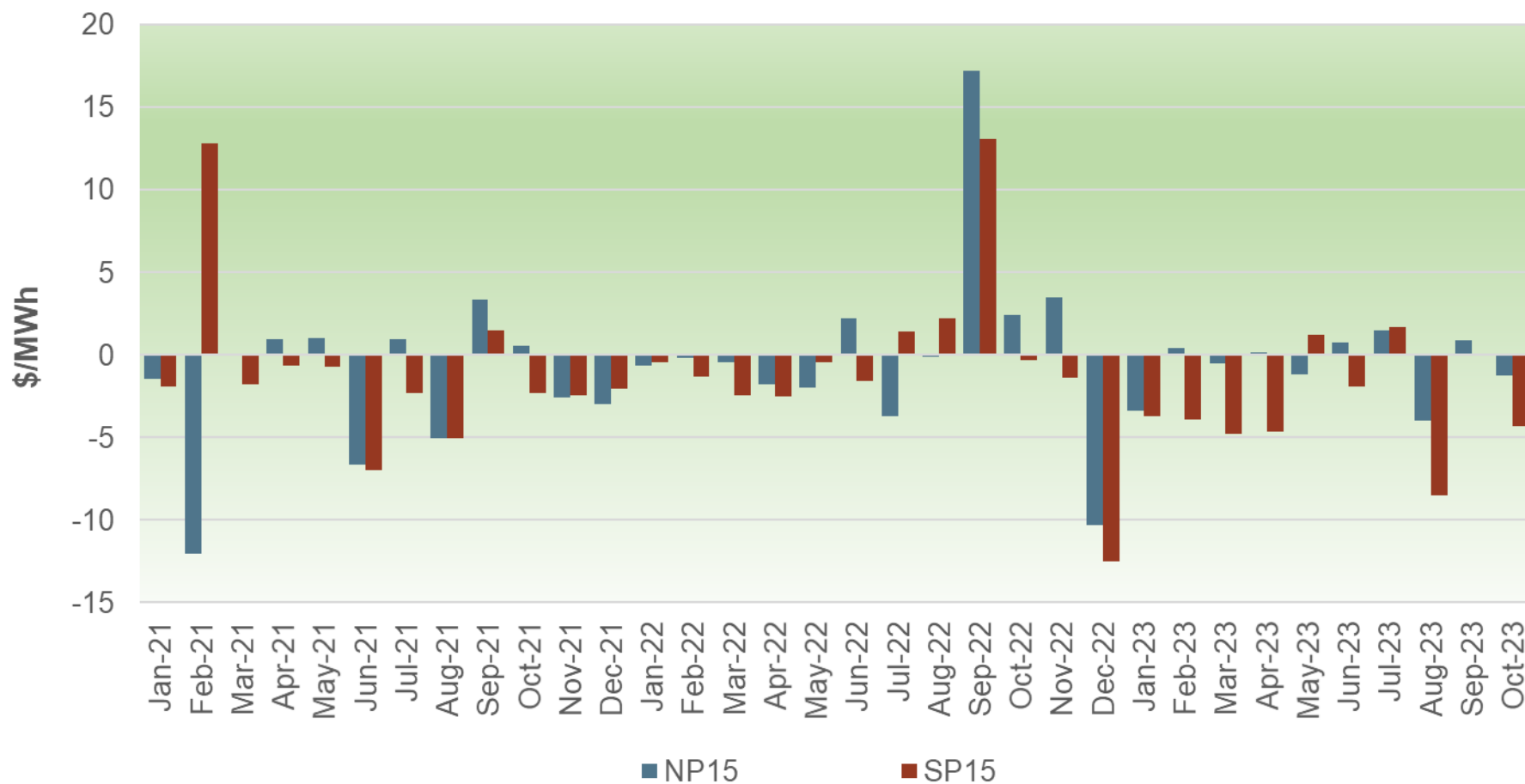


# Prices decreased in September due to mild temperature

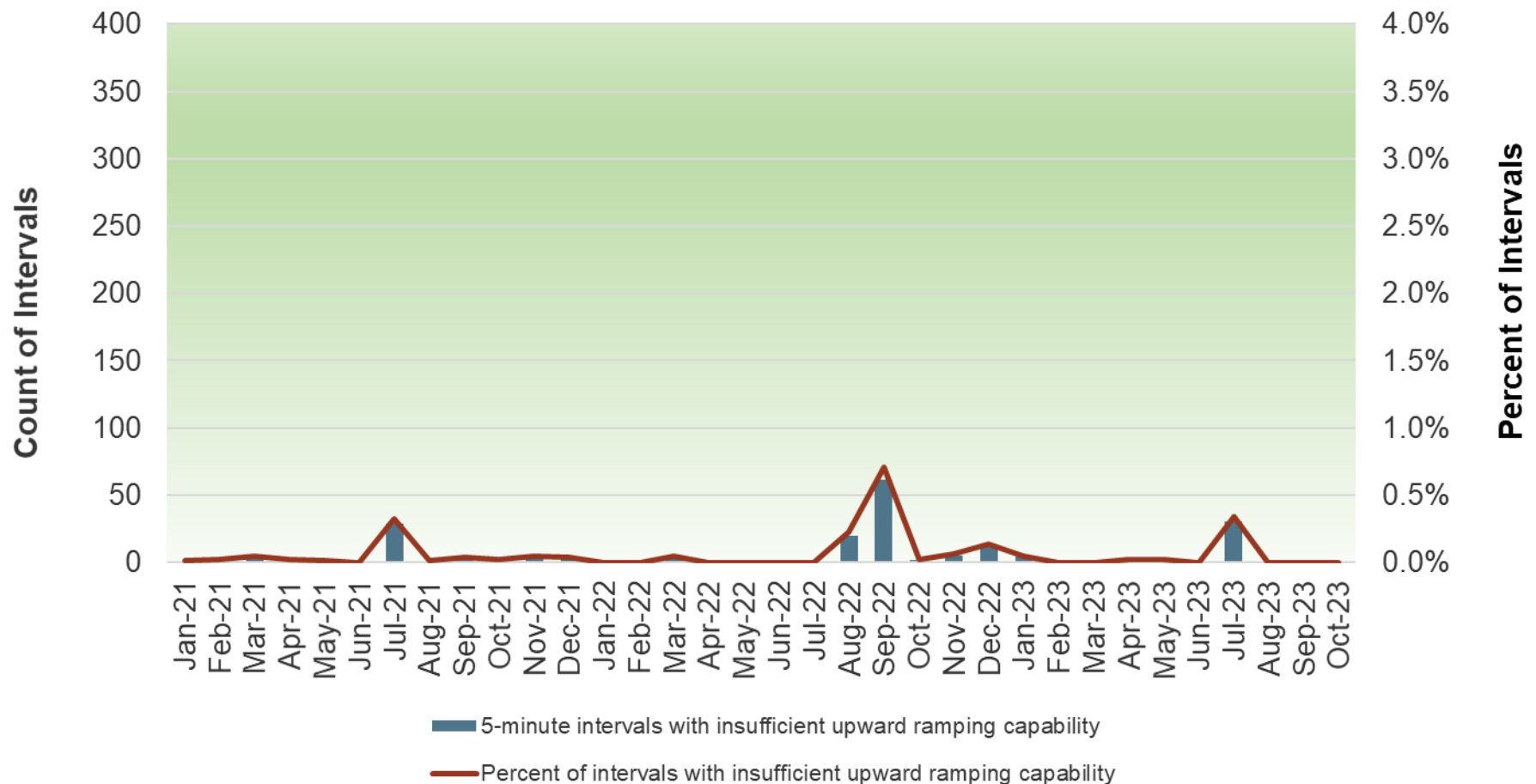


Note: Metric Based on System Marginal Energy Component (SMEC)

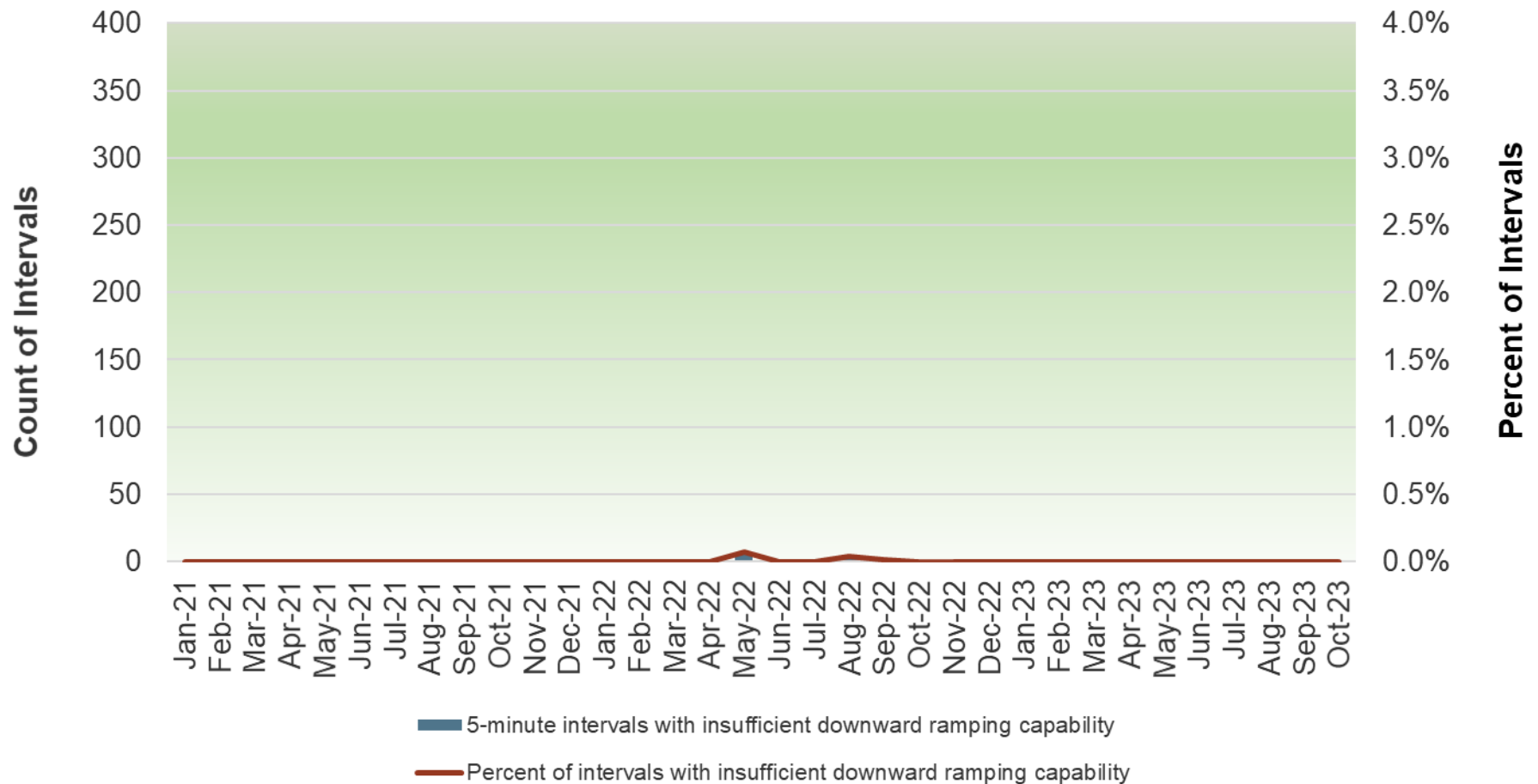
## Real-time prices lower than day-ahead prices for both NP15 and SP15 in October



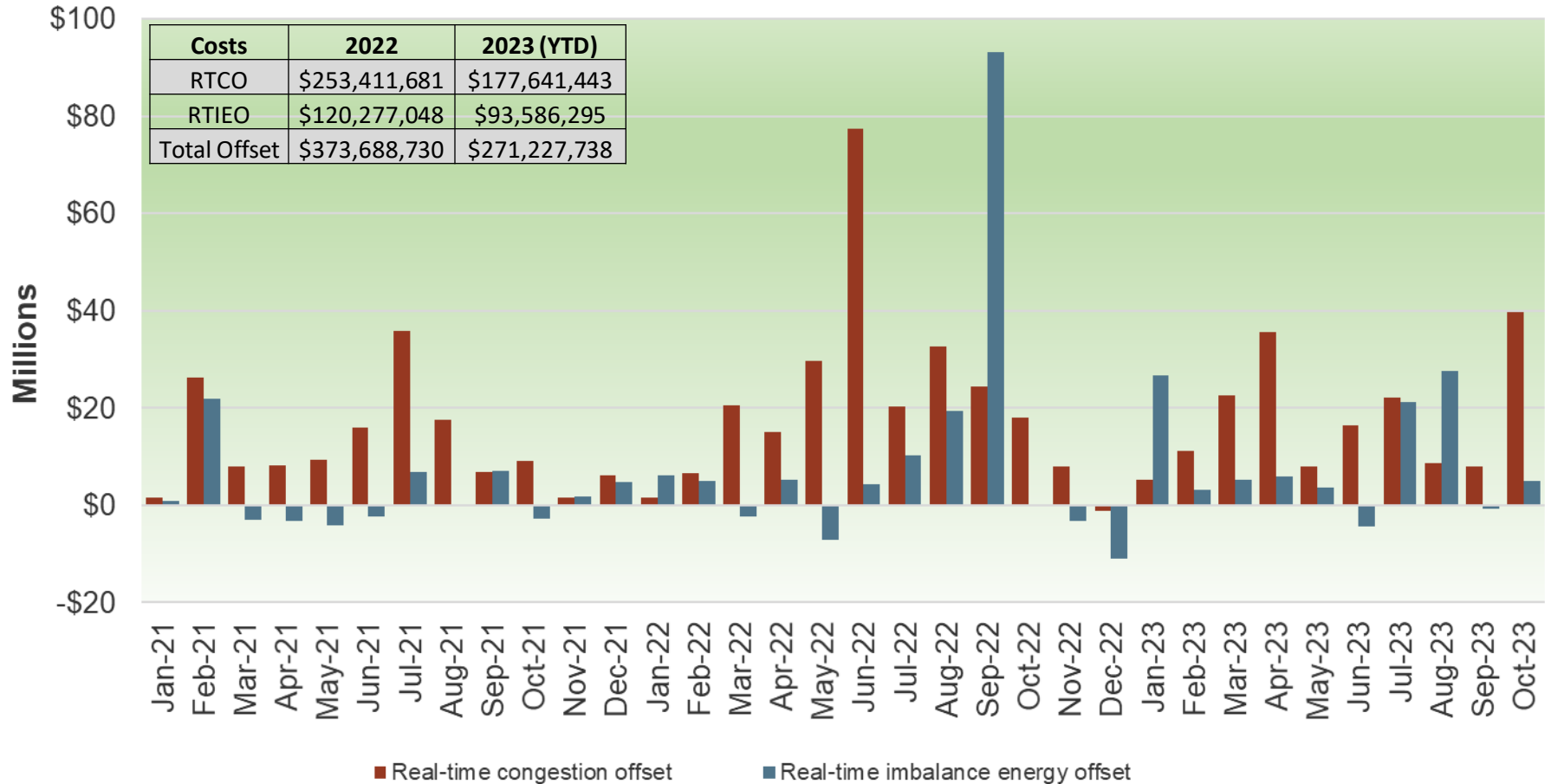
# Insufficient upward ramping capacity in ISO real-time remained at low levels



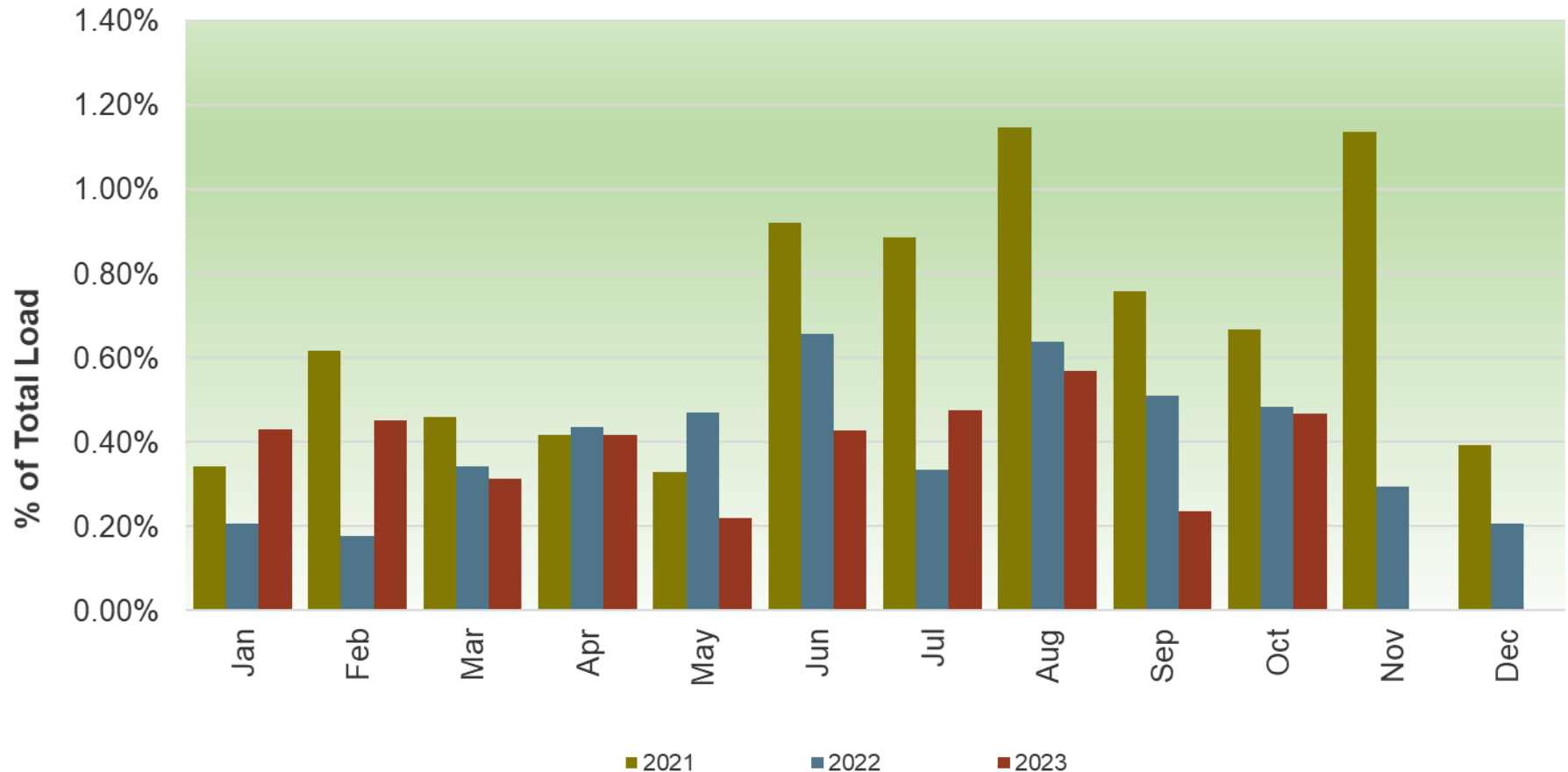
# Insufficient downward ramping capacity in real-time stayed low



# ISO area real-time congestion offset increased in October

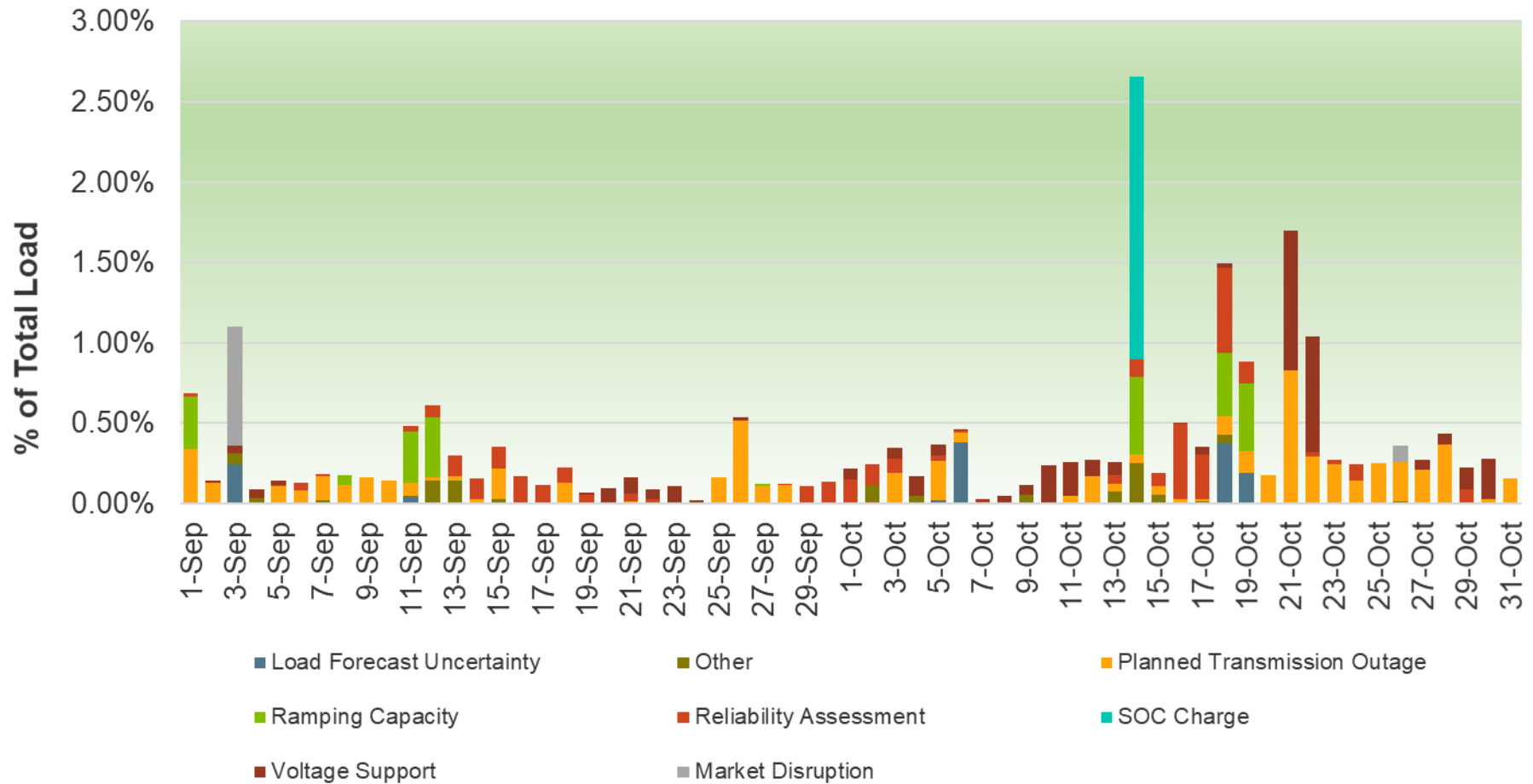


# Exceptional dispatch volume in the ISO area are at low levels

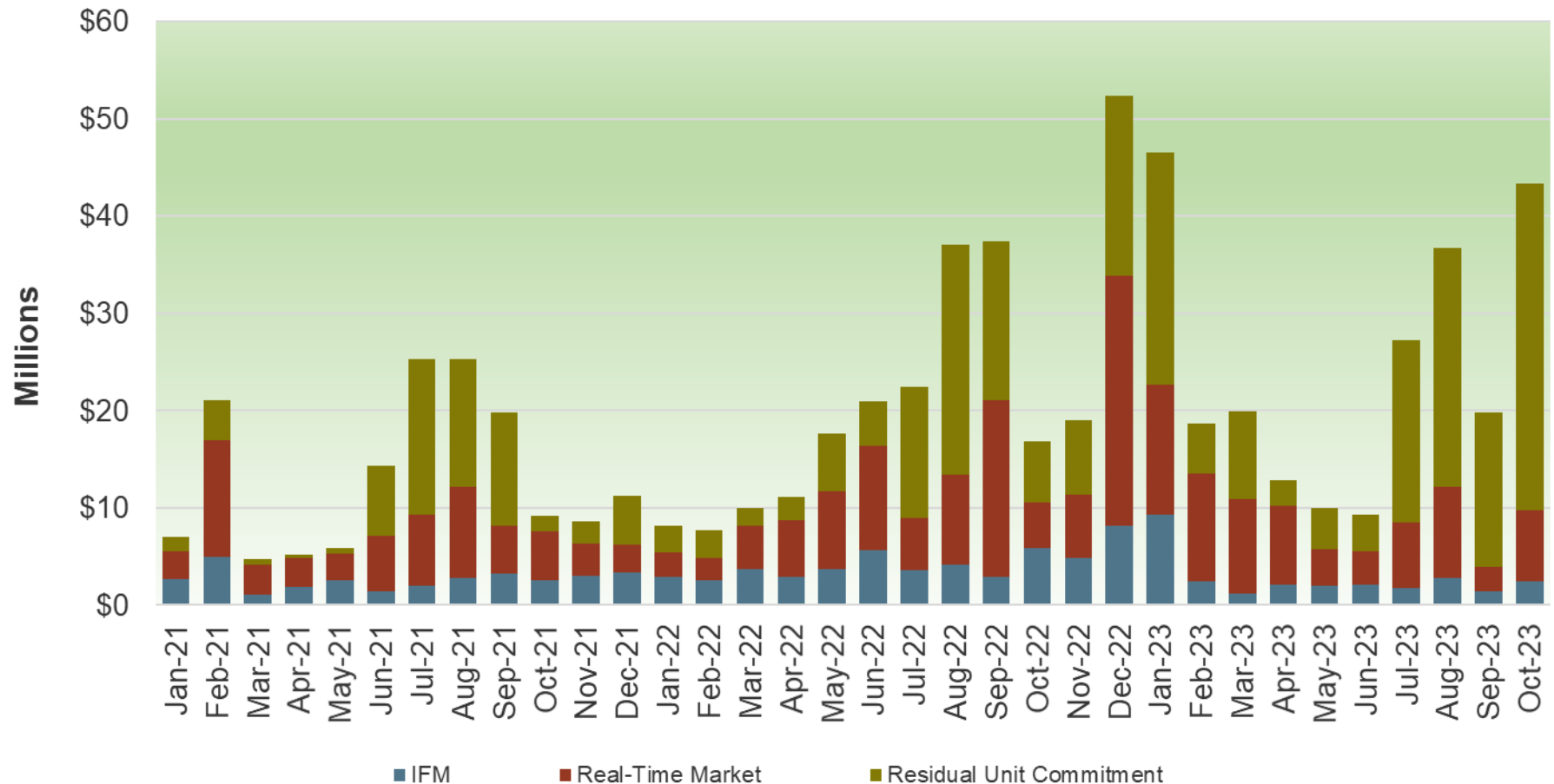




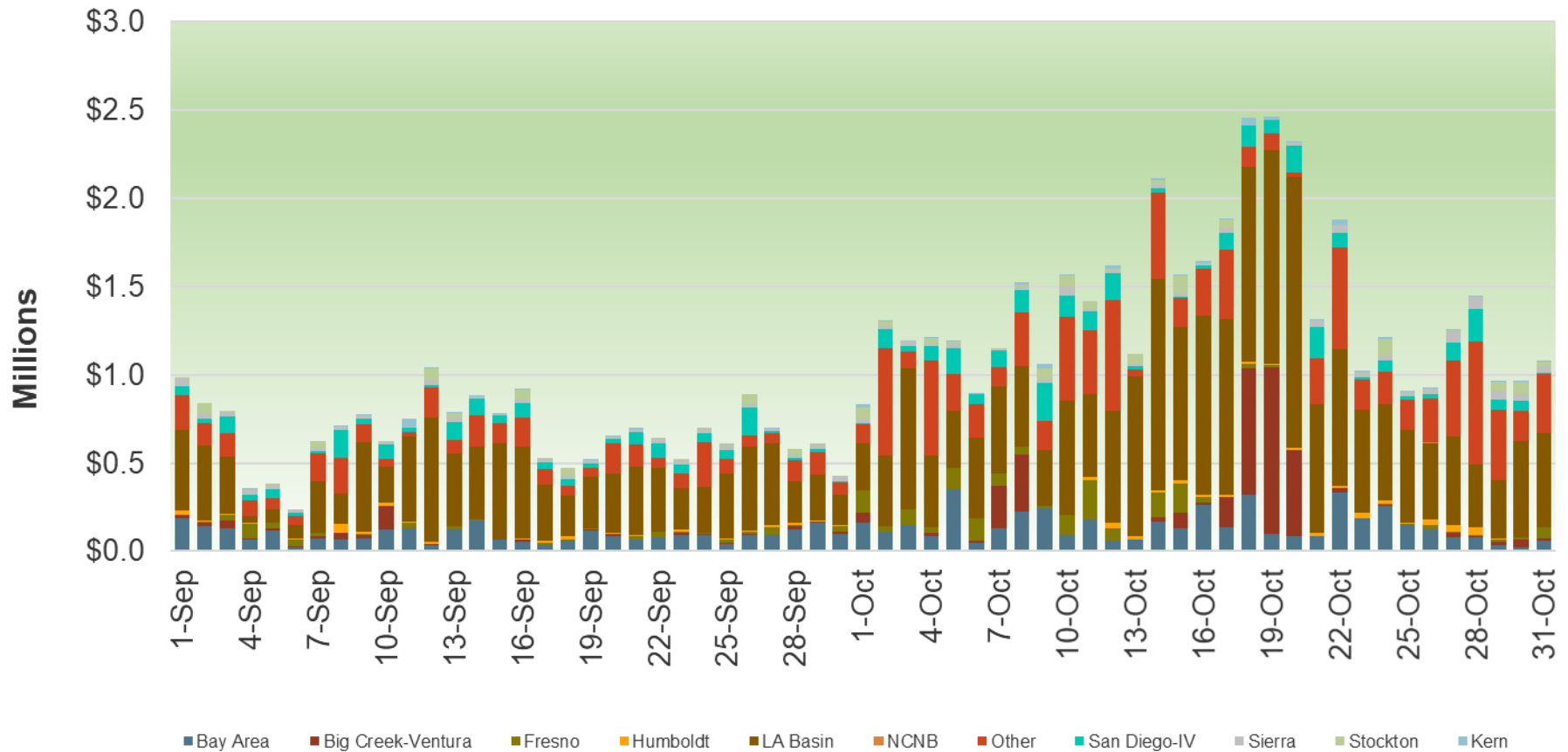
# Exceptional dispatches volume driven by a variety of reasons



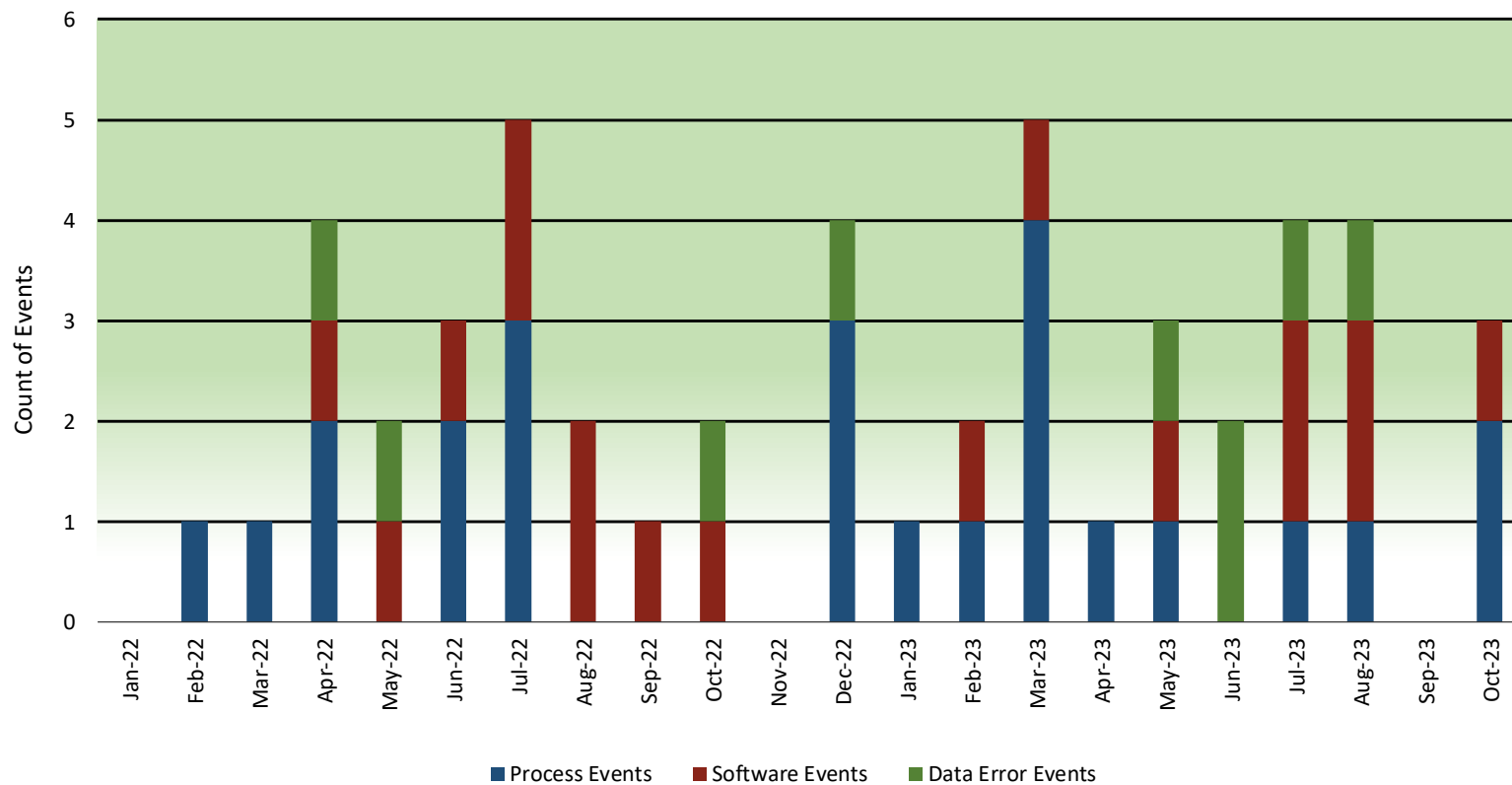
## Bid cost recovery in RUC increased in recent months due to use of higher RUC adjustments



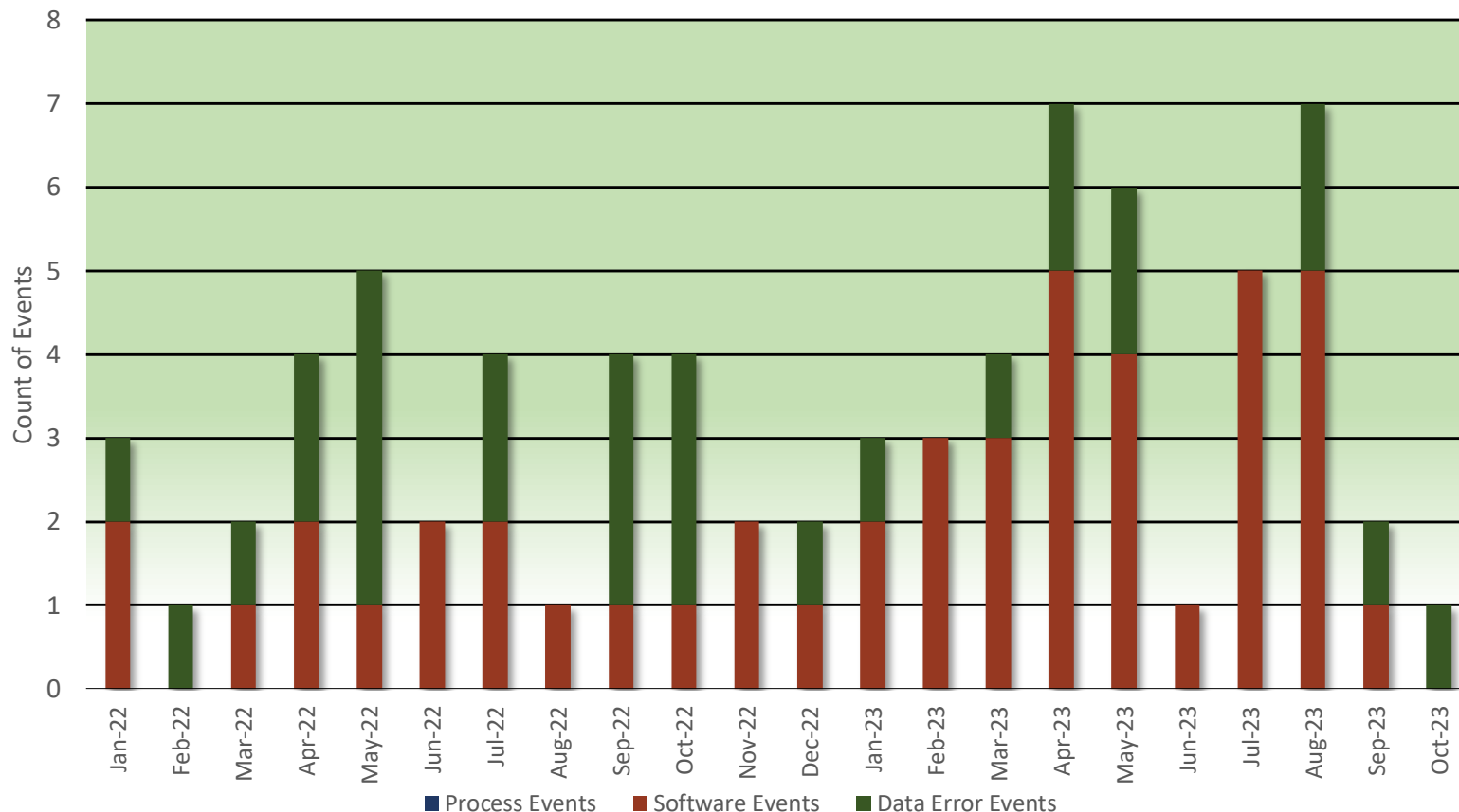
# Bid cost recovery (BCR) by Local Capacity Requirement area



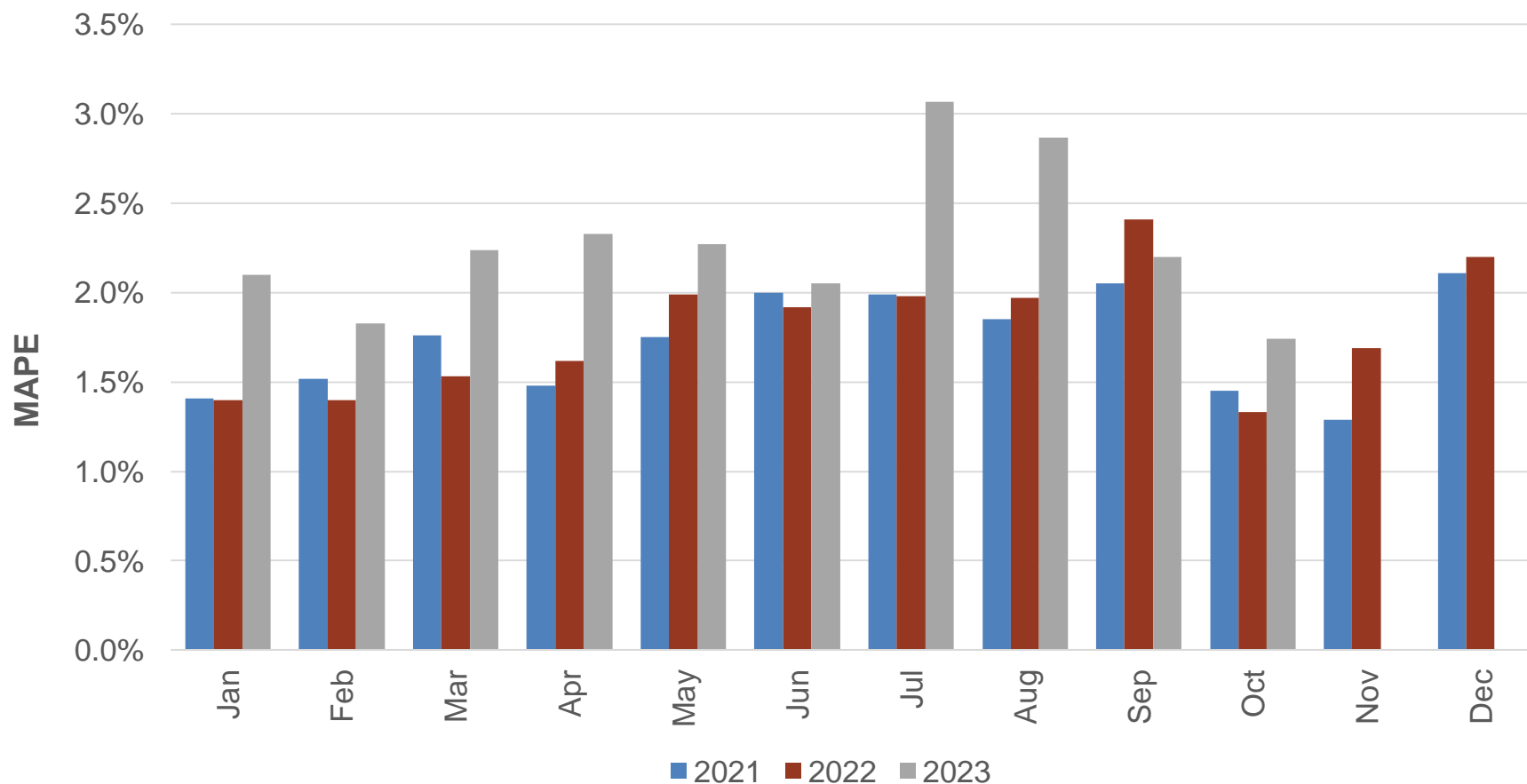
# CAISO price correction events increased in October



# EIM-related price corrections decreased in September and October

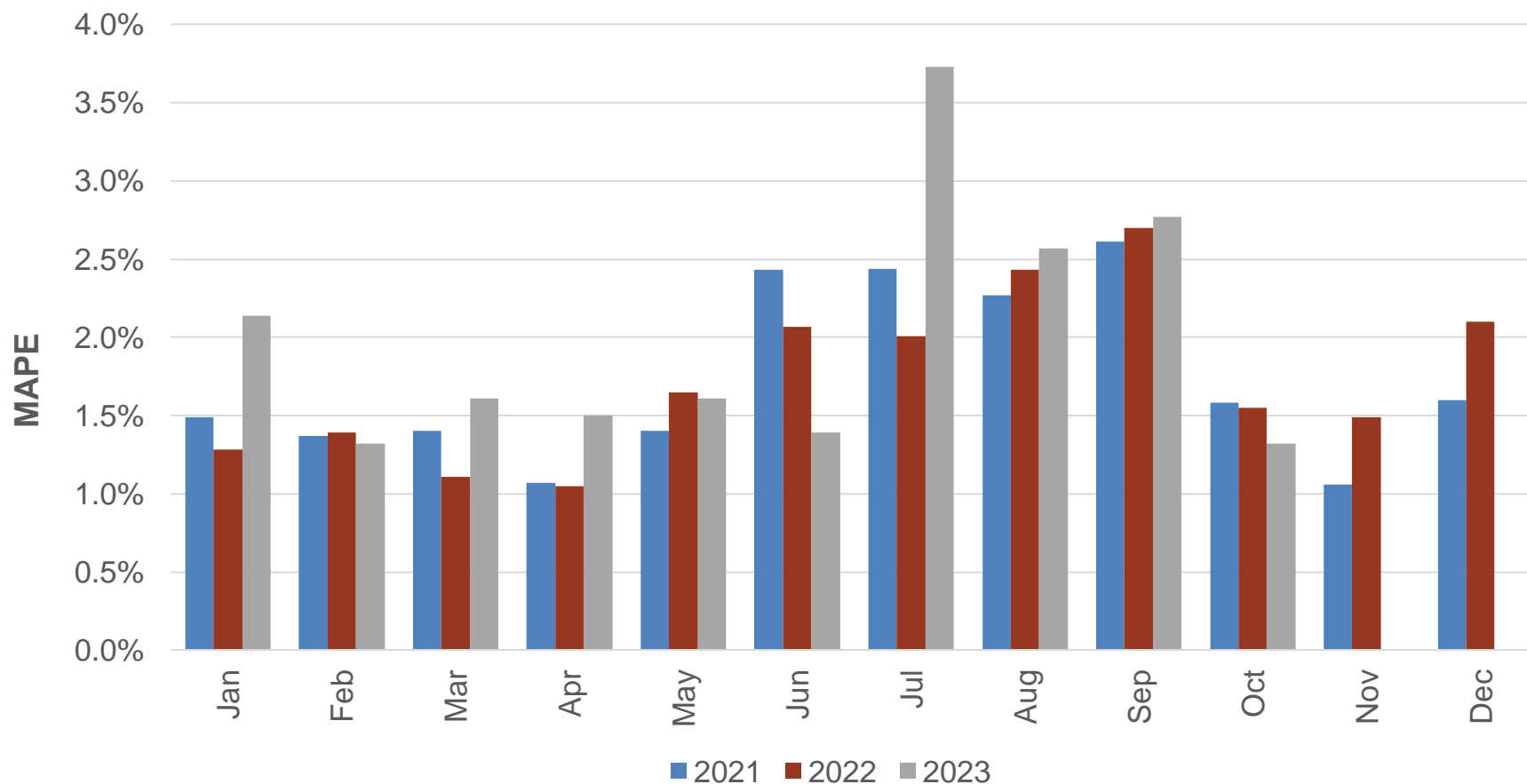


# Day-ahead load forecast



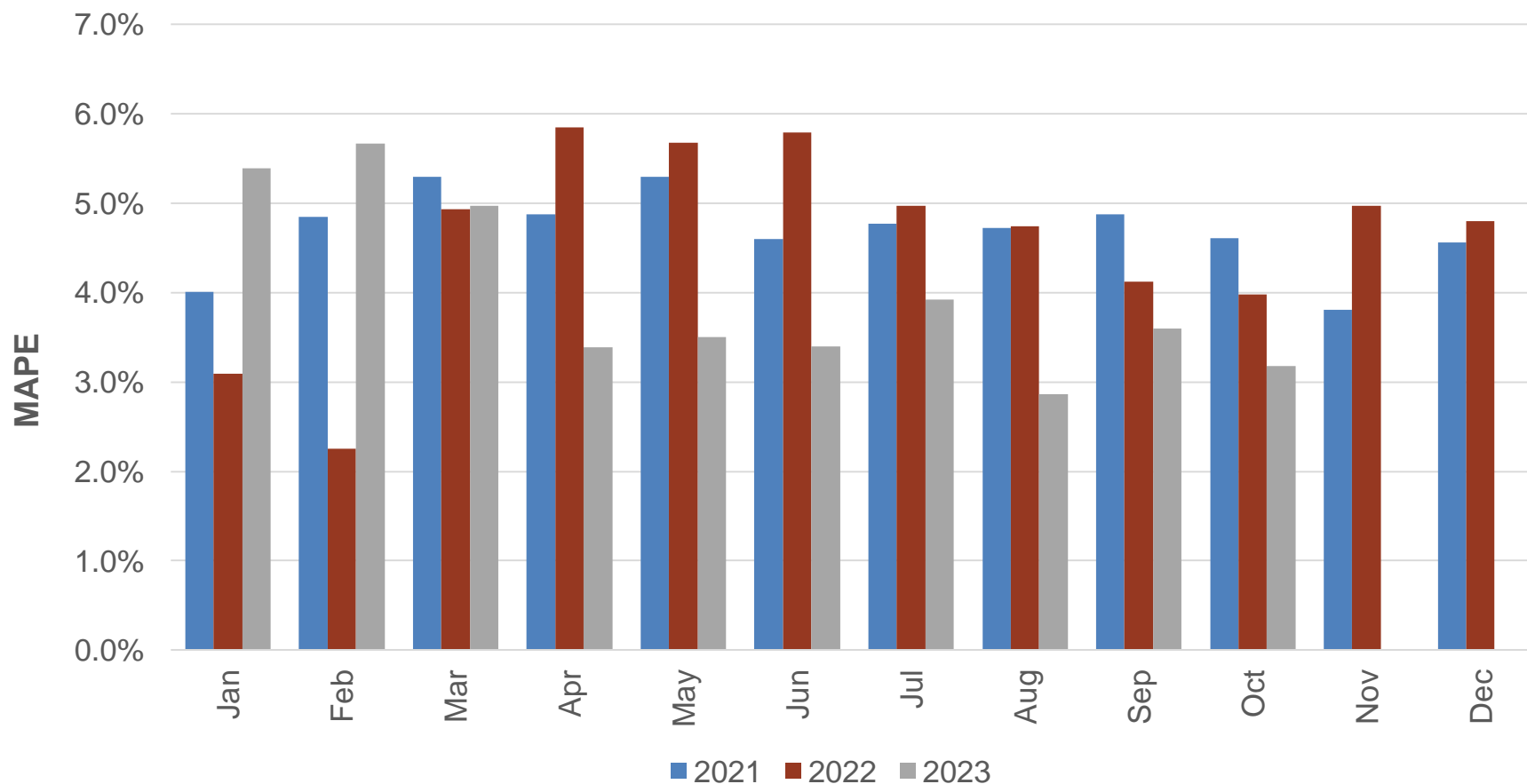
\*\*MAPE =  $\text{abs}(\text{Forecast} - \text{Actual})/\text{Actual}$

# Day-ahead peak forecast



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

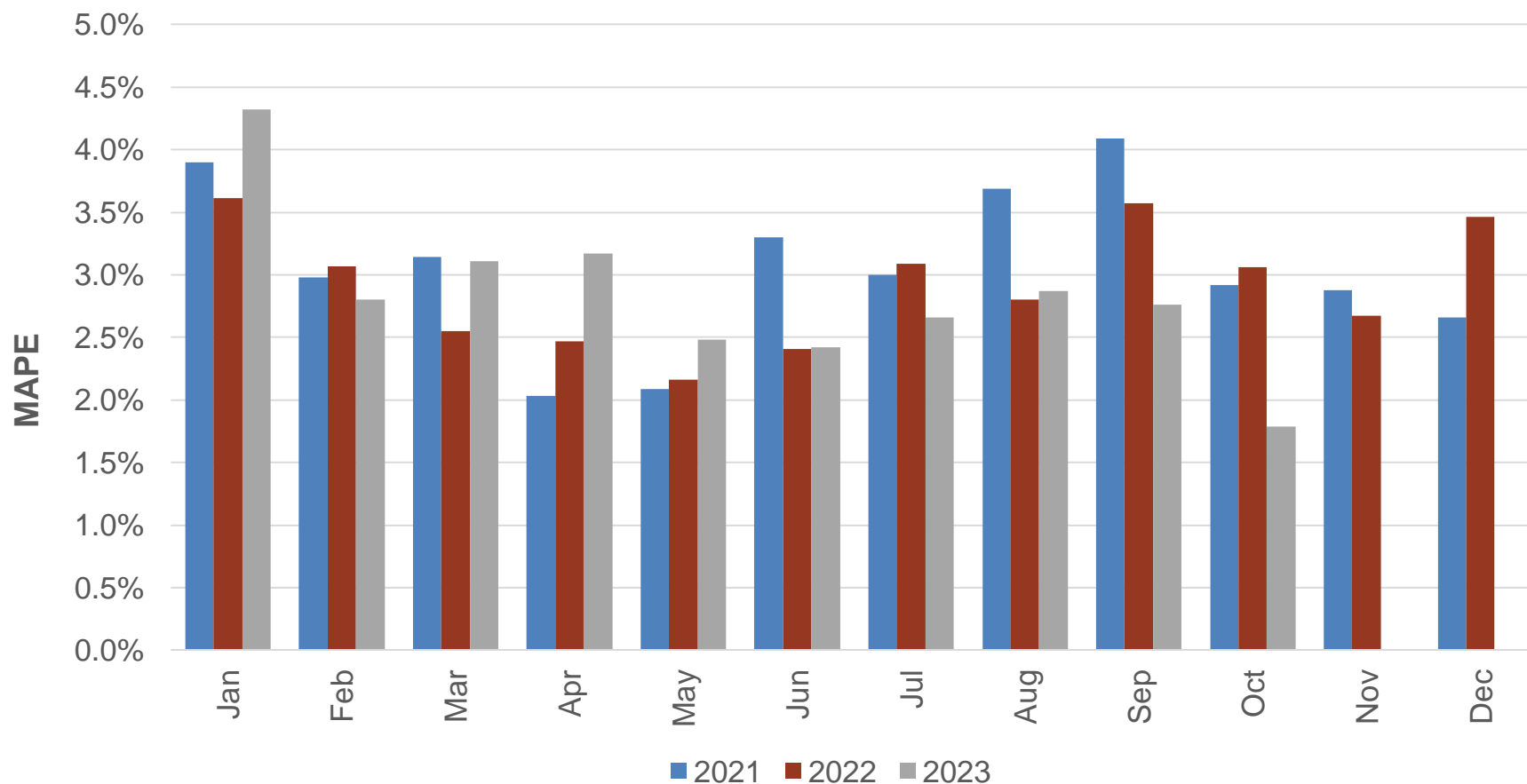
# Day-ahead wind forecast



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

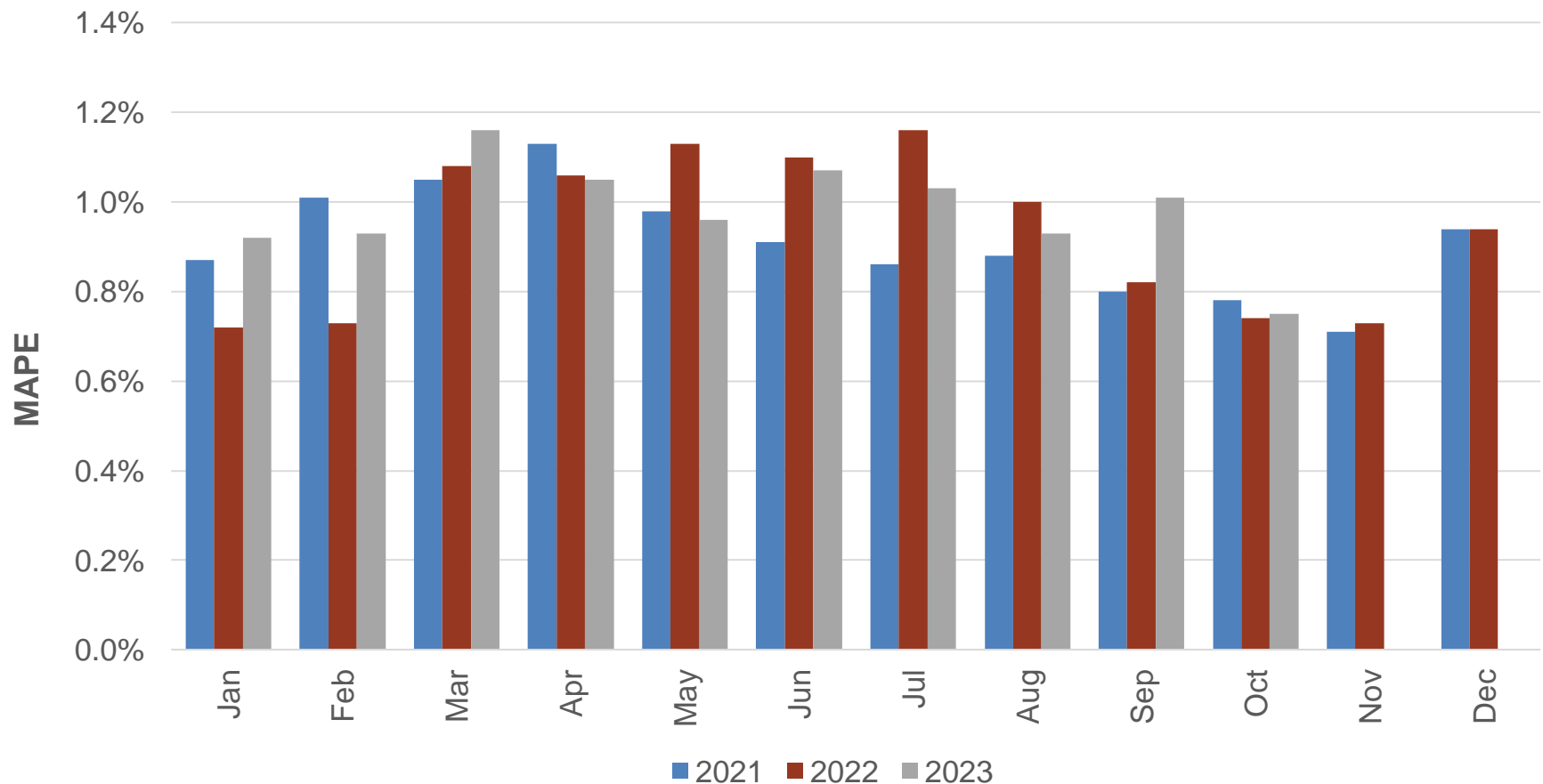


# Day-ahead solar forecast



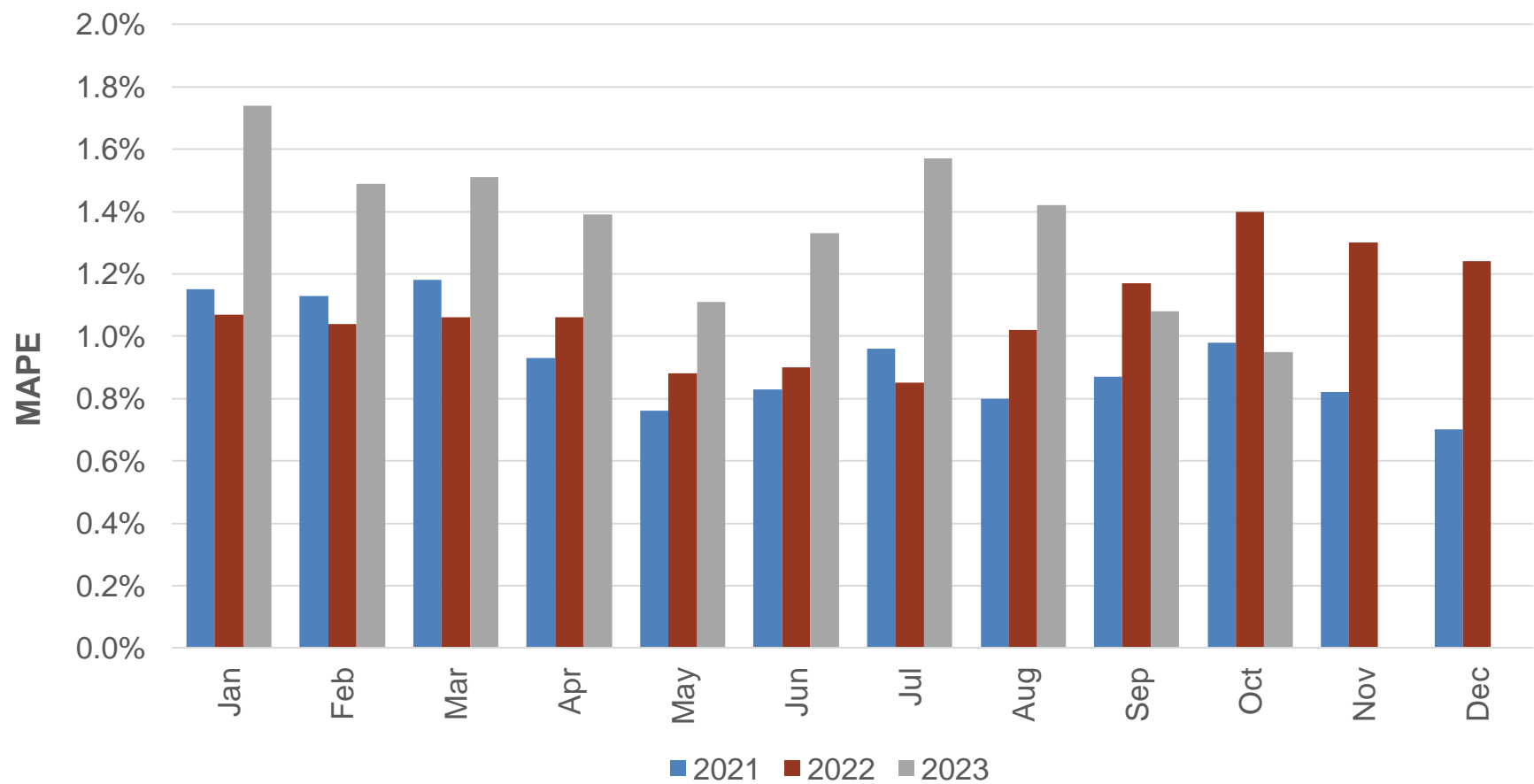
\*\*MAPE =  $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Capacity}$

# Real-time wind forecast



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

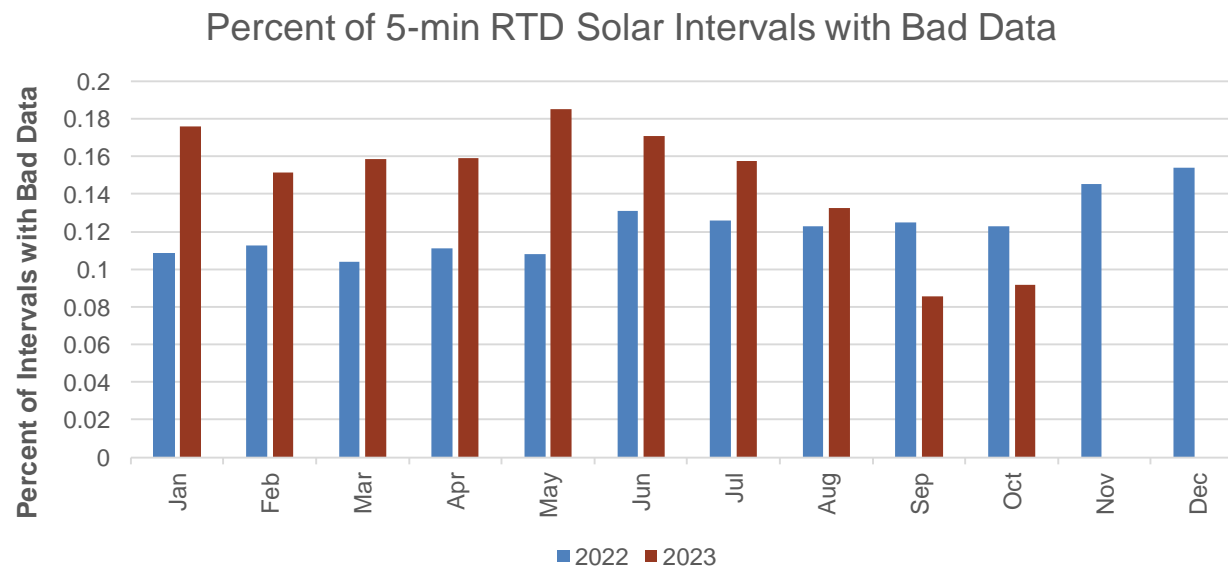
# Real-time solar forecast



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

# Real-time solar forecast

- Observed an increase in RTD solar error from September 2022 through September 2023
- Determined it was largely due to an increase in bad data quality coming from the resources

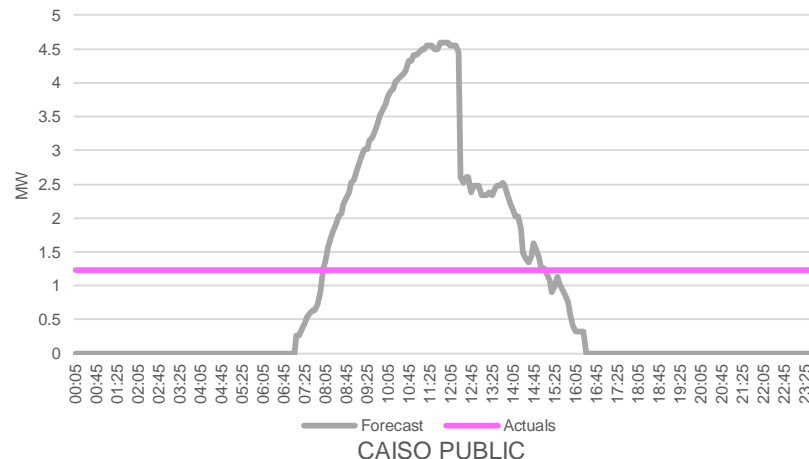


# Real-time solar forecast

- Impacts the forecast by having less periods of good data to use in training
- Impacts the **actuals** as they are no longer representative of what the resource could generate

$$MAPE = abs(\frac{forecast - total\ actual^*}{capacity})$$

\*where total actual = actual + abs(supplemental energy)

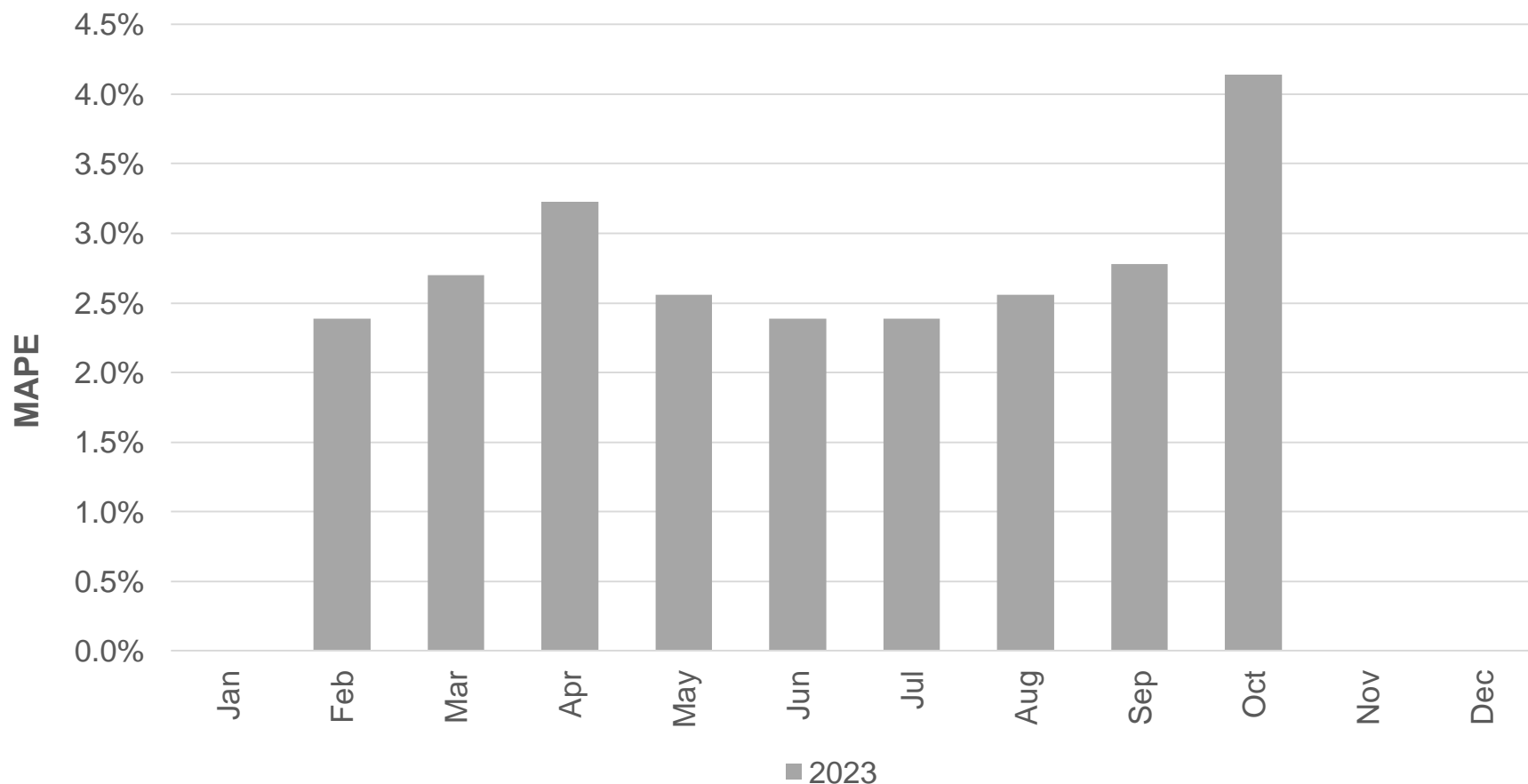


# Real-time solar forecast

- What can resources do to ensure a quality forecast?
  - Importance to receive quality telemetry and meteorological station data from the resources
  - Checking the values to ensure they are accurate
  - Communication of the individual points to the ISO, as well as the RIG
  - Resolving any issues in a timely manner

# Real Time Solar Hybrid Performance

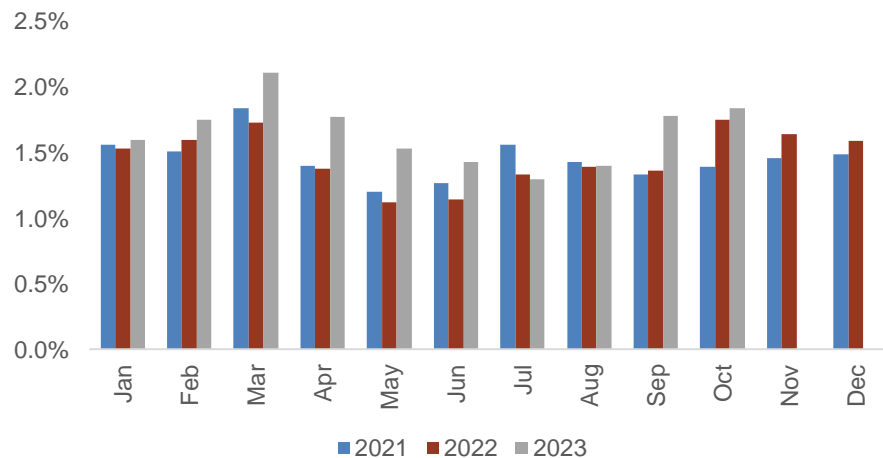
\*\*Comparison of DOT to MW Production



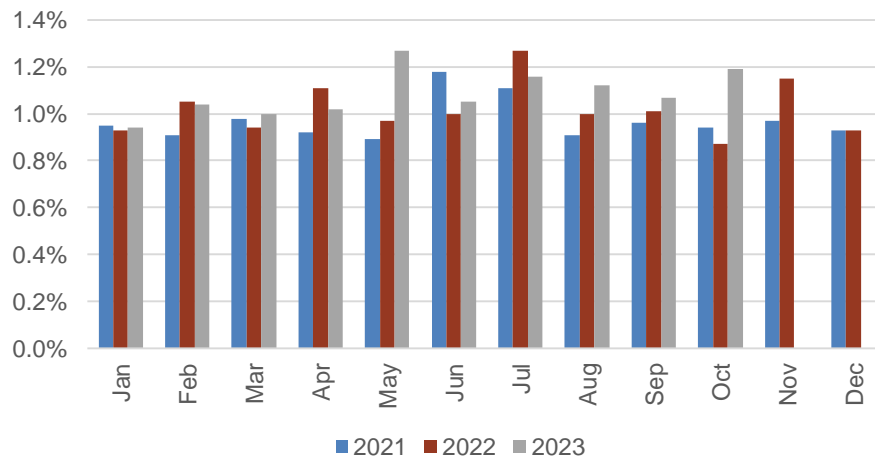
\*\*MAPE =  $\text{abs}(\text{DOT} - \text{Actual}) / \text{Capacity}$

# EIM T-60 forecast

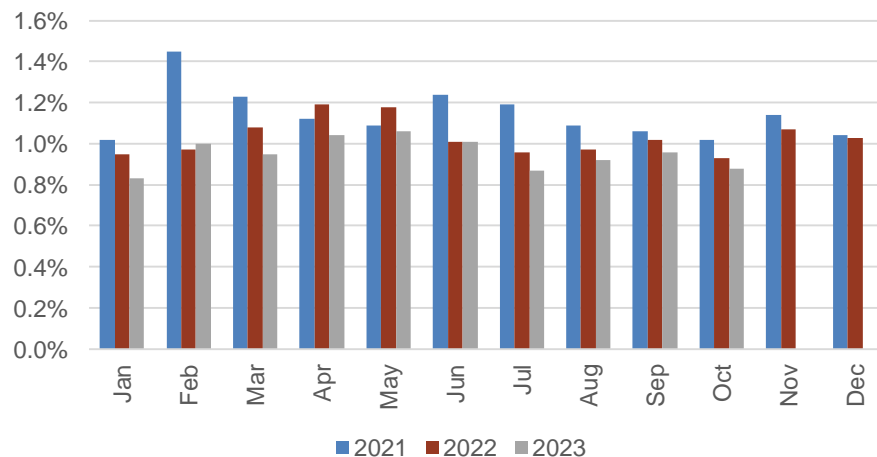
AZPS T-60 Forecast



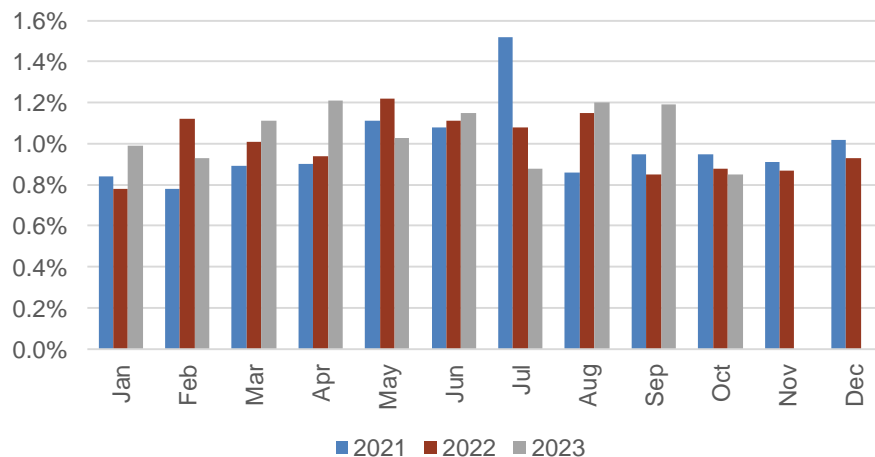
IPCO T-60 Forecast



PGE T-60 Forecast



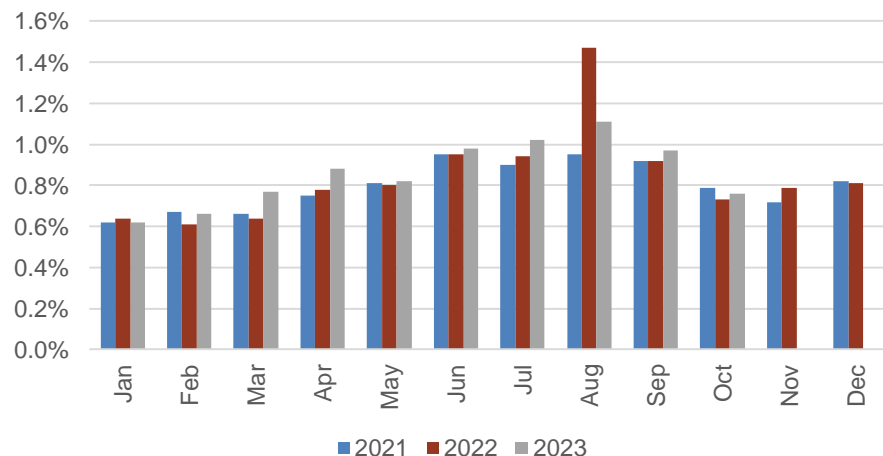
NVE T-60 Forecast



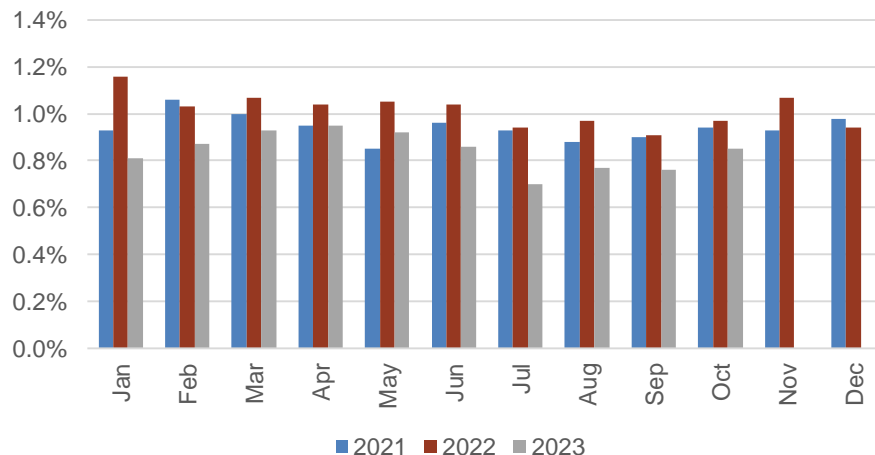


# EIM T-60 forecast

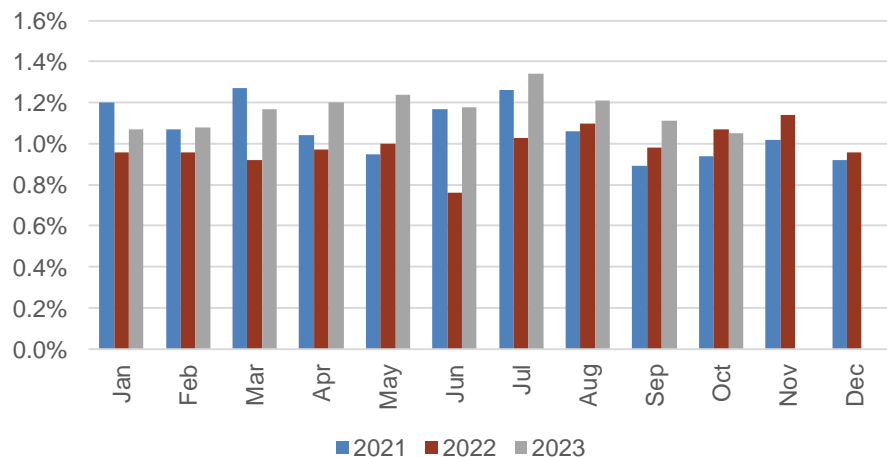
PACE T-60 Forecast



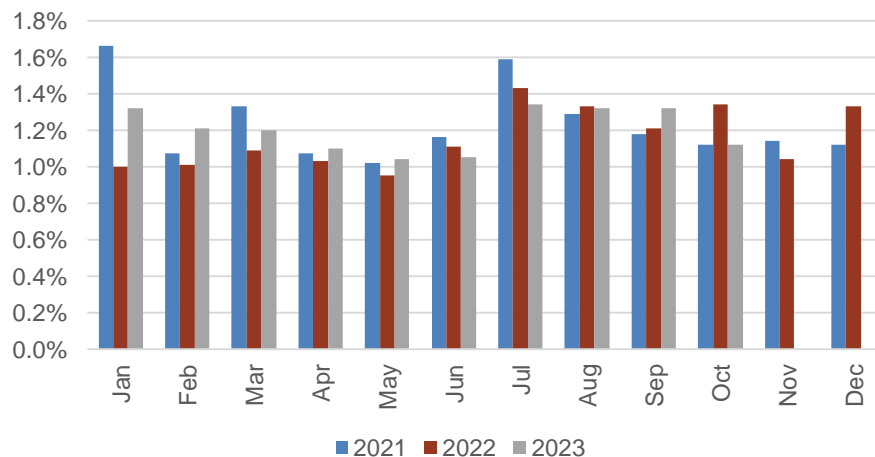
PACW T-60 Forecast



PSE T-60 Forecast

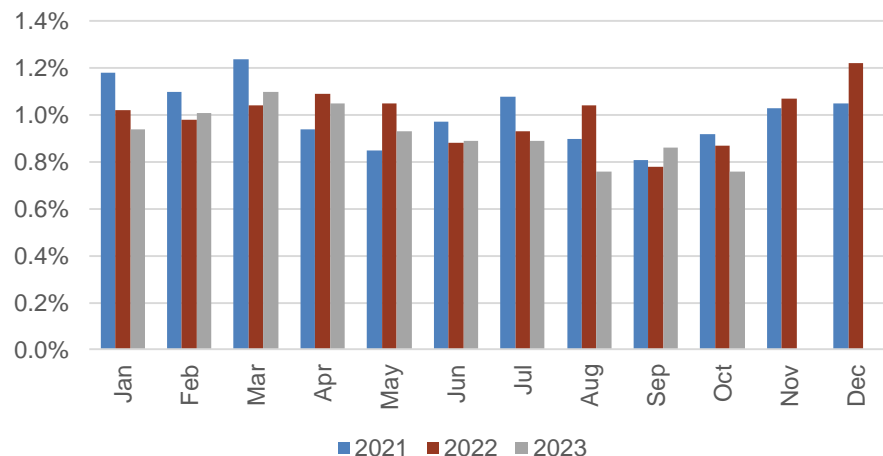


SRP T-60 Forecast

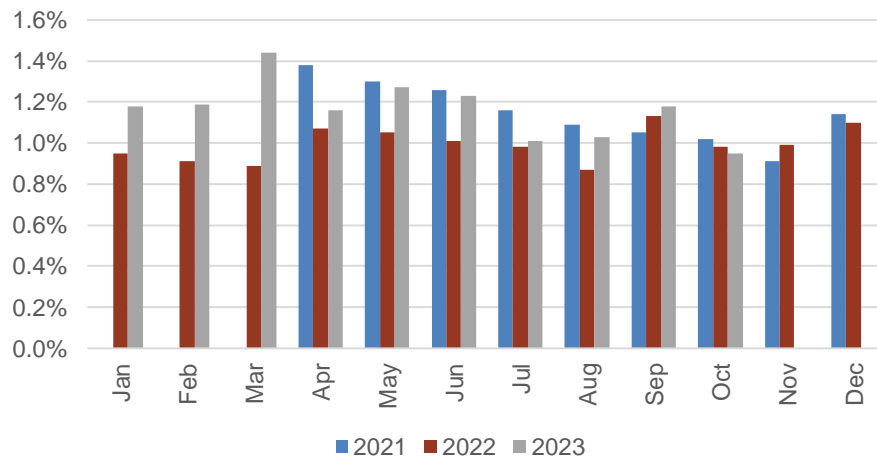


# EIM T-60 forecast

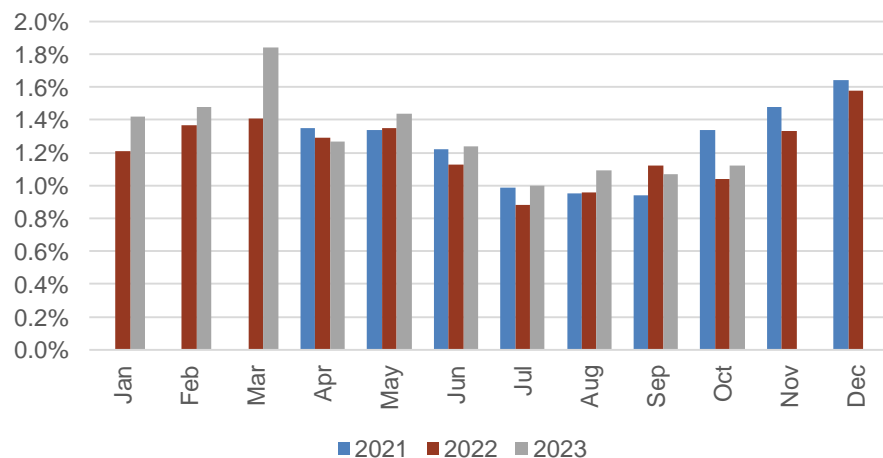
SCL T-60 Forecast



LADWP T-60 Forecast



TIDC T-60 Forecast

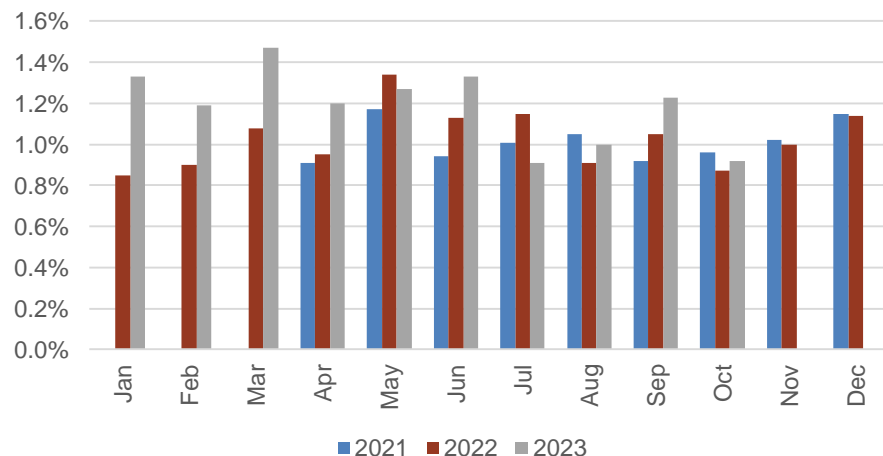


PNM T-60 Forecast

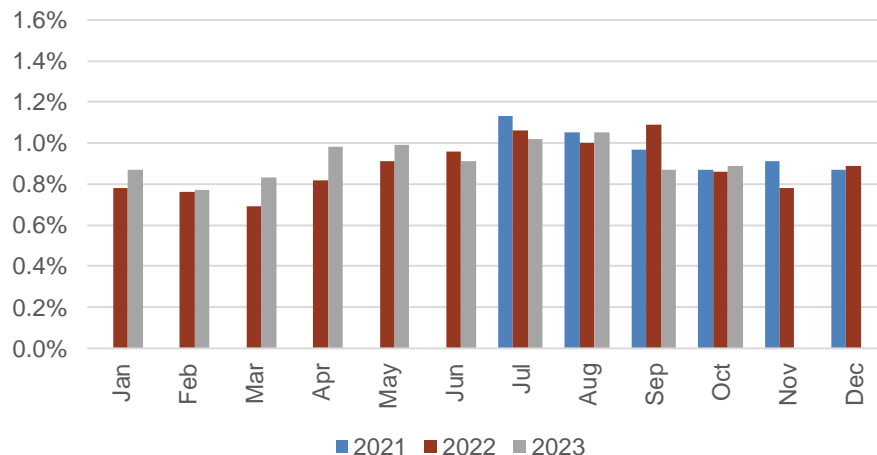


# EIM T-60 forecast

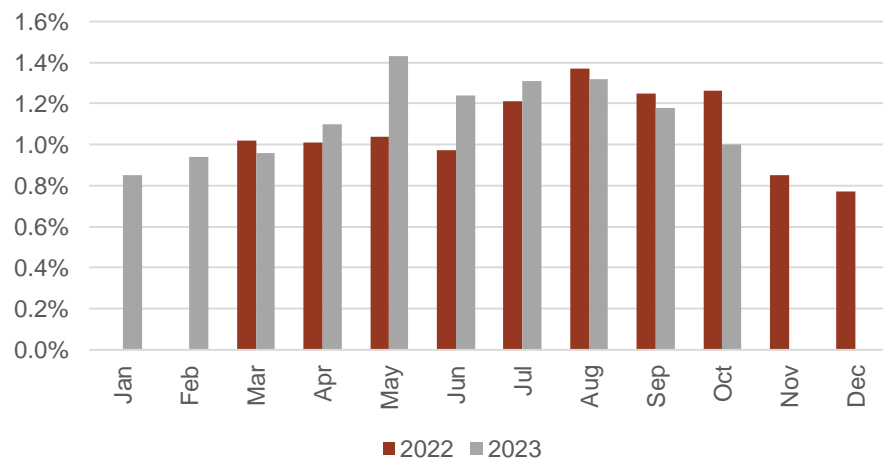
BANC T-60 Forecast



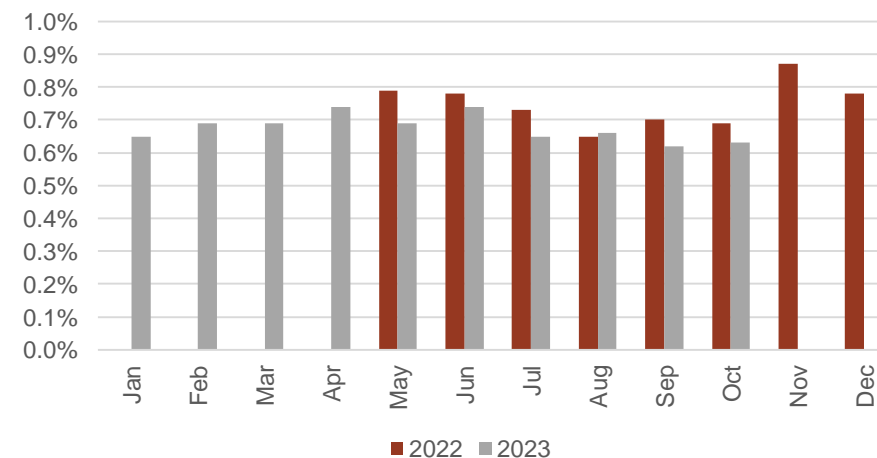
NWMT T-60 Forecast



AVA T-60 Forecast

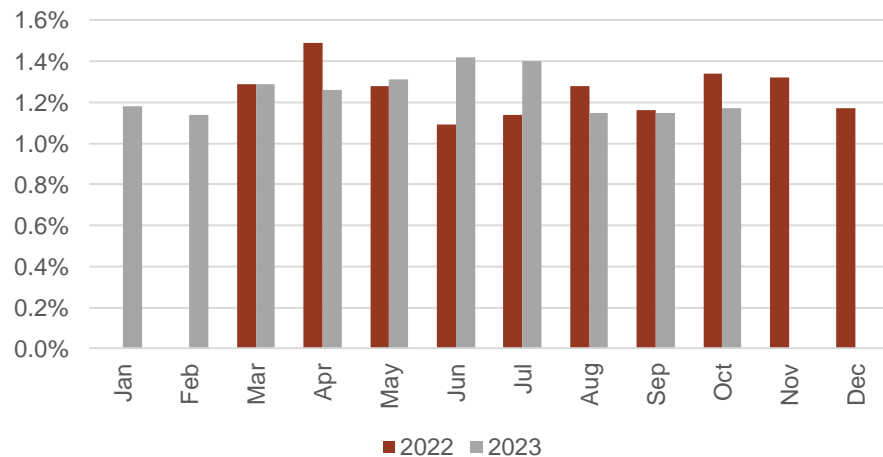


BPA T-60 Forecast

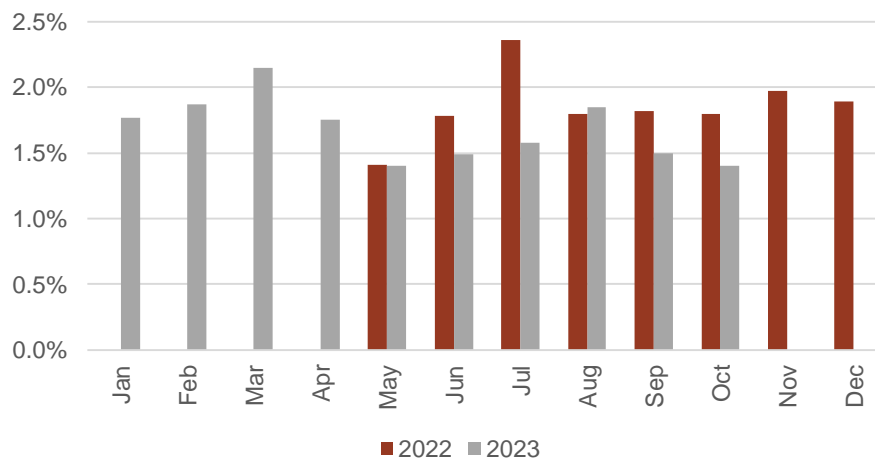


# EIM T-60 forecast

TPWR T-60 Forecast



TEP T-60 Forecast



## 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](mailto:bcorona@caiso.com) or [isostakeholderaffairs@caiso.com](mailto:isostakeholderaffairs@caiso.com)



- *Energy Matters* blog provides timely insights into ISO grid and market operations as well as other industry-related news

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

Read a recent article featured in the blog:



November 27, 2023

*Markets*

## Enhancing resource adequacy

By Partha Malvadkar, Principal, Resource Adequacy and Market Policy Development

California, on its way to the reliable carbon-free electrical grid called for in state energy policy, has made notable strides related to resource adequacy in recent years.

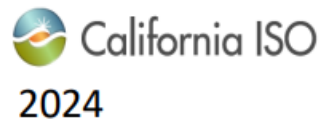
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# Upcoming MPPF meeting

The next MPPF is scheduled on March 14, 2024.

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



Market Performance and Planning Forum Meetings

Note: dates subject to change; for the latest information please visit the Calendar on [www.caiso.com](http://www.caiso.com)



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

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

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

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

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