California ISO

Market Performance and Planning Forum

Q3
September 27, 2023

New pre-registration process to join meetings

- Pre-registration is required for all future stakeholder meetings in order to receive a link to join the meeting.
  - The link to pre-register is available in the meeting notice, and the ISO calendar.
- A recent update to WebEx disabled the ability to view the list of meeting attendees.
- The new pre-registration process will allow us to provide the list of meeting attendees to stakeholders during the call.
- Please make sure your systems administer white list our domain to receive the web conference notification email.

Housekeeping Forum Reminders:

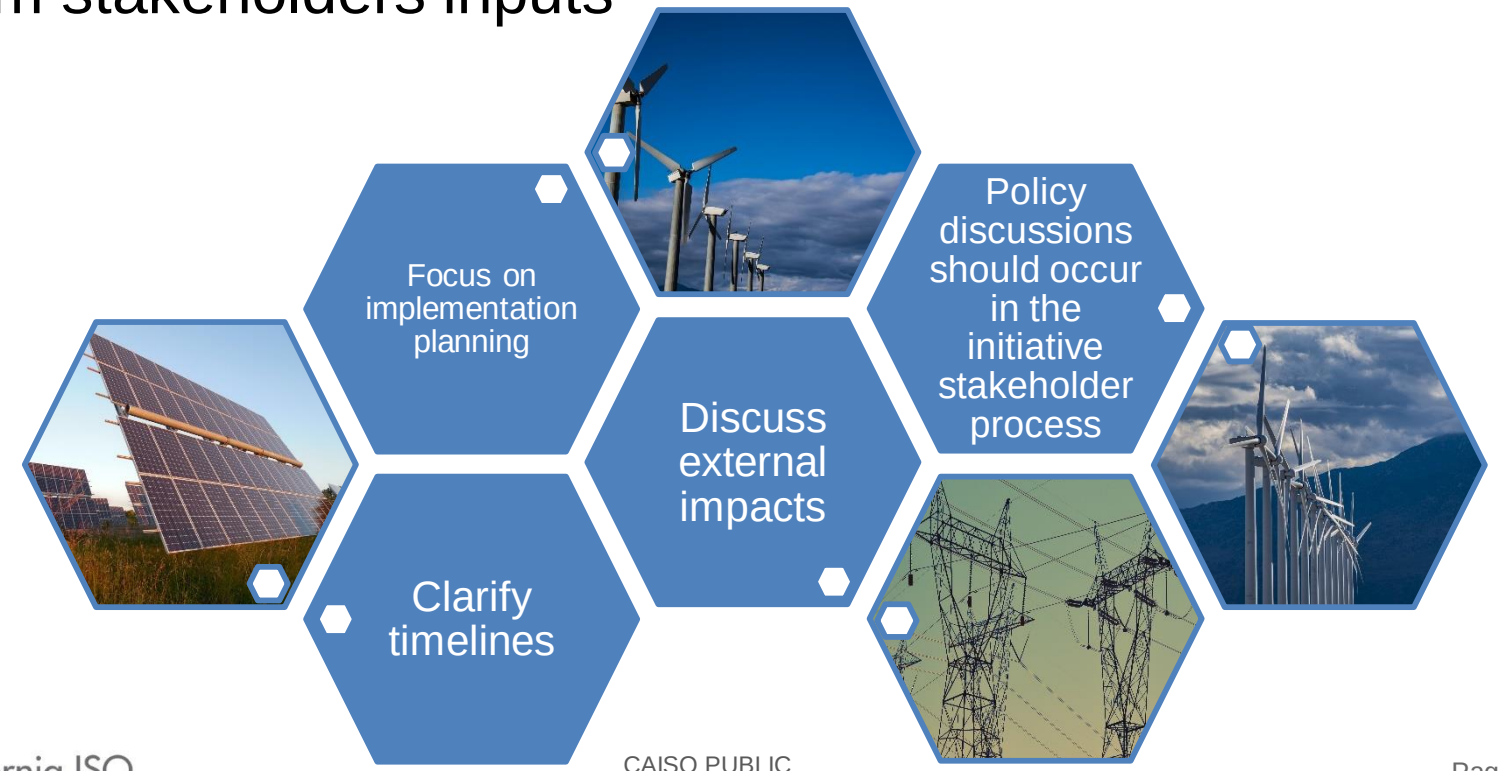
- This quarterly forum that engages stakeholders in review of market performance issues and in high level dialogue on release planning, implementation and new market enhancements. This is intended to foster open dialogue and sharing of ideas and perspectives
- This call is being recorded for informational 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 – Sep 27, 2023
9 a.m. – 2 p.m. (PST)

Time:	Topic:	Presenter:
9:00 – 9:05	Introduction, Agenda	Brenda Corona
9:05 – 9:30	Policy Update	Gillian Biedler, Market Strategy and Governance
9:30 – 10:00	Release Update	Trang Vo, Project Management
12:00 – 1:00	*Break*	
10:00 – 12:00 1:00 – 2:00	Summer Market Performance for July 2023 Market Performance Updates • Congestion revenue rights • FRP performance • Assistance Energy Transfer • Prices, gas and wholesale costs • Load Conformance • Batteries • General market performance	Market Analysis and Forecasting

Policy Update

Gillian Biedler

Policy Integration and Governance Manager

Greenhouse Gas (GHG) Coordination Working Groups

In August, the ISO initiated the GHG Coordination Working Group which is focused on continuing to evaluate and evolve the ISO's GHG accounting design.

- Meetings held on 8/16 and 9/13
- Upcoming meeting 10/19

Stakeholders suggested the following topics to focus on:

Review of market operations as well as the WEIM and EDAM GHG accounting design

Market consideration of diverse state GHG reduction policies

Emissions tracking, analysis, and accounting to support market participants

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

Gas Management Working Groups

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

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

Capacity Procurement Mechanism – Track 2

- Scope: Increased the CPM soft offer cap from $6.31/kw-month to $7.34/kw-month
- Decisional Classification: CAISO Board only
- Status:
  - Final proposal and draft tariff language posted on 8/17/23
  - Approved at September 2023 Board of Governors

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:
  - Summer 2023 Track 1 - Jul 01, 2023 Activation
    - Exception for revisions to add regulation to SOC constraint
  - CAISO has stakeholder and testing potential revisions to the constraint for planned activation prior to 11/1/2023
  - Fall 2023 Track 2: Planned 11/1/2023 activation

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

Day-Ahead Market Enhancements

- Scope:
  - Co-optimizing supply in IFM based on both cleared demand and imbalance reserve product needs
  - Residual unit commitment process improvements
- Status:
  - May 2023 CAISO Board and WEIM Governing Body meeting approval
  - Jun 23, 2023 Draft Tariff Language Meeting
  - July 2023 Revised Draft Tariff Language Meeting
  - Aug 22, 2023 FERC filing
  - Implementation workshops to be scheduled

Extended Day-Ahead Market

- Scope: Extending day-ahead market to WEIM entities. Scope includes:
  - Design elements that facilitate efficient commitment of generation in the day-ahead market across the wider footprint, providing economic, reliability and environmental benefits.

- Status:
  - Feb 2022 CAISO Board and WEIM Governing Body meeting approval
  - Aug 22, 2023 tariff filed with FERC

Transmission Services and Market Scheduling Priorities

- Scope:
  - Process for transactions wheeling through the CAISO BAA to establish market scheduling priority.

- Status:
  - Feb 2023 CAISO Board and WEIM Governing Body approval
  - FERC filing of Track 1 (ATC and short-term wheeling) on July 28, 2023
  - On-going stakeholder tariff development targeting Jan 2024 Track 2 (long-term wheeling and upgrades) FERC filing

Price Formation Enhancements

- Scope:
  - Phase 1
    - Scarcity pricing enhancements
    - BAA-level market power mitigation
    - Analysis of fast-start pricing in the CAISO markets
  - Phase 2
    - Review of market pricing to incentivize and appropriately compensate flexible resources (fast-start pricing, extended FRP horizon)
  - Phase 3
    - Review of multi-interval optimization impact on storage resources
    - Market changes to facilitate real-time co-optimization of ancillary services
- Status:
  - Jul 12, 2022 Issue paper posted
  - Initiative update call was held Jun 26, 2023
  - Working Groups Kick: Session 5 meeting Sep 27
  - Phase 1 Straw proposal Q4 2023 – 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
  - Expected tariff filing in Q4
  - Planned PRR initiation to further define usages of EDAM net export constraint in 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 Aug 29
  - Draft final proposal targeted for Oct 30
  - Stakeholder meeting Nov 6
  - Q4 CAISO Board meeting

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:
  - Sept 20, 2023 WEIM/BOG approval
  - Tariff process dates forthcoming
  - Track 2 dates forthcoming

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
    - Sep 21 Straw proposal posting
    - Oct 12 Comments due
    - Nov 21 Draft final proposal posting
    - Jan 8 Final proposal and draft tariff language posting
    - Feb 2024 Board of Governors meeting

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:
  - Call scheduled on Oct 24 at 1pm to discuss changes envisioned for the upcoming policy catalog review in support of the development of the 2025-2028 roadmap. More information to come on a notice the week of Oct 16.

Release Plan Update

Trang Vo
Senior Project Manager,
Project Management

Release Plan Summary

Release Communication

Fall 2023 Release

- Maximum Import Capability Enhancements
- Washington WEIM Greenhouse Gas Enhancements & Interim Solution Effective May 1, 2023
- WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 – Post HASP Curtailments
- Energy Storage Enhancements – Revised Formulation of Attenuation Factors
- Energy Storage Enhancements Track 2
- Hybrid Resources 2C – Metered Quantities

Independent 2023 Releases

- Variable Operations & Maintenance Cost Review
- URL & IP Changes – Application Delivery Resiliency
- Operations Notification System
- Transmission Registry System Upgrade

2024 Releases

- Transmission Service & Market Scheduling Priorities Phase 2
- Transmission Exchange Agreement
- WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3 – DR Inclusion
- Hybrid Resources Phase 2C – RIMS
- Congestion Revenue Rights System Upgrade

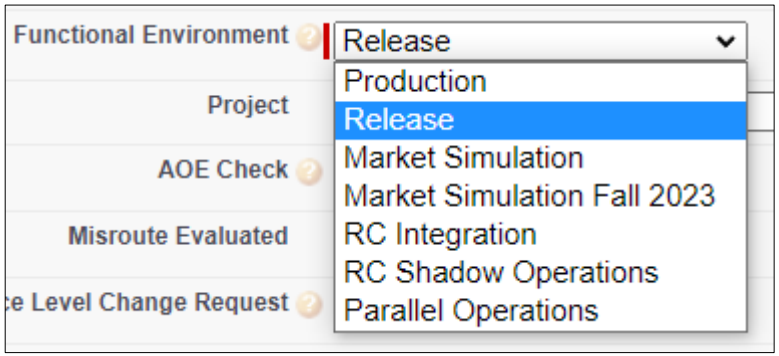
Future Releases

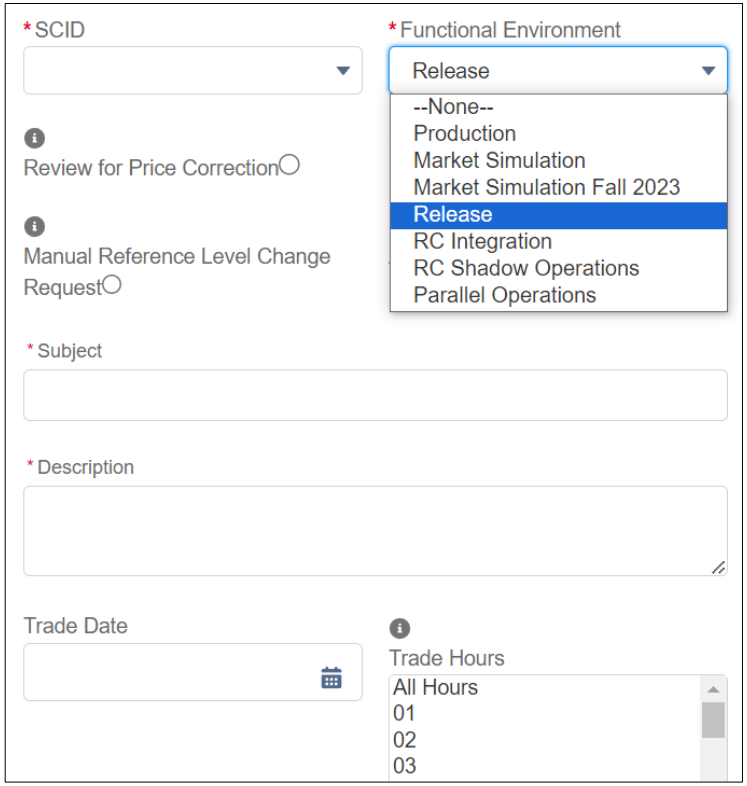
- Day-Ahead Market Enhancements
- Extended Day-Ahead Market

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:**
    - Inquires that are related to the MAP-Stage environments (non-production) for the Fall 2023 Release Market Simulation for MIC Enhancements, Hybrid Resources 2C Metered Quantities, WA WEIM GHG Enhancements, RSEE2T2, and ESE2. *Following Fall 2023 Release, only the option of 'Market Simulation' will remain as we are removing the seasonal options.

- Contact: release@caiso.com





Fall 2023 Release

Fall 2023 Release Overview

Project	BOG	Tariff	BRS	Settlements CG	Settlements Effective Date	Technical Specifications	Market Simulation	Production Activation
MIC Enhancements	Nov 2022 – Approved	• Accepted 5/28/21 • Accepted 3/18/22	• 04/11/22 • 08/21/23 1.1 • **09/06/23 1.2**	NA	NA	OASIS 7.4.0 7/17/23	8/14/23 – 9/29/23	11/1/23
Washington WEIM Greenhouse Gas Enhancements	Oct 2022 - Approved	• Filed 11/21/22 • Accepted 02/10/23 • Filed Amendment 03/13/23 • Amendment Accepted 04/20/23 • Waiver Accepted 08/24/23	02/06/23	NA	NA	• MFRDT 8.4 8/10/23 • MF GRDT 18 • RDT 8/22/23 • Definitions 18 8/29/23 • OASIS 7.4.0 7/17/23	9/7/23 – 9/29/23	11/1/23
WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2	Approved 12/14/22	NA	• 02/10/23 • 03/31/23 1.1 • 06/27/23 1.2 • 09/05/23 1.3 • **09/20/23 1.4** • **09/22/23 1.41**	NA	NA	• ADS 8/10/23 • CMRI 6.4.1 8/10/23 • MFRDT 8.4 8/10/23 • MF GRDT 18 • RDT 8/22/23 • Definitions 18 8/29/23	**9/25/23 – 10/13/23**	11/1/23
Energy Storage Enhancements Track 2	Approved 12/14/22	• Draft 02/10/23 • Revised DTL 03/15/23 • Filed 03/31/23 • Track 2 Filed 08/01/23 • FERC response requested by 10/1/23	• 05/25/23 • 06/29/23 1.1 • 08/08/23 1.2 • 08/18/23 1.3 • **09/12/23 1.4**	• 02/17/23: Tech Doc • 1st DCF 07/26/23 • **2nd DCF 9/6/23** • Pre-prod DCF 10/18 • Prod deploy & Final Config Output file 10/25	1st of the month; new CCs	• CMRI 6.4.0 7/17/23 • OASIS 7.4.0 7/17/23 • SIBR 17 8/14/23	9/18/23 – 9/29/13	11/1/23
Hybrid Resources 2C – Metered Quantities	NA	NA	08/17/23	NA	NA	NA	9/7/23 – 10/06/23	11/1/23

Fall 2023 Release Overview – System Impacts

Project	ADS	CIRA	CMRI	ITS	Master File	MF RDT	OASIS	OMS	RIMS	MRI-S Metering	Settlements	Market	SIBR
MIC Enhancements		X					X*						
WA WEIM GHG Enhancements			X		X	X*	X*				X	X	X
WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2	X		X*	X	X	X*						X	
Energy Storage Enhancements Track 2			X*		X		X*		X		X	X	X*
Hybrid Resources 2C – Metered Quantities										X			

X* = Technical Specifications

Fall 2023 Release Overview – System Interface Changes

System	Project	UI	API	Data/Comments	Tech Specs
ADS	RSEE2T2	Existing – bottom right grid for Instructions ADS will start showing under 'Instruction Type' column, values that include "EN", "DAPT", and "DALPT", with corresponding value in the 'Cleared MW' column. For multiple priority types, there will be multiple rows with the different Instruction Type/Priority and associated Cleared MW value.	Changes to getDispatchBatch v8 API to populate EN instructions and Breakdown of Cleared MW by priority types for Batch Type 5.	Currently, ADS only processes advisory, and with this RSEE2T2 change, it will start processing energy and showing Priority Type and Cleared MW. Will display all Resource-specific market priority types and their associated MW data for export resources, including but not limited to: • ETC (including CRN ID and Type) • TOR (including CRN ID and Type) • DAPT • DALPT (this includes rolled-over DAECON) • RTPT • RTLPT • RTECON (RT economic exports that clear HASP)	8/10/2023
CIRA	MIC Enhancements	New: Plans > Manage Import Allocation > SC Request Unassigned Import Capability Reserved Import Capability Contact Information New: Reports > Import Capability RA Report	NA		NA

Fall 2023 Release Overview – System Interface Changes

System	Project	UI	API	Data/Comments	Tech Specs
CMRI	ESE2	New report to display Exceptional Dispatch Hold State of Charge New: Post-Market > Exceptional Dispatch Hold State of Charge	New: RetrieveStorageUpliftData_CMRIv1 RetrieveStorageUpliftData_CMRIv1_DocAttach		7/17/2023
CMRI	RSEE2T2	New report for resource-specific market priority types and associated MW schedules breakdown for export resources New: Day-Ahead > RUC ~~Import~~ Export Schedules by Market Priority Types	New: RetrieveMarketPriorityType_CMRIv1 New: RetrieveMarketPriorityType_CMRIv1_DocAttach	Similar to the Existing Day-Ahead > DA Import-Export Schedules report, but the Schedule Type column shall be replaced with "Market Priority Type" and its data enumeration shall be: • ETC (including CRN ID and Type) • TOR (including CRN ID and Type) • DAPT • DALPT (this includes rolled-over DAECON)	8/10/2023
CMRI	RSEE2T2	New report for resource-specific market priority types and associated MW schedules breakdown for export resources New: Real-Time > Real-Time Export Schedules by Market Priority Types	New: RetrieveMarketPriorityType_CMRIv1 New: RetrieveMarketPriorityType_CMRIv1_DocAttach	Similar to Existing Real-Time -> Real-Time Unit Commitment (RTUC) Advisory Schedules report, but only report binding intervals for export resources and the Schedule Type column shall be replaced with "Market Priority Type" and its data enumeration shall be: • ETC (including CRN ID and Type) • TOR (including CRN ID and Type) • DAPT • DALPT (this includes rolled-over DAECON) • RTPT • RTLPT • RTECON (RT economic exports that clear HASP)	8/10/2023
CMRI	WA WEIM GHGE	NA	NA	New Attributes/Records to indicate state/include GHG index price for each state	NA

Fall 2023 Release Overview – System Interface Changes

System	Project	UI	API	Data/Comments	Tech Specs
ITS	RSEE2T2	Existing	NA	Exports e-Tagging Submission Requirement > SCs shall be required to e-tag the following as "Firm Provisional Energy (G-FP)", via utilizing Misc. field: o RT economic (RTECON) exports that clear HASP o DA economic (DAECON) exports that clear both RUC and HASP o RTLPT exports that clear HASP o DALPT exports that clear both RUC and HASP > SCs shall be required to e-tag the following as "Firm Energy (G-F)": o RTPT exports that clear HASP o DAPT exports that clear both RUC and HASP	NA
MF RDT	RSEE2T2	Add a new Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag	Add a new Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag: capacityTestFTSExemptFlag under Resource Attributes		- Tech Spec 8/10/2023 - GRDT 8/22/2023 - RDT Definitions 8/29/23
MF RDT	WA WEIM GHGE	Add a new BAA level attribute to identify BAAs associated with Washington State	SubmitGeneratorRDT_MFRDv5 SubmitGeneratorRDT_MFRDv5_DocAttach RetrieveGeneratorRDT_MFRDv5 RetrieveGeneratorRDT_MFRDv5_DocAttach Minor Version 20231001 Added GHG section in the Elements Table - GHGComplianceObligFlag - GHGEmissionFactor - State	1. Convert the GHG details in 0..N nested element to record GHG details for each State applicable to the Generator. 2. Add an additional element "State" to indicate CA, WA etc.	- Tech Spec 8/10/2023 - GRDT 8/22/2023 - RDT Definitions 8/29/23

Fall 2023 Release Overview – System Interface Changes

System	Project	UI	API	Data/Comments	Tech Specs
OASIS	ESE2	Existing: Energy > System > Operator-Initiated Commitment report	Existing: System > Operator-Initiated Commitment report	New ED type Reason Code: "SOC Hold" and "SOC Charge"	7/17/2023
OASIS	MIC Enhance ments	New: Available Import Capability Data New: Import Capability used in RA Plan Data	New: AVAIL_IMP_CAP_GRP New: ANNUAL_IMP_CAP_USED_RA_PLAN_GRP MONTHLY_IMP_CAP_USED_RA_PLAN_GR		7/17/2023
OASIS	WA WEIM GHGE	Existing: Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Existing – Prices > Index Prices > Greenhouse Gas Allowance Index Prices	Add WA GHG index prices, display average of daily WA GHG price indices	7/17/2023
RIMS	ESE2	Existing: Existing > App & Study > Equipment Configuration tab > Generation as Modeled and Implemented grid	NA	> Pull storage resource MWh from MF > Add new field for calculated MWh > Add new field for storage resource duration in hours	NA
SIBR	ESE2	New Hourly feature on Hourly tab to elect Y/N for Off Grid Charge.	New optional element in xsd for 'offGridCharge' used by designated resource to manage Sub/Stand Alone ACC. RawBidSet, BidResults, CleanBidSet v5 xsd. Version 20231101.	New HourlyParameter for offGridCharge this is a Yes/No type that is optional.	8/10/2023
SIBR	WA WEIM GHGE	Existing	Existing	Consume WA GHG adders	NA

Fall 2023 – MIC Enhancements

Project Information	Details
High Level Project Scope	The purpose of this initiative is to address potential improvements to either the calculation of Maximum Import Capability or the process used to allocate and track it during Resource Adequacy validation process. This initiative will focus on the following scope items: 1. Additional transparency with making data publicly available 2. Inclusion of contractual data from non-CPUC jurisdictional LSEs into the main portfolio 3. Request for MIC expansion 4. Give “same day priority” to the step 13 unallocated Remaining Import Capability for LSEs with existing RA Contracts 5. Update Tariff and BPM language to be consistent with current approved practice
BPM Changes	Reliability Requirements, Transmission Planning Process, Market Instruments
Tariff Changes	Yes
Impacted Systems	CIRA, OASIS

Fall 2023 – MIC Enhancements

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board Approval	Nov 03, 2021	✓
External BRS	Post External BRS BRS 1.1 **BRS 1.2 - Removed "On Demand" from BRQ005**	Apr 11, 2022 Aug 21, 2023 **Sep 06, 2023**	✓ ✓ ✓
Tariff	ER21-1469 Accepted ER22-844 Accepted	May 28, 2021 Mar 18, 2021	✓ ✓
BPMs	Draft BPM changes – Reliability Requirements 1523 Draft BPM changes – Market Instruments 1524 BPM changes approved – Transmission Planning Process	Jul 27, 2023 Jul 28, 2023 May 18, 2022	✓ ✓ ✓
Tech Spec	CIRA OASIS	NA Jul 17, 2023	✓ ✓
Training	Training	Aug 7, 2023	✓
Market Sim Scenarios	Market Sim Scenarios	Jul 28, 2023 Aug 09, 2023	✓ ✓
Market Sim	Market Sim Window	Aug 14, 2023 – Sep 29, 2023	
Production Activation	Maximum Import Capability (MIC) Enhancements	Nov 1, 2023	

Fall 2023 – WA WEIM GHG Enhancements - Overview

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

Fall 2023 – WA WEIM GHG Enhancements - Overview

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

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

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

Fall 2023 – WA WEIM GHG Enhancements

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Oct 26, 2022	✓
	WEIM Governing Board Approval	Oct 26, 2022	✓
External BRS	Publish External BRS	Feb 06, 2023	✓
Settlements Config Guides	Settlements Config Guides	NA	
Tech Spec	MFRDT Tech Spec MF RDT File Draft RDT Definitions Draft OASIS	Aug 10, 2023 Aug 16, 2023 Aug 18, 2023 Jul 17, 2023	✓ ✓ ✓ ✓
Tariff	File Tariff ER23-474 Tariff Accepted Filed Amendment Amendment Accepted Waiver Accepted	Nov 21, 2022 Feb 10, 2023 Mar 13, 2023 Apr 20, 2023 Aug 24, 2023	✓ ✓ ✓ ✓
BPMs	Publish Draft BPM for Interim Solution – WEIM PRR 1506 Publish Draft BPM for Interim Solution – Market Instruments PRR 1507 Publish Draft BPM for full functionality – Market Instruments PRR 1534 Publish Draft BPM for full functionality – WEIM PRR 1535	Apr 26, 2023 Apr 26, 2023 Aug 24, 2023 Aug 24, 2023	✓ ✓ ✓ ✓
Training	Training	Aug 28, 2023	✓
Market Sim	Unstructured Testing	Sep 7, 2023 – Sep 29, 2023	
Production Activation	Interim Solution WA WEIM GHG Enhancements	May 01, 2023 Nov 01, 2023	✓

2023 – WA WEIM GHG Enhancements – Interim Solution

- ✓ Effective May 1, 2023, the CAISO has implemented an alternative interim solution to activate functionality in the Washington WEIM GHG Enhancements initiative.

- The alternative interim solution would allow SCs for resources in Washington to reflect their GHG costs in the default energy bids and commitment costs.

- This effectively activates the tariff language for this initiative and the alternative interim solution will remain in effect until it is replaced with the full initiative implementation later this year. We don't expect the interim solution to delay the implementation of the full functionality.

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

Project Information	Details

High Level Project Scope	• **Track-2**
	  • Item2A – Clarification of Post-HASP Block Hour Low-Priority Export
	  • Operator-Driven Low-Priority Export Curtailment
	  • CAISO operator's ability to initiate pro-rata curtailment based on identified MW, given the following priority order:
	  • RTECON (RT economic hourly block export schedules that clear HASP).
	  • RTLPT (RT Self-Schedule hourly block export schedules not backed by Generation from non-RA Capacity and cleared HASP).
	  • Non-high-priority DA export [i.e. DAECON (DA economic hourly block export schedules that clear both RUC and HASP), or DALPT (DA hourly block export schedules not backed by Generation from non-RA Capacity that also cleared both RUC and HASP and are protected Self-Schedules)]
	  • CAISO operator's ability to identify/filter exports by market priority types as well as "Firm Provisional Energy (G-FP)" eTag identifier.
	  • Publish resource-specific market priority types and their associated MW data to ADS.
	• Item2B – Develop MF resource identification Capacity Test Failed-to-Start Rule Exemption flag to allow SCs of WEIM and CISO short start units that start with non-positive telemetry to identify specific resources that will be exempted from this functionality in RSE Capacity test. (Implemented in Phase 1 – enhancements needed)

BPM Changes	WEIM, Market Instruments, Market Operations
Tariff Changes	Yes
Impacted Systems	MF, Market, ITS, ADS

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

System	High Level Changes
MF	• Definition and Submission of Resource-Specific Capacity Test Failed-to-Start Rule Exemption Flag via GRDT • Make Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag accessible to downstream systems.
ITS	• Clarification of Post-HASP Block Hour Low-Priority Export • Consume DAM Resource-Specific Market Priority Types and Resource-specific RUC Energy Awards from RUC. • Consume All Resource-Specific Market Priority Types from RTM. • SCs shall be required to submit Misc Info field Prior Type attribute for “Firm Provisional Energy (G-FP)” e-tags to identify RTECON, DAECON, RTLPT, DALPT. • SCs shall be required to submit Misc Info field Prior Type attribute for “Firm Energy (G-F)” e-tags to identify RTPT, DAPT. • Validate submitted export e-Tags against data received from RUC and RTM to approve/deny and adjust (if warranted) the submitted e-Tags.
Market	• Access Resource-Specific Capacity Test Failed-to-Start Rule Exemption flag from MF. • Exempt Specific Resources from Capacity Test Failed-to-Start Rule/Functionality. • Clarification of Post-HASP Block Hour Low-Priority Export • Broadcast All Resource-specific market priority types to ITS (from RTM).

ADS	• Clarification of Post-HASP Block Hour Low-Priority Export
	  • Consume Resource-Specific Market Priority Types and their Associated MW Data from RTM.
	  • Publish Resource-Specific Market Priority Types and their Associated MW Data.
	  • Include Resource-Specific Market Priority Types in ADS Query Functionality.

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

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval WEIM Governing Board Approval	Dec 14, 2022	✓
External BRS	Post External BRS Post External BRS v1.1 Post External BRS v1.2 Post External BRS v1.3 **Post External BRS v1.4** **Post External BRS v1.41**	Mar 10, 2023 Mar 31, 2023 Jun 27, 2023 Sep 05, 2023 **Sep 20, 2023** **Sep 21, 2023**	✓ ✓ ✓ ✓ ✓ ✓
Settlements Config Guides	NA	NA	
Tech Spec	ADS CMRI MFRDT Tech Spec MFRDT File Draft RDT Definitions Draft	Aug 10, 2023 Aug 10, 2023 Aug 10, 2023 Aug 22, 2023 Aug 29, 2023	✓ ✓ ✓ ✓ ✓
Tariff	Tariff	NA	
BPMs	Draft BPM changes – Market Instruments PRR 1531 Draft BPM changes – WEIM PRR 1532 Draft BPM changes – Market Operations PRR 1533 Draft BPM changes – Market Instruments PRR 1537 Draft BPM changes – Market Operations PRR 1536	Aug 23, 2023 Aug 24, 2023 Aug 24, 2023 Aug 25, 2023 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 Market Sim – Pro Rata Curtailment	Sep 25, 2023 – Oct 13, 2023 TBD	
Production Activation	Resource Sufficiency Evaluation Enhancements Phase 2 Track 2	Nov 01, 2023	

Fall 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 BRS 1.3 – 9/6/23

Updated for the following:

Track 2

- Section 1.3 (Scope), Section 4 (Details of Business Need/Problem), RSEE2-BRQ-03060 (Track-2) – Item2A
  - Updated to remove DAECON enumeration and clarify that DAECON is rolled over to DALPT.
- RSEE2-BRQ-03060 (Track-2) – Item2A
  - Updated to clarify use of CAISO Priority Type Misc field.
  - Updated ETC/TOR market priority types tags to enter CRN in CAISO Contract field.
  - Updated to revise CRN market priority type to ETC/TOR.
- RSEE2-BRQ-03080 (Track-2) – Item2A
  - Updated to remove DAECON enumeration and clarify that DAECON is rolled over to DALPT.
  - Updated to revise validation rules regarding CRN.
  - Updated to revise CRN market priority type to ETC/TOR.
  - Updated to add clarification bullet that validations will apply to newly created eTags as well as modifications to existing eTags.
- RSEE2-BRQ-03160
  - Updated to remove DAECON enumeration.
- RSEE2-BRQ-04010, RSEE2-BRQ-05480 (Track-2) – item2A
  - Added to roll over DAECON to DALPT.
- RSEE2-BRQ-08040 (Track-2) – item2A
  - Updated to remove DAECON enumeration and clarify that DAECON is rolled over to DALPT.
  - Updated to clarify inclusion of CRN ID and Type
- RSEE2-BRQ-08560, RSEE2-BRQ-08580 (Track-2) – item2A
  - Updated to remove DAECON enumeration and clarify that DAECON is rolled over to DALPT.
  - Updated to clarify inclusion of CRN ID and Type
  - Add a note to publish CRN and CRN Type for CMRI reports.
- RSEE2-MSIM-10060, RSEE2-MSIM-10080 (Track-2) – item2A
  - Updated to remove DAECON enumeration and clarify that DAECON is rolled over to DALPT.
- RSEE2-MSIM-10100 (Track-2) – item2A
  - Updated to remove DAECON enumeration.
- Appendix-D: Reports
  - Added for new CMRI report data samples for the two CMRI reports.

Track 3

- RSEE2-BRQ-02160 (Track-3) – item3A
  - Revised the DR Performance Adjustment process.
- RSEE2-BRQ-02170 (Track-3) – Item3A
  - Updated calculation to show application of DR Performance Adjustment percentage of 75%

Fall 2023 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 2 BRS 1.4 & 1.41 – 9/20/23 & 9/22/23

Updated for the following:

Track 2

- RSEE2-BRQ-03060, RSEE2-BRQ-03080 (Track-2) – Item2A
  - o Updated to expand ETC/TOR market priority type to separate ETC, TOR.
- RSEE2-BRQ-04010, RSEE2-BRQ-05480 (Track-2) – Item2A
  - o Updated to limit DAECON roll over into DALPT to export resources only.
- RSEE2-BRQ-08040 (Track-2) – Item2A
  - o Updated to make it applicable to export resources only.
  - o Updated to expand ETC/TOR market priority type to separate ETC, TOR.
- RSEE2-BRQ-08560, RSEE2-BRQ-08580 (Track-2) – Item2A
  - o Updated to expand ETC/TOR market priority type to separate ETC, TOR.
- Appendix-D: Reports (Track-2) – Item2A
  - o RUC Export Schedules by Market Priority Types
    - Updated CMRI report name
    - Updated to expand ETC/TOR market priority type to separate ETC, TOR.
  - o Real-Time Export Schedules by Market Priority Types
    - Updated to expand ETC/TOR market priority type to separate ETC, TOR.

Updated for the following:

- Appendix-D: Reports (Track-2) – Item2A
  - o RUC Export Schedules by Market Priority Types
    - Updated to delete Effective Interties column.

Fall 2023 – Energy Storage Enhancements Track 2

Project Information	Details
High Level Business Problem or Need	This initiative evolves processes and systems to help storage resource scheduling coordinators better manage resource state of charge and continue to ensure efficient market outcomes. The purpose of this initiative is to enhance reliability tools and the co-located model with regards to storage resources. The reliability enhancements include updates to bidding rules, exceptional dispatch of storage resources, storage resource opportunity costs, and local area minimum online constraints. The co-located model enhancements include preventing co-located resources from charging when beyond generation levels for on-site resources and allowing pseudo-tied resources to use the co-located model. The scope of Track 1 covered the enhancements for Summer 2023 Release. The remaining scope in the Energy Storage Enhancements Policy is covered in Track 2 for Fall 2023 Release.

High Level Project Scope	**Reliability Enhancements**
	• Include lost opportunity from not generating in storage compensation due to hold Exceptional Dispatch (ED) to hold SOC (i.e. 0 MW ED)
	  • Calculate counterfactual energy revenues with and without the SOC hold ED
	  • If prices are below bids counterfactuals will not include discharges
	  • Use actual LMPs (the ISO will not generate counterfactual LMPs)
	  • Include SOC hold ED period through the end of the day in time horizon
	• Allow for Exceptional Dispatches (EDs) to be issued for storage resources to hold SOC
	  • Develop functionality within ED User Interface; automate existing excel tool functionality
	  • Storage may receive a traditional ED or an SOC ED, but not both
	Co-Located Model Enhancements
	• Develop an electable co-located model available to all storage resources
	  • Storage schedules to never exceed renewable schedules (i.e. no grid charging)
	  • Storage may deviate down to match solar, when solar is producing less than schedules in real-time
	  • Deviations to be subject to imbalance energy charges
	  • Require storage resources to submit outages when depleted and unable to charge
	  • Require all resources to respond to operator and ED instructions within physical bounds of operation
	• Allow for co-located pseudo-tie resources to apply Aggregate Capability Constraint (ACC)
	  • Resources under an ACC must be pseudo-tied from the same BAA

BPM Changes	Market Operations, Settlements & Billing
Impacted Systems	Settlements, Market, CMRI, RIMS, MF, OASIS, ADS, OMS, ITS

Fall 2023 – Energy Storage Enhancements Track 2

System	High Level Changes
Market	• Allow operator to enter exceptional dispatch (ED) in the market to allow for EDs of storage resources by SOC in addition to capacity • Update the definition of EDs to allow the operator to enter EDs for storage resources identified with two new Reason Codes under Instruction Type: System Emergency ("SYSEMR")
ADS	ADS consumes new ED Reason Codes ("SOC Hold" and "SOC Charge") applicable to storage resources
Settlements	• New rules to align with Tariff settlement language for SOC formula • New inputs for the storage resource ED opportunity cost values • Design and configure new charge code for the allocation of ED SOC uplift • Modify real-time bid cost recovery (BCR) charge code to account for revenue from storage resources ED SOC uplift • Configure No Pay rules and assessment for ED SOC
CMRI	Receive and shall publish the ED SOC information using new UI and API on a new report entitled "Exceptional Dispatch Hold State of Charge"
OASIS	Receive and publish new ED reason Codes ("SOC Hold" and "SOC Charge") under System Emergency Instruction Type as "Reason" on the Operator Initiated Commitment OASIS Report
RIMS	• Add field for storage resource duration (hours) • Add field for calculated MWh • Calculate energy (MWh) using duration*MW • Allow pseudo tied resources to be modeled as co-located
MF	• Apply co-located flag to pseudo tied resources • Set minimum ACC constraint to zero for co-located resources that cannot or choose not to not grid charge • New MF attribute to denote resources that select to not grid charge
OMS	Storage resources must submit outage cards if: • The co-located VER cannot provide the charging energy as forecasted per Tariff requirements • System shall require storage resources to submit outage cards if the resource has depleted its SOC and there is no ability to charge the resource per Tariff requirements
ITS	System shall model pseudo-tied and dynamic co-located storage resources following the standard NRI pseudo-tie and dynamic rules and practices Note: pseudo-tied and dynamic storage resources must be registered as TNGR resources

Fall 2023 – Energy Storage Enhancements Track 2

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Dec 14, 2022	✓
	WEIM Governing Board Approval		
External BRS	Post External BRS	May 26, 2023	✓
	V1.1	Jun 29, 2023	✓
	V1.2	Aug 08, 2023	✓
	V1.3	Aug 18, 2023	✓
	V1.4 Remove BRQ094	**Sep 12, 2023**	✓
Settlements Config Guides	First Draft Technical Documents	Feb 17, 2023	✓
	1st Draft Config Output File	Jul 26, 2023	✓
	2nd Draft Config Output File	**Sep 06, 2023**	✓
	Pre-production Draft Config Output File	Oct 18, 2023	
	Production deploy & Final Config Output File	Oct 25, 2023	
Tech Spec	Publish Interface Specification – CMRI	Jul 17, 2023	✓
	Publish Interface Specification – OASIS	Jul 17, 2023	✓
Tariff	File Tariff	Mar 31, 2023	✓
	FERC Response	Jun 01, 2023	✓
	File Extension of MSOC	Mar 28, 2023	✓
	FERC Approval of Extension of MSOC	May, 25, 2023	✓
	File Tariff Track 2	Aug 01, 2023	✓
	FERC response requested by	Oct 01, 2023	
BPMs	Draft BPM changes – Market Operations 1526	Aug 18, 2023	✓
	Draft BPM changes – Market Settlements & Billing 1528	Aug 21, 2023	✓
	Draft BPM changes – Market Instruments 1537	Aug 25, 2023	✓
	Draft BPM changes – Market Operations 1536	Aug 24, 2023	✓
Training	Training	Sep 13, 2023	✓
Market Sim Scenarios	Market Sim Scenarios	Aug 03, 2023	✓
	1.1	Aug 22, 2023	✓
Market Sim	Market Sim Window	Sep 18, 2023 – Sep 29, 2023	
Production Activation	Energy Storage Enhancements Track 2	Nov 01, 2023	

Energy Storage Enhancements Stakeholder Workshop

The California ISO held a public hybrid stakeholder workshop for Energy Storage Enhancements on August 3, to discuss functionality for modeling regulation awards for storage resources.

During this meeting, the ISO and stakeholders discussed the planned implementation for state of charge equation in the Summer 2023 Release, unintended consequences from that implementation and possible alternative modeling implementations. The ISO discussed the proposed changes to include regulation awards in the state of charge equation that had the observed outcomes from the Market Simulation testing environment when this change was introduced there. The ISO also discussed potential alternative methods that could be used to model storage resources that receive awards for ancillary services.

The video is available here: https://youtu.be/3CjBhBNdezw

Comments were due August 17, 2023

Market Simulation Oct 3.

Target Activation– Nov 1st

Fall 2023 – Hybrid Resources 2C Metered Quantities for Hybrids

Project Information	Details/Date
High Level Project Scope	System (MRI-S) shall allow the SC of a Hybrid resource the ability to submit Metered Quantities on a component ID only, which would override the current Metered Quantities. This ability shall be made available regardless if the resource is ISO Polled or SCME. Implementation note: ISO Polled or SCME based on the MasterFile flag. New data type: ISOME
Impacted Systems	MRI-S

Fall 2023 – Hybrid Resources 2C – Metered Quantities for Hybrids

Milestone Type	Milestone Name	Dates	Status
BRS	BRS	Aug 17, 2023	✓
Tech Spec	Create and Publish ISO Interface Spec (Tech Specs)	NA	
Market Sim	Market Sim Window	Sep 09 2023 – Sep 29, 2023	
Production Activation	Hybrid Resources 2C – Metered Quantities for Hybrids	Nov 01, 2023	

Independent 2023 Releases

2023 - Variable Operations and Maintenance Cost Review

Project Information	Details/Date
High Level Project Scope	Through this triennially recurring stakeholder process, the ISO will review the default variable operations and maintenance (VOM) adders and, if necessary, update these default values. After reviewing the currently effective default VOM adders, the ISO is proposing to update the default values by applying a 18.73% inflation increase. For any resources currently using default values, the ISO will automatically update their VOM adder values in Master File. Any negotiated VOM adder values will not be affected by this initiative.
BPM Changes	Market Instruments
Tariff Changes	Section 30.4.5.4
Impacted Systems	NA (Master File data update only)

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board briefing/approval	Sep 20, 2023	
Tariff	Draft Tariff Language	Aug 23, 2023	✓
	FERC Filing	Late Sep 2023	
	FERC Response	Nov 30, 2023	
BPMs	Post Draft BPM changes	Late Sep 2023	
Market Sim	Market Sim Window	NA	
Production Effective Date	Effective Date	Dec 1, 2023 (expected)	

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)

Plan

- MAP-Stage new API URLs **available as of May 18, 2023** to transition
- MAP-Stage old API URLs **no longer available as of Sep 01, 2023**
- Please open the entire 45.42.16.0/21 network on ports 80 & 443 for our new IP space to access new API URLs

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

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 API URLs; however, the IP addresses will be changed. Please stay tuned for more information.

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 30 business days to validate and transition to the new UI URLs.

Applications & Environments	Deployment Start Dates	New User Interface (UI) URLs
Balancing Area Authority Operations Portal (BAAOP)		
MAP Stage	Fri 7/28/23	https://mapstage-baaop.caiso.com
Production	Wed 9/20/23	https://baaop.caiso.com
Base Schedule Aggregation Portal (BSAP)		
MAP Stage	Fri 7/28/23	https://mapstage-bsap.caiso.com
Production	Thu 9/21/23	https://bsap.caiso.com
Reliability Coordinator Base Schedule Aggregation Portal (RCBSAP)		
MAP Stage	Fri 7/28/23	https://mapstage-rcbsap.caiso.com
Production	TBD	https://rcbsap.caiso.com
Schedule Infrastructure & Business Rules (SIBR)		
MAP Stage	Fri 7/28/23	https://mapstage-sibr.caiso.com
Production	Thu 9/21/23	https://sibr.caiso.com
Reporting (Includes SIBR Reports, Transmission Registry, RIMS, Master File, and FSP folder)		
MAP Stage	Mon 7/31/23	https://mapstage-reporting.caiso.com
Production	TBD	https://reporting.caiso.com
Market Participant Portal (MPP)		
MAP Stage	TBD	https://mapstage-mpp.caiso.com
Production	TBD	https://mpp.caiso.com
Customer Market Results Interface (CMRI)		
MAP Stage	Thu 8/3/23	https://mapstage-cmri.caiso.com
Production	TBD	https://cmri.caiso.com
Congestion Revenue Rights (CRR)		
MAP Stage	Mon 8/7/23	https://mapstage-crr.caiso.com
Production	TBD	https://crr.caiso.com
WEIM Portal		
MAP Stage	**Done**	https://mapstage-weim.caiso.com
Production	**Done**	https://weim.caiso.com
Master File (MF)		
MAP Stage	Wed 8/9/23	https://mapstage-mf.caiso.com
Production	TBD	https://mf.caiso.com
Transmission Registry (TR)		
MAP Stage	Tue 9/5/23	https://mapstage-tr.caiso.com/
Production	TBD	https://tr.caiso.com

Future Releases

Future Releases Overview

Project	BOG	Tariff	Production Activation
Transmission Service & Market Scheduling Priorities Phase 2	Feb 2023 – Approved	• 03/27/23: Draft Tariff Language • 06/14/23: Revised DTL • 07/14/23: Track 2 DTL • File Track 1 July 28, 2023 • File Track 2 Jan 2024	Summer 2024
Transmission Exchange Agreement	NA		Summer 2024
WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3	Dec 14, 2022 – Approved	NA	Summer 2024
Hybrid Resources 2C - RIMS	NA	NA	2024
Day-Ahead Market Enhancements	Feb 2023 – Briefing May 17, 2023 – Approved	• 06/02/23: Draft Tariff Language, Draft Tariff Matrix • 06/16/23: Comments due on DTL • 06/23/23: Meeting • 07/11/23: Revised DTL • File 08/22/23 • FERC Response requested by 12/21/23	2024-2025
Extended Day-Ahead Market On-Boarding	Feb 2023 – Approved	• 03/30/23: Draft Tariff Language • 05/24/23: Working DTL • 06/08/23: Revised DTL • 07/06/23: Comments due on DTL • 07/25/23: Revised DTL • 07/26/23: Meeting • File 08/22/23 • FERC Response requested by 12/21/23	2024-2025 2026

2024 – Transmission Service & Market Scheduling Priorities Phase 2

Project Information	Details
High Level Business Need	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.
High Level Project Scope	The following are the key design elements of the proposed framework for establishing wheeling through scheduling priority across the ISO system: • Calculating Available Transfer Capability (ATC) in Monthly & Daily Increments • Accessing and Reserving ATC • Transmission study and expansion process • Application of priorities in post-HASP process • Compensation framework for wheeling through scheduling priority
BPM Changes	• Market Instruments • Market Operations • Reliability Requirements • Settlements and Billing • Transmission Planning Process • Generator Interconnection and Deliverability Allocation Procedures
Tariff Changes	Sections: • §23.1, §23.2, §23.3, §23.4, §23.5, §23.6, §23.7 • §26.1.4.5 • §30.5.1 • §34.12.3 • §Appendix A • §Appendix L
Impacted Systems	• AIM • System for ATC calculation, access, and reservation • SIBR • RTM • Settlements • OASIS • ITS

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	Q4 2023	
Settlements Config Guides	Post Draft Config Guides	Yes	
Tech Spec	Create ISO Interface Specifications	Yes	
Tariff	Filed ER23-2510 for Wheeling Through File Track 2	Jul 28, 2023 Jan 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	Summer 2024	

2024 – Transmission Exchange Agreement

Project Information	Details/Date
High Level Business Problem or Need	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.
High Level Project Scope	• WAPA needs functionality to sell their TOR (using ETC/TOR terminology instead of CRN) to other parties on their OASIS. • 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. • 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. • WAPA will not take on the obligation to settle with their purchaser. • 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] • 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. • If there are outages on the line, the curtailment should be consistent with current practice.
BPM Changes	Settlements Configuration Guides
Tariff Changes	N/A
Impacted Systems	SIBR, DAM/RTM, Settlements, ITS, MF

2024 – Transmission Exchange Agreement

Milestone Type	Milestone Name	Dates	Status
External BRS	Post External BRS	Q4 2023	
Settlements Config Guides	Post Draft Config Guides	Yes	
Tech Spec	Create ISO Interface Specifications	Yes	
Tariff	NA	NA	
BPMs	Draft BPM changes – Settlements & Billing	Yes	
Production Activation	Transmission Exchange Agreement Renegotiation	Summer 2024	

2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3

Project Information	Details
High Level Project Scope	**Track-3** • Item3A – DR Inclusion with RSE via ALFS (RSEE-1060) (Implemented in Phase 1 – enhancements needed) • Furnish ALFS-SOA API integration to DR SCs to automatically submit their DR LF Adjustment (that reflect Non-Participating DR Schedules) to account for DRs that are not explicitly modeled in real-time markets.
BPM Changes	Demand Response, WEIM
Tariff Changes	NA
Impacted Systems	MF, ALFS, Market, BAAOP

2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3

System	High Level Changes
MF	• RSEE-1060 – Business Process: Ensure DR Inclusion Flag Submission by WEIM Entity Only via CIDI. • RSEE-1060 – Business Process: STF Notification of Changes to DR Inclusion Flag on WEIM Entity / WEIM Sub-Entity Level.
ALFS	• Access DR Inclusion Flag on WEIM Entity/Sub-Entity Levels from MF. • Translate the WEIM Entity/Sub-Entity DR Inclusion Flag to their associated LF zones (During MF transfer, the sub-area LF zone will adopt the WEIM Entity attestation flag). • Receive Non-Participating DR Schedules from WEIM Entity or WEIM Sub-Entity • Broadcast Non-Participating DR Schedules for WEIM Entity BAA or WEIM Sub-Entity. • Broadcast DR LF Adjustment Data (that have been adjusted in ALFS) to downstream systems.

Market	• Consume the following from ALFS:
	  • ALFS-DF-Submitted DR LF Adjustment (hourly aggregate)
	  • STF-DF-Excluded DR LF Adjustment (hourly aggregate)
	• Accounting for DR LF Adjustments in RSE.

BAAOP	Display DR LF Adjustments received from ALFS in BAAOP. Disable manual entry via BAAOP UI on a sunset date, after all participants transition to ALFS API submission.

2024 – WEIM Resource Sufficiency Evaluation Enhancements Phase 2 Track 3

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval WEIM Governing Board Approval	Dec 14, 2022	✓
External BRS	Post External BRS Post External BRS v1.1 Post External BRS v1.2 Post External BRS v1.3 **Post External BRS v1.4 (No changes to Track 3)**	Mar 10, 2023 Mar 31, 2023 Jun 27, 2023 Sep 05, 2023 **Sep 12, 2023**	✓ ✓ ✓ ✓ ✓
Settlements Config Guides	NA	NA	
Tech Spec	Create ISO Interface Spec (Tech spec) – ALFS	Yes	
Tariff	Tariff	NA	
BPMs	Draft BPM changes – Demand Response Draft BPM changes – WEIM	Yes	
Market Sim Scenarios	Market Sim Scenarios	Yes	
Market Sim	Market Sim Window	Yes	
Production Activation	Resource Sufficiency Evaluation Enhancements Phase 2 Track 3	Summer 2024	

2024 – Hybrid Resources 2C RIMS

Project Information	Details/Date
High Level Business Problem or Need	The ISO launched this stakeholder initiative to identify new or enhanced market rules and business processes needed to accommodate hybrid resources, resources that consist of two sets of market rule changes that will facilitate mixed-fuel type (hybrid and co-located resources) project participation in the ISO markets. Prior to this initiative, Phase 1 identified a first set of modifications generally concerned with setting up and operating co-located resources. Building on phase 1, Phase 2 focuses on modifications that will explore how hybrid generation resources can be registered and configured to operate within the ISO market. The initiative will further develop solutions allowing developers to maximize the benefits of their resource's configuration. Additionally, hybrid resource configurations also raise new operational and forecasting challenges that the ISO plans to address during this initiative.
High Level Project Scope	With this initiative, there's an opportunity to increase storage and the number of hybrid resources that can connect to the ISO grid. Currently the interconnection queue includes more than 24,000 MW of mixed fuel projects and nearly 20,000 MW of storage which represents roughly half of all generation in the current interconnection queue.
BPM Changes	Settlements & Billing
Impacted Systems	Summer 2023: Settlements Fall 2023: Metered Quantities for Hybrids **Independent 2024: RIMS** Completed: Today's Outlook, ISO Today Mobile Application, Reports
Requirements	http://www.caiso.com/Documents/BusinessRequirementsSpecifications-HybridResourcesPhase2.pdf

2024 – Hybrid Resources 2C RIMS

Milestone Type	Milestone Name	Dates	Status
External BRS	Publish External BRS	Jan 31, 2023	✓
Settlements Config Guides	NA for RIMS	NA	
Tech Spec	Create and Publish ISO Interface Spec (Tech Specs)	NA	
Market Sim	Market Sim Window – RIMS	NA	
Production Activation	Hybrid Resources 2C – RIMS	2024	

2024 - Congestion Revenue Rights (CRR) Upgrade

Project Information	Details/Date
High Level Project Scope	The Congestion Revenue Rights (CRR) system was implemented by CAISO in 2008 as part of the Market Redesign and Technology Upgrade (MRTU) implementation. The current CRR system is at its end of life, does not have the flexibility to accommodate future policy changes and requires the ISO to calculate data and run processes manually outside the current system to produce a successful CRR Auction. The CAISO has decided on a significant upgrade of the existing CRR system and adopt the latest technology stack aligned with CAISO's technology standards, consolidate all CRR related functions, minimize human errors, reduce processing time, eliminate manual workarounds, and positions the system to accommodate policy changes down the road. **Congestion Revenue Rights (CRR) system replacement project scope is the roll-out of a:** • Brand new user-interface (UI) system with an updated new look-and-feel, to replace the existing legacy system implemented during the MRTU 2008 go-live and brought up to current ISO technology standards • Set of application-programming interfaces (APIs) to enable integration between ISO and market participant systems **Overall, to support the following in one consolidated CRR external-facing system:** • Annual/Monthly Auction and Allocation market participant bid submission and results retrieval • Load data submission by CRR LSEs, CEC • Load migration data submission by CRR UDCs • Secured "Congestion Revenue Rights Full Network Model" information access • Private and public access of CRR market input and output information
BPM Changes	Congestion Revenue Rights • Enhancements made to the new CRR product. • Automatic publishing of CRR market results. • Automatic CRR notification. • New CRR schedule calendar. • New CRR FNM access. • New CRR data submission and download interface UI/API. • New CRR market results interface. • Load Migration
Tariff Change	No
Impacted Systems	CRR, AIM, CMRI, OASIS, CTS, Market Clearing, EMMS, IFM/RTN, MQS, Master File, MPP, Settlements, WebOMS, ETCC.

2024 - Congestion Revenue Rights (CRR) Upgrade

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

2024 - Congestion Revenue Rights (CRR) Upgrade

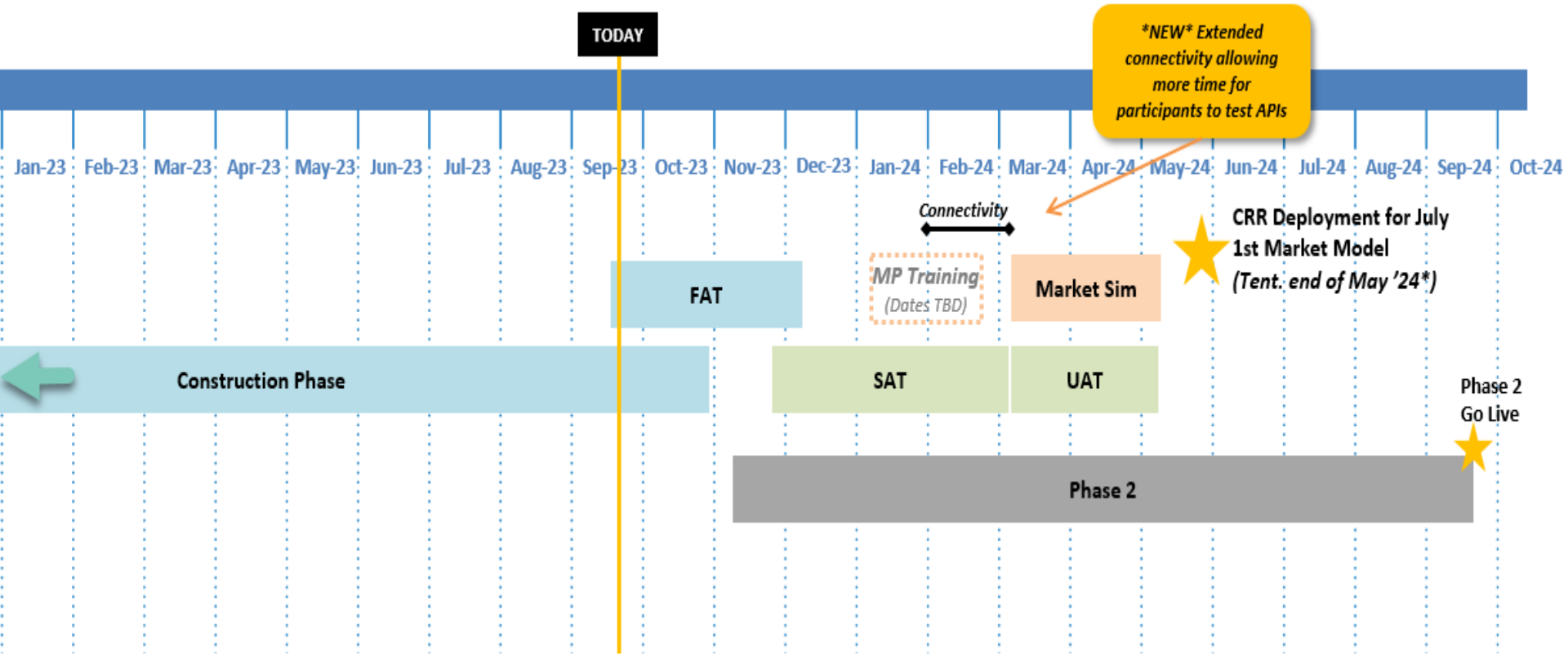
Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	NA	
External BRS	Publish External BRS BRS Revision v1.3	Nov 16, 2022 Mar 29, 2023	✓ ✓
Config Guides	Post Draft Config Guides	Yes	
Tech Spec	Publish Technical Specification	Feb 24, 2023	✓
Deployment Plan	Draft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

Customer Partnership Group	**Next CPG**
	- **Project updates**
	  - **Updated timeline**
	  - **Draft Market Sim plan**
	- **B2B Improvement Initiative: API Mock Service**
		Sep 20, 2023	

2024 - Congestion Revenue Rights (CRR) Upgrade

Updated September 2023

- Construction nearing end, but will continue through Factory Acceptance Testing (FAT)
- **Big Milestone!** Factory Acceptance Testing started week of 9/18, but delayed from target date
- Opportunities identified to compress functional testing timelines (SAT), so time savings anticipated
- **Impact on Go Live Date still TBD** – will know more as FAT progresses
- Connectivity – 3 weeks extend connectivity plus standard one week connectivity.



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
    - Meeting details and presentation materials are available on the CAISO Developer site at www.developer.caiso.com , which requires an account to be setup for access
  - **CRR Customer Partnership Group**
    - **Next CPG meeting is Wed, 10/18 @ 10 AM**
    - Monthly
    - Meetings available on the CAISO calendar on www.caiso.com
    - Meeting details and presentation materials are available on www.caiso.com > Stay Informed > Meetings & Events > Customer Partnership Groups

Day Ahead Market Enhancements

Project Information	Details/Date
High Level Business Problem or Need	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. Another reason for the energy imbalance is the day-ahead market operates on hourly time increments, whereas real-time market schedules energy in 15 and 5-minute intervals. This discrepancy in granularity results imbalances since the rea-l-time market schedules fluctuate within the hour while day-ahead market schedules remain fixed for the entire hour. 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.
High Level Project Scope	Enhance the California ISO's (CAISO's) day-ahead market by: • Introducing an imbalance reserve (IRU/IRD) product to provide flexible capacity to account for real-time ramping needs • Enhancing the residual unit commitment process to also ensure there is sufficient downward dispatch capability (RCU/RCD) • Enhancing the day-ahead market to maximize benefits of greater West-wide diversity in the day-ahead optimization for Western Energy Imbalance Market participants
BPM Changes	Settlements and Billing, Market Instruments & Market Operations
Tariff Changes	Sections 27, 31, 34, 39
Impacted Systems	MF, SIBR, DAM, OASIS, CMRI, Settlements & Internal Systems

Day Ahead Market Enhancements

System	High Level Changes
MF	• Define IRU, IRD, RCU, RCD eligibility for the resource ID in MF.
SIBR	• IRU,IRD,RCU,RCD bid rules
DAM	• Calculate IRU/IRD requirements • MPM: Market Power Mitigation for IRU/IRD • IFM: procure IRU/IRD • IRU/IRD deployment scenarios • IRU/IRD requirement distribution • IRU/IRD in NA-AC power flow • Include IRU/IRD in constraints • RCU/RCD procurement • RUC-MPM pass • Impact on RUC performance with additional MPM pass • LMP for EN, IRU/IRD, RCU/RCD
OASIS	• IRU, IRC, RCU,RCD related public reports
CMRI	• IRU, IRC, RCU,RCD related private reports
Settlements	• IRU, IRC, RCU,RCD Settlements

Day Ahead Market Enhancements

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board briefing/approval	May 17, 2023	✓
External BRS	DAME External BRS Published	Jul 25, 2023	✓
Tariff	First Draft Tariff Posting	Jun 02, 2023	✓
	Second Draft Tariff Posting	Jul 11, 2023	✓
	FERC Filing	Aug 22, 2023	✓
	FERC Response Requested by	Dec 21, 2023	
Config Guides	Post Draft Config Guides - First set of charge codes	Jan 16, 2024	
	Post Draft Config Guides - Second set of charge codes	Feb 26, 2024	
	Post Draft Config Guides - Third set of charge codes	Apr 08, 2024	
Tech Spec	Publish Technical Specifications	Oct 31, 2023	
BPMs	Post Draft BPM changes	Apr 04, 2024	
Market Sim	Market Sim Scenarios	Aug 04, 2023	✓
Implementation - Inactive	Day Ahead Market Enhancements Implementation Activities	2024-2025	
Activation	DAME Activation (Financially Binding)	2026	

Extended Day Ahead Market (EDAM) Implementation

Project Information	Details/Date
High Level Business Problem or Need	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 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 Western Energy Imbalance Market (WEIM) to increase regional coordination, support state policy goals, and cost effectively meet demand..
High Level Project Scope	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, and that will enhance price formation. EDAM introduce new products, imbalance reserve and reliability capacity, as well as new penalties, RSE surcharge.
BPM Changes	Definitions and Acronyms Energy Imbalance Market (EIM) Market Instruments Market Operations Settlements and Billing EDAM
Impacted Systems	MF, ALFS, ALFS-SOA, SIBR, RTSI, RTBS, BSAP, DAM (IFM and RUC), DA-RSE (new), RTM (RTPD and RTD), STUC, MPM, SMDM, ITS, BARC, GHG Pass (new), Settlements, CMRI, OASIS, ADS, WebOMS
Requirements	Published Aug 02, 2023

Extended Day Ahead Market (EDAM) Implementation

Milestone Type	Milestone Name	Dates	Status
External BRS	Publish External BRS	Aug 02, 2023	✓
Tariff	Draft Tariff Language Revised Draft Tariff Language Updated Revised Draft Tariff Language FERC Filing FERC Response requested by Requested effective date for tariff changes for EDAM agreements and onboarding provisions	Mar 30, 2023 Jun 8, 2023 Jul 25, 2023 Aug 22, 2023 Dec 21, 2023 Dec 21, 2023	✓ ✓ ✓ ✓ ✓
Settlements Config Guides	Draft Technical Documents – Tier 1 Draft Technical Documents – Tier 2 Draft Technical Documents – Tier 3	Jan 16, 2024 Feb 26, 2024 Apr 08, 2024	
Tech Spec	Create and Publish ISO Interface Spec (Tech Specs)	Oct 2023	
BPMs	Definitions and Acronyms Energy Imbalance Market (EIM) Market Instruments Market Operations Settlements and Billing EDAM	TBD	
Training	Training	TBD	
Production	EDAM Implementation Activities EDAM Onboarding (Financially Binding)	2024-2025 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 for meeting dates and times and add events to your calendar
    - Typically held on Mondays and Thursdays
  - Market Performance and Planning Forum
    - Bi-monthly review of market performance issues
    - High level discussion of release planning, implementation and new market enhancements

What to look for on the calendar…

Market Sim

Release Users Group (RUG)

Market Sim

Calendar of Meetings, Training and Events

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

◄ ► today **February 2018** month day

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

RUG Calendar 2023

California ISO

2023

Release User Group Meetings

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

January

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Meeting Holiday

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Market Update

Market Analysis
Short Term Forecasting

Stay Informed

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Release Users Group (RUG)

Market Sim

Calendar of Meetings, Training and Events

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

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Next RUG: Oct 3, 2023

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

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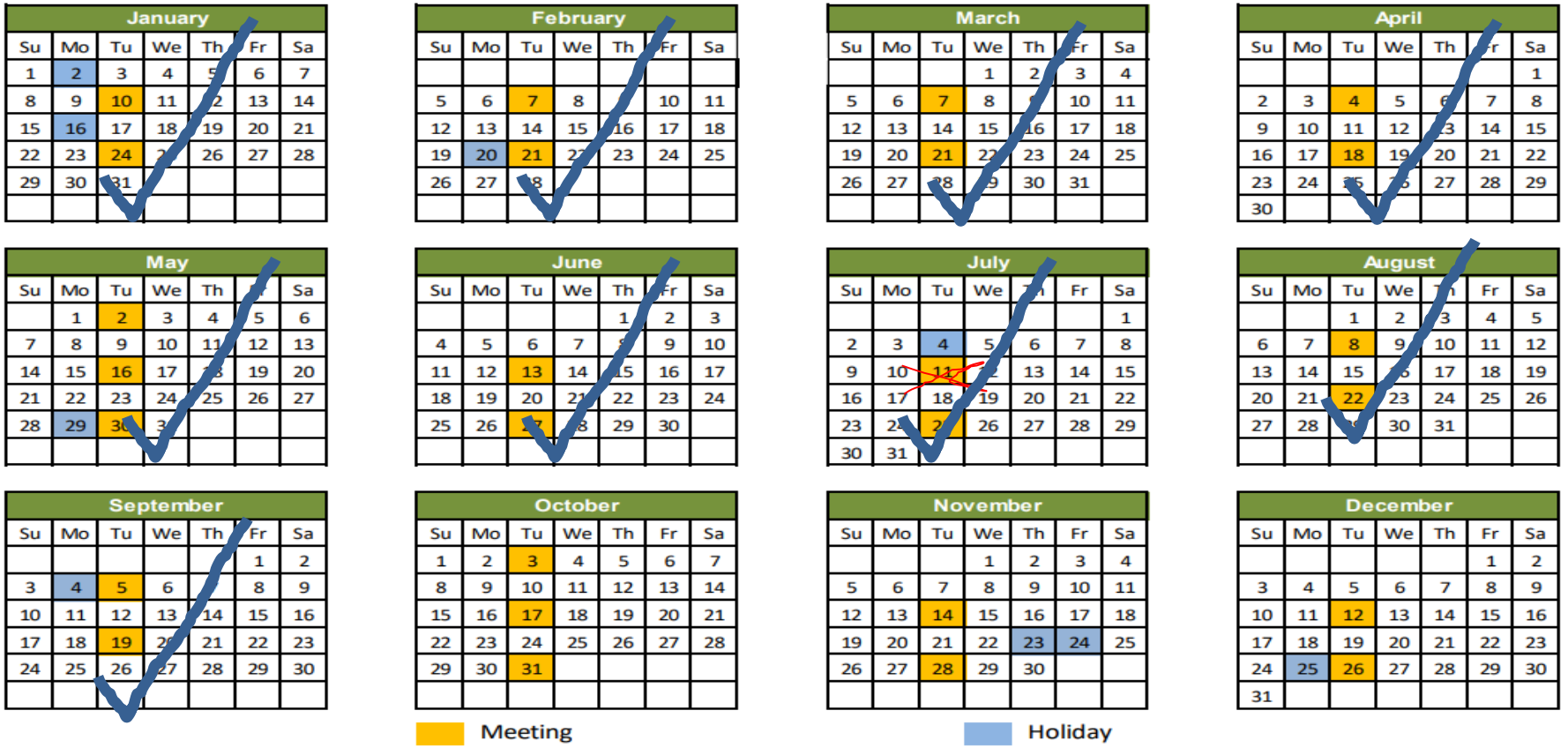
RUG Calendar 2023

California ISO

2023

Release User Group Meetings

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



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Meeting

Holiday

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User Groups Calendar - 2023

California ISO

2023

Settlement User Group Meetings

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

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California ISO

2023

Technical User Group Meetings

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

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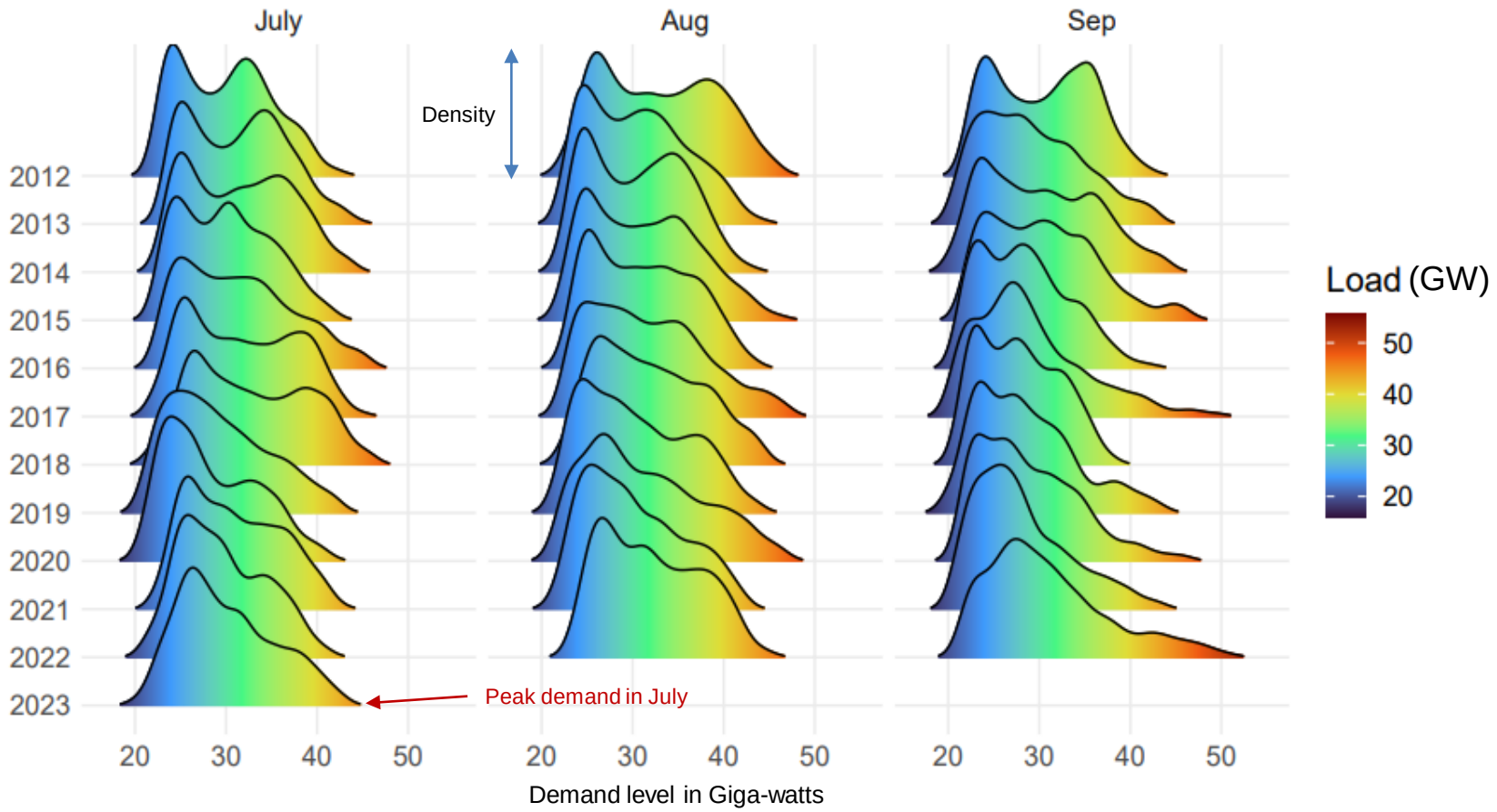
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

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						

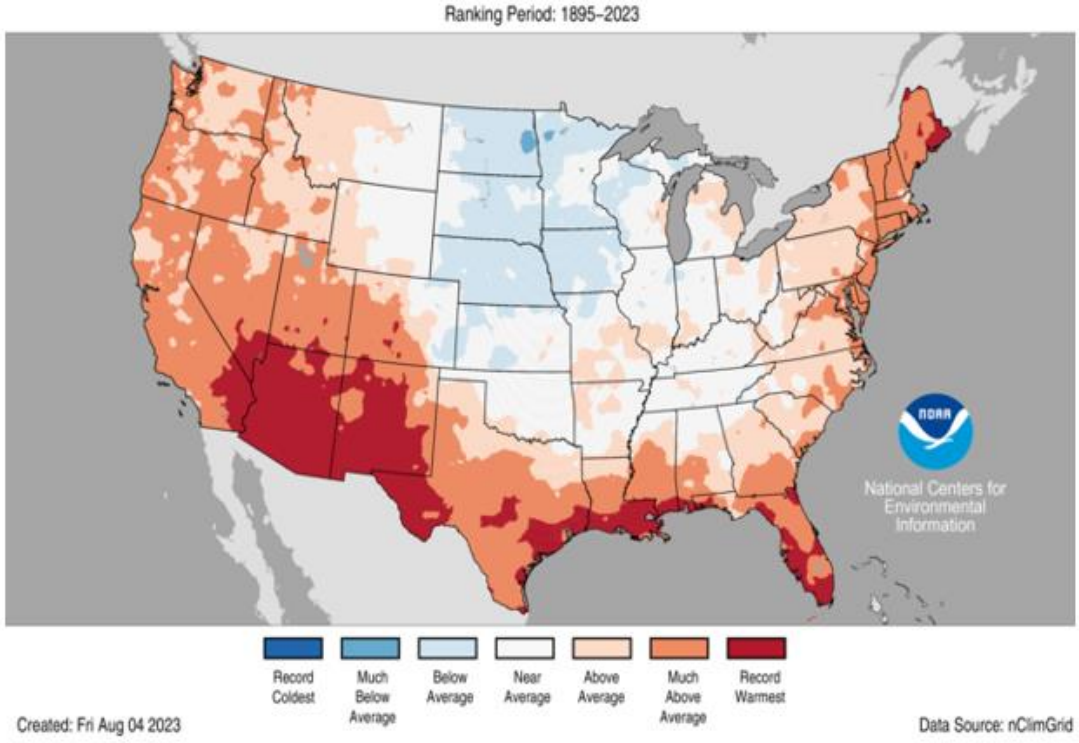
Summer Marker Performance Report
July 2023

CAISO's loads in July were moderate, reaching a peak of 43,545 MW on July 25



In contrast, demand in other areas of west experienced higher levels of demand

From above-average to record-warmest mean temperatures were observed across the western United States throughout July



Warmer maximum temperatures were widespread and larger in magnitude in the rest of the west

The Desert Southwest, including the California desert, saw the more extreme temperature departures

The ISO issued Energy Emergency Alerts (EEAs) on three days of July

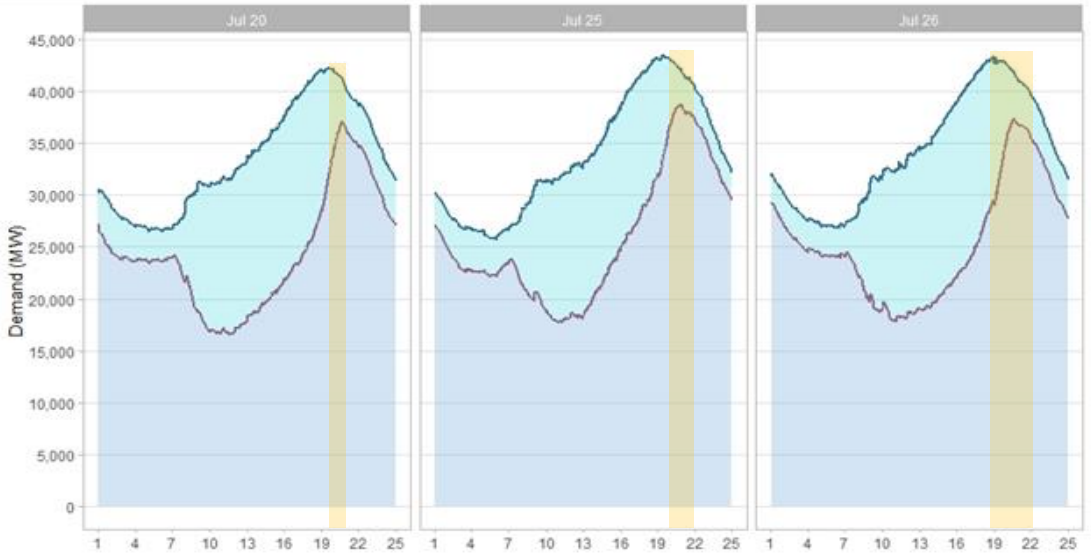
Date	Alert level	Timeframe	Definition
20-Jul	EEA1	7:30—8:30pm	All resources in use or committed for use, and energy deficiencies are expected.
25-Jul	EEA Watch	7:26—10:00pm	All available resources committed or forecasted to be in use, and energy deficiencies are expected.
26-Jul	EEA Watch	6:00—10:00pm	

Despite the challenging system conditions, the ISO operated the grid reliably without escalating to higher emergency stages or implementing rotating outages

The emergencies were issued for the time covering the net load peak, which is the most critical period in the grid

	Gross Peak		Net Peak	
Date	**Time**	**MW**	**Time**	**MW**
20-Jul	6:35pm	42,275	7:42pm	37,005
25-Jul	6:27pm	43,545	7:54pm	38,750
26-Jul	5:58pm	43,349	7:34pm	37,333

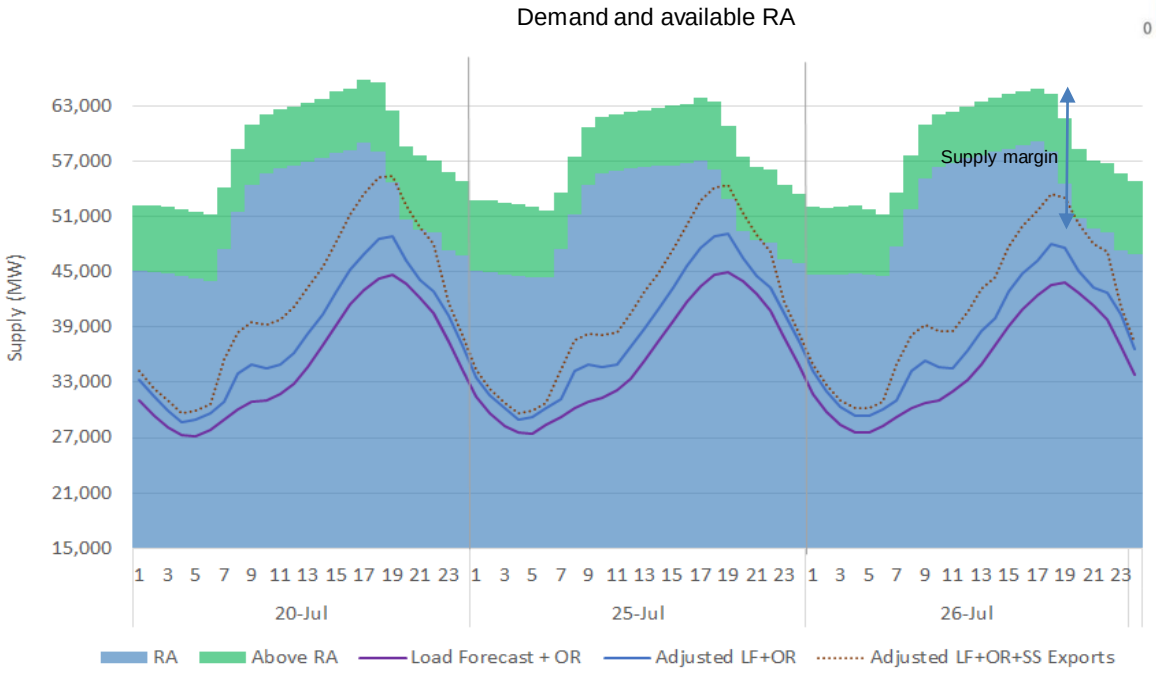
Gross and net load



California ISO

Resource-adequacy supply in July was deemed adequate to meet projected load obligations but getting thinner considering uncertainties

The July events were not the result of a shortage of forward capacity to meet peak demands

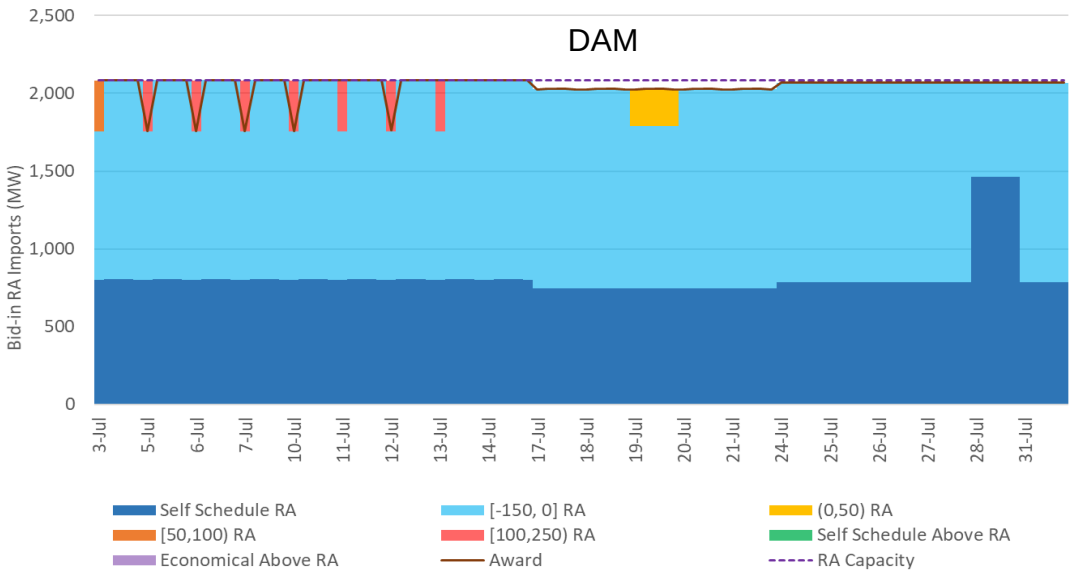


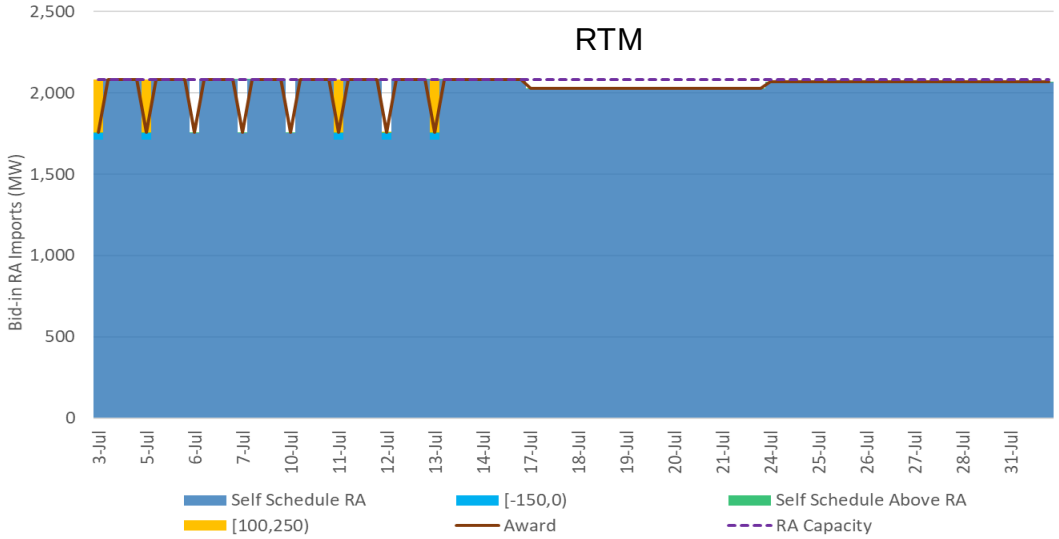
About 97 percent of RA imports bid in at or below $0/MWh in July

Assessment is based on only

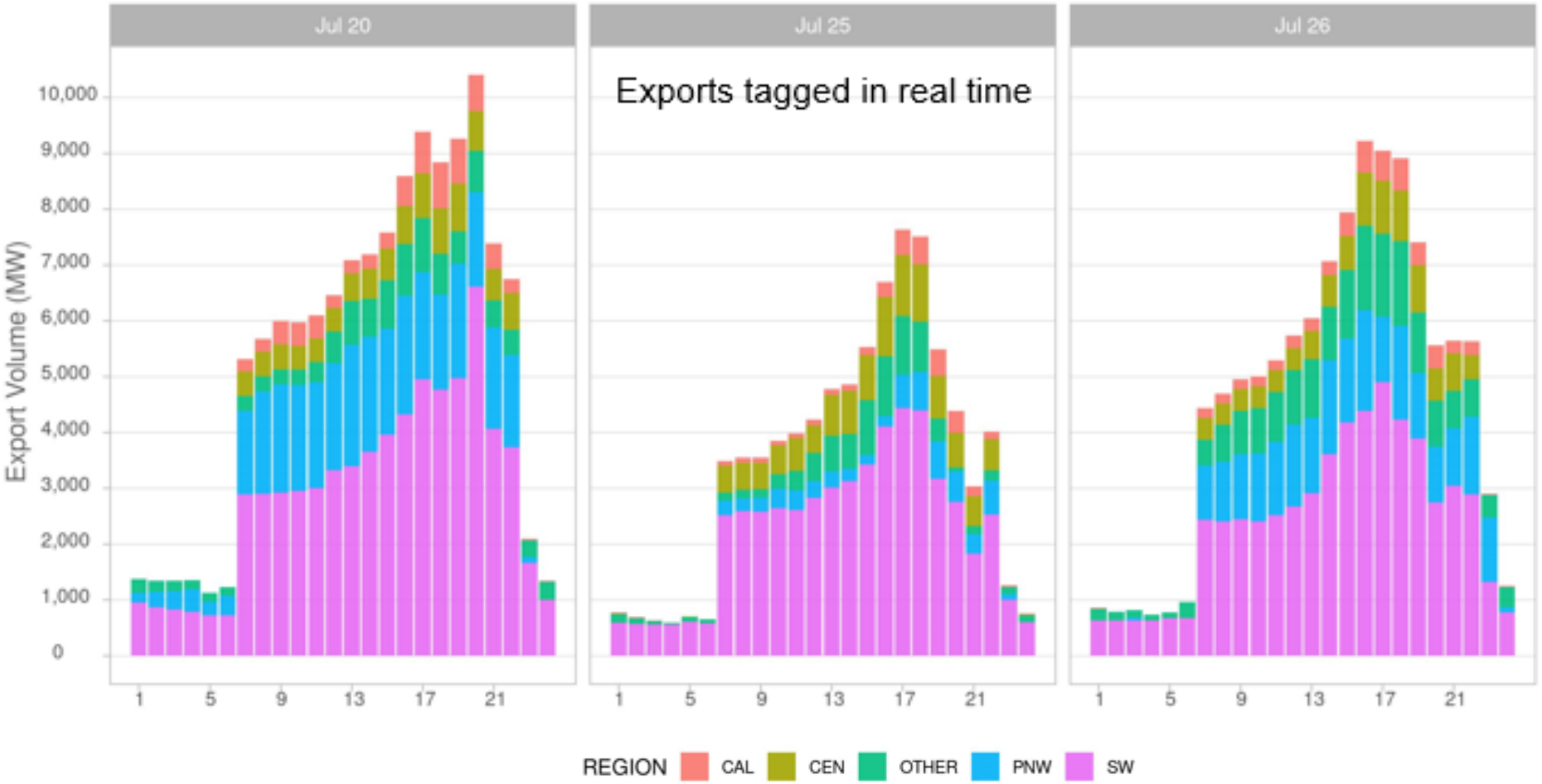
- Static imports only
- CPUC-jurisdictional Imports
- Non-resource specific Imports
- Weekdays and peak hours

All RA imports with self schedules or bids at or below $0 were cleared in both the day-ahead and real-time markets



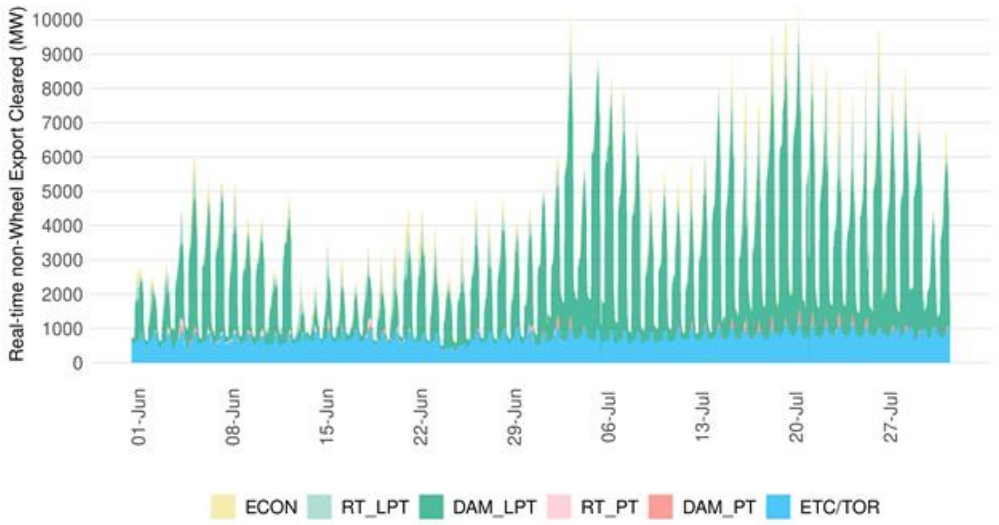


The ISO's market cleared substantial volumes of exports, which reduced the supply margins available in real time



CAL: California, CEN: Central, PNMW: Pacific Northwest, SW: Southwest, Other: Non-WEIM

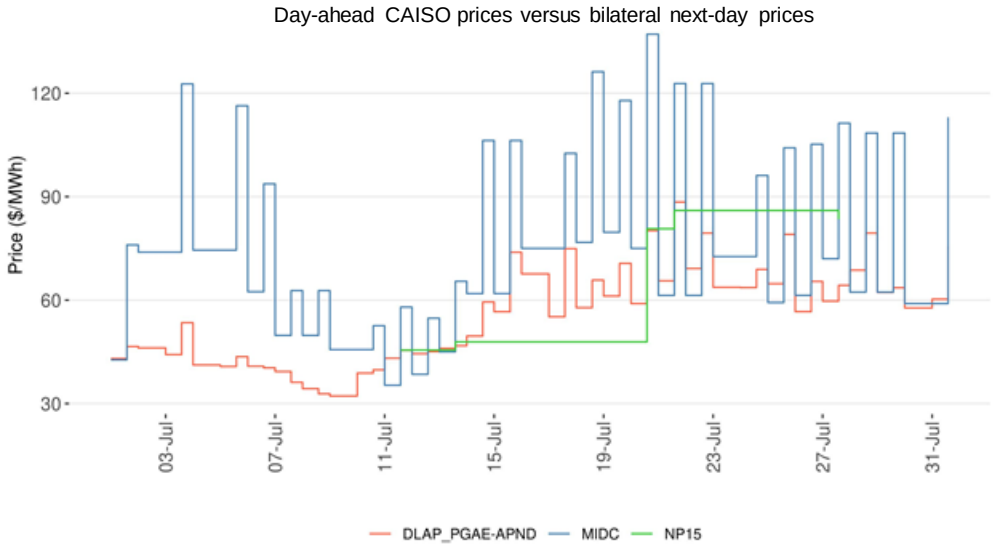
The majority of exports cleared in the ISO's market were price takers



The ISO area's average prices were generally lower than external bilateral prices, potentially creating incentives to clear exports in the ISO's market

High ISO prices at peak offset by low prices in midday hours

Higher exports due to below-average water levels in the Pacific Northwest and unprecedented high demand in the Desert Southwest



The emergency alerts were driven by a confluence of rapidly emerging intra-hour conditions in real time that could not be anticipated far in advance

- While supply margins were reducing, there were no projections of capacity issues days in advance to trigger further steps in the summer protocol
- The day-ahead market did not project any supply shortfalls
- The emergencies in real time were driven by loss of supply (outages, derates, import cuts due to fire impacts, lower renewable production, resource deviations including exports tags), changes in loads, unrealized import transfers and transmission congestion
- The flexible ramp product in real time does not procure capacity to cover all types of supply changes

July 20. CAISO issued an EEA level 1 for 19:30-20:30 hrs

- Two days in advance, there was projection of thinning supply margins
- RA supply was adequate to meet load obligation plus 4,000 MW of uncertainty and up to 9,000MW of exports
- The hour-ahead process and the pre-dispatch market did not project any supply shortfalls while accounting up to 1,600 MW of advisory import transfers for net load peak hour
- At 19:00 hrs the balancing market began seeing supply shortfalls which progressively intensified, reaching up to 1,500 MW, as the system approached the net load peak
- There was contradictory information regarding 1,000 MW of dispatchable supply being available
- Regulation was being depleted and levels of operating reserves were reducing
- There was not one but multiple concurrent changes that reduced significantly the supply margin, including unrealized transfers, outages and derates, resource deviations and impacts of fire
- An EEA was issued starting at 19:30hrs as reserves projected to be below requirements
- Up to 850 MW of Reliability demand response was dispatched
- Additional operating reserves were manually procured and load conformance was increased
- Certain resources were reached to ask to follow instructions
- Load conformance had worked well in prior days. Based on this event, the ISO started to use higher load conformance in the hourly market

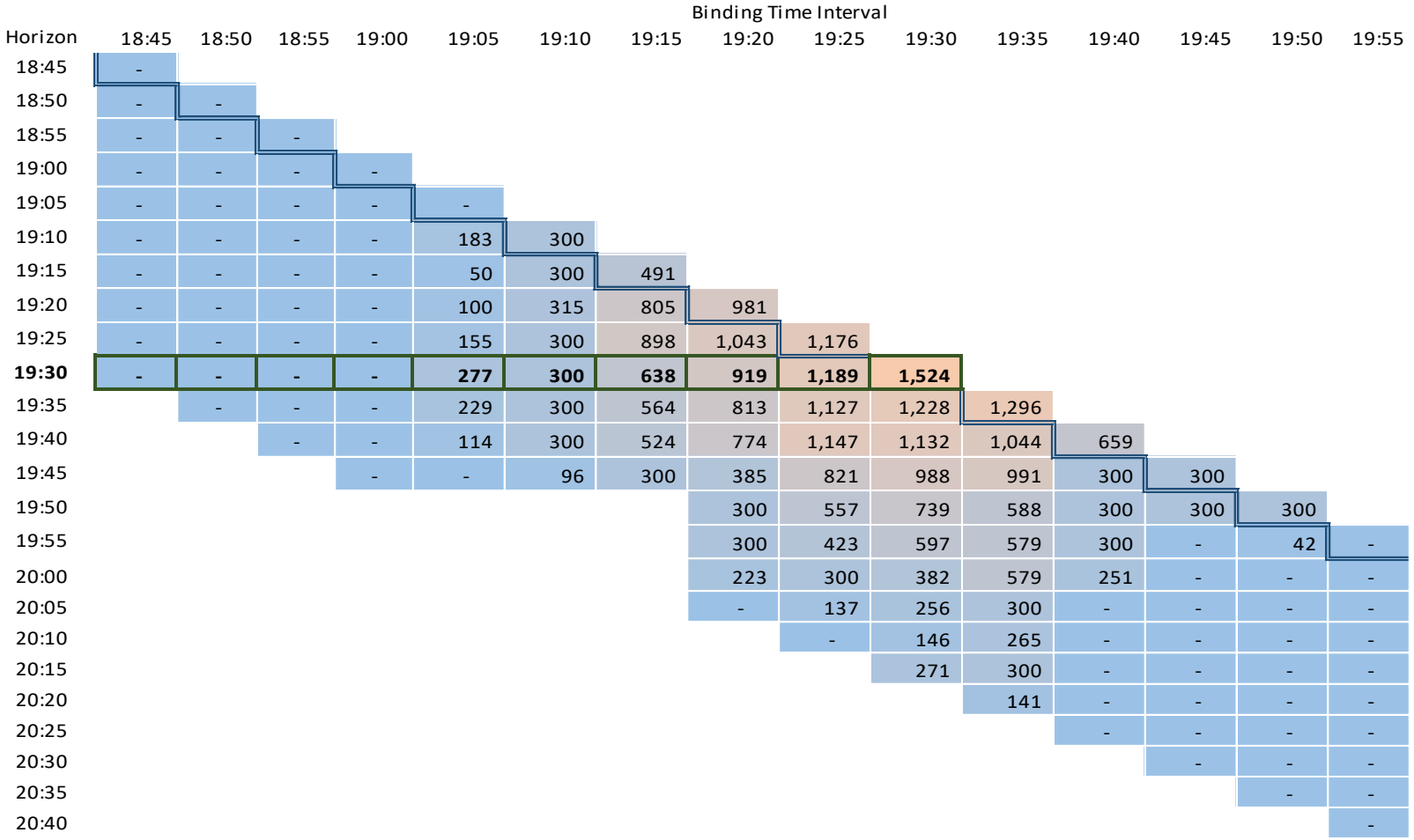
July 25. CAISO issued an EEA Watch 1 for 19:26-22:00 hrs

- Two days in advance, there was only a minor projection of thinner supply margins
- RA supply was adequate to meet load obligation plus uncertainty of 3,900MW and up to 7,500 MW of exports
- Load conformance of up to 5,000MW was used in the hourly market to position resources
- The hour-ahead process and the pre-dispatch market did not project any supply shortfalls while reducing up to 4,800 MW of economical and low priority exports for net load peak hour
- The ISO was providing energy assistance to other balancing area due to loss of generation
- At 19hrs the balancing market began seeing consistent supply shortfalls as the system approached the net load peak
- The real-time market saw significant southbound congestion on Path 26, which stranded supply north of Path26
- There was not one but multiple concurrent changes that reduced significantly the supply margin, including unrealized transfers, outages and derates (including about 2,000 MW from the day-ahead), resource deviations and impacts of fire
- Regulation was being depleted and operating reserves were reducing
- About 2,400 MW of projected exports reductions did not tag accordingly, which further strain the grid and extended the condition of limited supply. They also exacerbated congestion on Path 26
- ISO issued an EEA Watch at 19:26
- Additional operating reserves were procured
- ISO recalled energy emergency being provided to other balancing area to self preserve capacity
- ISO manually curtailed 600 MW of low priority exports
- Supply impacted by the Victor fire returned to service

July 26. CAISO issued an EEA Watch 1 for 18:0-22:00 hrs

- Ultimately, the conditions on July 26 were less severe compared to those experienced in previous days
- No concern were projected from eighth days in advance up to the day-ahead market
- RA supply was adequate to meet load obligation plus uncertainty of 4,100 MW and up to 8,600 MW of exports
- With ongoing concerns regarding high demand in external balancing areas, continuing resource outages, continued fire risk, and the uncertainties experienced in preceding days, the ISO proactively issued an EEA Watch starting at 18:00 hrs
- Load conformance of up to 5,000MW was used in the hourly market to position resources
- ISO started to limit dynamic import transfers in the hourly ahead scheduling process and 15-minute markets to rely only on internal supply and intertie schedules to meet load obligation

On July 20, supply changes rapidly resulted in progressively higher supply shortfalls



Binding Time Interval

Horizon	18:45	18:50	18:55	19:00	19:05	19:10	19:15	19:20	19:25	19:30	19:35	19:40	19:45	19:50	19:55
18:45	-														
18:50	-	-													
18:55	-	-	-												
19:00	-	-	-	-											
19:05	-	-	-	-	-										
19:10	-	-	-	-	183	300									
19:15	-	-	-	-	50	300	491								
19:20	-	-	-	-	100	315	805	981							
19:25	-	-	-	-	155	300	898	1,043	1,176						
19:30	**-**	**-**	**-**	**-**	**277**	**300**	**638**	**919**	**1,189**	**1,524**					
19:35		-	-	-	229	300	564	813	1,127	1,228	1,296				
19:40			-	-	114	300	524	774	1,147	1,132	1,044	659			
19:45				-	-	96	300	385	821	988	991	300	300		
19:50								300	557	739	588	300	300	300	
19:55								300	423	597	579	300	-	42	-
20:00								223	300	382	579	251	-	-	-
20:05								-	137	256	300	-	-	-	-
20:10									-	146	265	-	-	-	-
20:15										271	300	-	-	-	-
20:20											141	-	-	-	-
20:25												-	-	-	-
20:30													-	-	-
20:35														-	-
20:40															-

The ISO identified multiple reasons for supply changes on July 20

Some resources did not transition upward as expected

Production of some renewables was lower than previously forecast

Some resources had derated capacity or outages

Some others have manual dispatches limiting to move

Some storage resources had to maintain state of charge to support awarded regulation

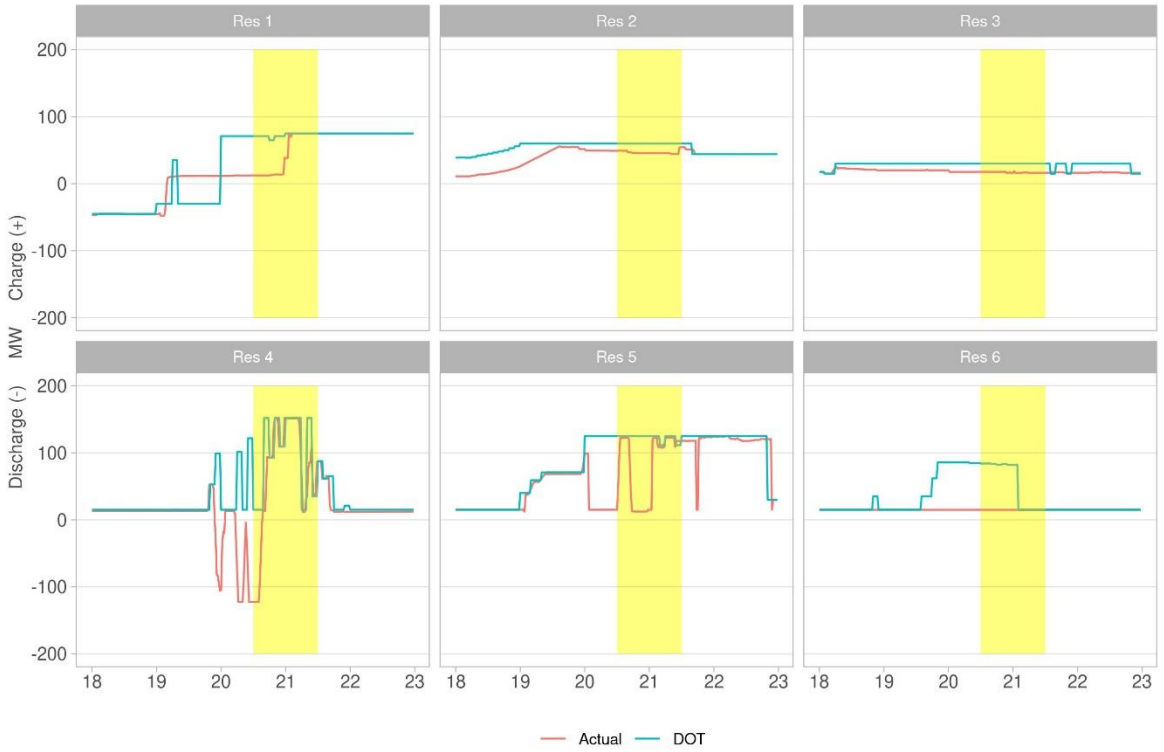
Some imports or base schedules were curtailed due to fire impacts

Some resources did not follow the dispatch operating target

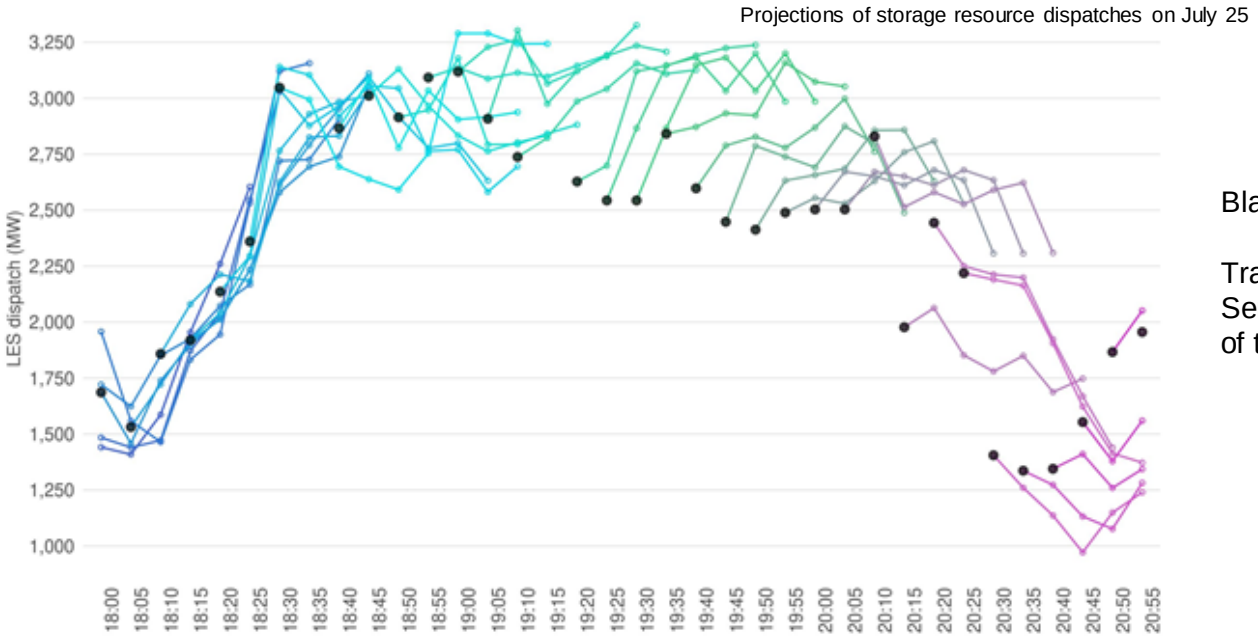
Unrealized supply in the balancing market on July 20

Region	CC	E	Hy	I	LES	MSG	ST	VER	CT	In	Other
CAL	-7	-73	-35	-70	-244	-31	-16	-342		-92	-67
DSW				-3	-4	-122	-15	-258			-10
MNW						-121		-151			
PNW				-59		-35		-71	-4		

Sample of resource deviations from instructions on July 20



The real time conditions are becoming increasingly complex, dynamic and interrelated



Black dots: Biding dispatch instruction

Trajectory starting at each the back dot: Series of advisory dispatches for the rest of the market horizon

The real-time market factors in all known conditions and find the best trade offs

As conditions change, such as instructions not followed, the entire spectrum of the system is re-optimized to the new reality

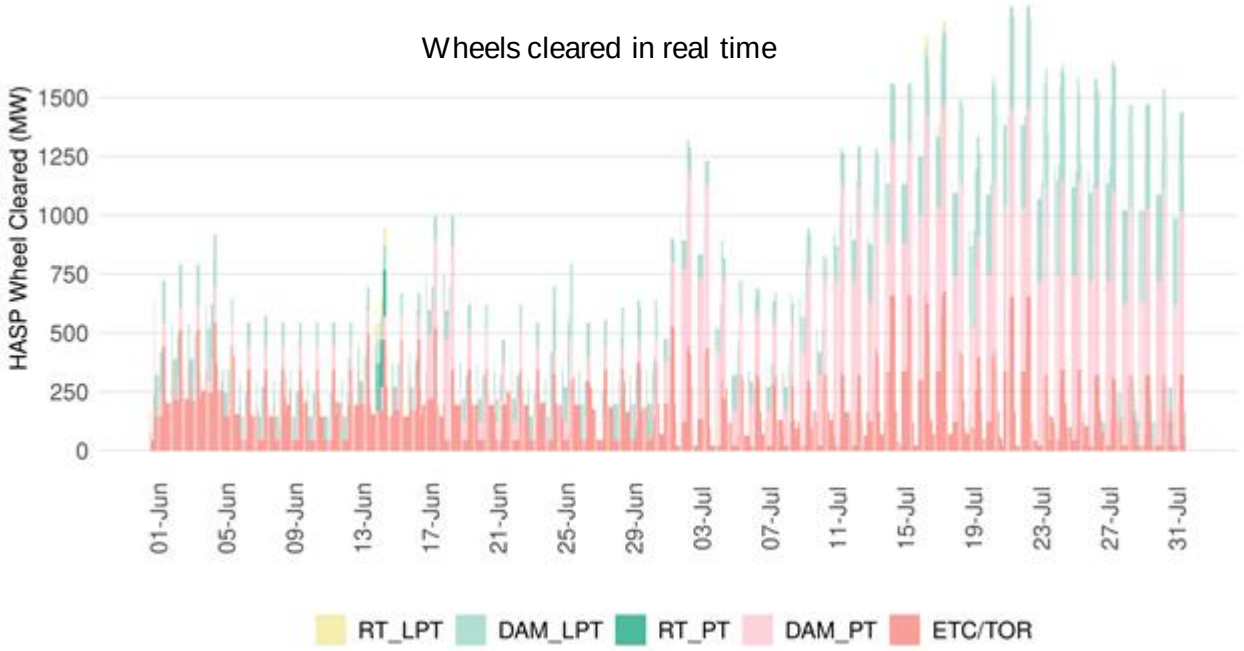
Storage resources are particularly sensitive to the real-time dynamics

In July, the market upheld all high-priority wheeling-through market transactions bid in the market

Registered wheels

Source	Sink	MW
CFEROA	PVWEST	50
CFETIJ	MEAD230	75
CTW230	LLL115	105
MALIN500	MEAD230	425
MALIN500	MCCULLOUG500	100
MALIN500	PVWEST	400
MIR2	RANCHOSECO	30
NOB	MEAD230	287
NOB	MCCULLOUG500	150
NOB	PVWEST	198
	Total:	1820

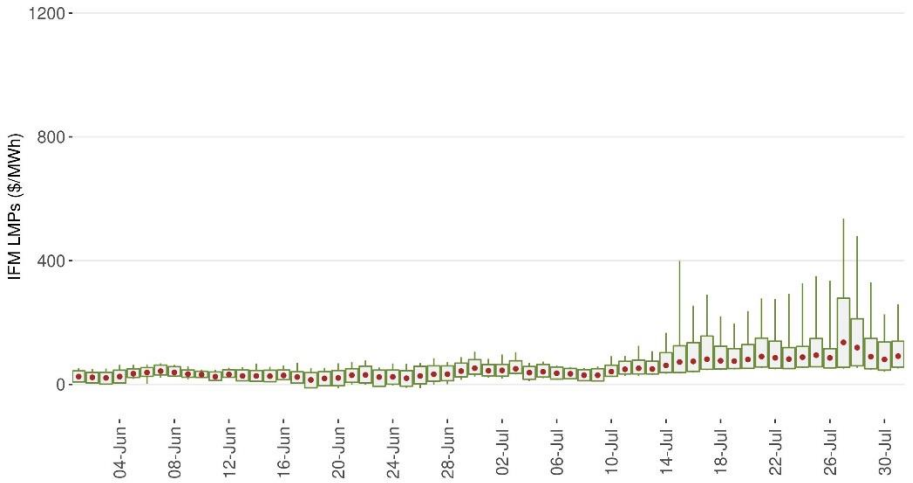
Wheels cleared in real time

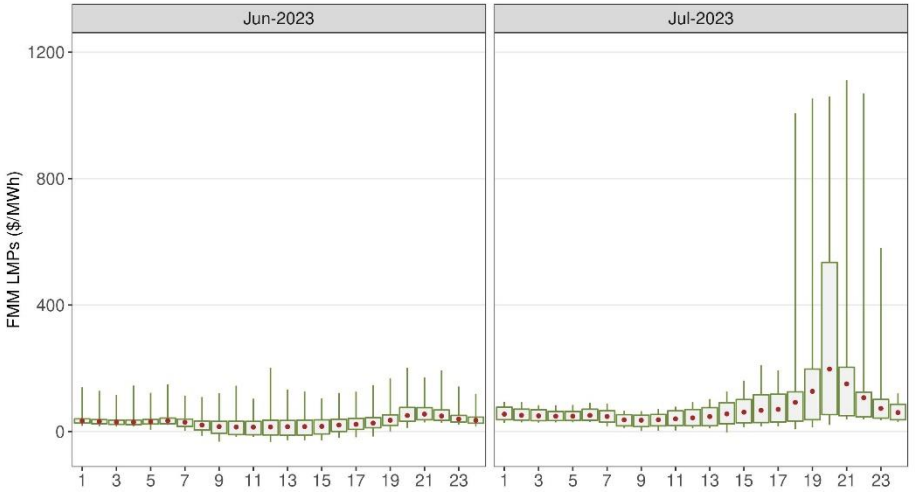


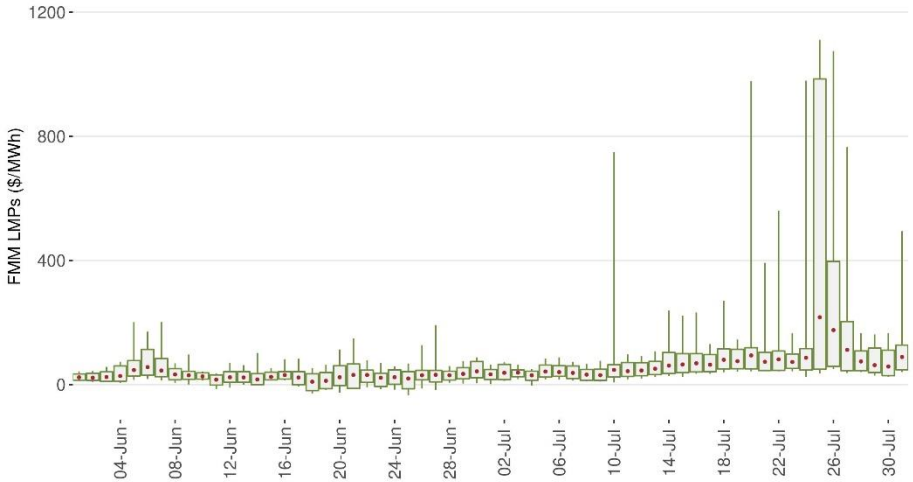
948 MW out of the total registered wheel-through capacity of 1,820 MW bid in the markets

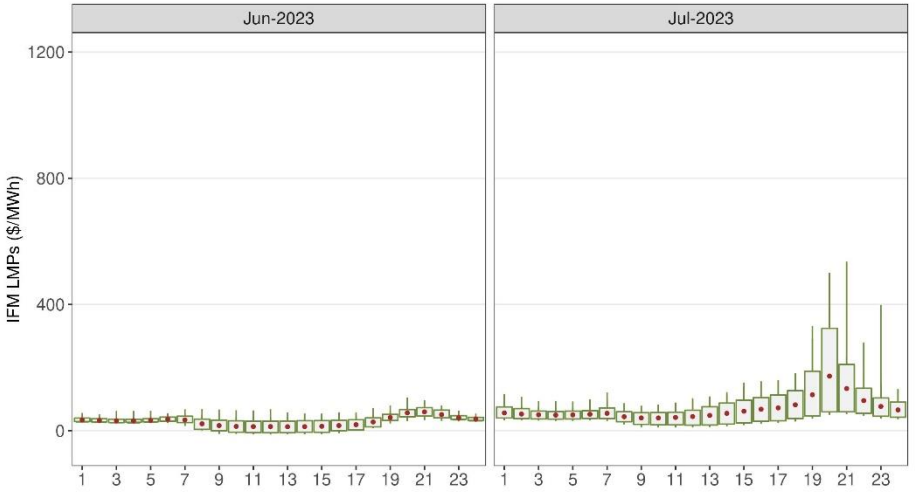
Up to 376 MW of lower priority exports were reduced on July 25. These wheels were properly registered in advance as high priority but were incorrectly bid in the market

Market prices reflected well the system conditions in July, with real-time prices spiking during the July events

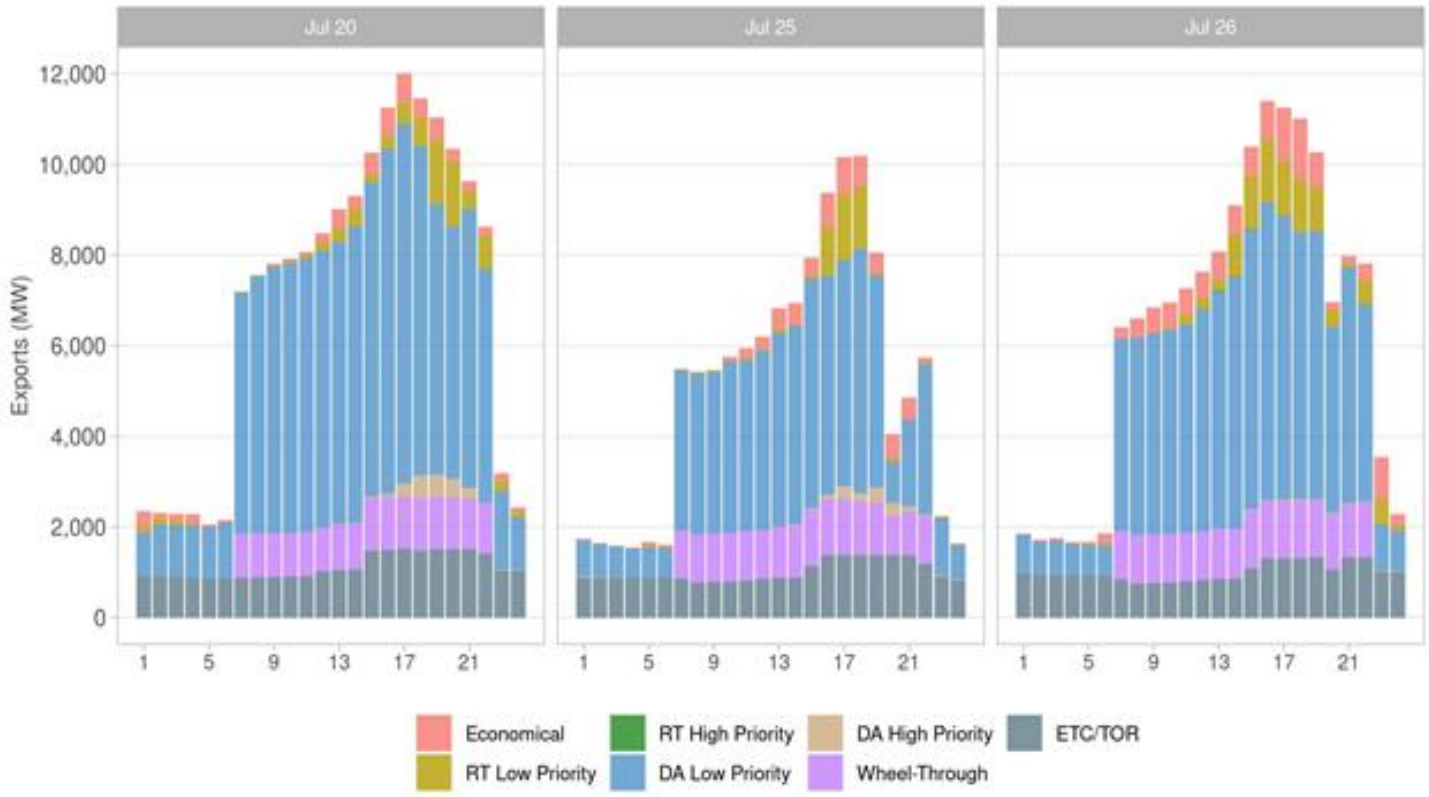








During the days of emergency, market cleared up to 9,300 MW of exports

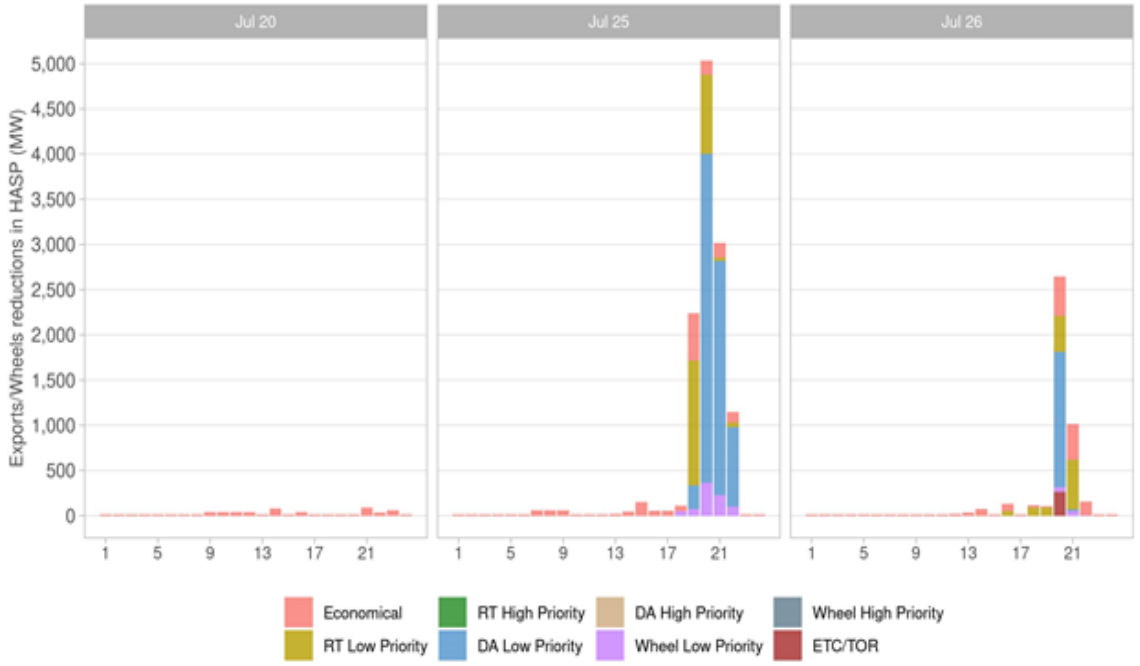


ETC/TOR and High priority exports do not compete for supply needed to meet load obligation to the ISO area and therefore are netted out of total exports when referring to “cleared” exports above

During the July events the hour-ahead process reduced up to 4,800 MW of exports

The HASP assesses the feasible and reliable level of exports that can be scheduled and supported for the upcoming hour

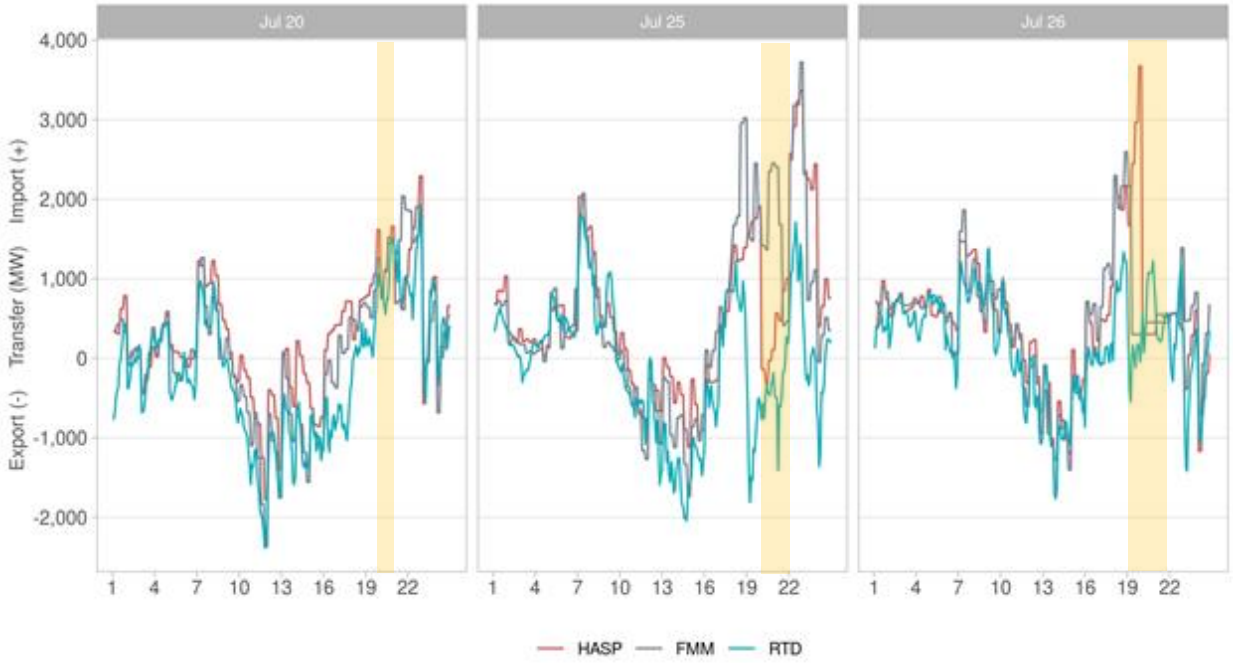
Reducing economical and low priority first is the expected first step to determine the optimal level of exports cleared



The reductions applied mainly to low priority exports, including export legs of low priority wheels

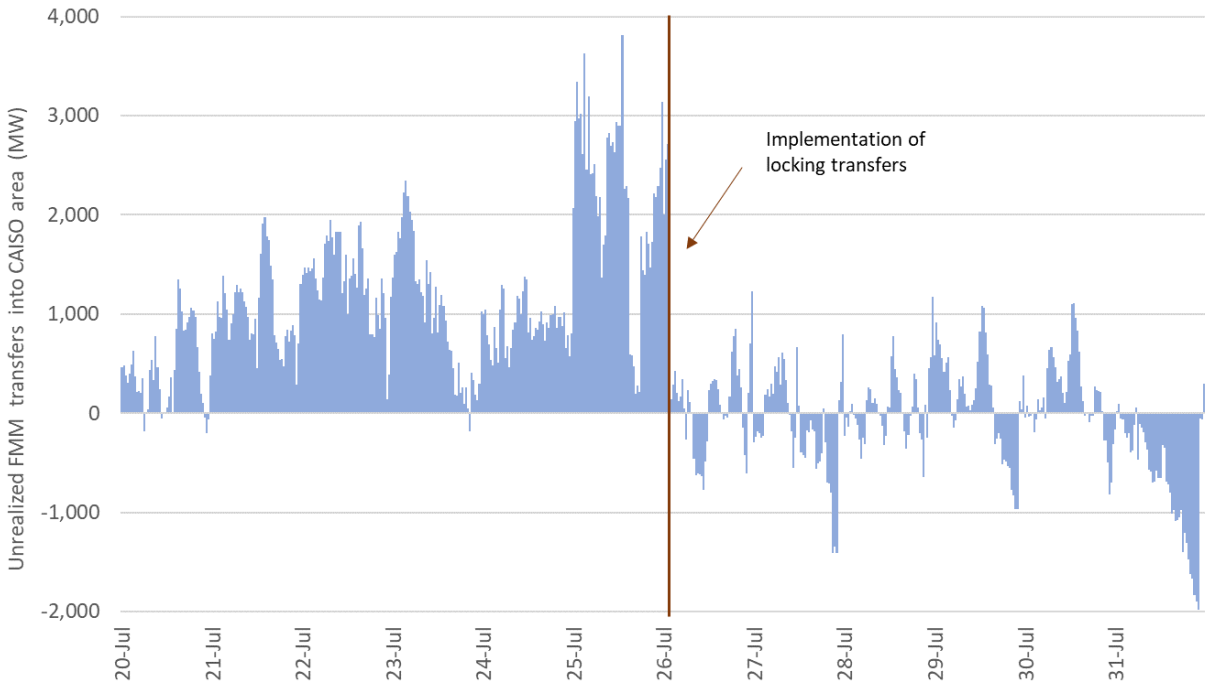
Emerging supply and demand changes in other areas resulted in unrealized WEIM import transfers that had been anticipated by the hourly and pre-dispatch markets

ISO resources were scheduled and exports cleared in the hourly process taking into consideration the availability of the advisory import transfers



Transfers in the hourly and pre-dispatch markets are advisory and re-evaluated in the five-minute market, representing a loss of supply for ISO area if not materialized

In the evening ramp hours of the emergencies, the unrealized WEIM transfers were over 3,000 MW



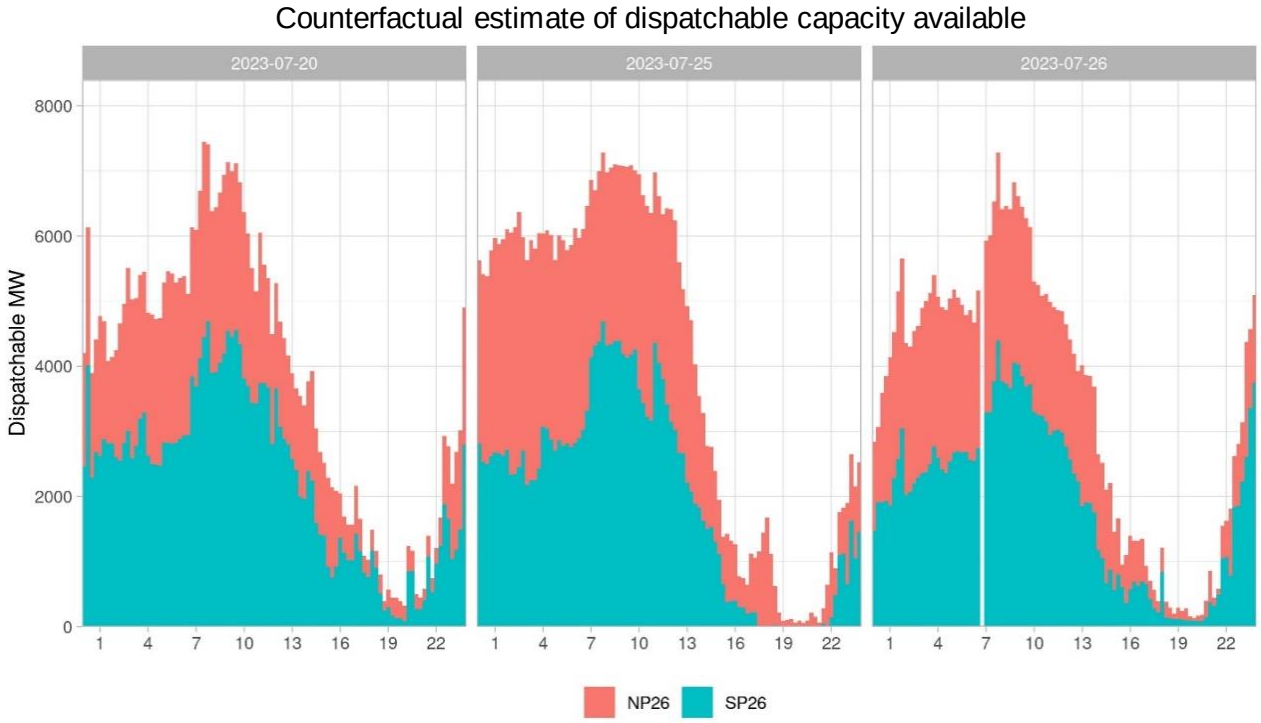
On the evening of July 26, ISO started to limit the reliance on dynamic import transfers into the ISO area for peak hours

This action may lead to price separating ISO area with higher prices from the rest of the WEIM

It allow the market to more reliable clearing ISO's load obligation and exports based only on internal resources or supplementary hourly intertie transactions

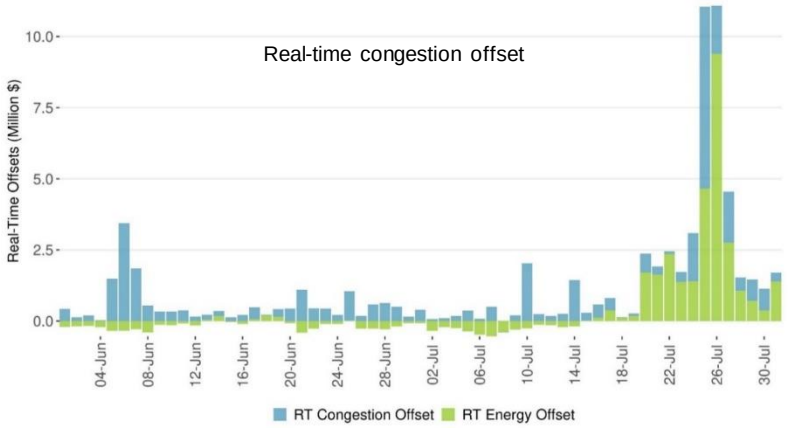
Display of dispatchable capability in the system impacted by imprecise calculation of storage resources

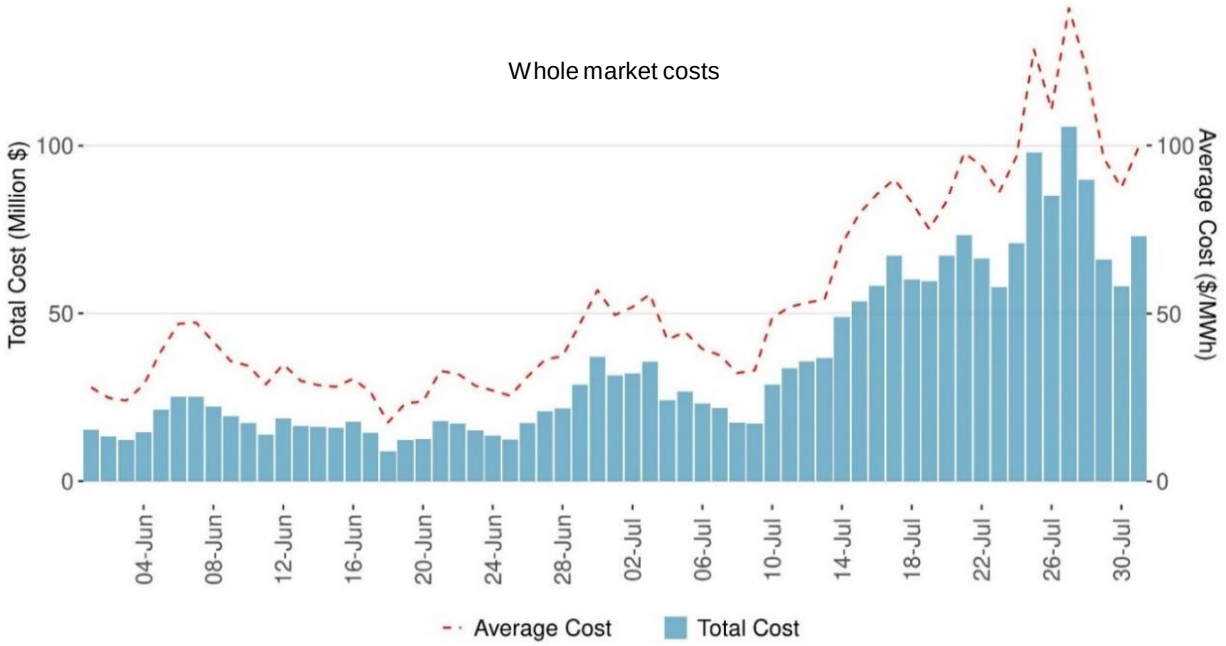
This inconsistent information may have complicated operators' ability to take proactive actions sooner



Market optimization accurately assessed available dispatch capability as supply conditions changed and already projected future shortfalls

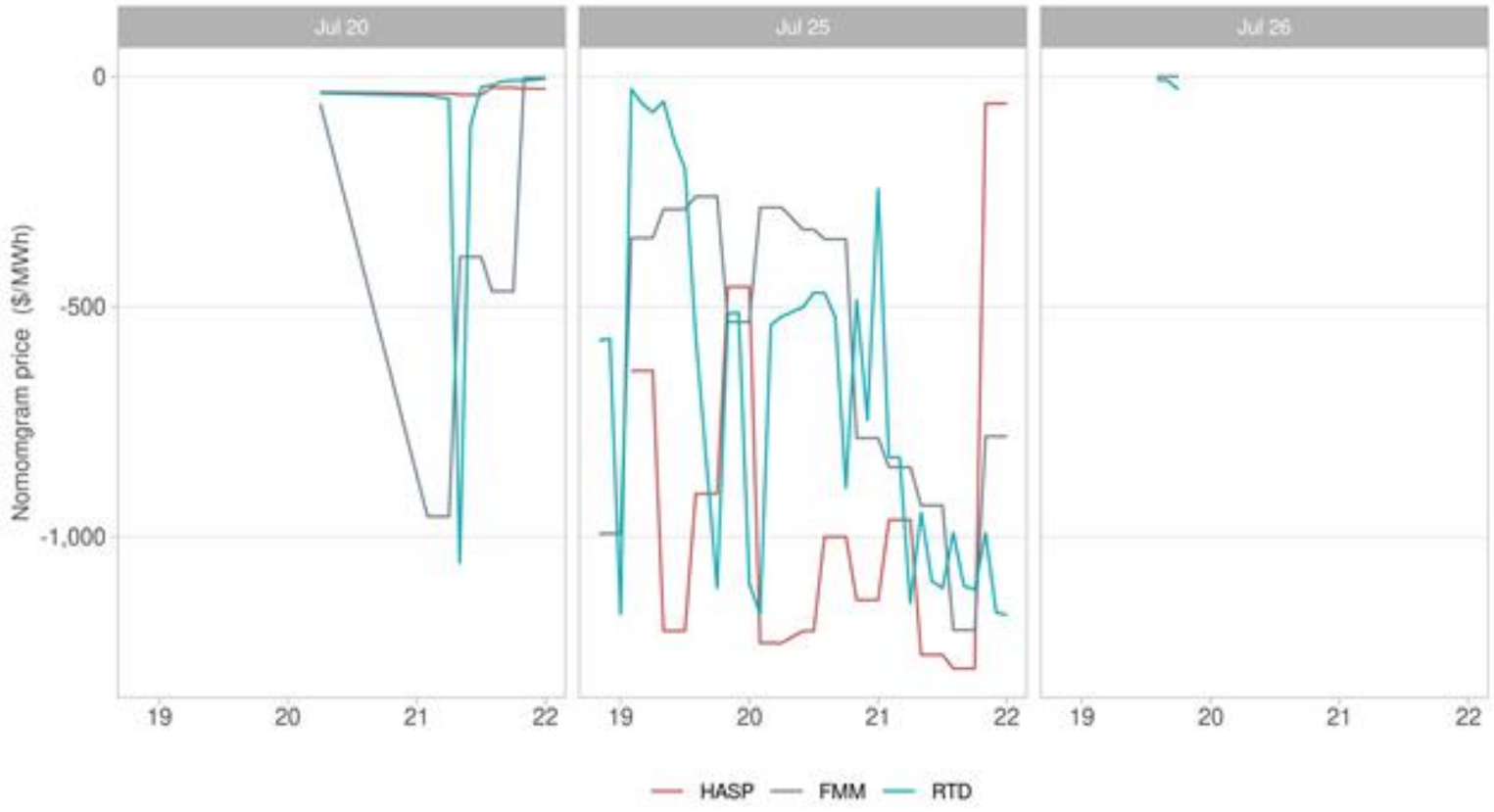
Average daily wholesale cost in July was about $52.4 million with the highest at $105 million on July 27





The spike of real-time congestion offset on July 25 and 26 was due to congestion on Path26

Significant congestion on elements related to Path26 was observed mainly on July 25 and to less extent on July 20



Congestion on Path26 was the result of compounded events and had multiple implications on the market and system conditions

- Congestion during the July events occurred due to:
  - Lower limit ratings of ~500 MW,
  - Procedural management of the path >500 MW
  - Inaccurate modelling of flow contributions due to different treatment of intertie transactions between areas >500 MW
  - Reduced exports not being tagged as instructed

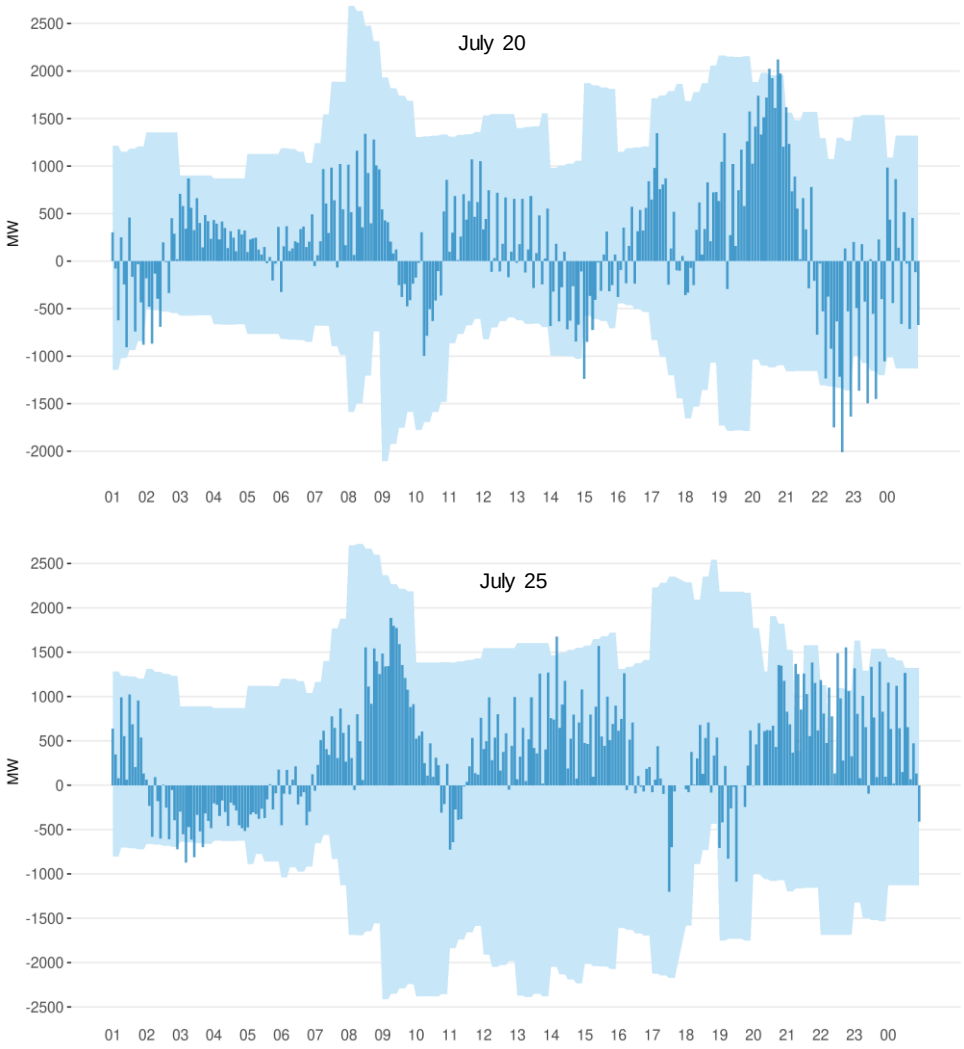
- In turn, the congestion resulted in
  - Extreme congestion at times with higher congestion offset costs
  - Limitations to increase supply from the north
  - Reduction of low priority exports and wheels
  - Exacerbated and extended emergency

Real-time market construct relies on flexible ramping capacity to manage variability from load and renewable resources

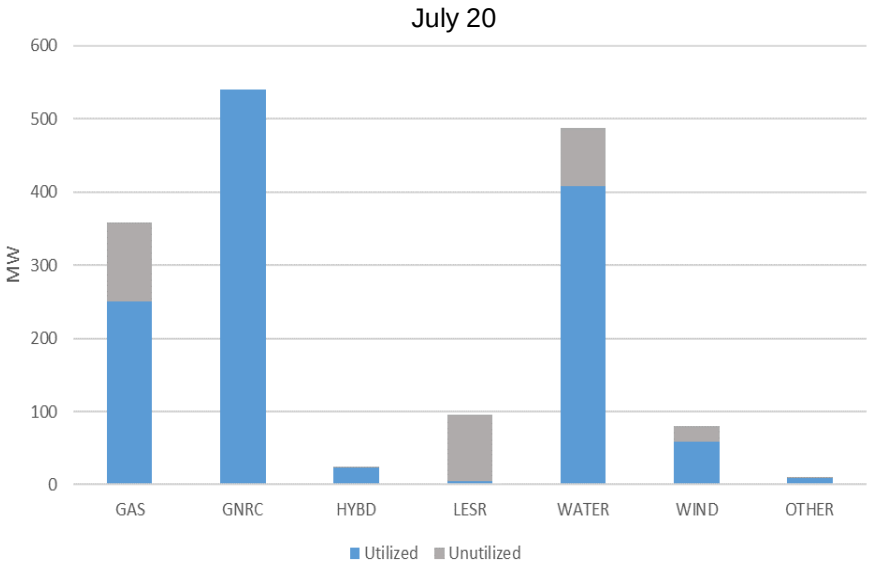
The amount of uncertainty realized (dark blue) was within the range of the requirement (light blue)

One complexity during the July event was compounded variability from other conditions (non-renewable resources deviations, load conformance, outages and derates, tie curtailments)

Flexible ramp is not designed to cover these other variations

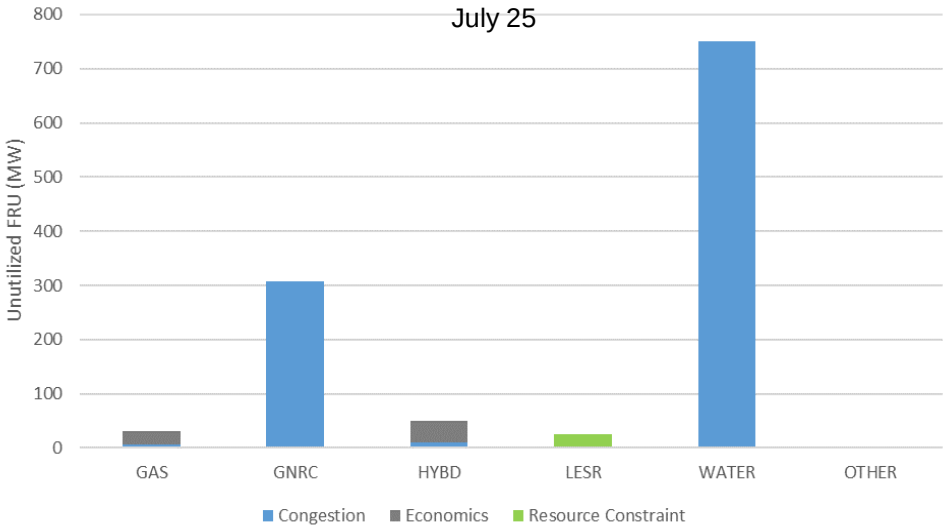


FRP had mixed performance during the July events



- On July 20 during the critical time, FRP had a good level of utilization

- On July 25 during the critical time, FRP showed a poor level of utilization
- This was due to congestion on nomograms stranding FRP
- Nomograms not enforced at that time; however, if nomogram were enforced, FRP would be relaxed by 1,000MW



For the most critical hour of July 25, about 2,300 MW of the export reductions were not materialized in real-time

- Exports reductions were either partially accepted, denied or reinstated through tags.
- Operators needed to manually curtailed some of these exports
- They exacerbated and extended the emergency condition
- They exacerbated congestion on Path26
- The ISO is evaluating changes and clarifications to the existing scheduling and tagging protocols
- Any practice changes are being implemented through a formal Business Practice Manual change

Opportunities for improvement

- Ensuring that exports are scheduled to the level that can be reliably supported by the system

The ISO is enhancing functionality and practices through BPM changes

- Harmonizing the accounting procedure for intertie transactions between ISO and some neighboring balancing areas

The ISO is currently developing additional logic to reconcile models

- Improving operator visibility of the real-time availability of dispatchable capability

The ISO enhanced these display effective September 13

Opportunities for improvement

- Expanding enforcement of nomograms and contingencies for flexible ramping product

The ISO activated nomograms on September 13 and will assess performance and conditions to enforce contingencies

- Revising and updating operational procedures for
  - Path 26 management
  - Activation of import bid incentives
  - Load conformance
  - Consideration of additional operational risks

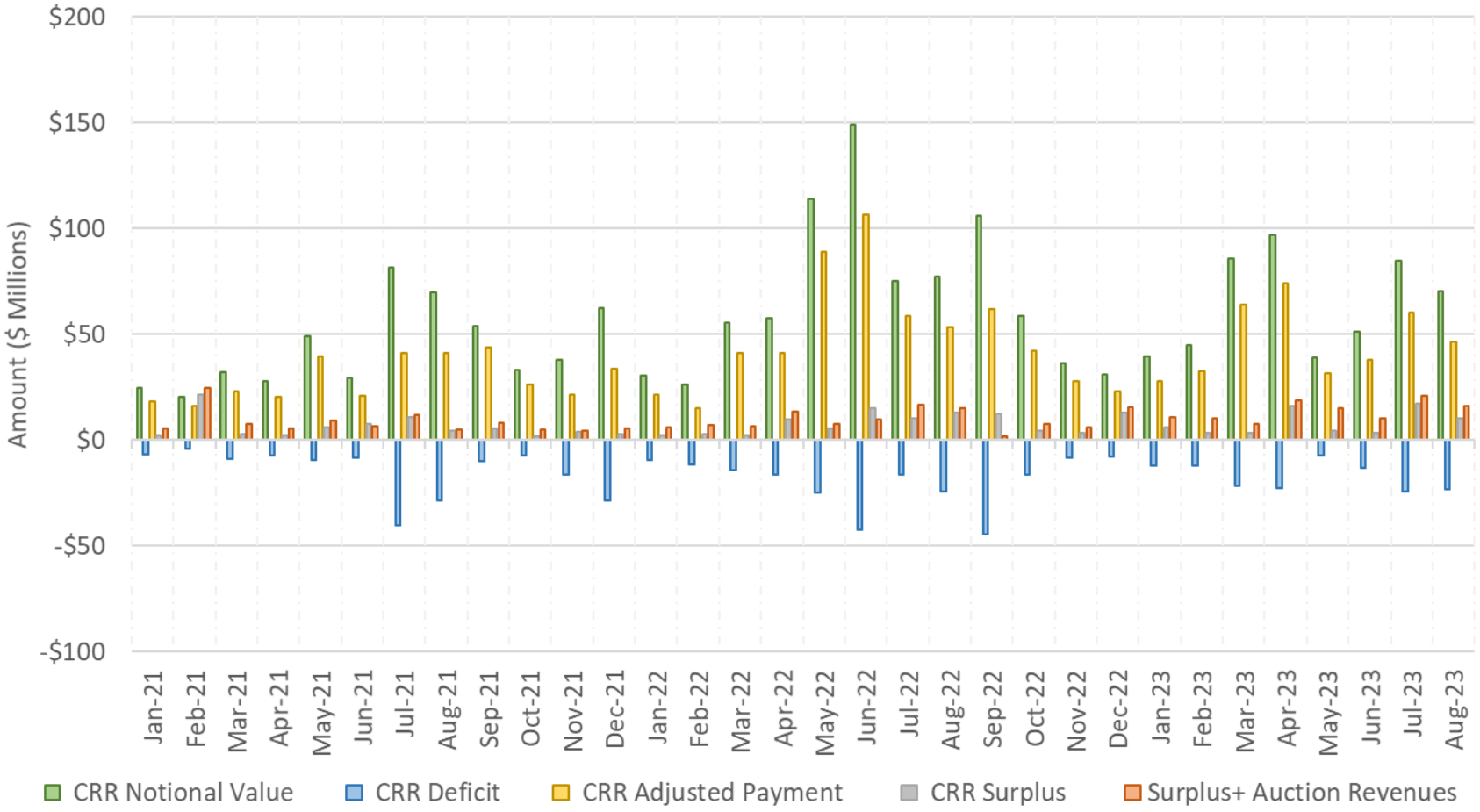
- Assessing further the implications of WEIM advisory transfers, load conformance and clearing of intertie transactions

Market Update

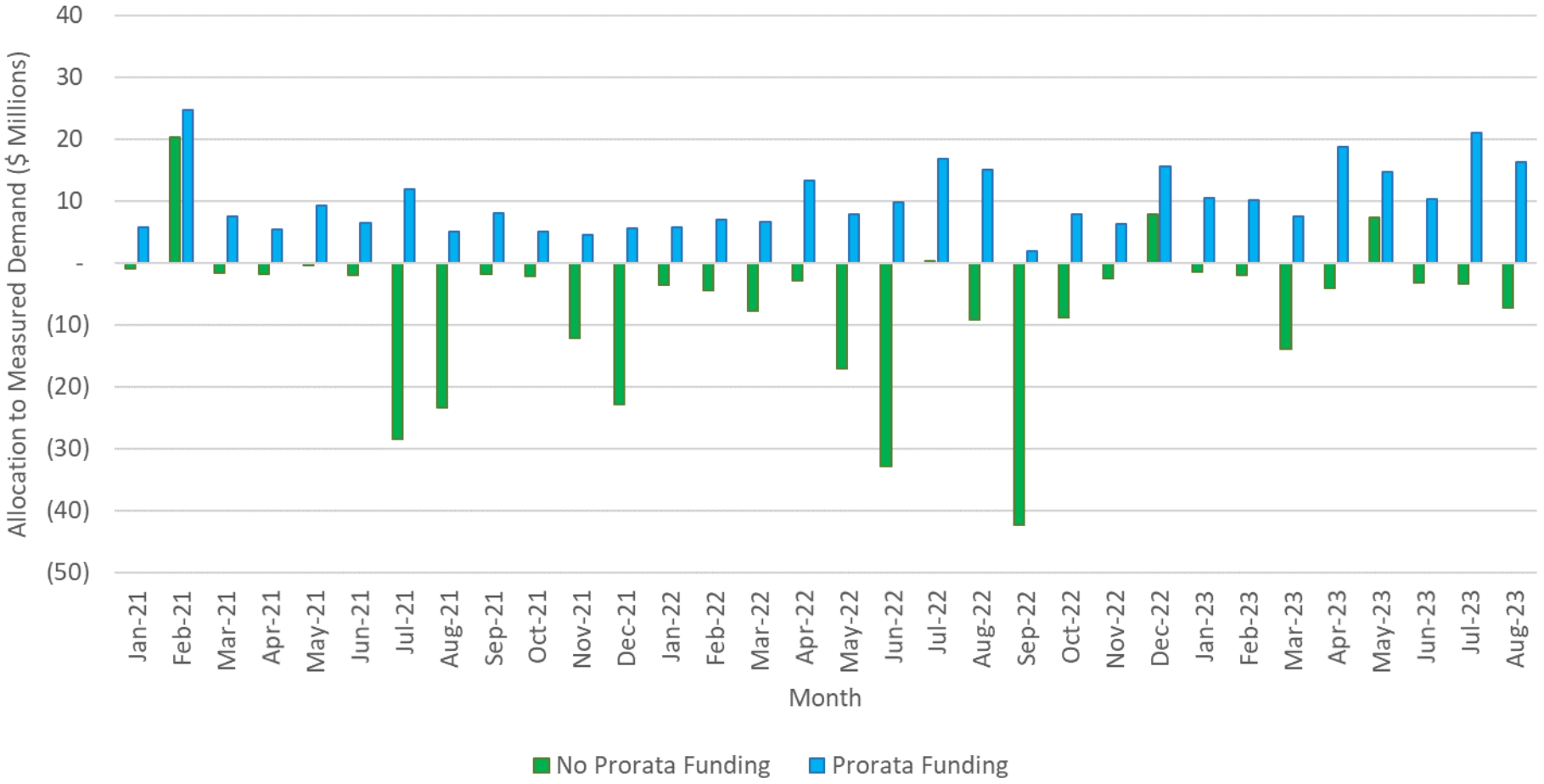
- Congestion revenue rights
- FRP performance
- Assistance Energy Transfer
- Prices, gas and wholesale costs
- Load Conformance
- Batteries
- General market performance

CRR Update

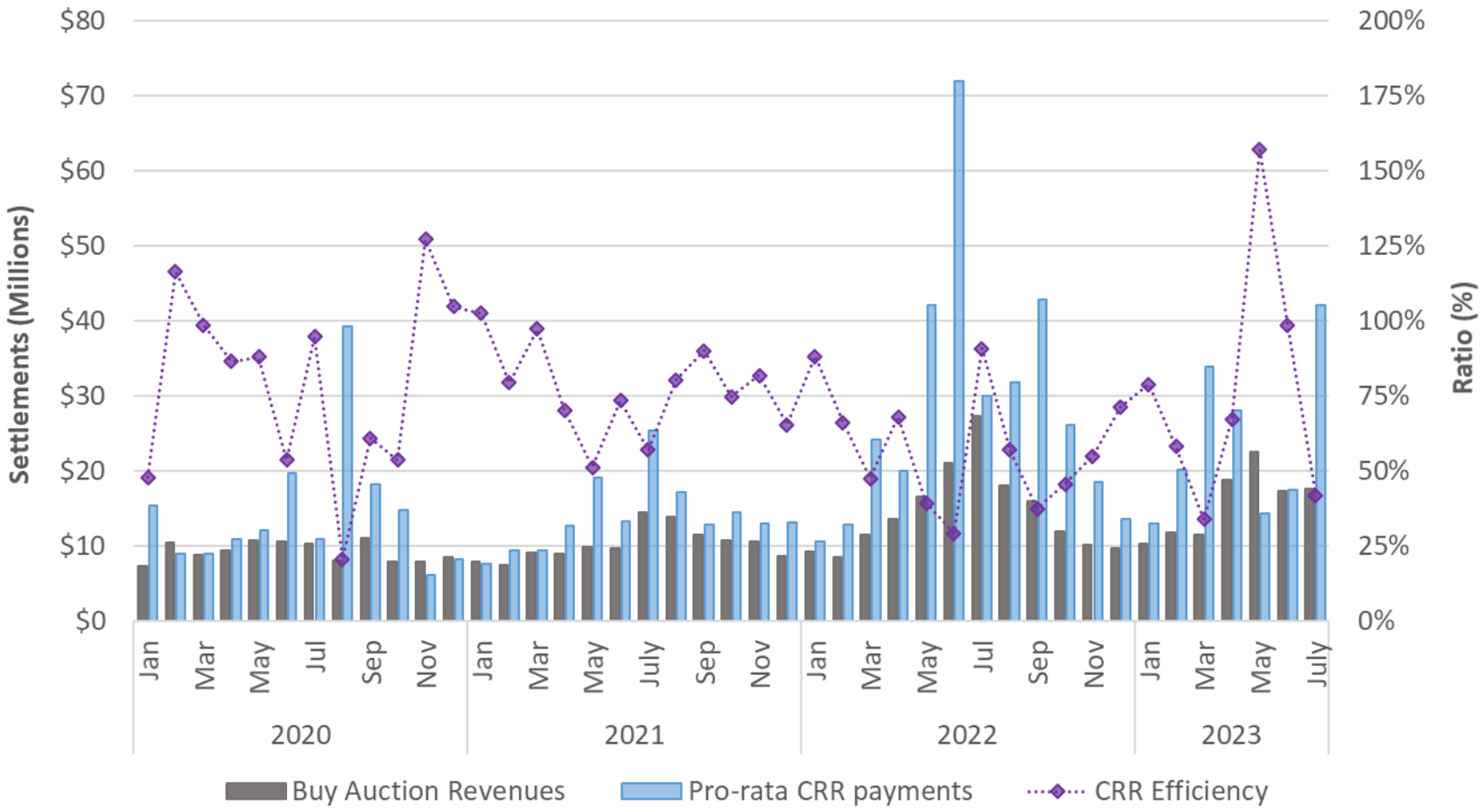
The magnitude of the overall CRR settlements has decreased after summer



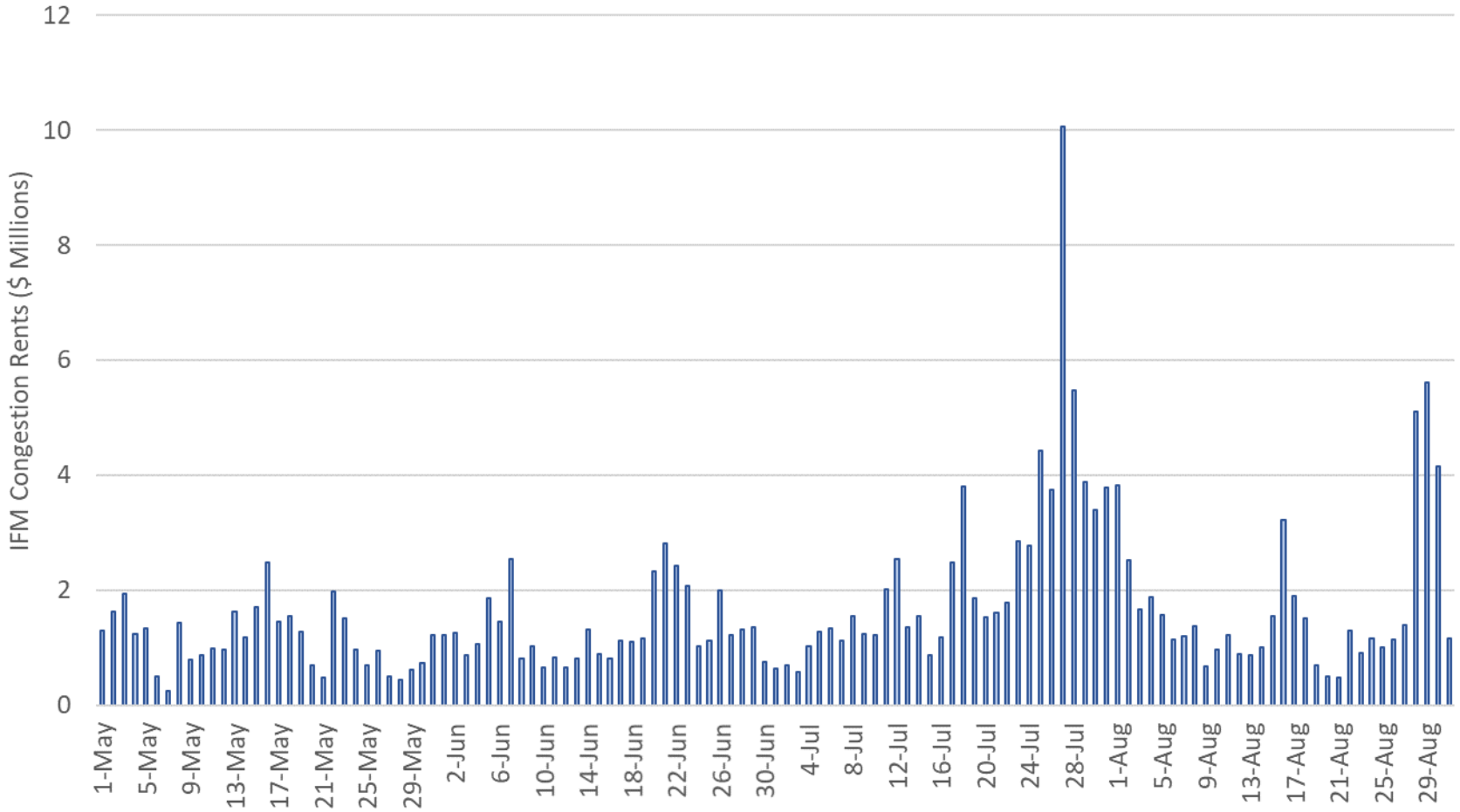
Implementation of pro-rata funding continues to improve revenue adequacy in 2022



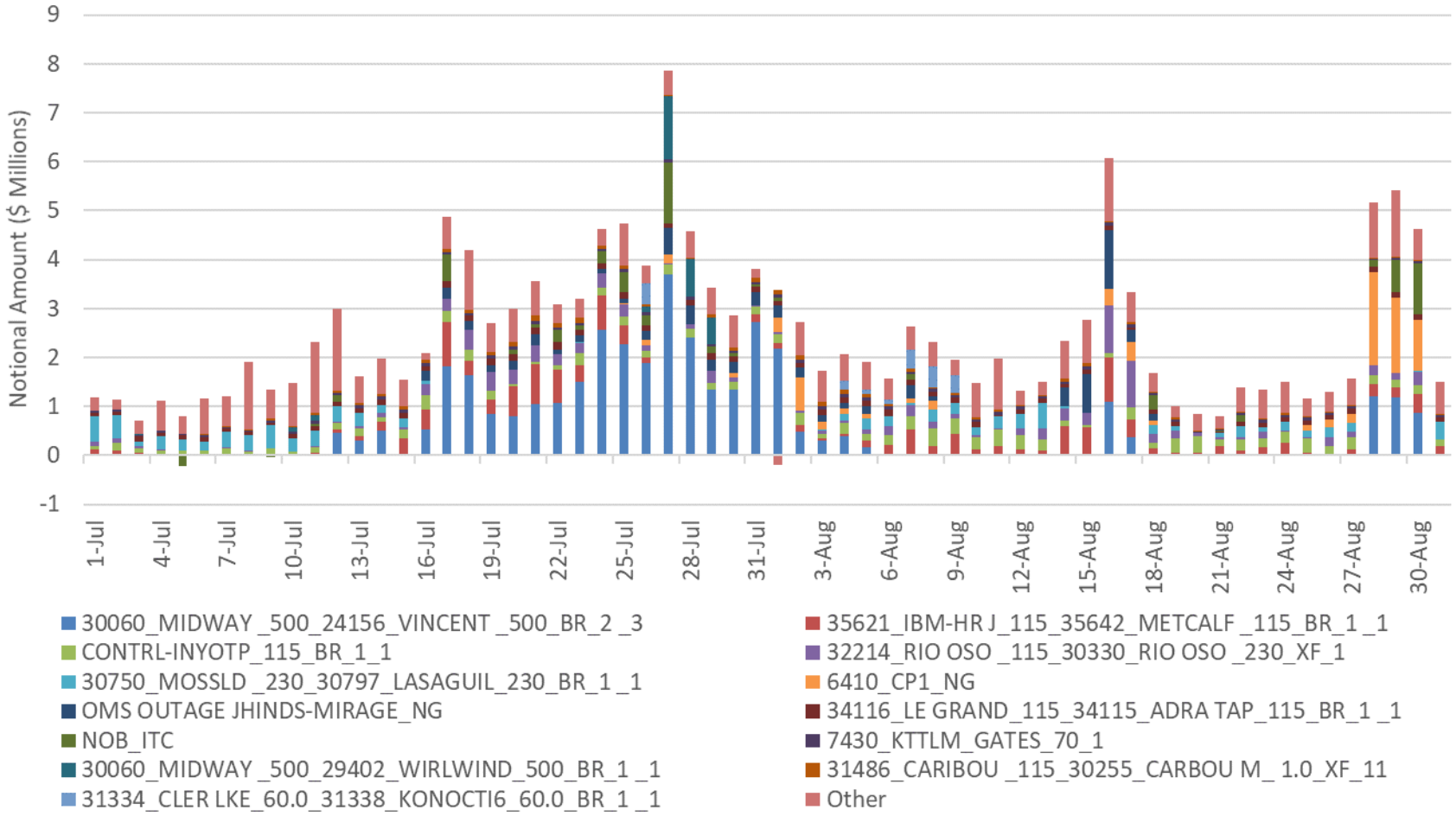
Auction efficiency has been fairly variable based on level of congestion observed



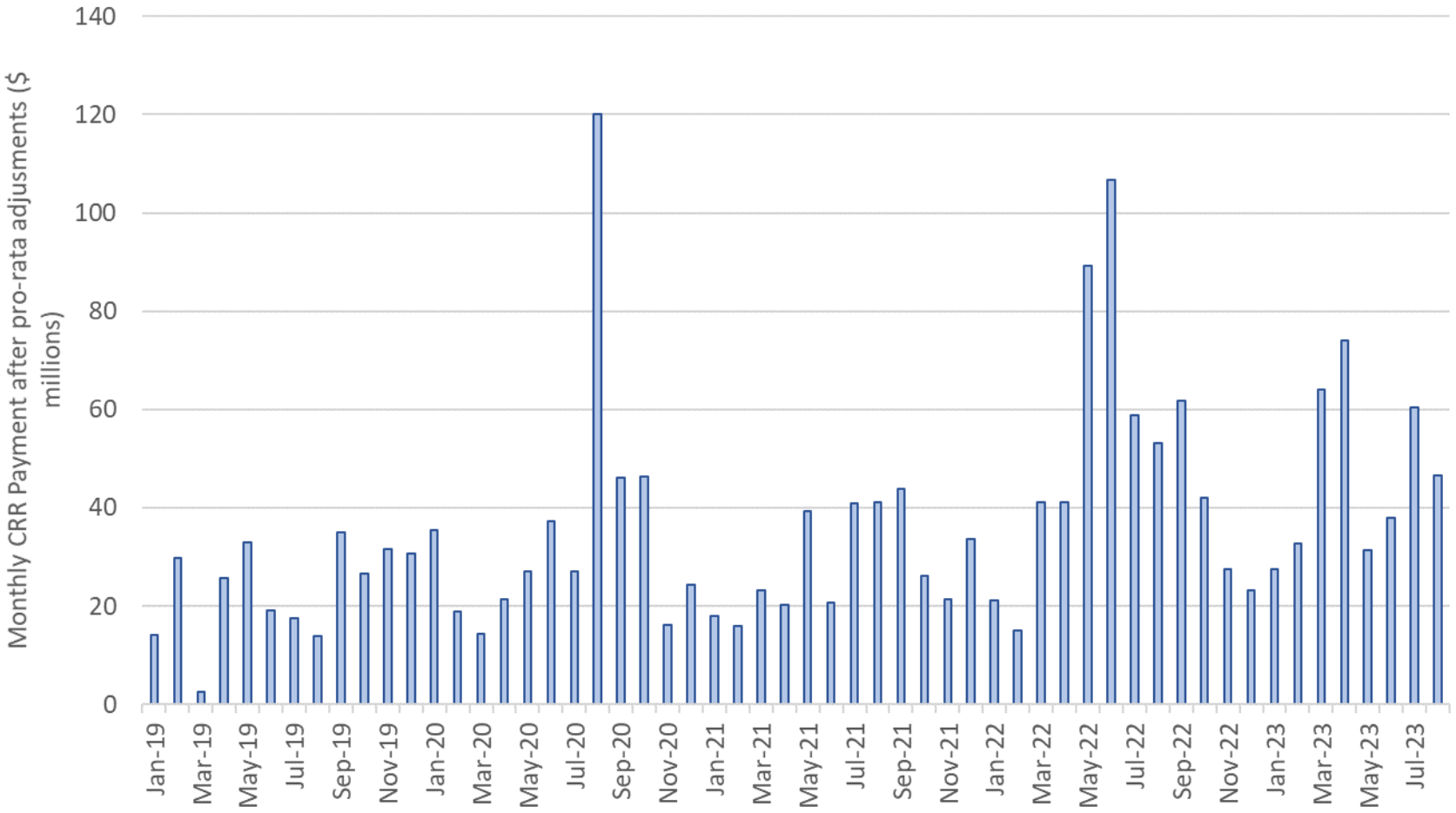
IFM congestion rents for the summer months



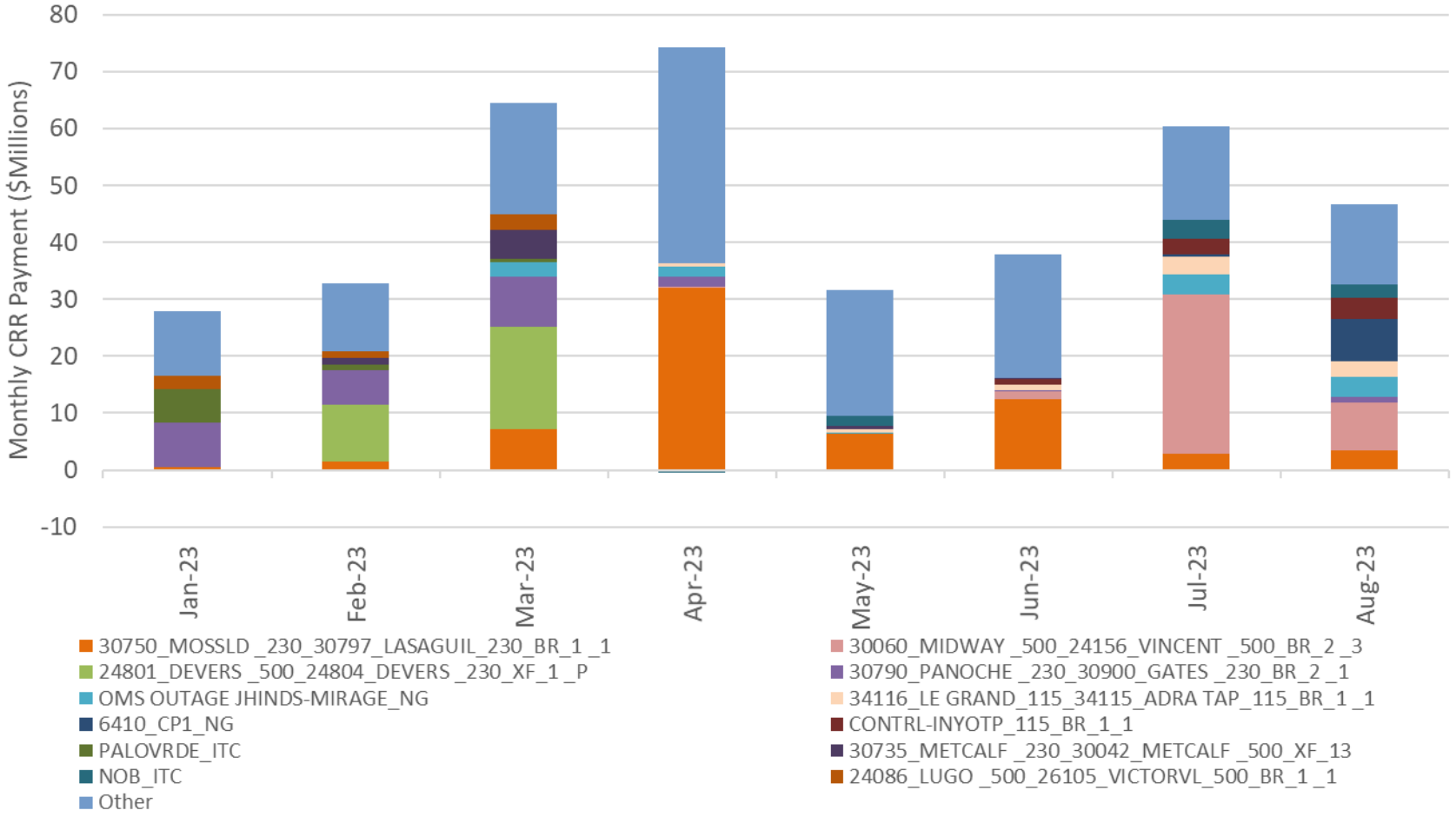
Daily Notional revenues by constraint for July – August 2023



Monthly CRR payments have increased slightly in the recent summer months



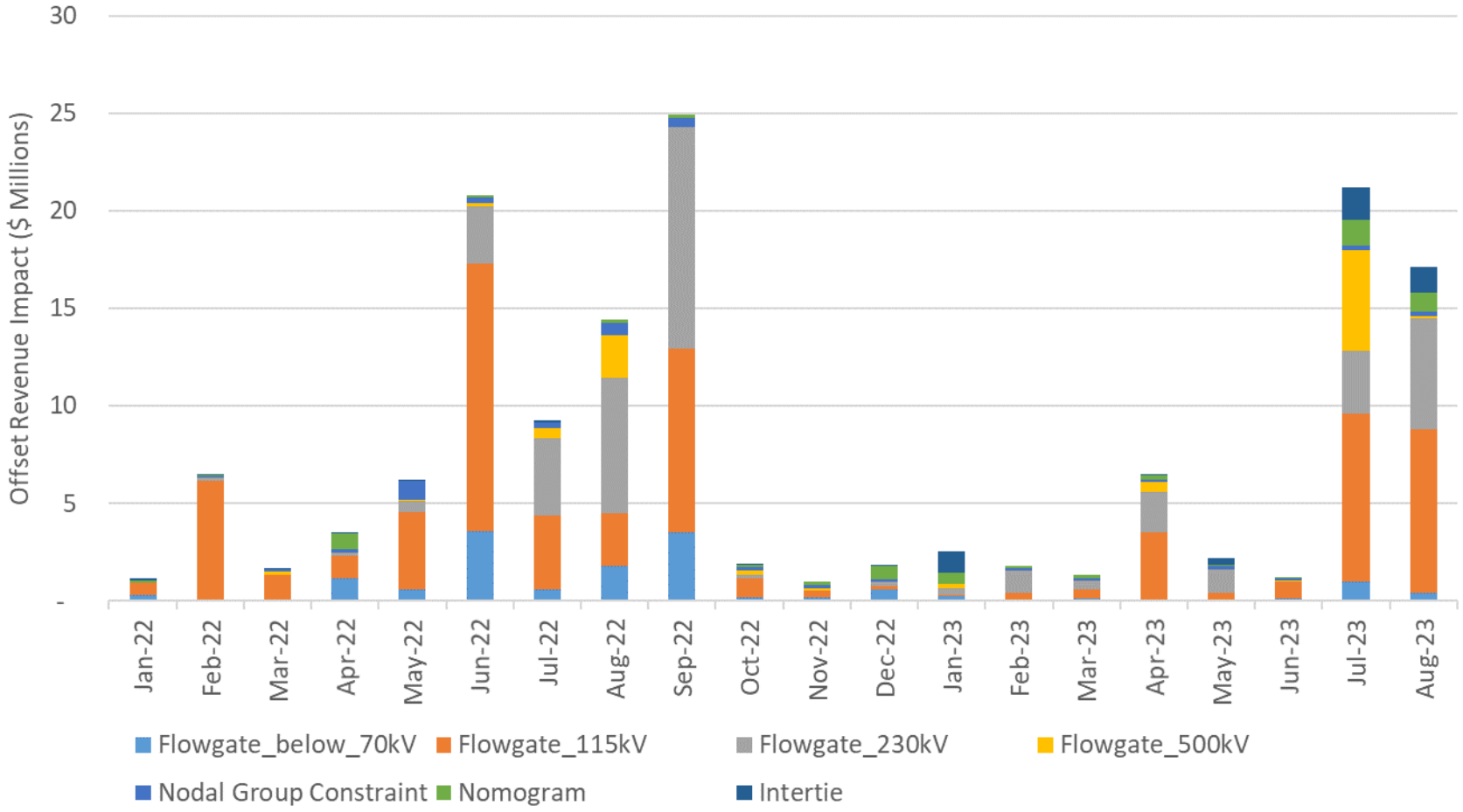
Monthly CRR payments by constraint starting January 2023



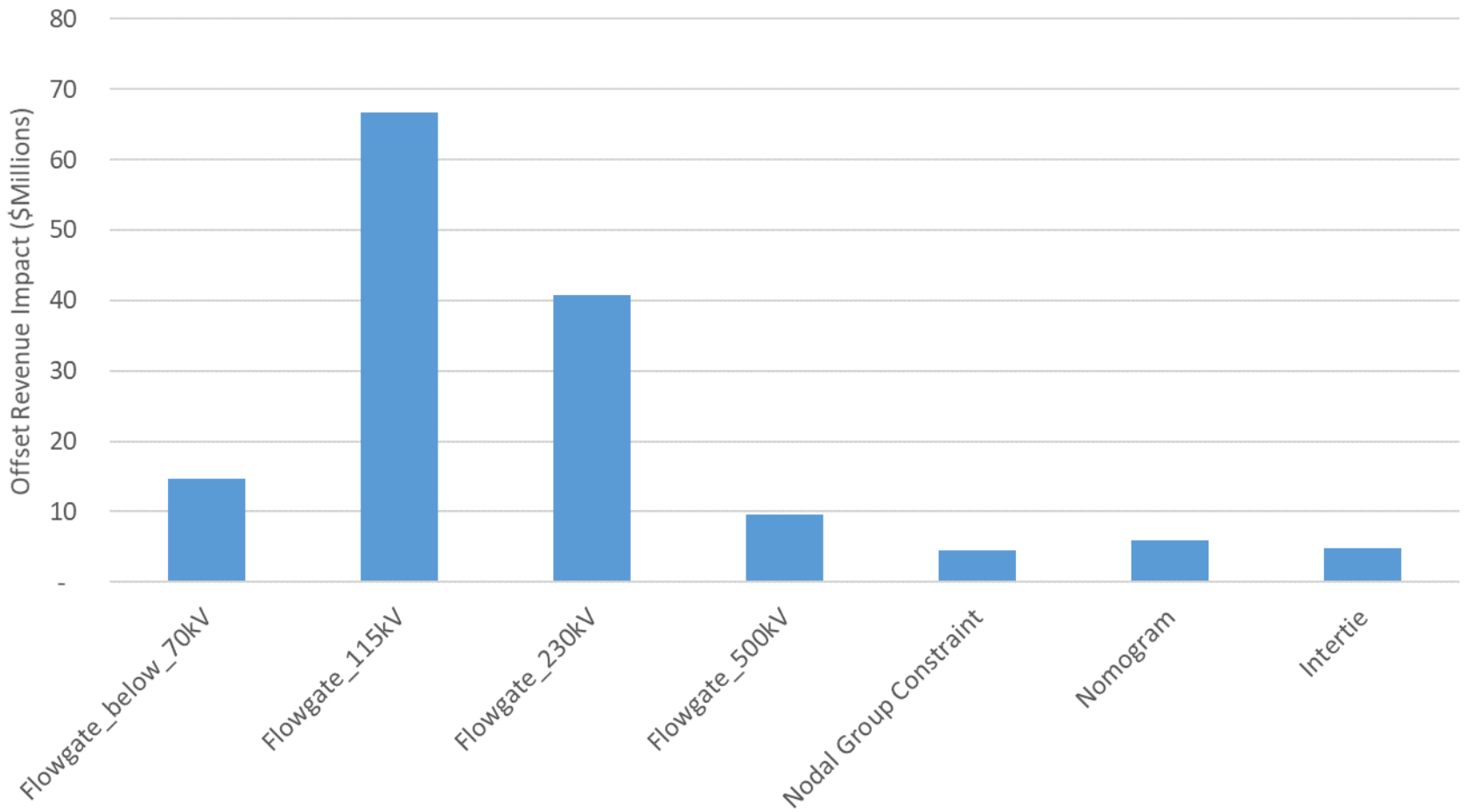
Offset Revenue Impact

- Amount of offset revenues that exceeded the notional revenues based on the historical percentages of offset for those same constraints
- How did we calculate the offset revenue impact –
- Example – Constraint A that is binding –
  - Notional revenue = $2000
  - Offset Revenue = -$2500
  - Historical Percentage of Offset on this constraint has been = -$1200
  - Offset Revenue impact would be = $1300
- Impact is applied to both charges and payments

Offset Revenue Impact



Offset Revenue Impact by constraint for the period January 2022 – August 2023



Update on Market Parameter Policy Initiative

- CAISO completed the stakeholder process to address the issue of shift factors threshold applied to aggregated locations
- Board of Governors and FERC approved this proposal.
- Software patch with the changes has been to deployed to stage and production. Monitoring the performance.
- This code was deployed to production on September 13th
- Next Stage - CAISO will perform more detailed analysis on CRR performance

FRP Update

FRP Enhancements implemented on February 2023

- Enhanced methodology to calculate FRP requirement as a function of demand, solar, and wind forecast
  - Change from histogram calculation to quantile regression
  - Recognize the current operating condition by using forecasts as inputs
- Remove features of NIC/NEC, FRU/FRD credit from uncertainty requirement in market optimization
- Enforce transmission constraints and EIM transfer constraints
  - Assume full uncertainty realization -> FRP deployment scenario
  - FRP nodal pricing

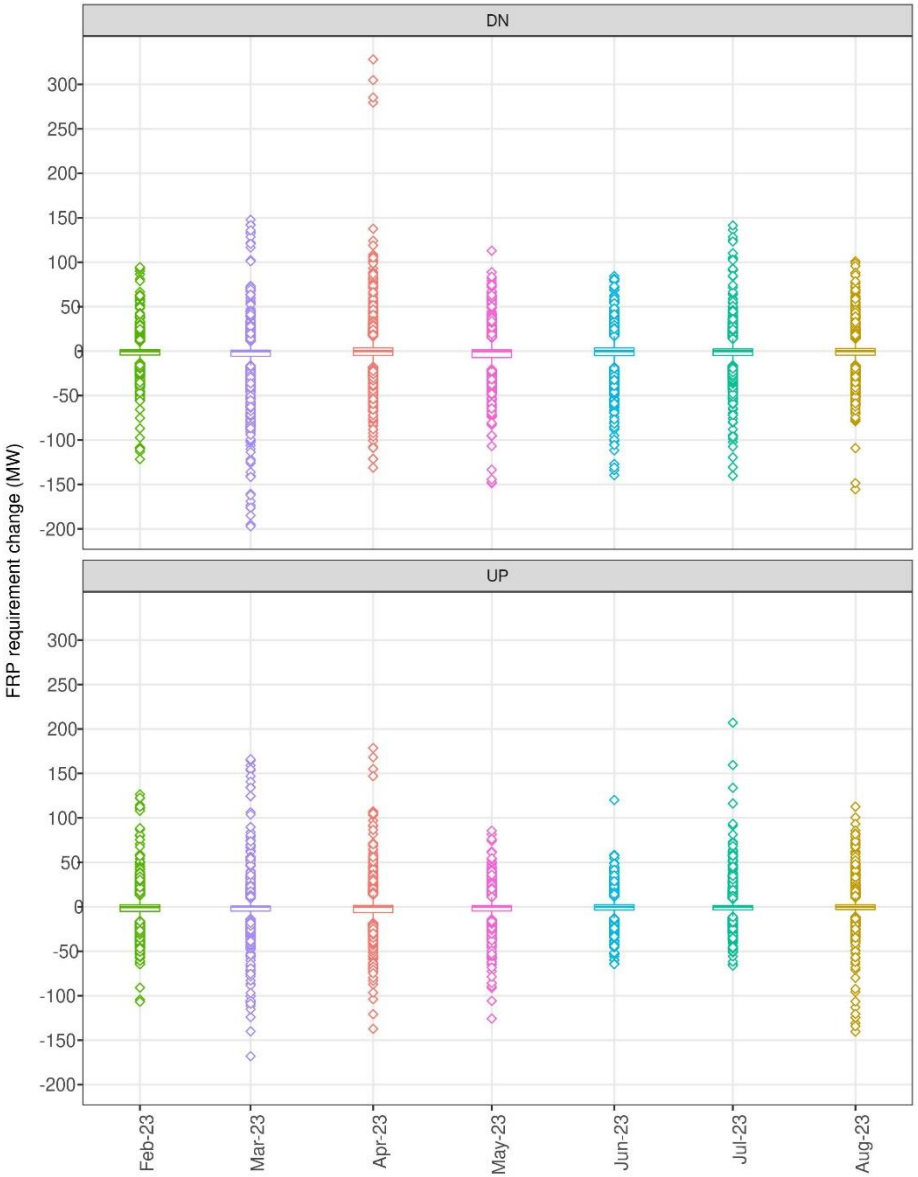
FRP requirements may change across the three test passes

For the flex test, there are three passes at T-75, T-55 and T-40

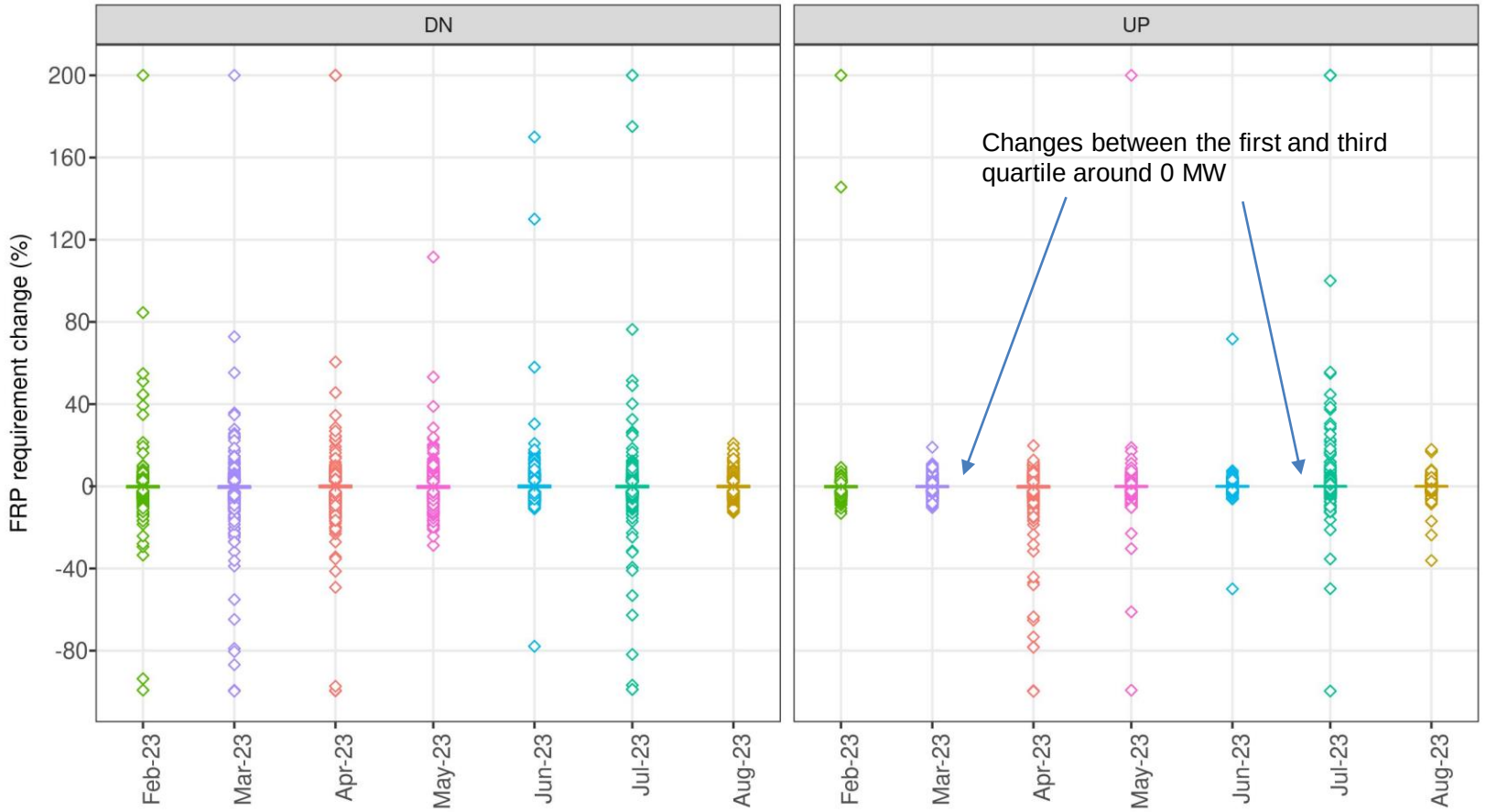
Changes happens only from T-75 to T-55

With inputs fixed for the last pass, there are no changes from T-55 to T-40

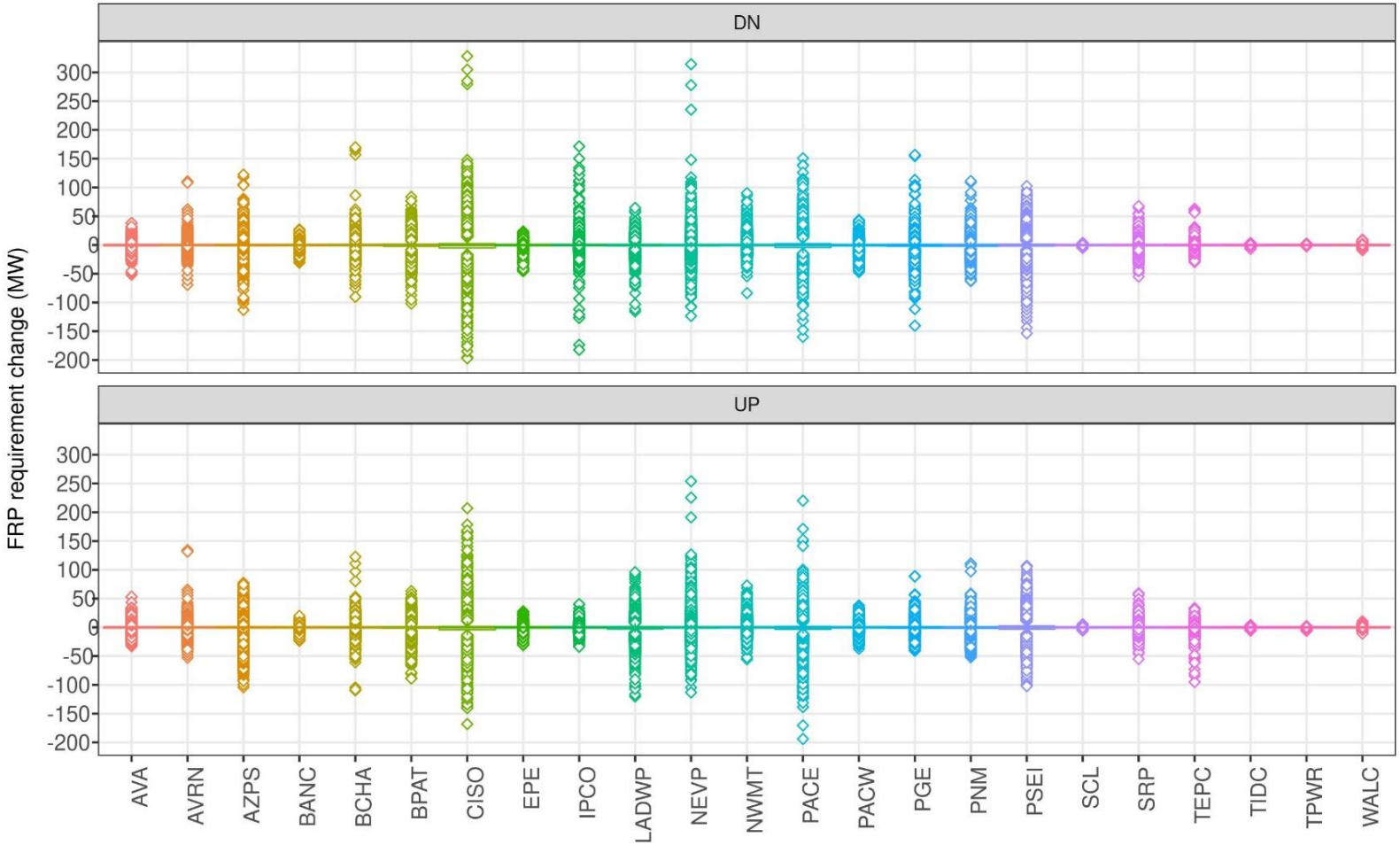
If T-55 > T-75 then requirements increased and the value of change is positive



The majority of the FRP requirement changes (in percent) between the test passes are relatively small for CISO area



The changes from the first to the second test is generally small across all WEIM areas for both directions of requirements



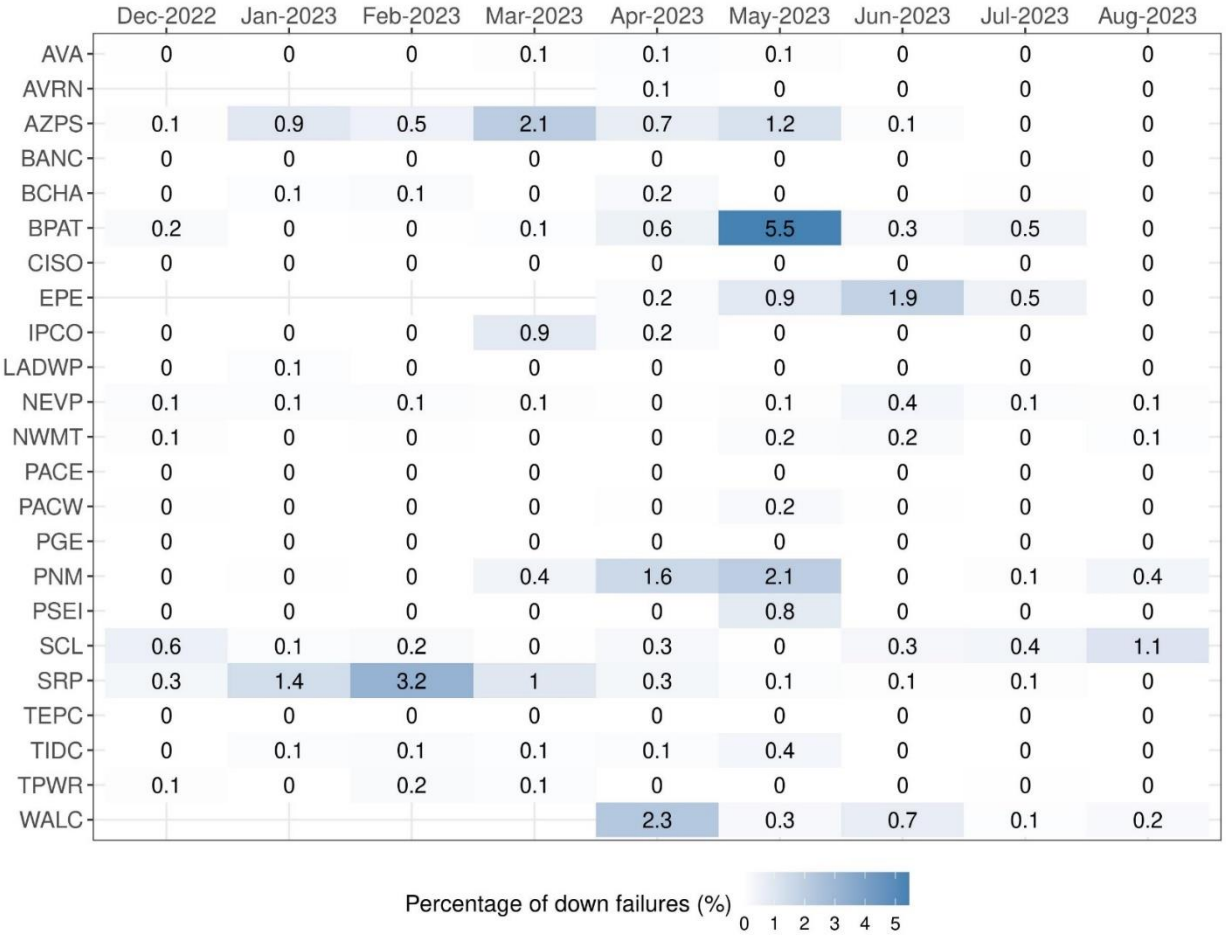
The frequency of flexible ramping test failures may appear to increase during the months of transitioning seasons

	Dec-2022	Jan-2023	Feb-2023	Mar-2023	Apr-2023	May-2023	Jun-2023	Jul-2023	Aug-2023
AVA	0.1	0	0	0	0.2	0.2	0	0	0
AVRN					1	0.7	0.1	0.2	0
AZPS	0.4	0.9	1.8	2.5	1.1	0.2	0.1	0	0
BANC	0	0	0	0	0	0.1	0	0	0
BCHA	0	0	0.2	0	0	0	0	0	0.1
BPAT	0.4	0	0.1	0.6	0.2	1.2	0.3	1.8	0.3
CISO	0	0	0	0	0	0	0	0	0
EPE					0.8	0.6	0.3	2.1	0.5
IPCO	0	0	0.1	0.3	0.3	0.5	0.1	0	0
LADWP	0	0	0.3	0	0.1	0	0.1	0	0.1
NEVP	0	0.1	0.3	0	0.1	0.1	0	0.1	0.2
NWMT	0.8	0.3	0.1	0.2	0.8	0.3	0.2	1	0.4
PACE	0	0.1	0	0	0.1	0	0	0.2	0
PACW	0	0.1	0.1	0	0.1	0.6	0	0.2	0
PGE	0.1	0	0.1	0	0.1	1.5	0.7	0.1	0
PNM	0.8	0.2	0	1.2	5.1	0.9	0.6	0.5	0.4
PSEI	0	0	0.1	0.8	0.2	1	0.6	2.6	1.3
SCL	0	0	0.1	0	0	0	0	0	0.5
SRP	0.8	3.5	1.2	1.8	2	0.6	0.2	3.5	1.1
TEPC	0.2	0.3	0.3	0.3	0.1	0.1	0	0.2	0.3
TIDC	1.2	0	0	0	0	0	0	0.1	0
TPWR	0	0.2	0.1	0.2	0	0.1	0	0	0
WALC					2	0.7	0.8	0.3	0.8

Percentage of up failures (%)
0 1 2 3 4 5

Percentage of failures remain relatively low

The frequency of flexible ramping test failures may appear to increase during the months of transitioning seasons

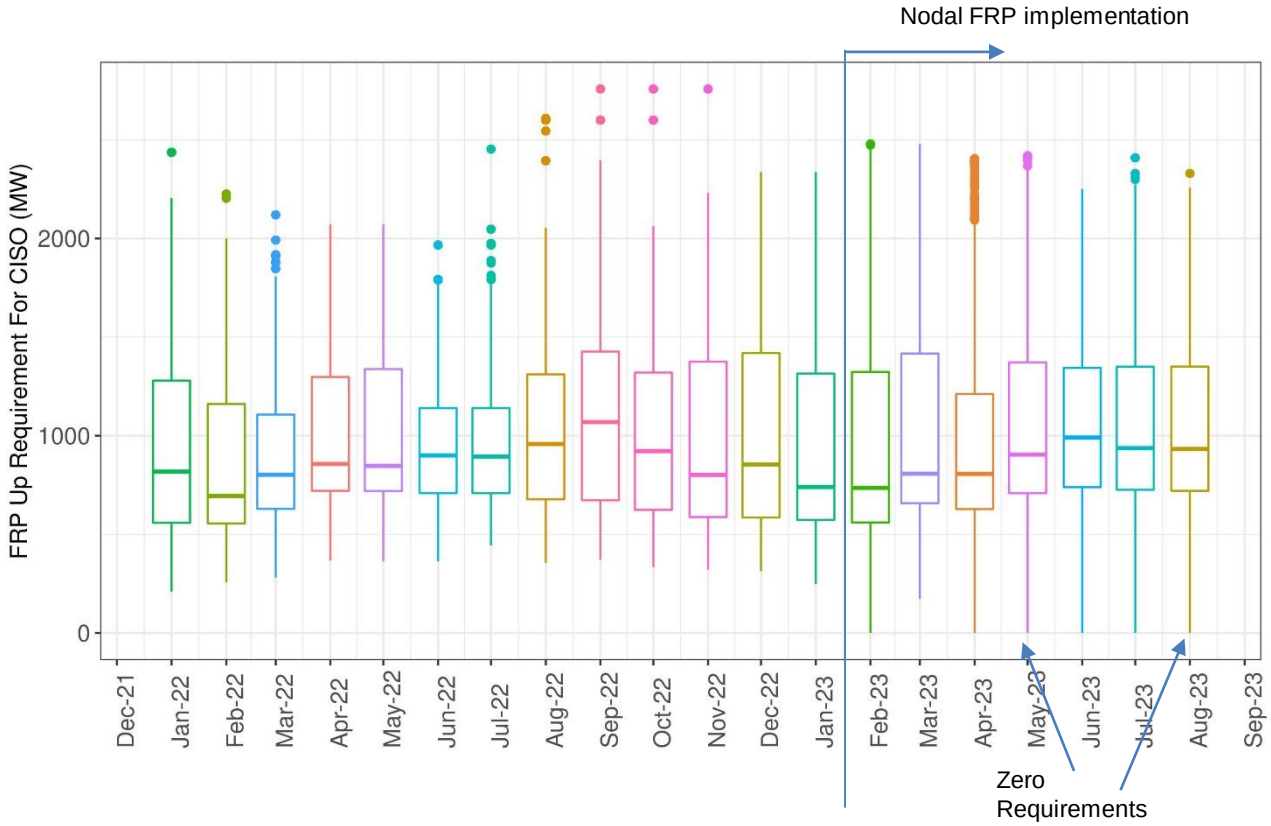


Percentage of failures remain relatively low

FRP Up Requirement for CAISO area remain within typical ranges

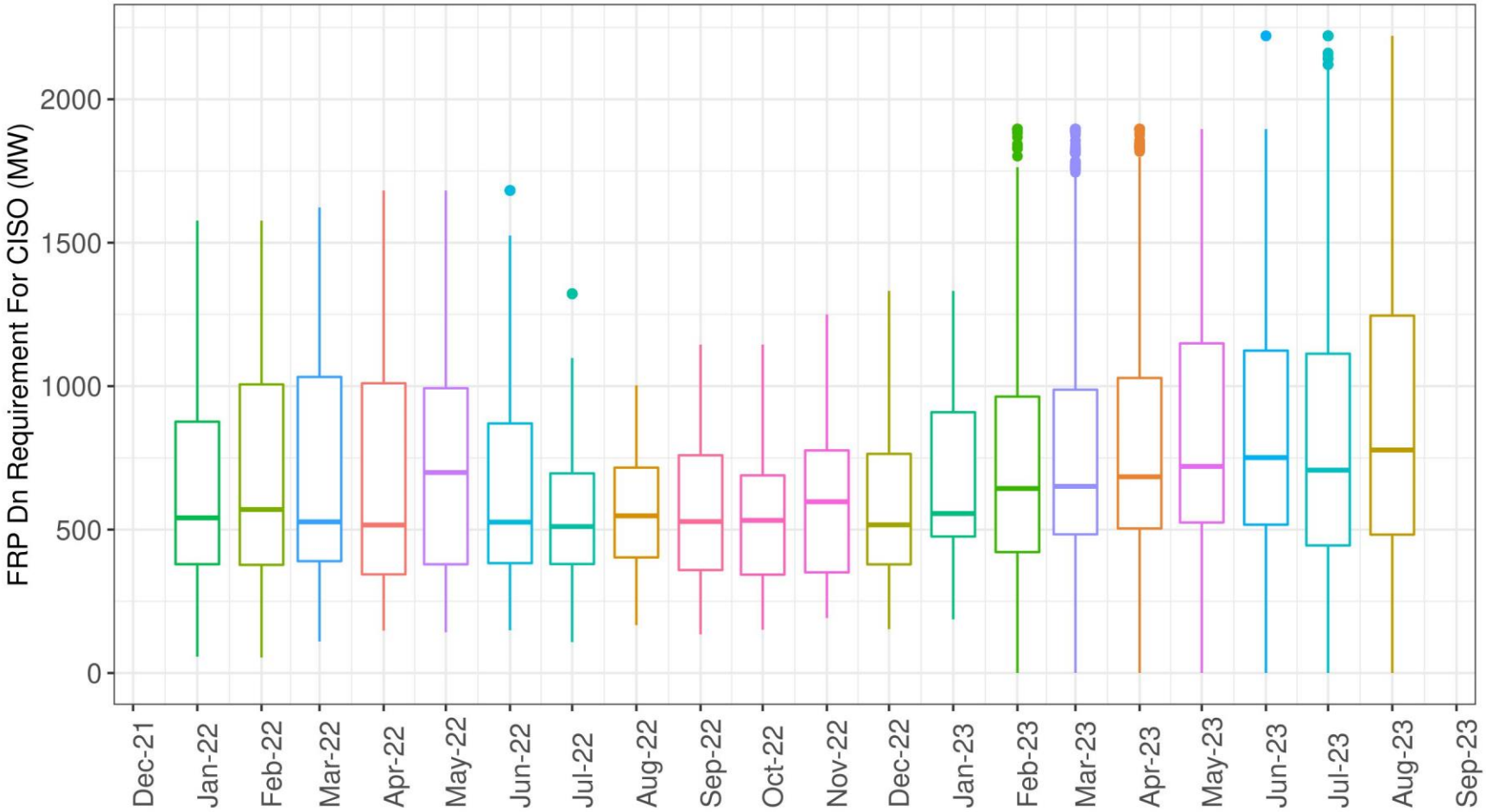
This is in part because of caps imposed on the naturally-produced requirements

Zero requirements are being now observed.

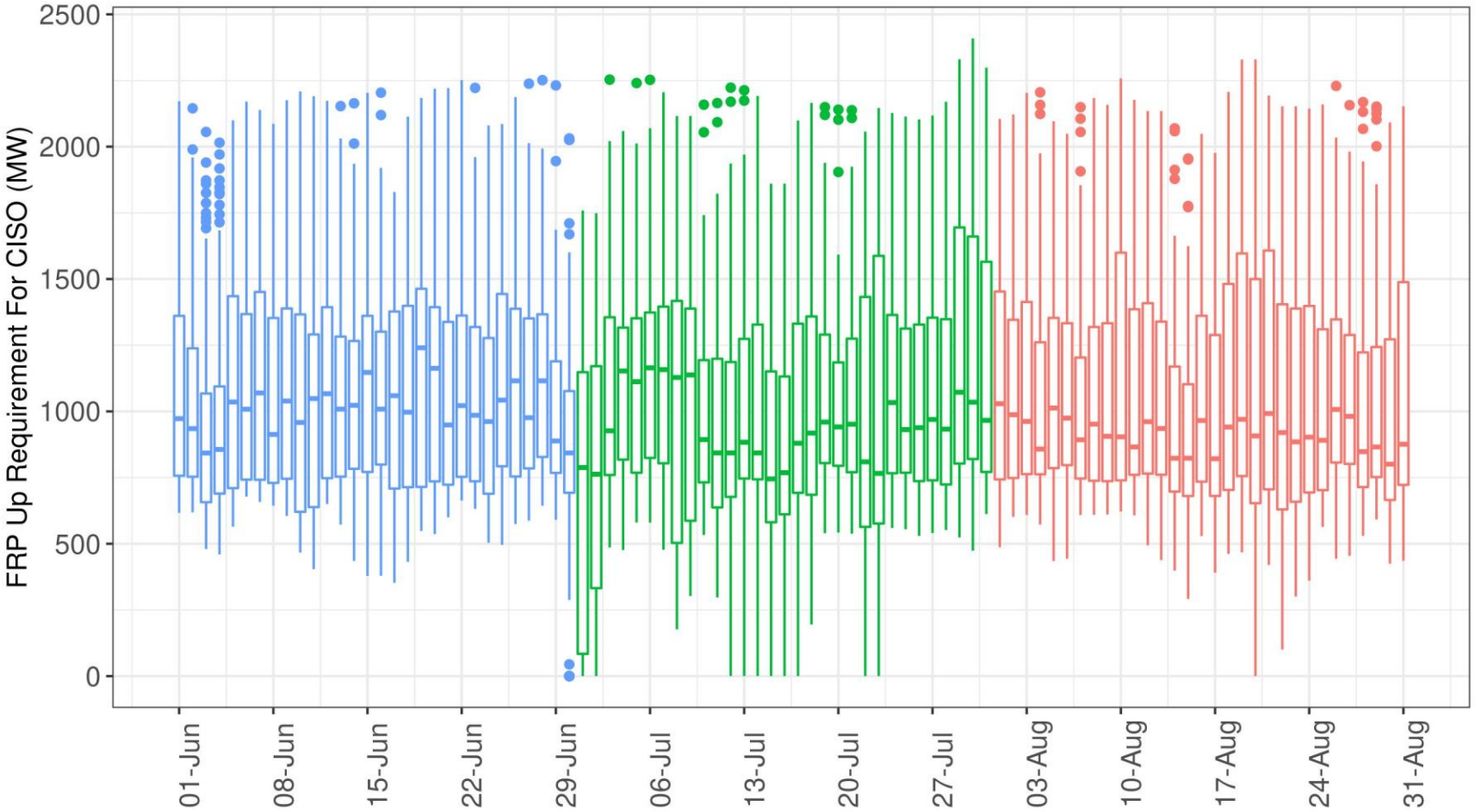


The final requirements produced by the Mosaic approach are bounded by
- a histogram-based cap
- a higher-percentile mosaic cap
- a 0.1MW lower bound to disregard negative requirements

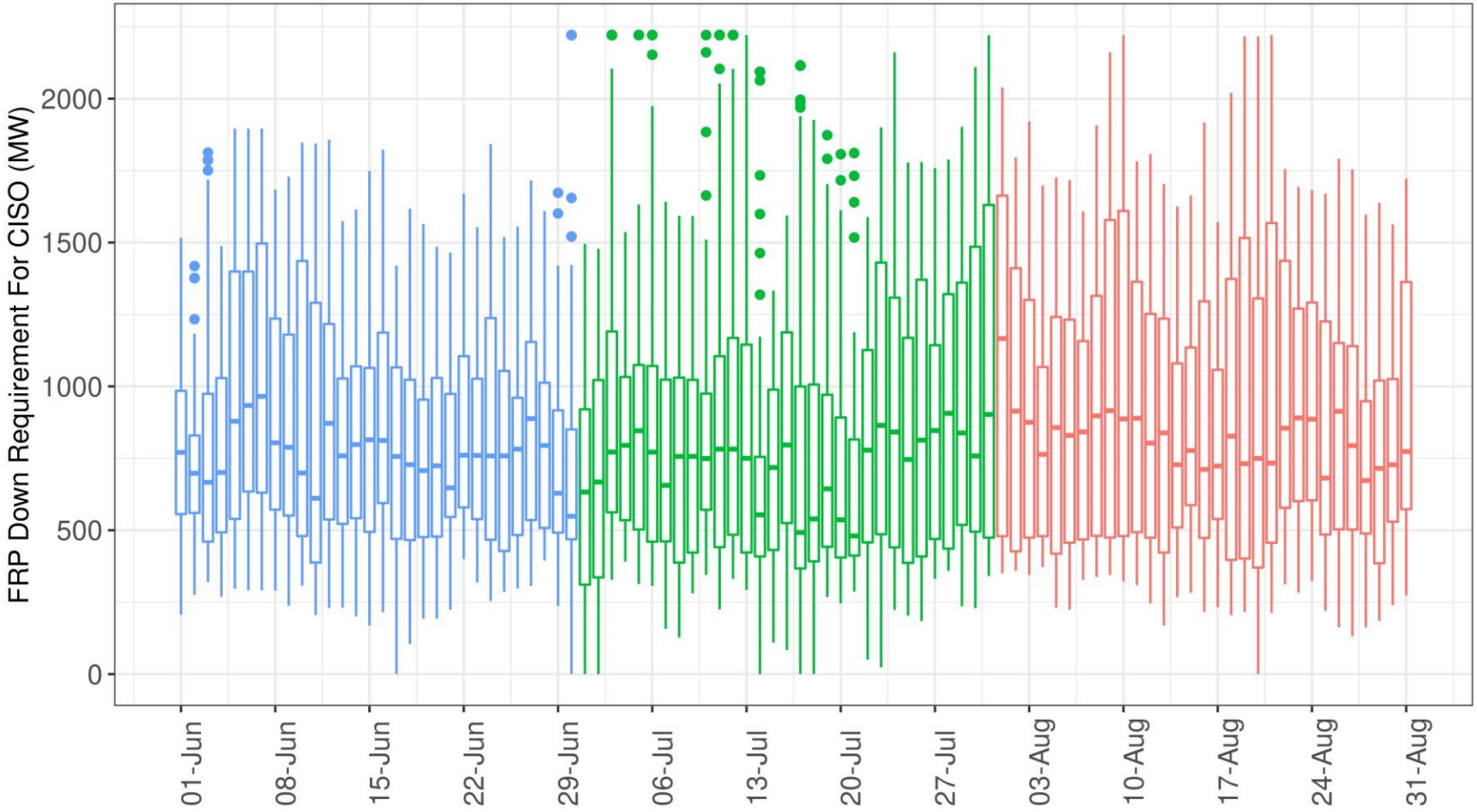
FRP Down Requirement for CAISO area remain within typical ranges



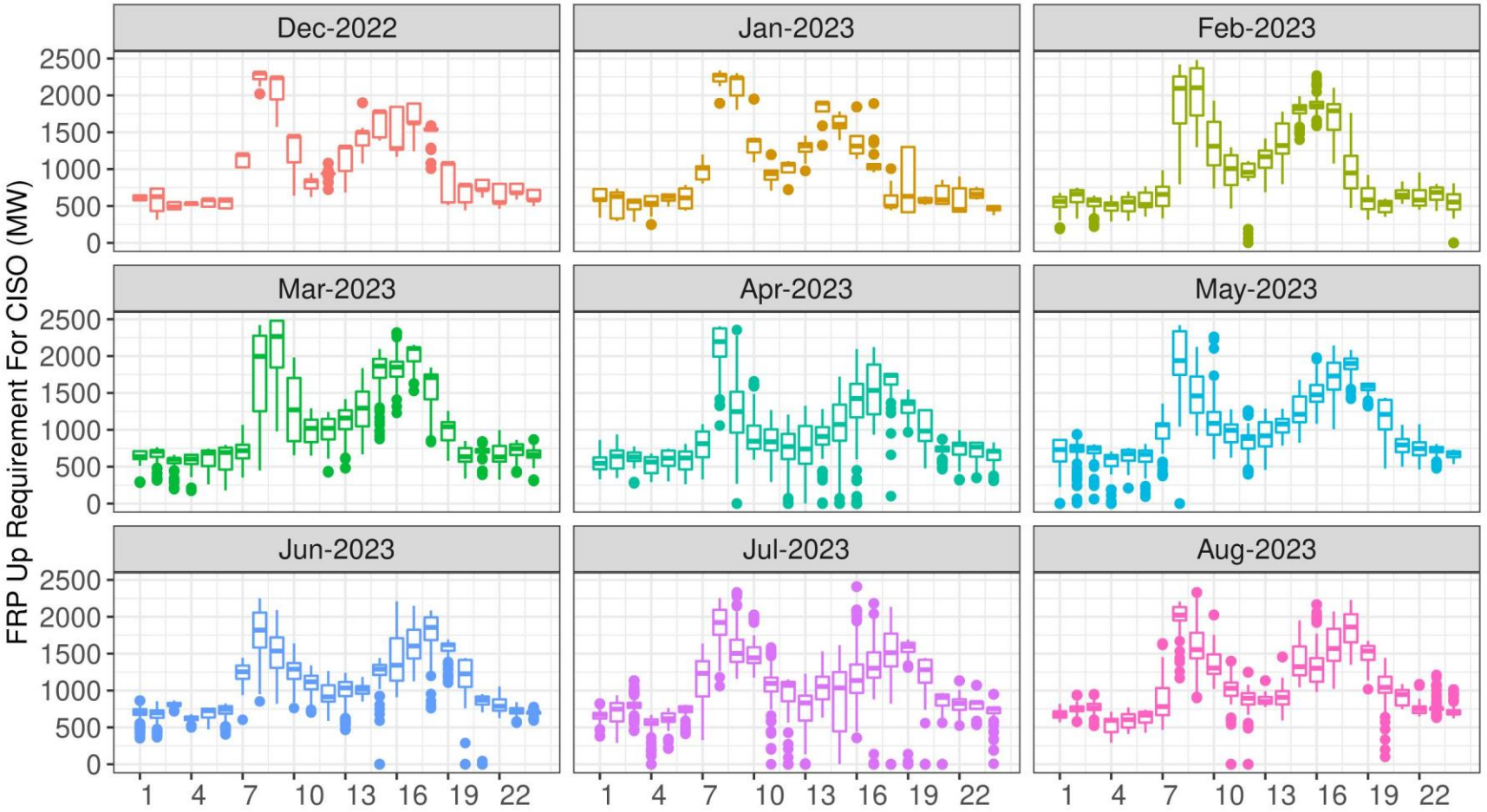
The daily distribution of FRP Up requirement in the last 3 months for CAISO area exhibit a steady trend



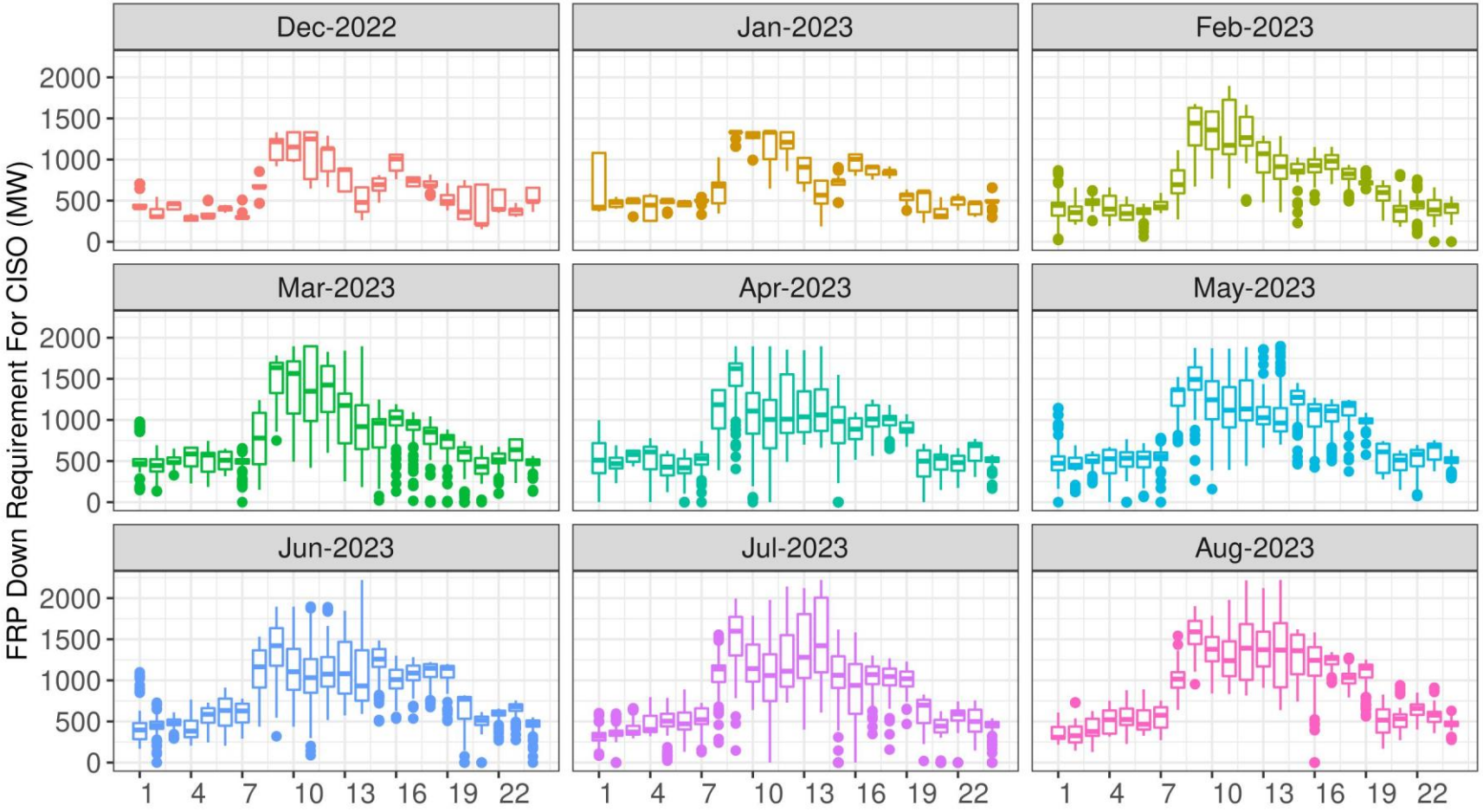
The daily distribution of FRP Down requirement in the last 3 months for CAISO area exhibit a steady trend



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



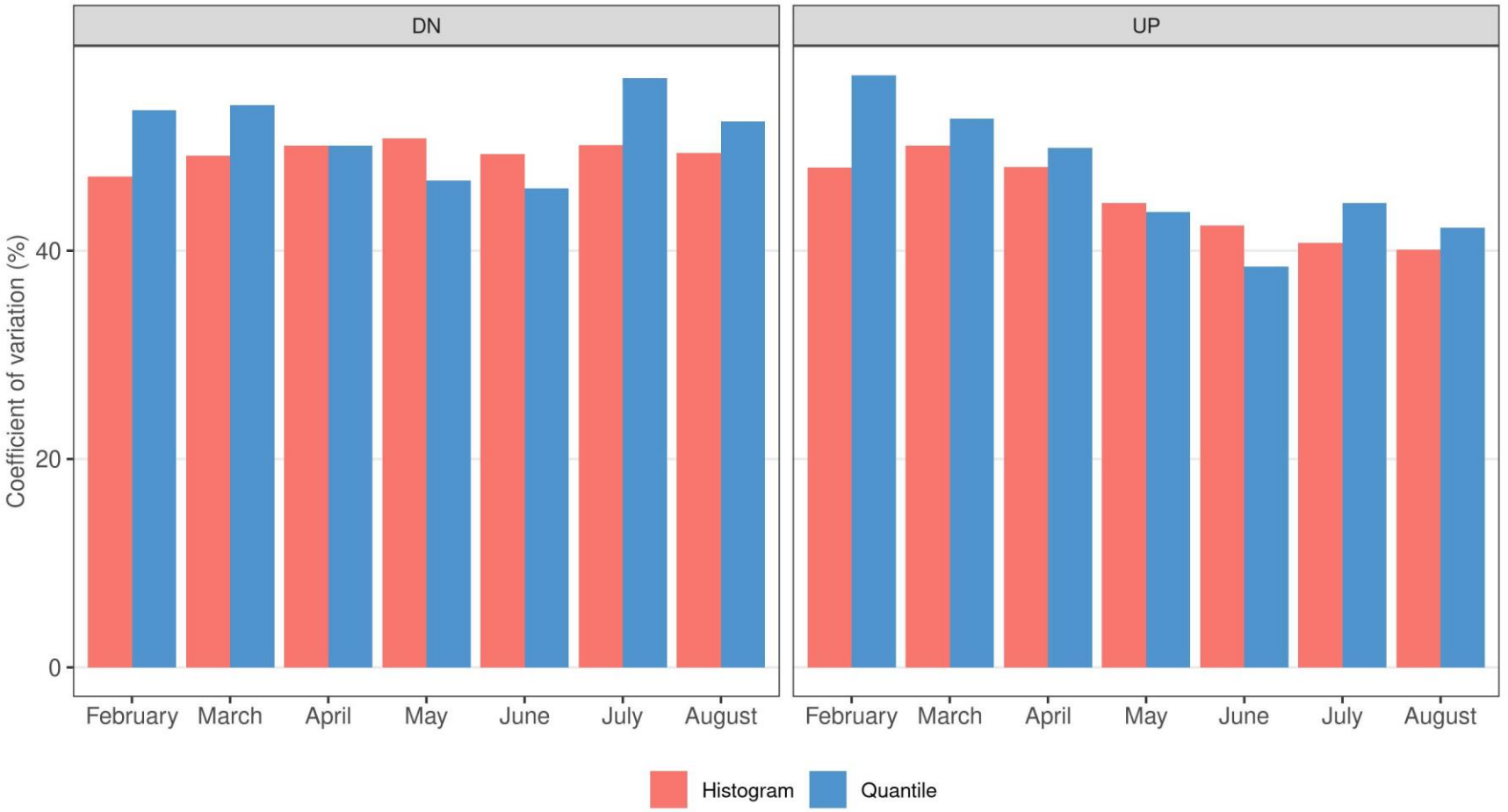
The hourly profile of downward FRP tends to follow a complementary pattern to the upward FRP, with higher values in midday hours



Methodology to calculate FRP requirements

- Previous methodology relied only on historical data of net load errors
  - a histogram calculation with the use of 97.5th and 2.5th percentiles to define the upward and downward requirement
  - Requirement were hourly
- New Mosaic calculation is used mainly to account also for current system conditions
  - Based on historical data
  - Based also on prevailing load, wind and solar forecasts
  - Use a type of quadratic regression methodology, with forecasts being the regressors
  - Because forecasts are on 15-minute basis, FRP requirements are now on 15 minute basis
  - Therefore, it was expected and by design that new methodology will produce more variability in the requirements

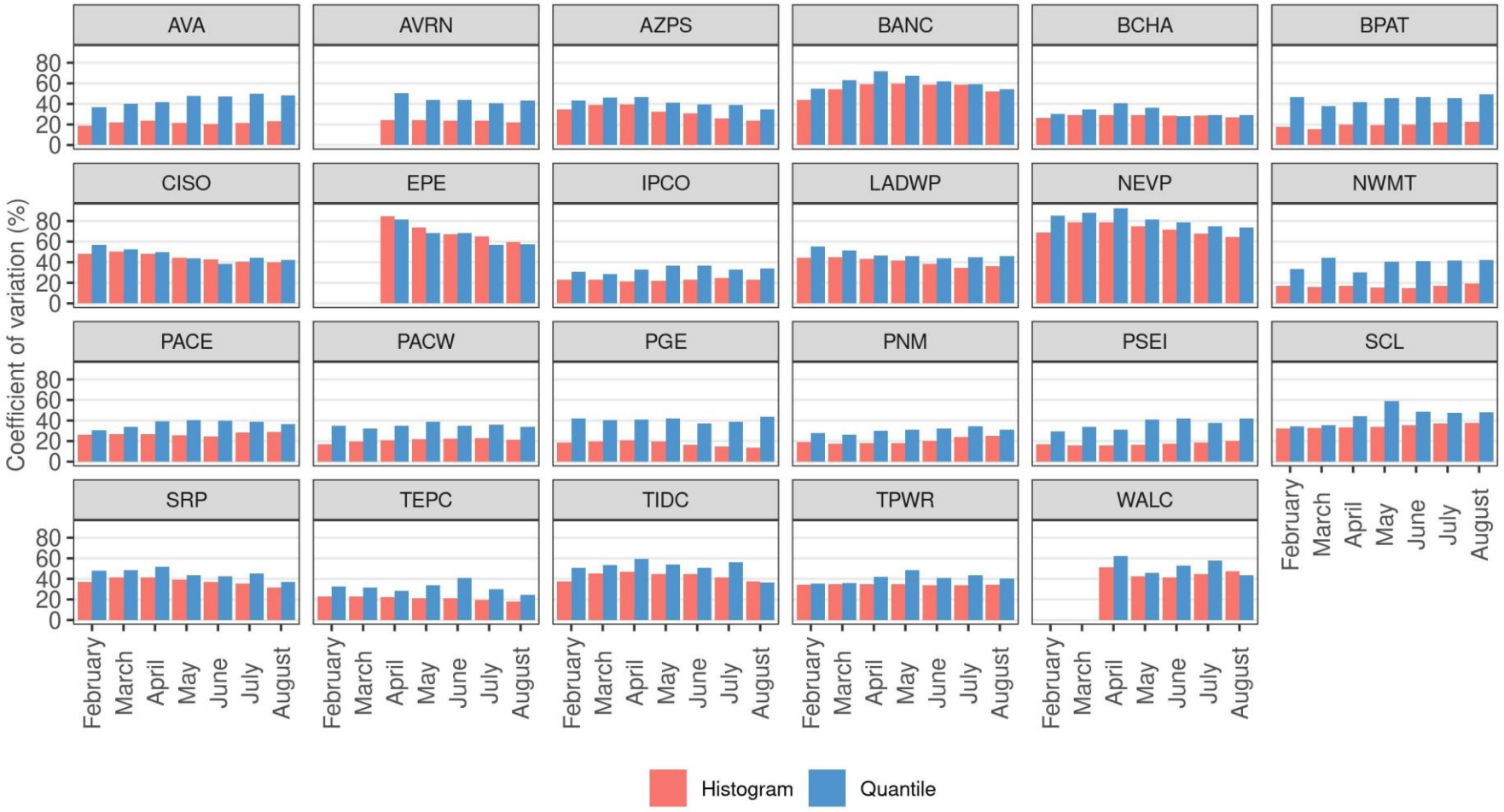
Overall the variation of requirements is higher with new methodology. CISO area



$$Coefficient\ of\ variation = 100\frac{Standard\ deviation}{mean}$$

This coefficient is useful to compare degree of dispersion of different data sets.
The higher the index the more variability in the data set

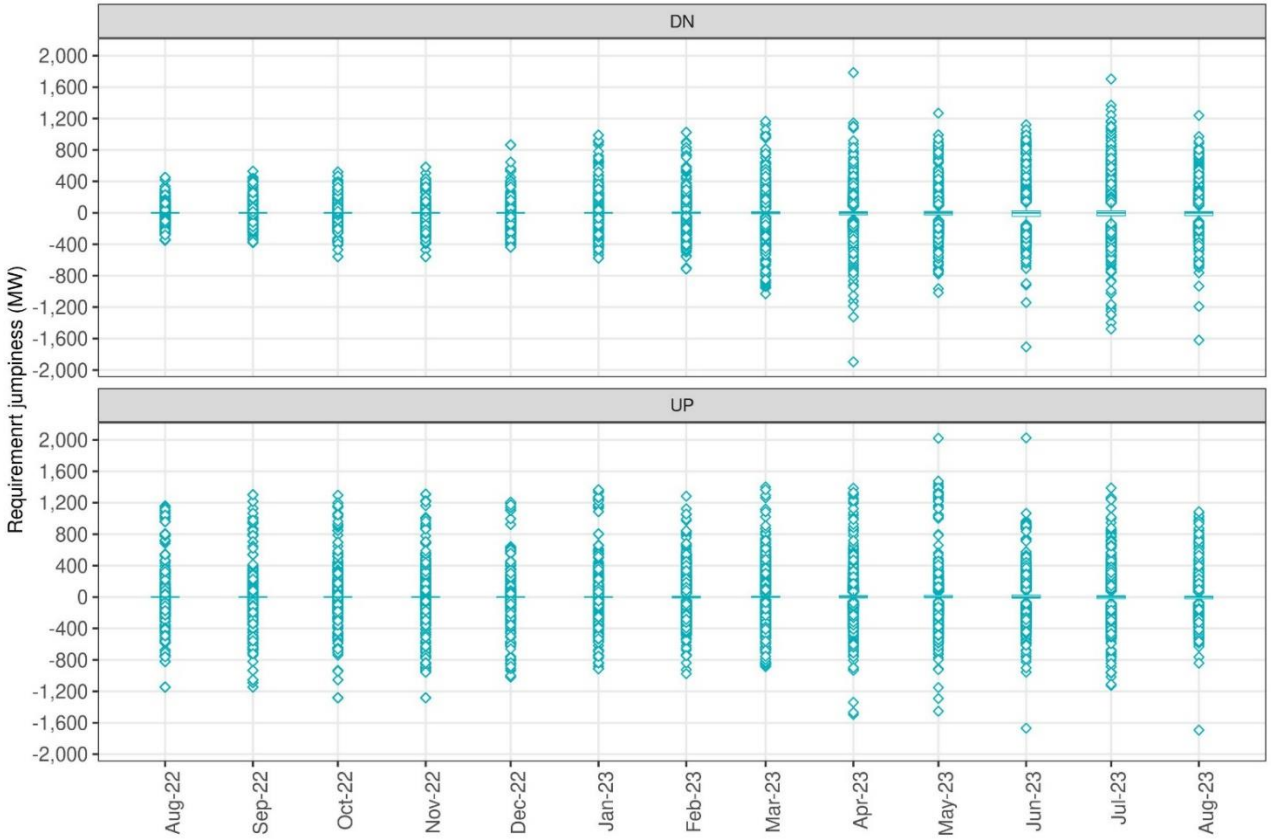
The level of variability among areas is more spread in the WEIM market, with some areas exhibiting larger variations with the new methodology



With the new methodology, FRP requirements are expected to exhibit more variability. CISO area only.

Inter-hourly variability:
- Use of different regression model among hours
- Use 15-minute forecasts

Intra-hour variability
- Use 15-minute forecasts

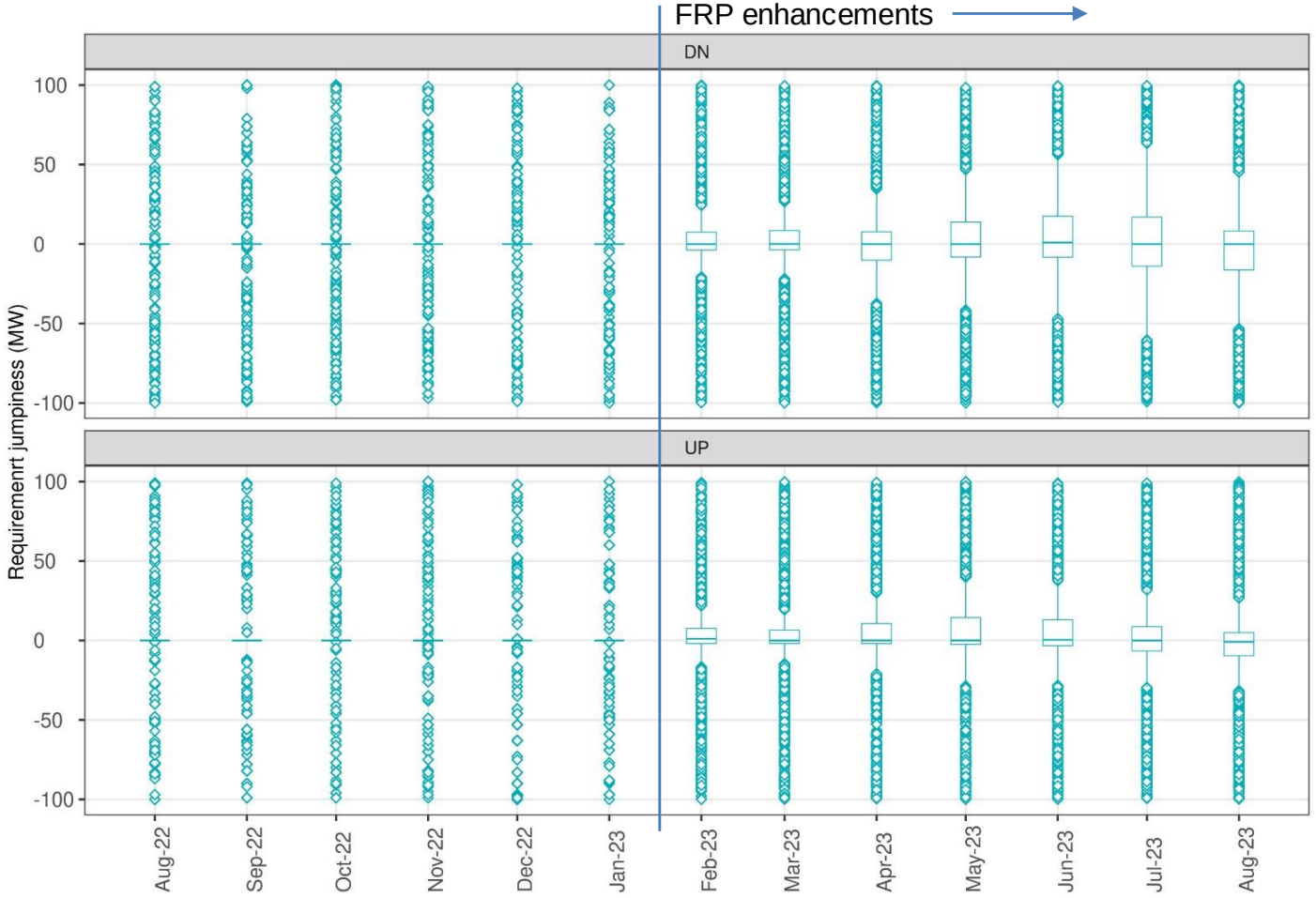


Variation = current interval req – previous interval req

A positive value means the requirement increase relative to previous interval

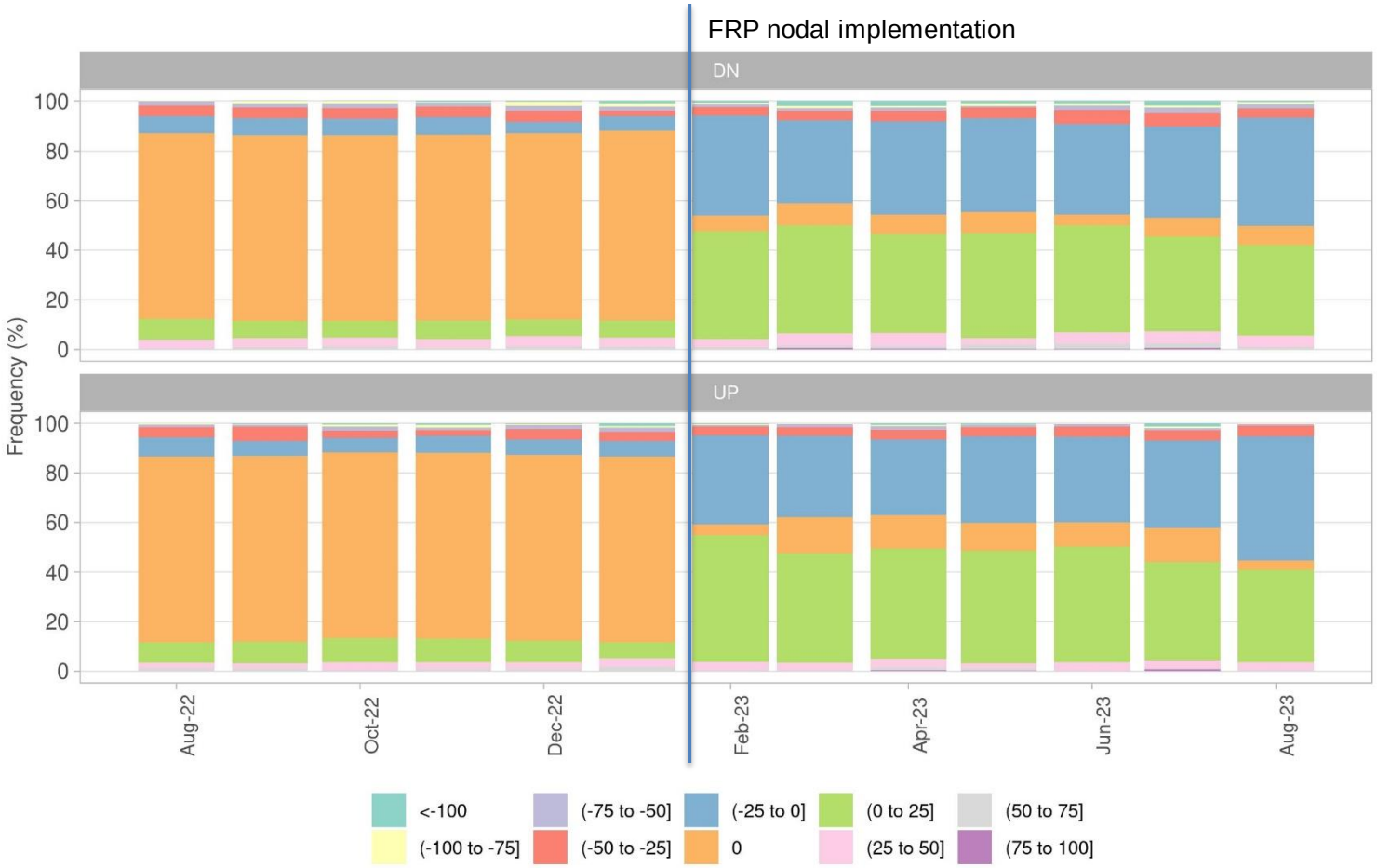
FRP requirement between adjacent intervals exhibits larger variability since February. CISO area only.

The most significant volume of variability is contained within a tight range between -50 MW to +50 MW



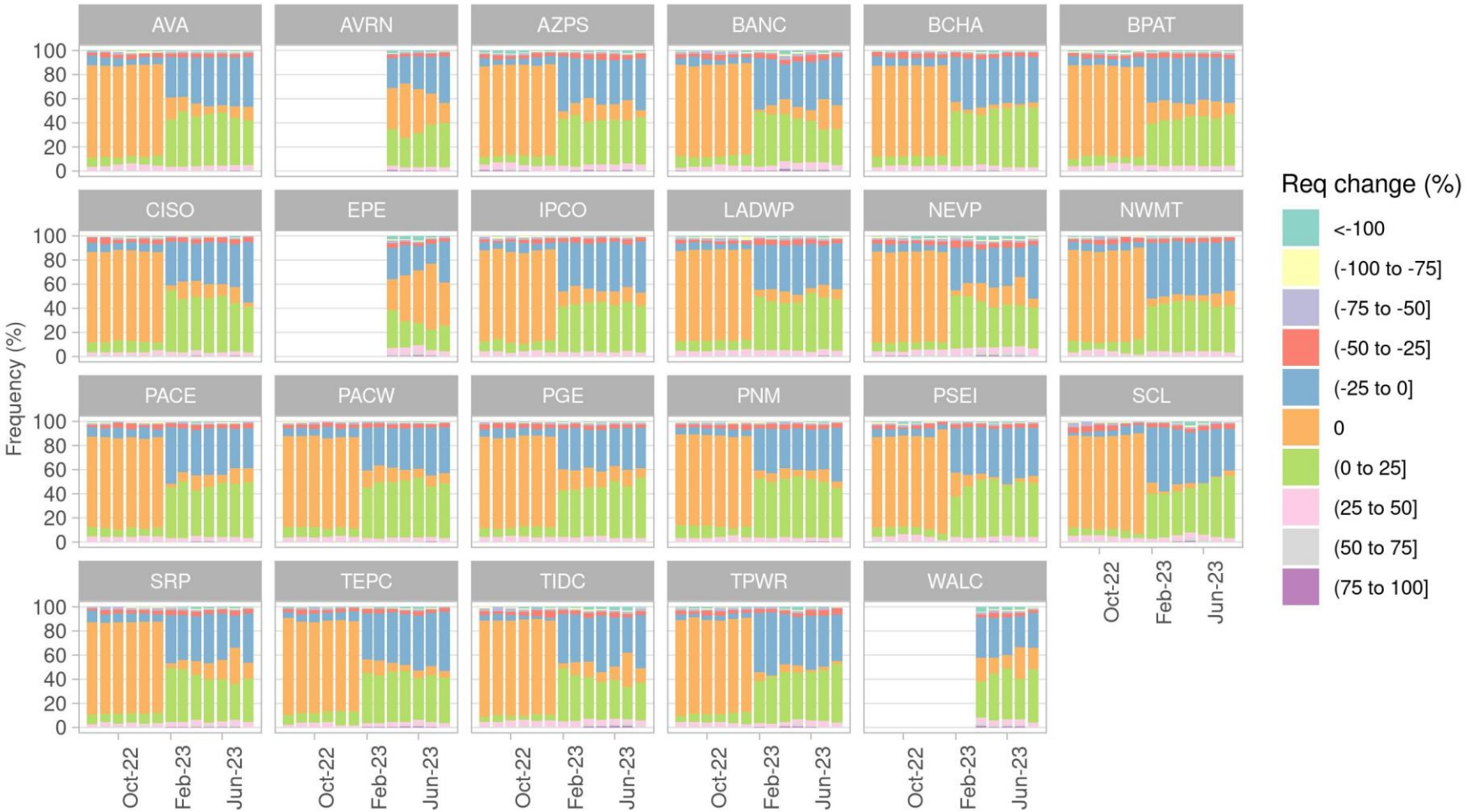
Shown distributions are zoomed into the range of -100 MW to +100 MW

Over 90 percent of the requirement changes are within ±25 percent of the value from previous interval. CISO area.

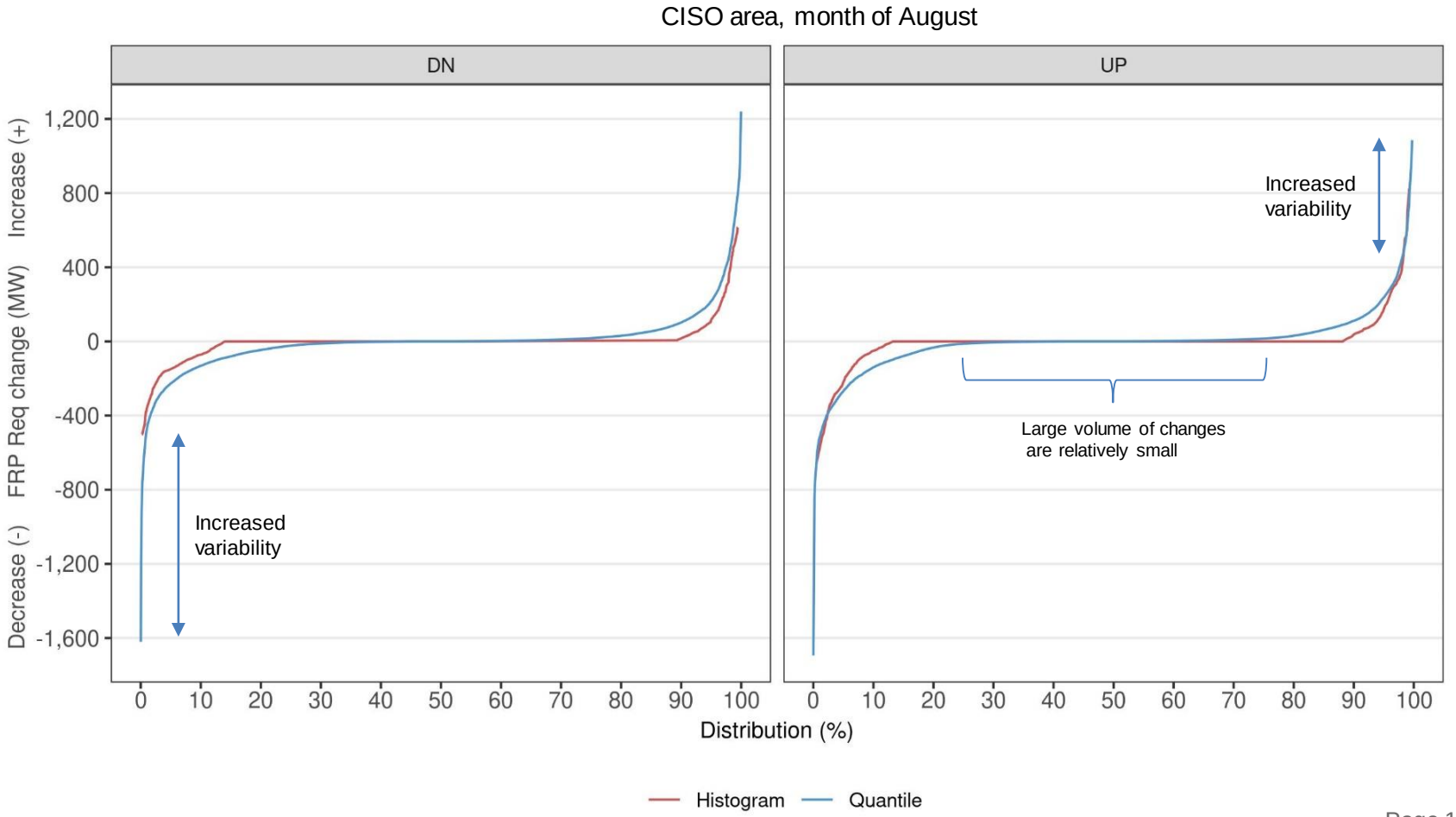


The percentage of each group is estimated $= \frac{current\ interval - previous\ interval}{previous\ interval}$

Across all WEIM areas, over 90 percent of the requirement changes are within 25 percent of the previous requirement



Although the majority of the variability is in a tight range, there are more extreme changes as reflected at the tails of the distributions



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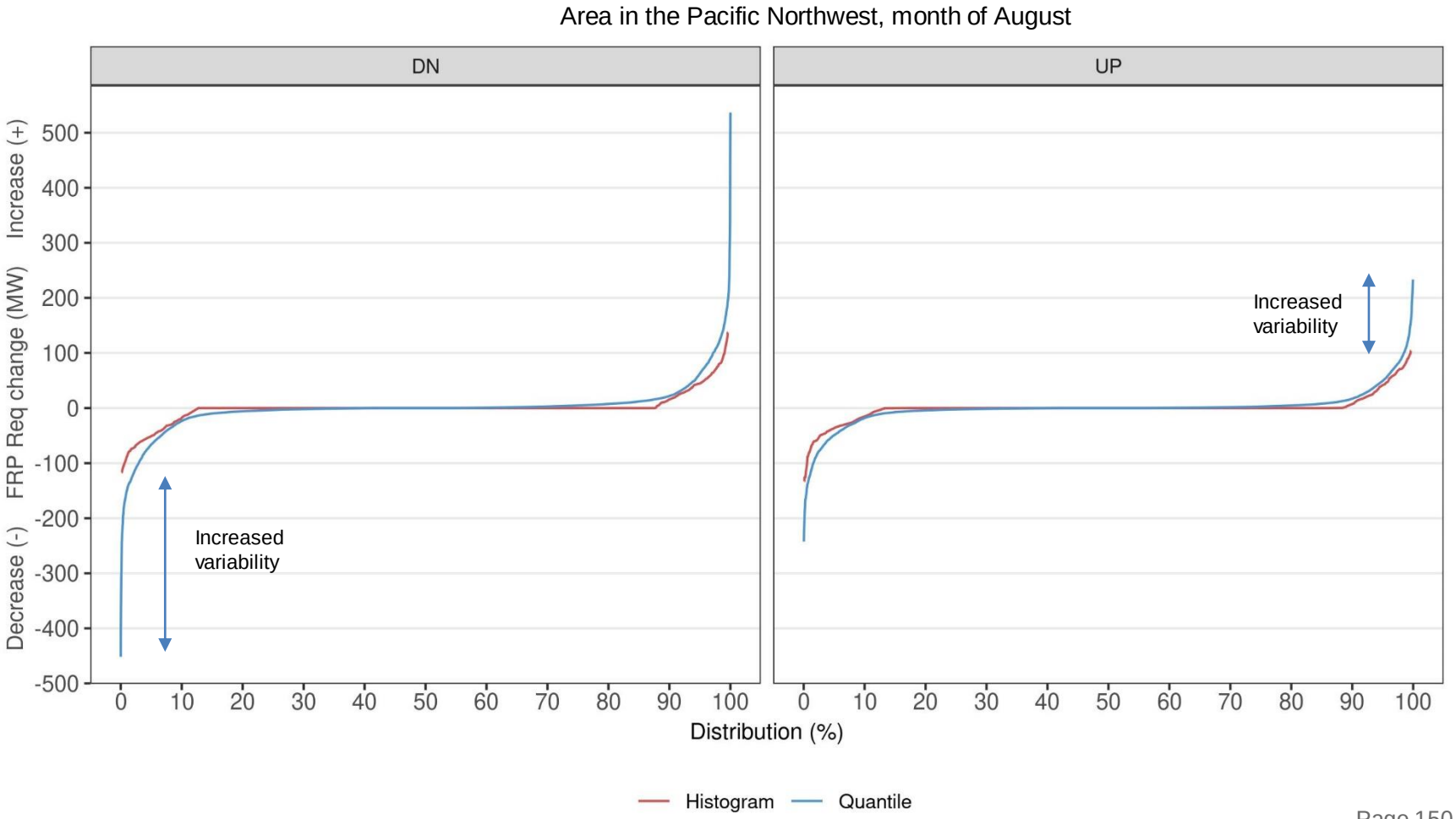
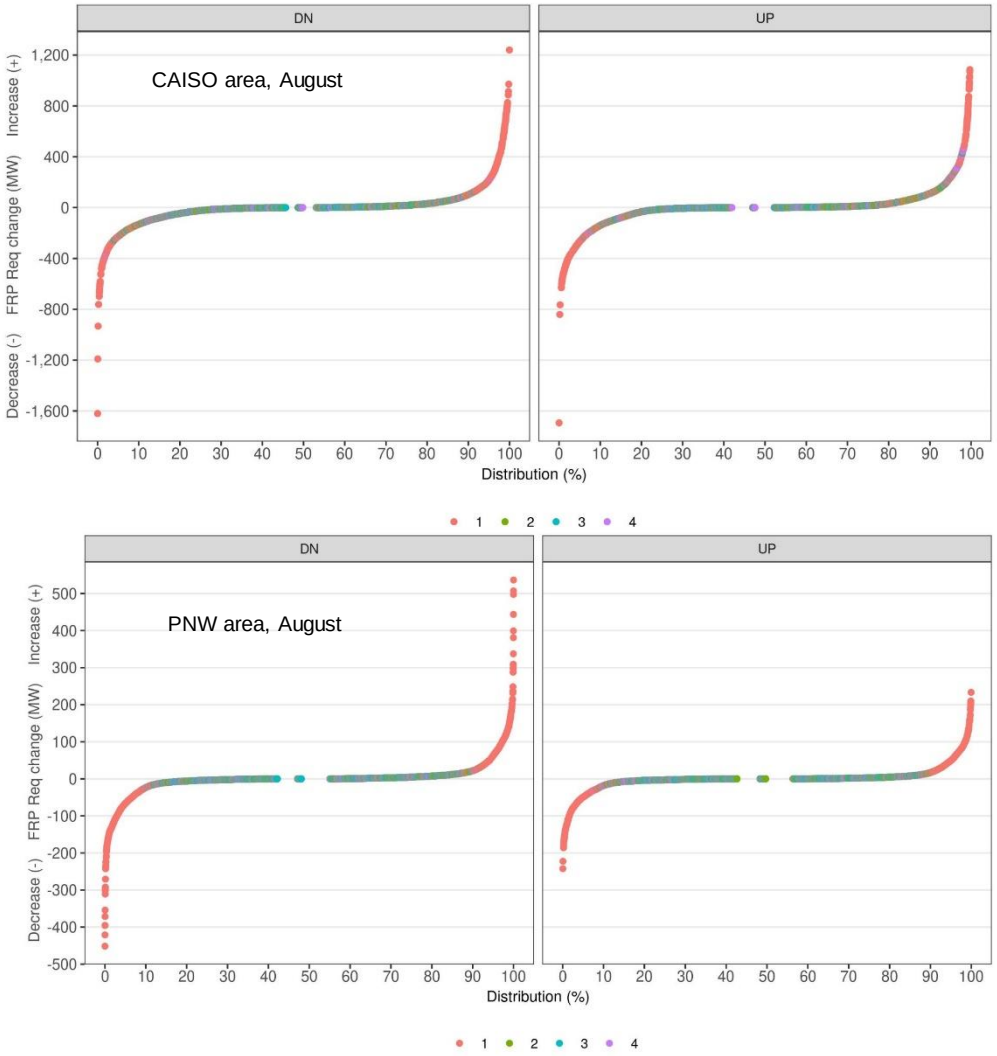


The largest changes of FRP requirements with the new methodology happen between hours

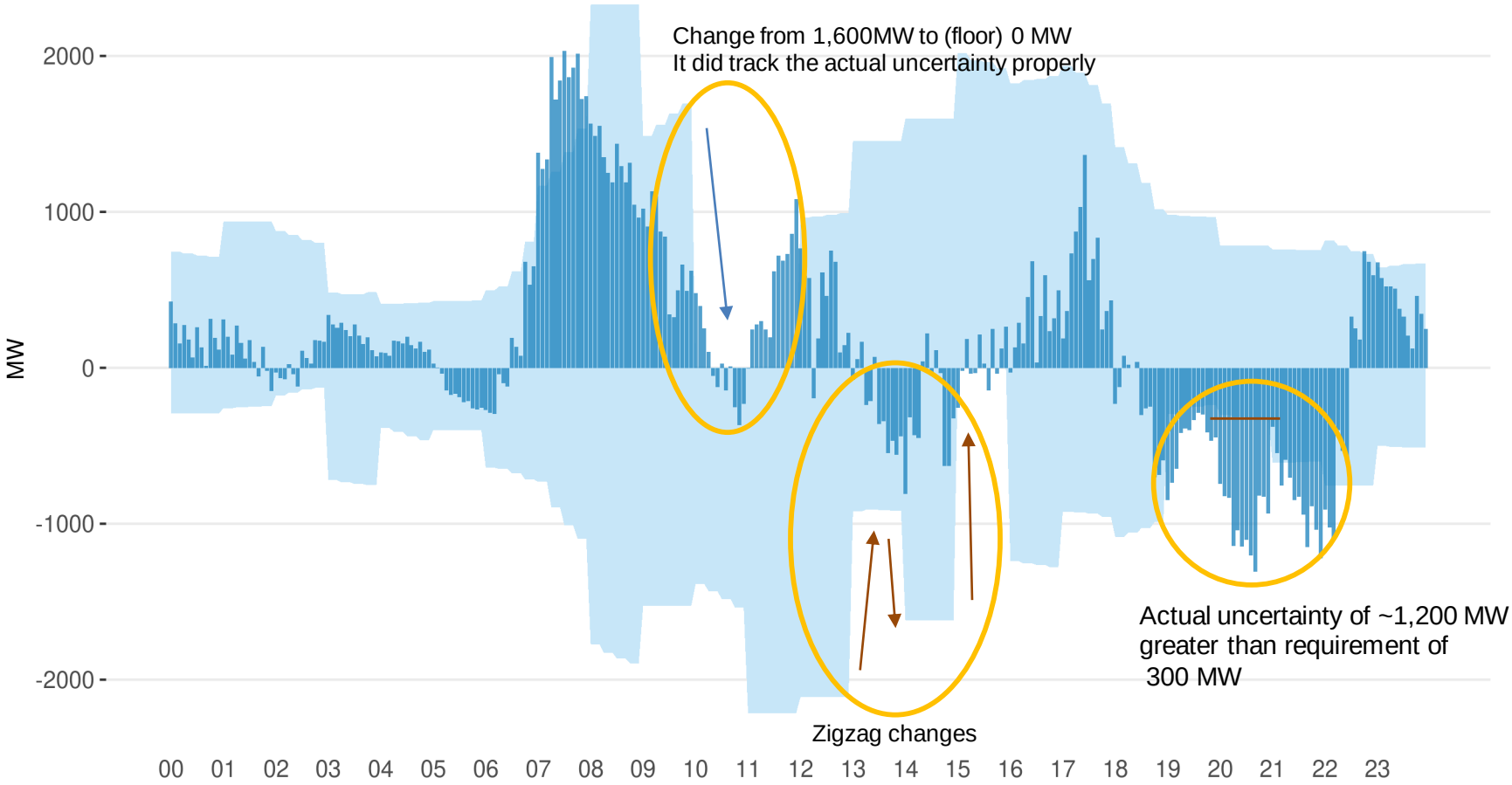
Changes from interval 4 to interval 1 means a change between hours

In addition to 15-minute changes of forecasts, the regression model changes between hours

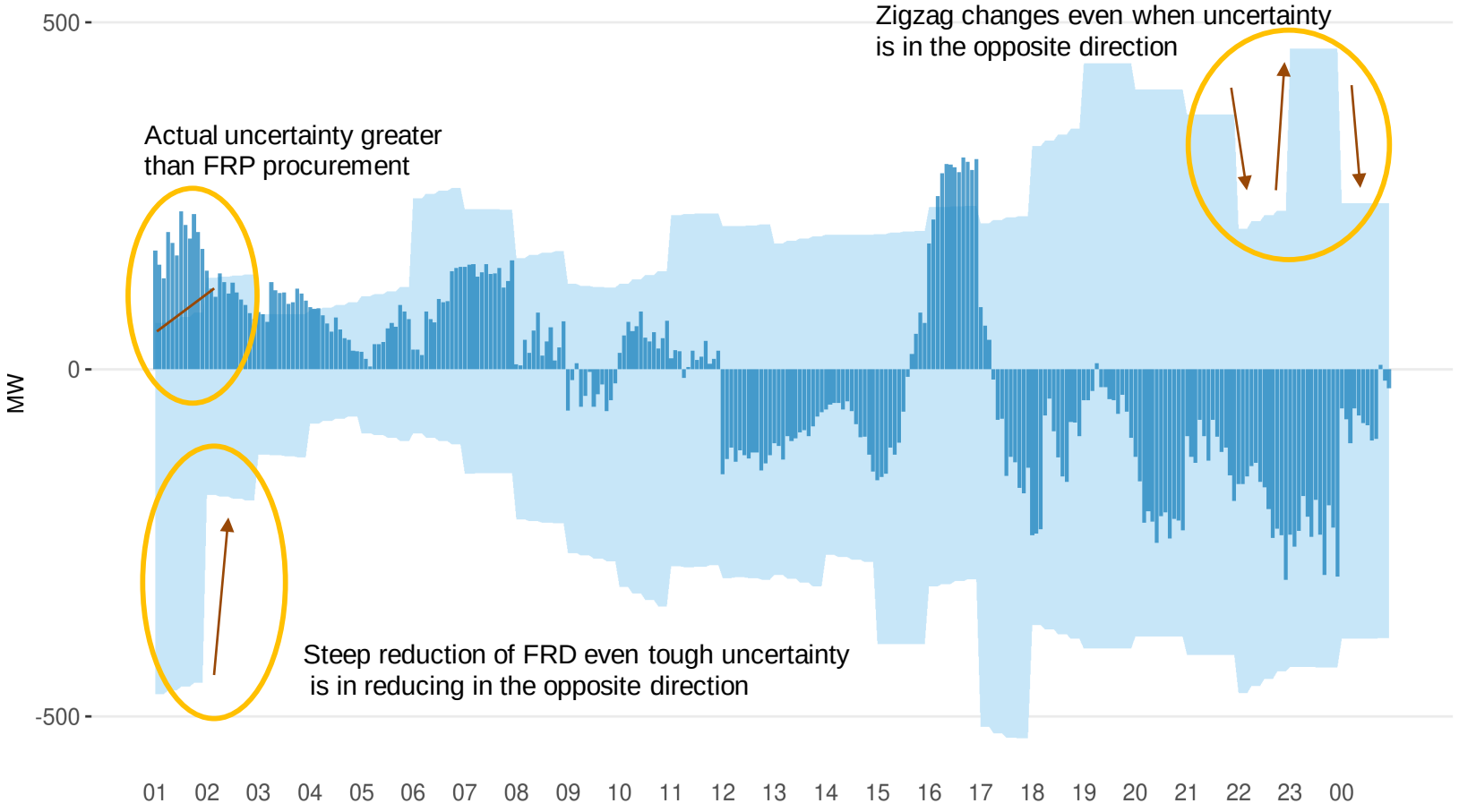
Hypothesis: Since intra-hour changes show to be smaller for other intervals, the extreme changes of requirements (red dots) clustered at intervals 1 seem to be driven by the regression coefficient changes



Visualization of one of the outlier of FRP changes for CISO area



Visualization of one of the outlier of FRP changes for an area in the Pacific Northwest



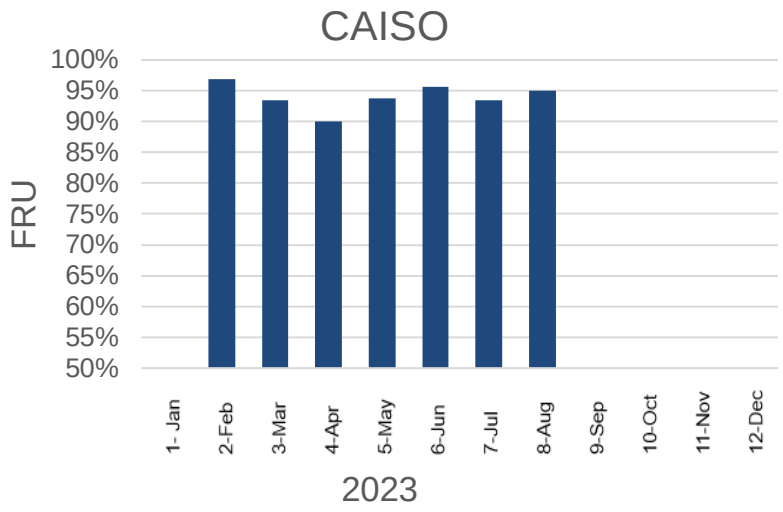
Steep changes in the requirements pose a challenge for entities to assess conditions to pass the test

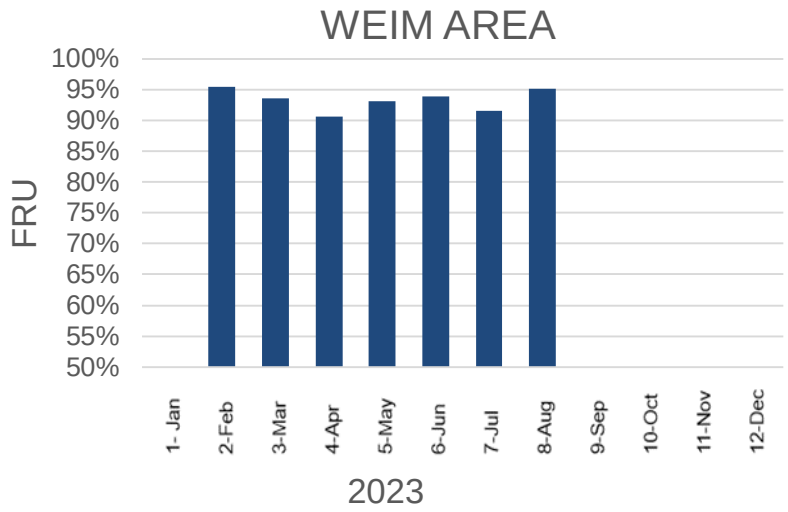
FRP Requirements Performance Measurements:

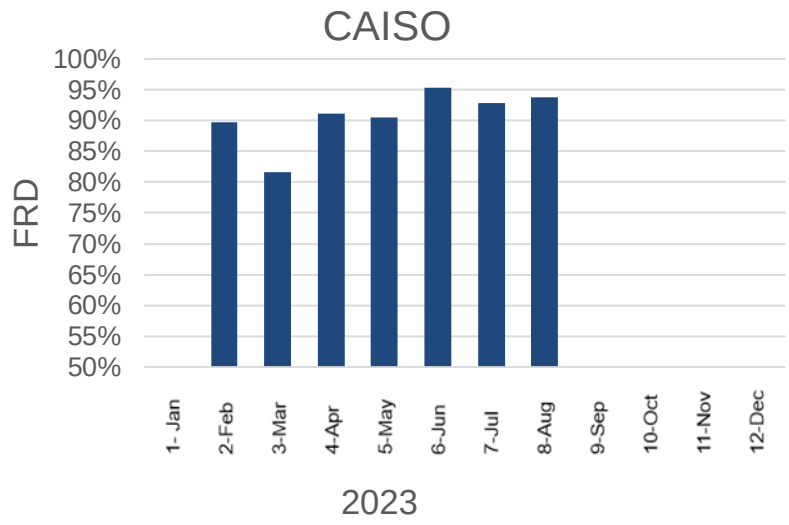
1. Coverage:
   - The percentage of observed uncertainty covered by the proposed requirement.
   - This is used to check the validity of a model, and is the coverage of observed uncertainty against the requirement.
2. Requirement:
   - The average of estimated requirements over a period of time.
3. Exceedance: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

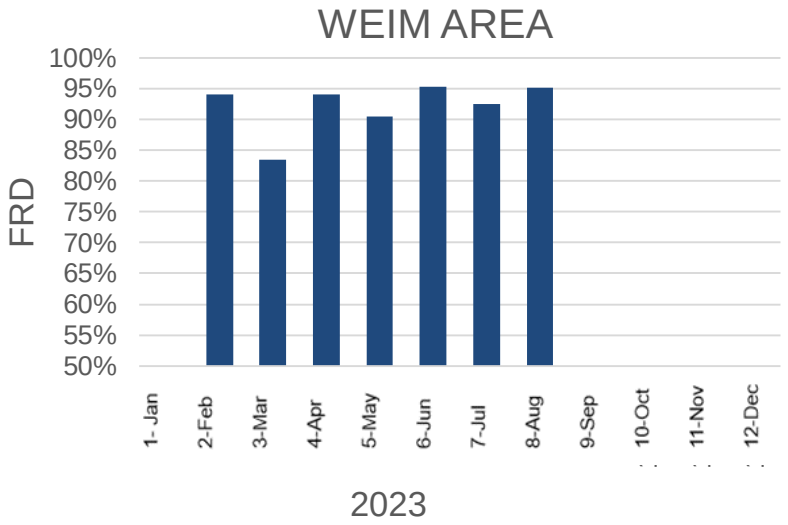
These measurements are designed to display the performance from four different perspectives: Coverage, requirement, exceeding, and closeness can be used to reflect operational reliability, cost, risk, and effectiveness.

FRP Coverage

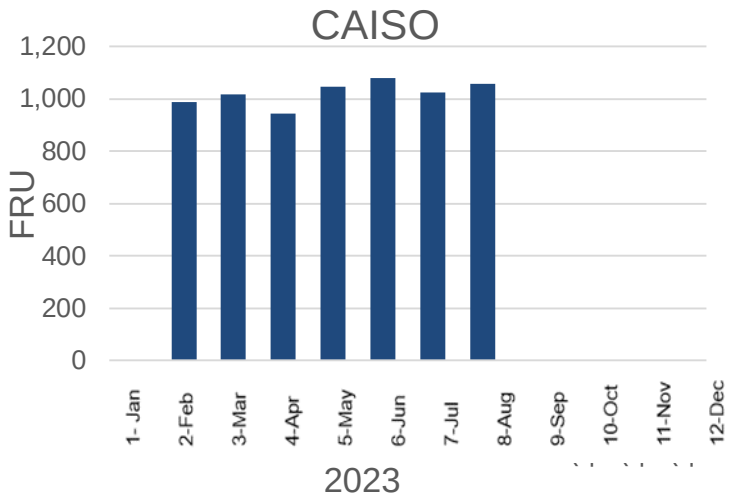


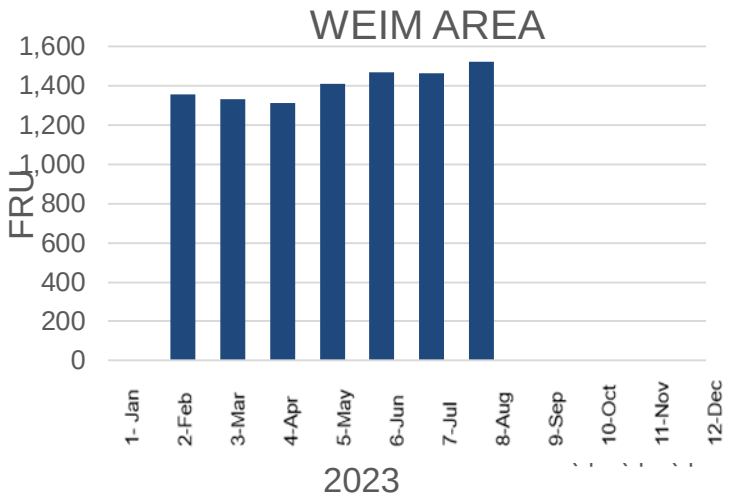


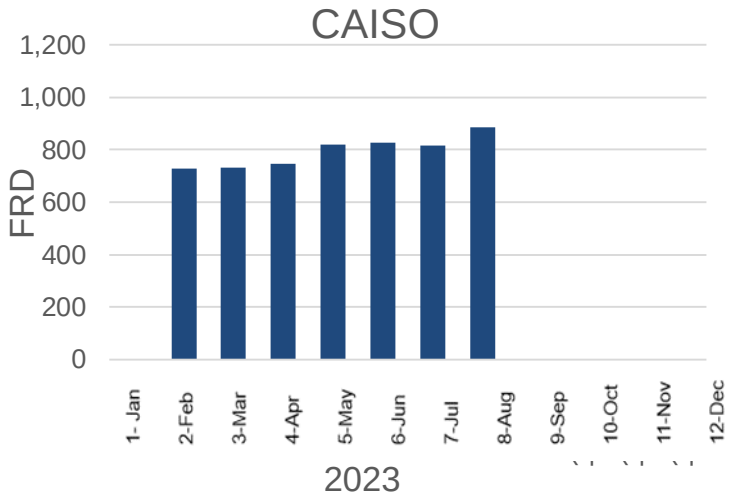


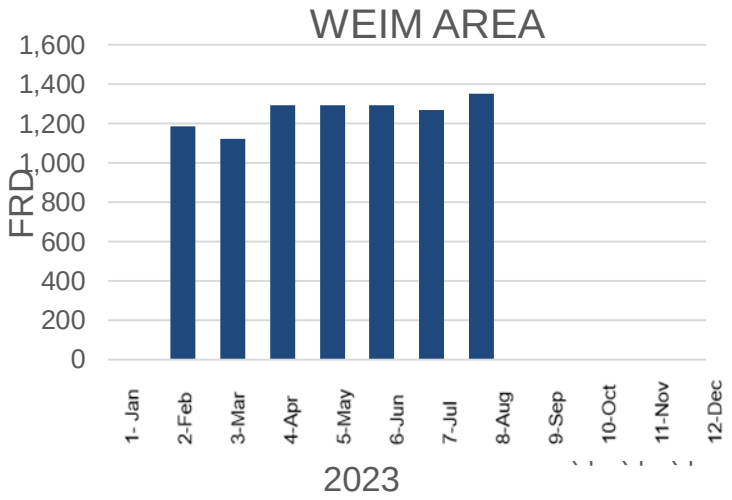


FRP Requirement

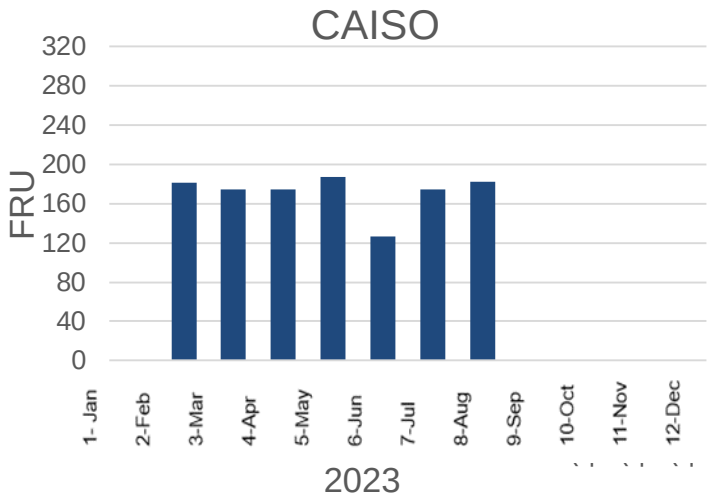


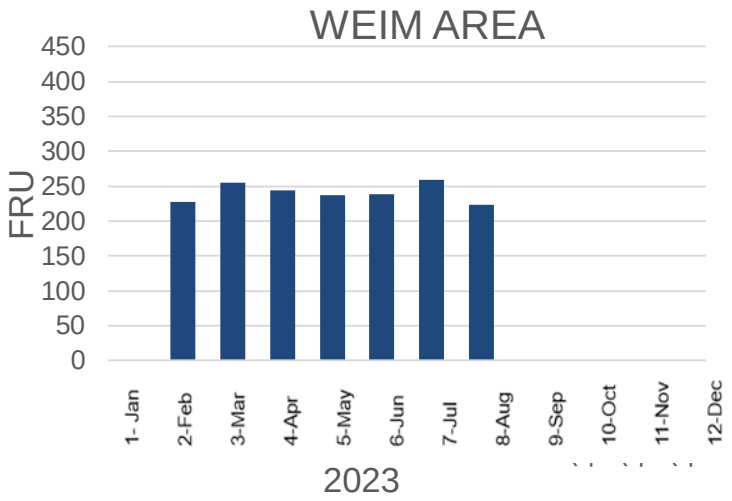


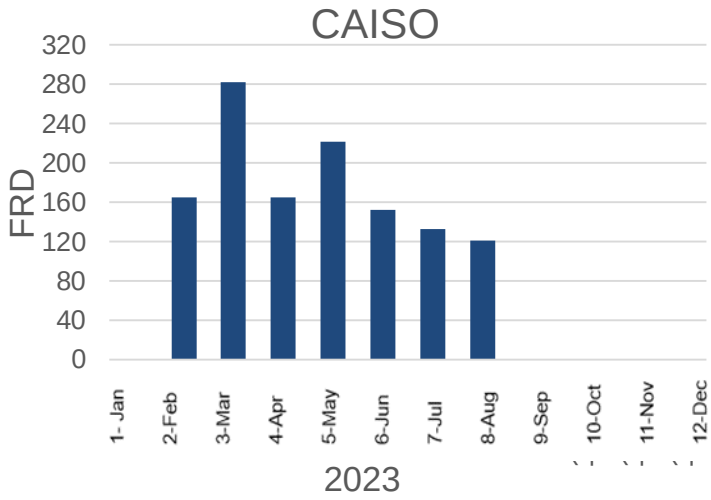


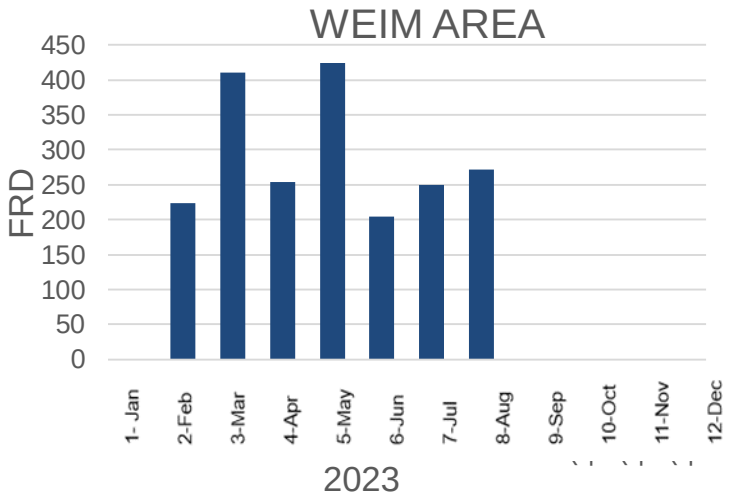


FRP Exceedance









Mosaic provides noticeable lower exceedance break-point than Histogram

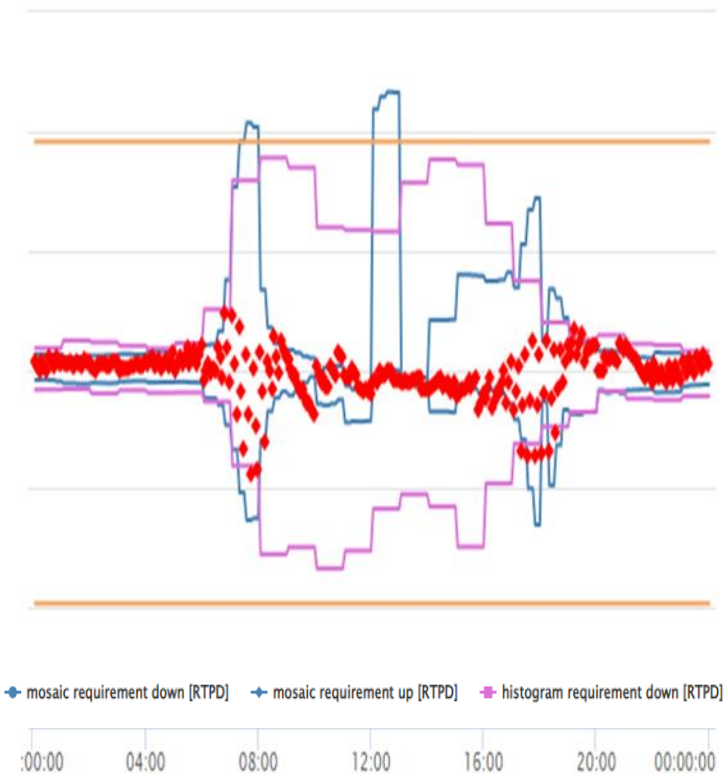
BAA	FRU_H	FRU_M	FRD_H	FRD_M
AVA	45.29	36.98	-48.98	-33.35
AVRN	143.96	88.05	-171.04	-92.59
AZPS	144.58	93.64	-117.39	-68.11
BANC	40.30	17.00	-39.23	-18.95
BCHA	150.11	64.41	-152.97	-61.83
BPAT	198.11	141.60	-316.89	-170.66
CISO	922.71	416.80	-801.78	-441.03
EIM_AREA	1254.36	479.85	-1238.66	-614.12
EPE	28.57	17.55	-19.34	-10.16
IPCO	94.36	63.56	-125.41	-79.04
LADWP	138.63	92.52	-154.18	-65.96
NEVP	158.43	106.41	-147.87	-111.63
NWMT	72.20	39.01	-71.24	-38.84
PACE	277.74	162.65	-341.80	-186.88
PACW	89.02	49.61	-100.66	-62.10
PGE	106.72	72.64	-109.22	-49.75
PNM	98.85	57.93	-104.37	-80.54
PSEI	129.19	62.82	-138.36	-57.23
SCL	23.25	10.26	-19.15	-6.87
SRP	89.85	48.28	-85.24	-51.89
TEPC	102.29	39.17	-77.73	-36.41
TIDC	7.09	2.42	-7.23	-2.06
TPWR	11.65	3.59	-11.00	-3.33
WALC	10.82	6.82	-9.58	-5.93

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

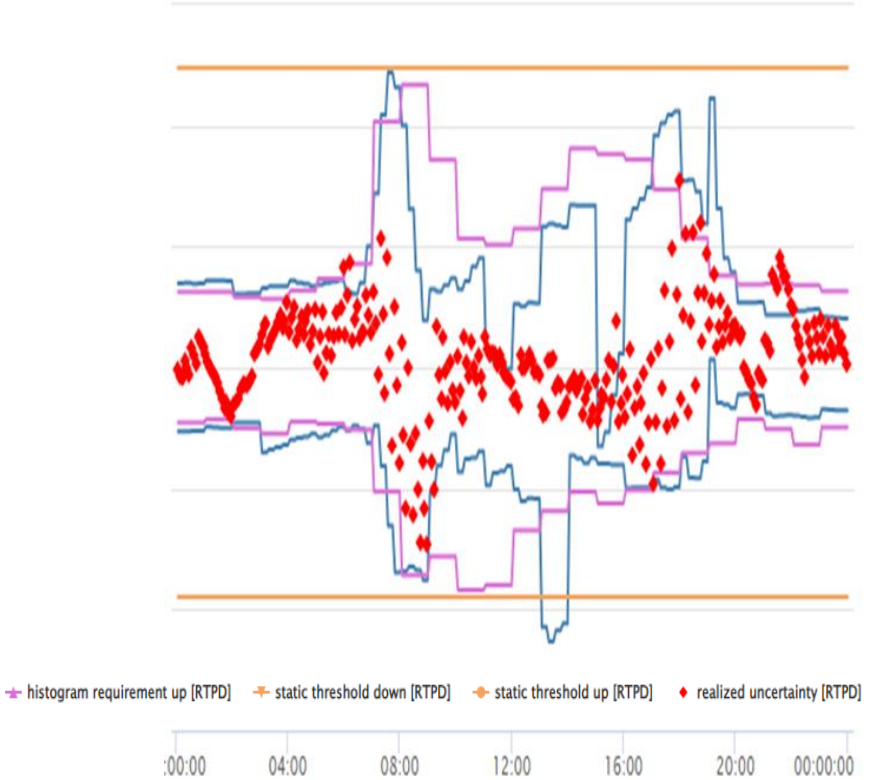
FRP Adaptability for Uncertainty Movement

Comparison of FRP for two WEIM entities in April 2023

EIM 1

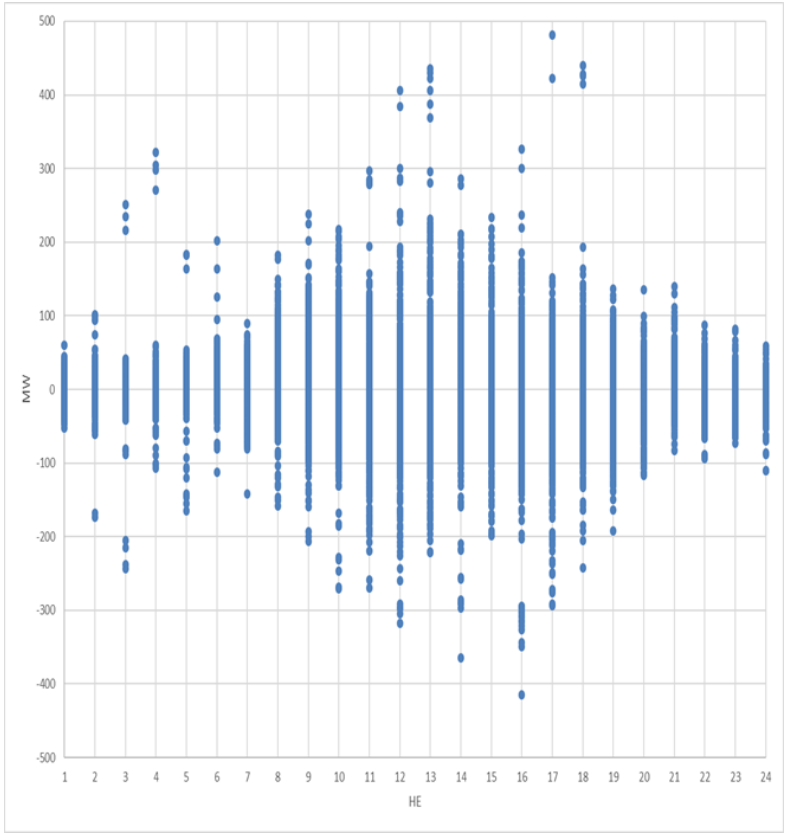


EIM 2

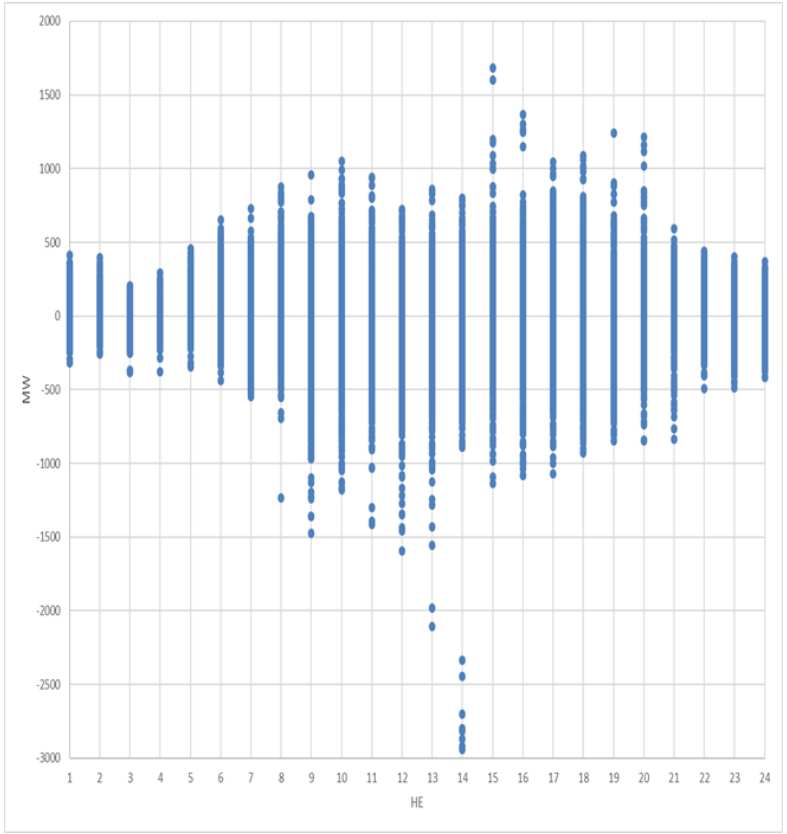


Historical Load Uncertainties

EIM 1



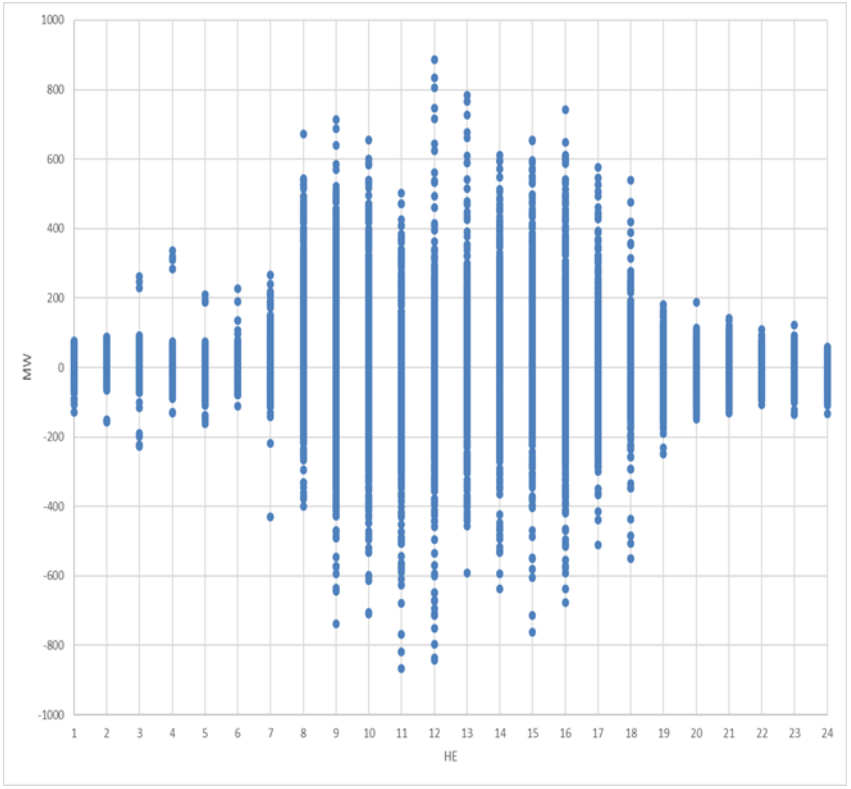
EIM 2



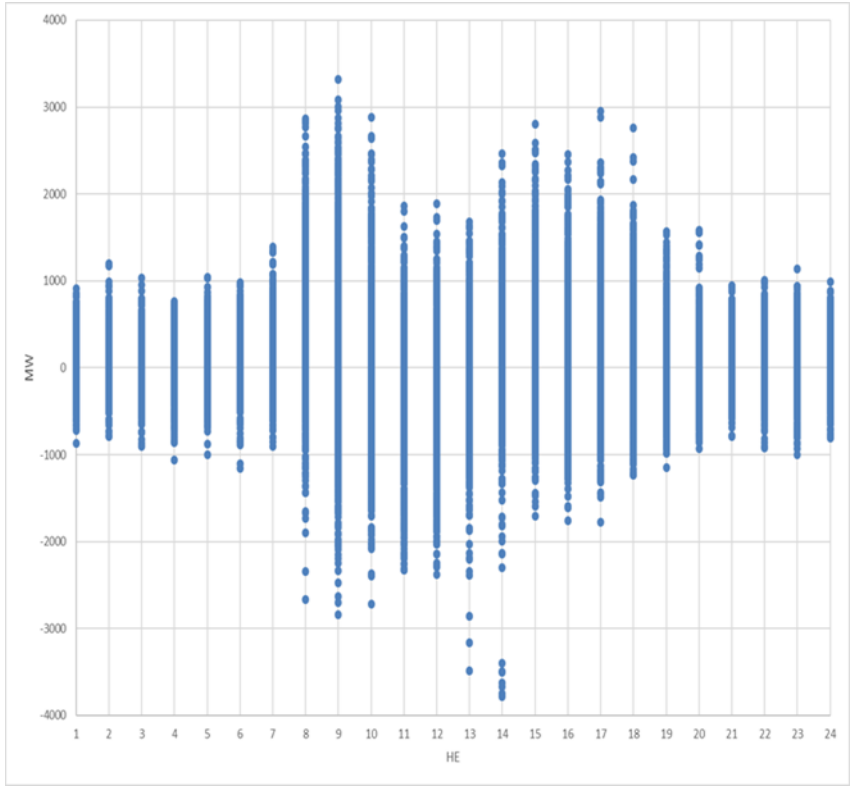
- The source of jumpiness in slide 158 is from historical load uncertainty
- The jumpiness can be viewed as mosaic is more adaptive to variability of component uncertainty

Historical Net Load Uncertainties

EIM 1



EIM 2



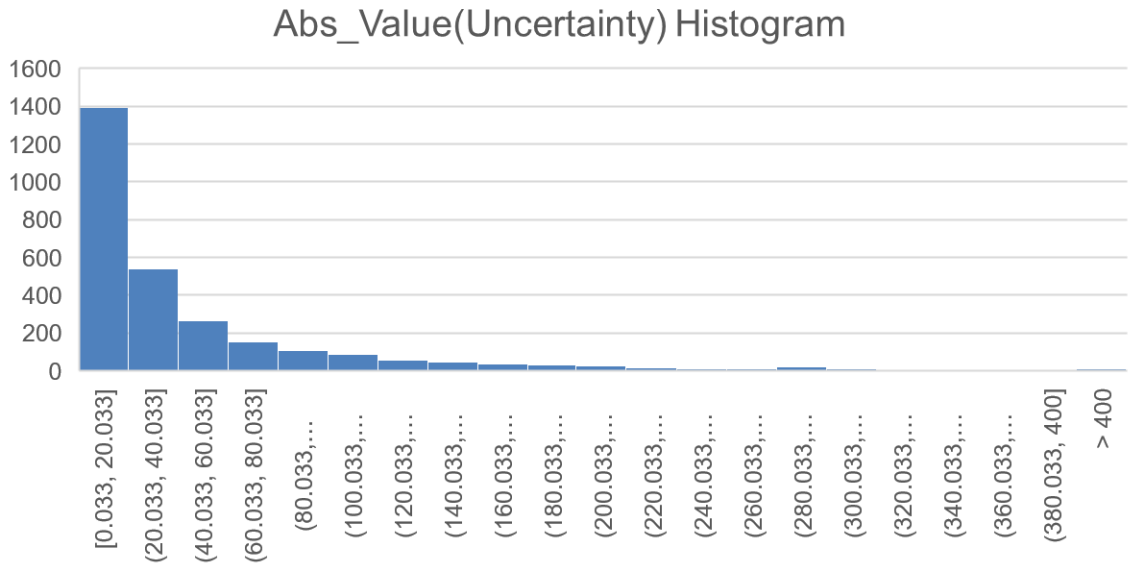
- The load uncertainty in slide 159 is reflected in net load uncertainty, plus
- The solar uncertainty in morning ramp is also reflected in net load uncertainty

FRP Jumpiness Investigation

- Mosaic regression model consists two-stage approach, first for load, wind, and solar component uncertainty, then for net load uncertainty
- Therefore, load, wind, and solar uncertainties will have heavier weight on mosaic requirement

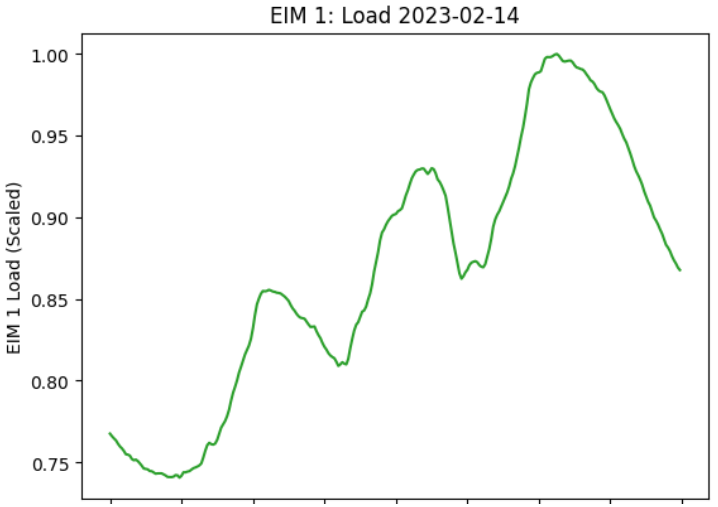
Deep dive into load uncertainty requirements for two EIM regions

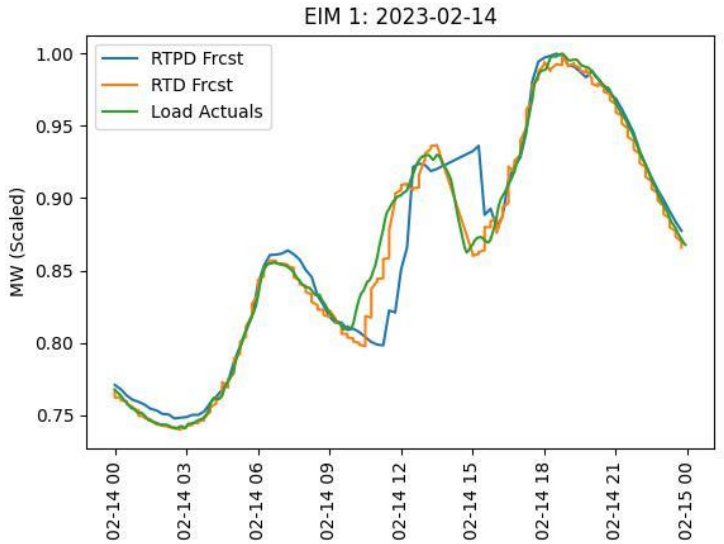
- Investigation into high EIM1 uncertainty compared to EIM2
- Uncertainty = RTD – RTPD
- 15-day dataset where | Uncertainty | > 250 MW at any point in day
  - 3 Days with obvious Pi Tag issue (excluded)
  - **12 Days with high BTM Solar fluctuation**
  - Occasional lagged forecast timing defect occurred until 5/15/23



Date	Max Uncertainty (MW)
10/11/22	286.7
10/12/22	481.6
12/1/22	-290.5
12/7/22	322.4
1/5/23	-251.1
1/10/23	435.7
1/16/23	-290.9
1/19/23	286.2
2/14/23	405.9
2/22/23	-268.2
3/1/23	-259.7
3/9/23	-259.1
3/10/23	297.1
3/15/23	326.7
4/3/23	-255.8

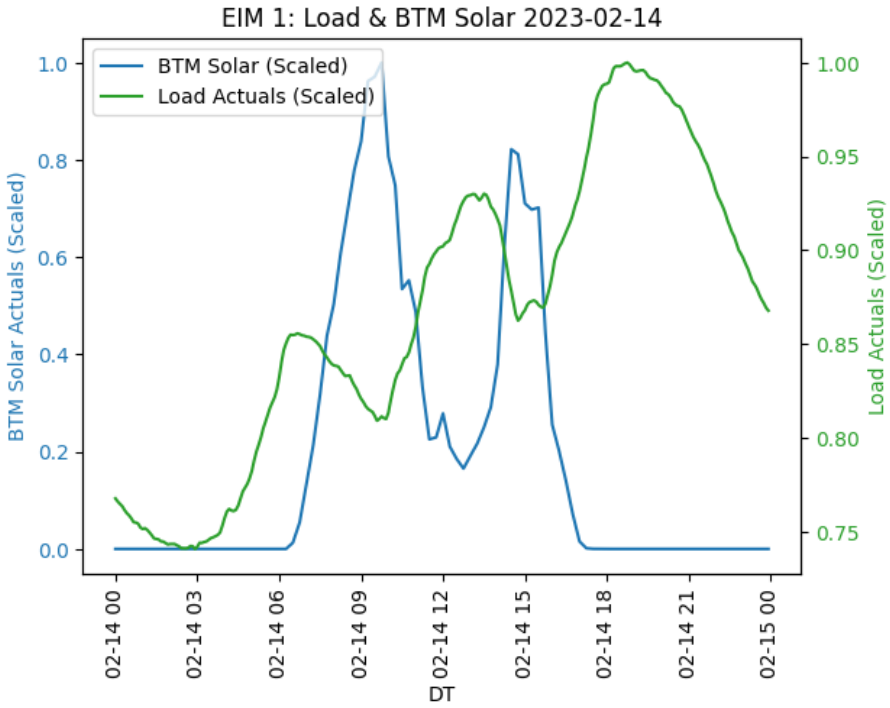
RTPD lags behind RTD during periods of high load fluctuation.

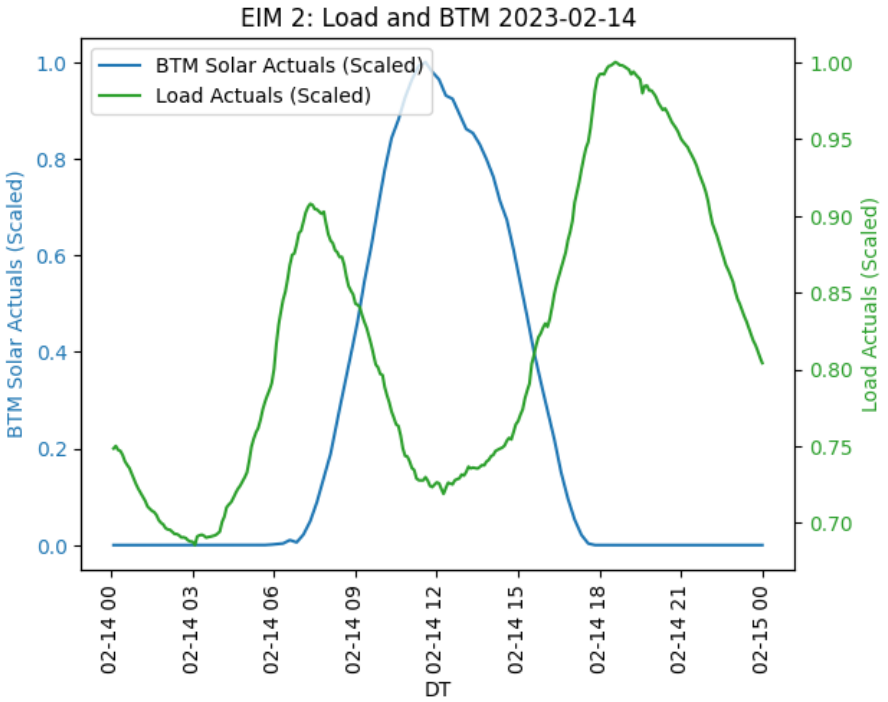




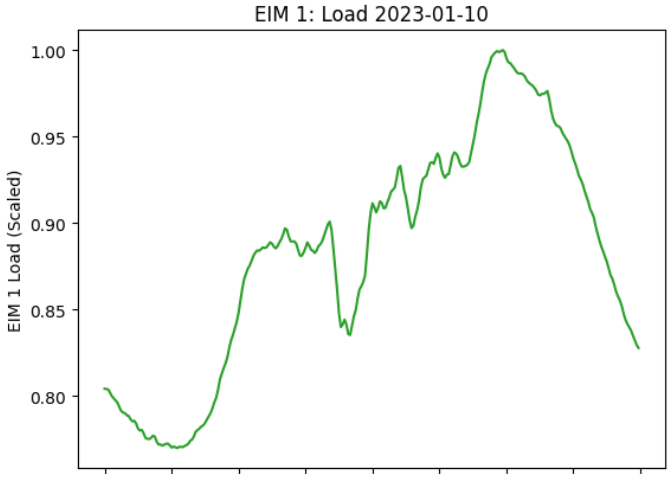
Month	Count Stale RTBS T80/T60 Forecast	Count Total RTBS Forecast	RTBS Forecast % Stale
2/1/2023	318	672	47.3%
3/1/2023	59	743	7.9%
4/1/2023	8	360	2.2%

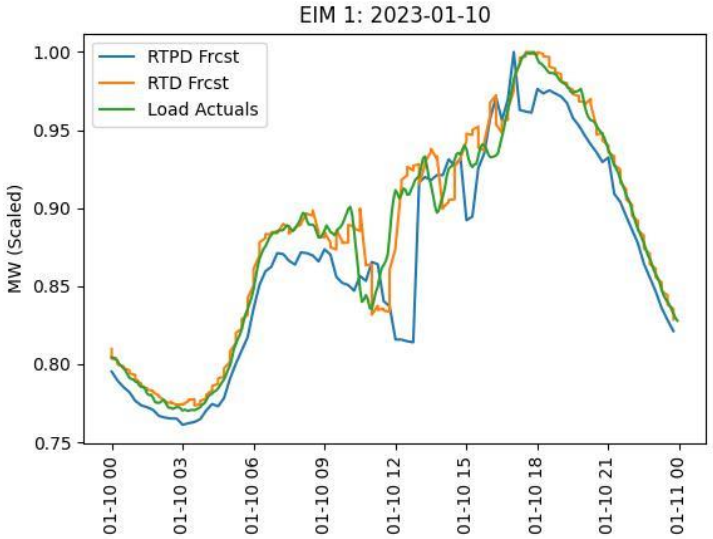
BTM Solar drives load fluctuations on high load uncertainty days.



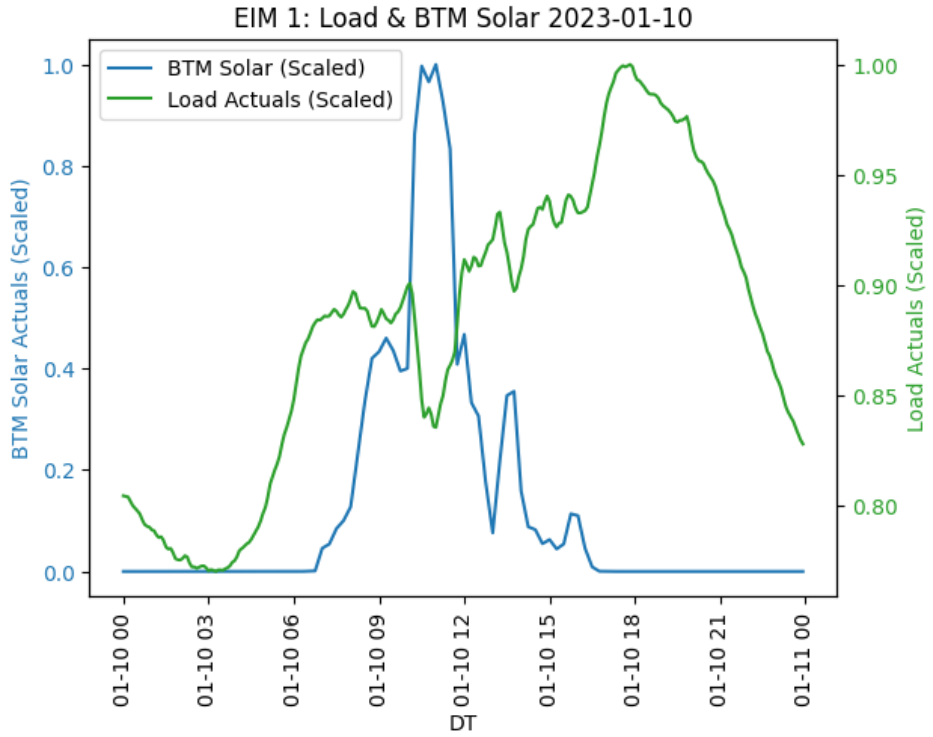


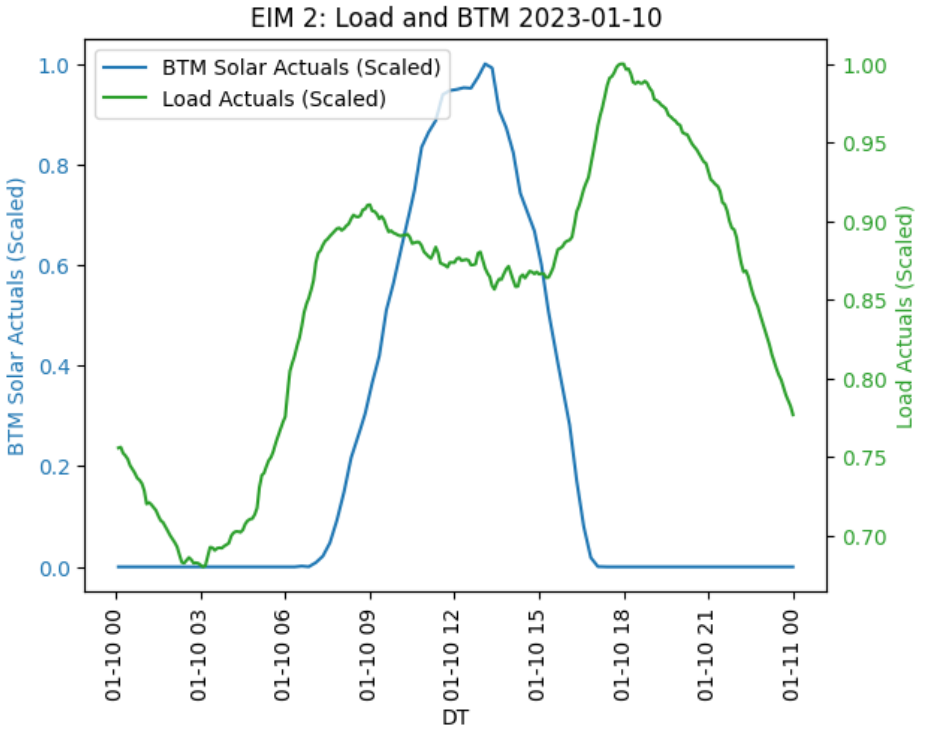
RTPD lags behind RTD during periods of high load fluctuation.





BTM Solar drives load fluctuations on high load uncertainty days.





Demand Uncertainty Requirement Conclusions

- Load fluctuations appear to be driven by BTM solar generation movement.

- RTD adjusts more quickly to changes in load (RTPD adjusts more slowly) resulting in uncertainty.
  - Occasional lagged forecast updates occurred, further inhibiting models ability to key off actual changes in load.

- Further discussion into residual uncertainty
  - Work to ensure BTM Solar Forecast and Actuals are incorporated into demand forecast to assist in capturing BTM impacts.
    - Note highly variable BTM solar days will still result in more movement of autoregressive models
  - Tuning AR lagged load terms via smoothing may result in reduced uncertainty between models.

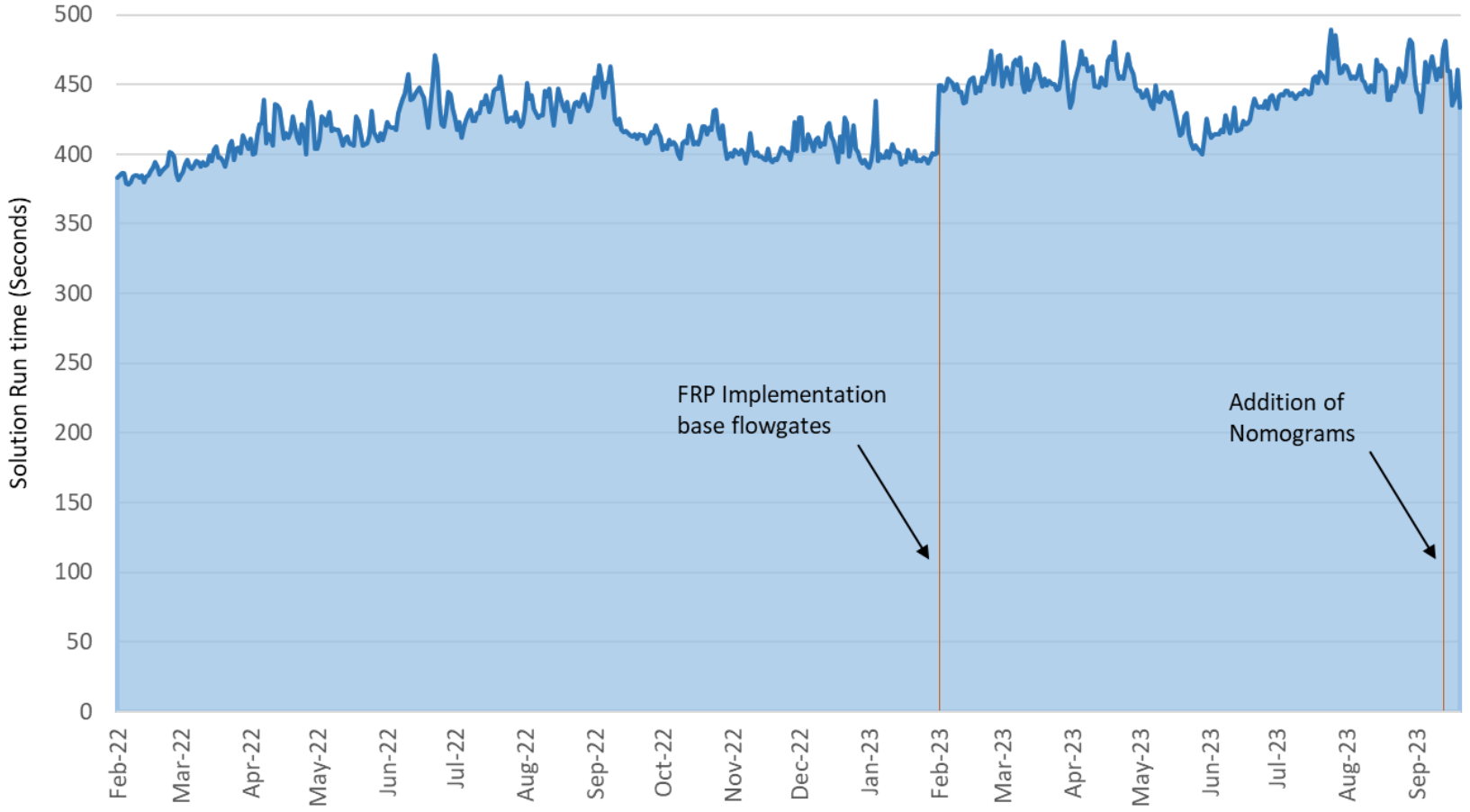
Nodal procurement of FRP

- Previous market formulation did not consider transmission feasibility when awarding FRP
- Previous CAISO analysis showed deliverability to be one of the main issues impacting FRP efficacy
- FRP enhanced formulation relies on new formulation to consider nodal procurement to tackle FRP deliverability
- New formulation enforce transmission constraints and EIM transfer constraints in FRP deployment scenarios

Considerations for enforcement of transmission constraints

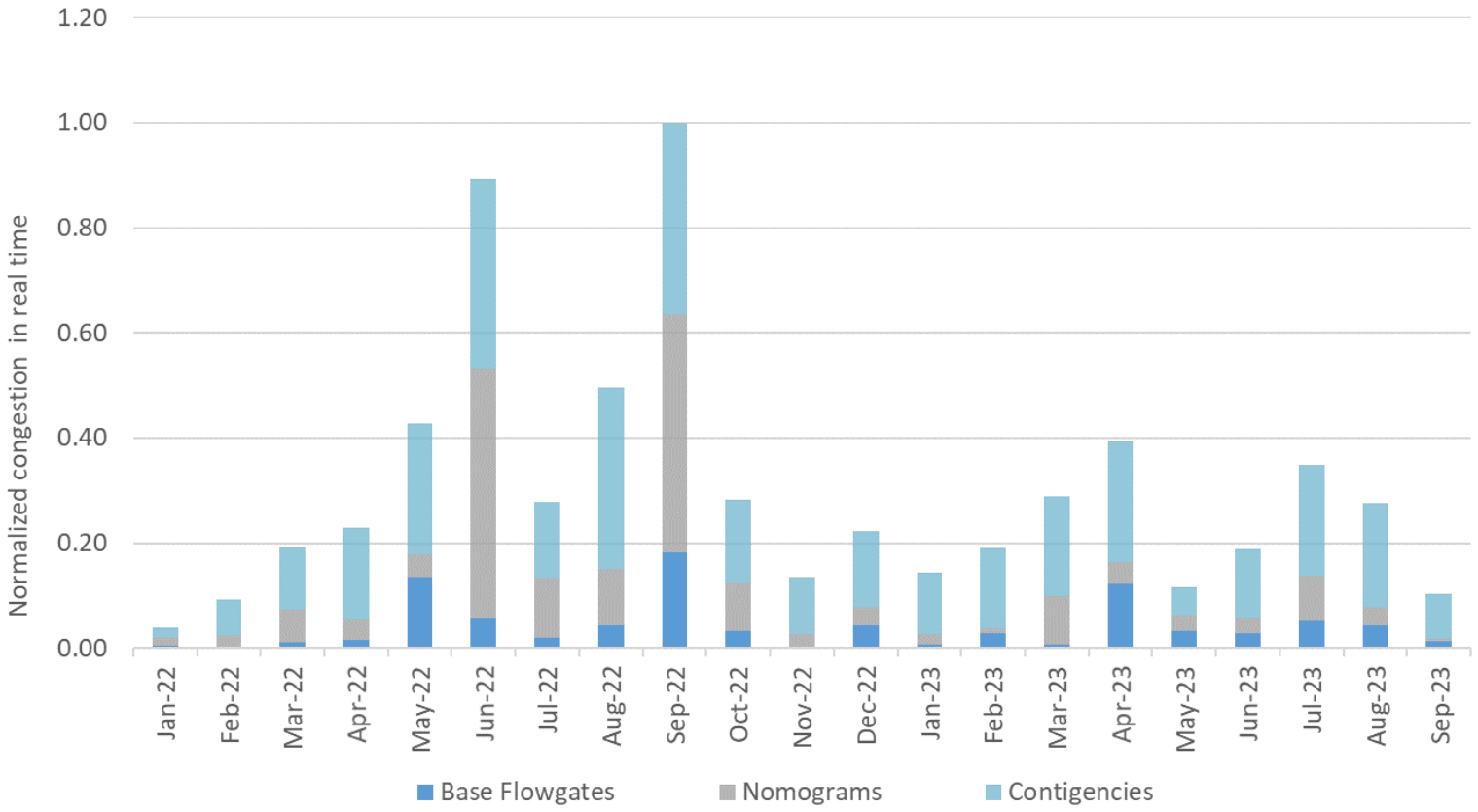
- Flow-based transmission constraints in CAISO's markets can be
  - Base flowgates
  - Contingency flowgates
  - Nomograms
- There are also Scheduling and transfer limits
- FRP nodal model introduced with a limited set of constraints while gaining operational experience and settling systems
- With the go-live on Feb 2023, only base flowgates constraints were enforced for FRP nodal procurement
- On September 13, nomograms started to be enforced for FRP

Nodal FRP has direct computational implications for the real-time market due to needing to solve for additional constraints



The inclusion of flowgate constraints for FRP increase run time by about 100 seconds
The real-time market runs need to be completed within specific pre-determined timelines

Nomograms started to be enforced for FRP on September 13; this added to the existing enforcement of base flowgates



The level of congestion observed in real-time for energy has been relatively modest for the base flowgates, which is the type of constraints enforced for FRP for the first six months of nodal FRP

Base Flowgate constraints have been binding at relatively low frequency for FRU in CAISO area

CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
22208_EL CAJON_69.0_22408_LOSCOCHS_69.0_BR_1 _1					0.13		0.05
22444_MESA RIM_69.0_22480_MIRAMAR _69.0_BR_1_1						0.20	
22476_MIGUELTP_69.0_22456_MIGUEL _69.0_BR_1 _1							0.44
22480_MIRAMAR _69.0_22756_SCRIPPS _69.0_BR_1 _1						0.91	
22740_SANYSDRO_69.0_22616_OTAYLKTP_69.0_BR_1 _1						0.37	
22884_WARNERS _69.0_22688_RINCON _69.0_BR_1 _1			0.20			0.17	0.05
24155_VINCENT _230_24128_S.CLARA _230_BR_1 _1		0.03					
24303_BIG CRK3_230_24235_RECTOR _230_BR_1 _1							0.66
24420_NEENACH _66.0_24452_TAP 85 _66.0_BR_1 _1		5.14	4.67	0.45	1.21	0.27	
24957_COLRIVER_230_24900_COLRIVER_500_XF_2 _P		0.17					
25406_J.HINDS _230_99254_J.HINDS2_230_BR_1 _1		0.03					
30005_ROUND MT_500_30015_TABLE MT_500_BR_1 _2				0.07			
30015_TABLE MT_500_30068_TB MT 5M_ 1.0_XF_5		0.14					
30040_TESLA _500_30050_LOSBANOS_500_BR_1 _1		0.66					
30055_GATES1 _500_30060_MIDWAY _500_BR_1 _1					0.20	0.27	0.60
30060_MIDWAY _500_24156_VINCENT _500_BR_1 _3					0.03		
30060_MIDWAY _500_29402_WIRLWIND_500_BR_1 _1					0.07		
30060_MIDWAY _500_29402_WIRLWIND_500_BR_1 _2				0.03			
30114_DELEVAN _230_30450_CORTINA _230_BR_1 _1					0.03		
30209_PIT5 JT2_230_30225_PIT4 JT _230_BR_2 _1			0.57				
30225_PIT4 JT _230_30245_ROUND MT_230_BR_2 _1			0.64				
30275_CRESTA _230_30330_RIO OSO _230_BR_1 _1		0.17					
30500_BELLOTA _230_38206_COTTLE A_230_BR_1 _1		0.28					
30515_WARNERVL_230_30800_WILSON _230_BR_1 _1		1.04	1.08		0.44		0.22
30622_EIGHT MI_230_30495_STAGG _230_BR_1 _1			0.44				
30765_LOSBANOS_230_30766_PADR FLT_230_BR_1A _1						0.03	
30797_LASAGUIL_230_30790_PANOCHE _230_BR_1 _1			0.03				
30805_BORDEN _230_30810_GREGG _230_BR_2 _1				0.03			
30870_PINE FLT_230_30875_MC CALL _230_BR_1 _1			0.27			0.57	
30900_GATES _230_30905_TEMPLETN_230_BR_1 _1			0.03				
31334_CLER LKE_60.0_31338_KONOCTI6_60.0_BR_1 _1		0.07					
31336_HPLND JT_60.0_31206_HPLND JT_115_XF_2			1.08				
31486_CARIBOU _115_30255_CARBOU M_ 1.0_XF_11		6.15	3.06	6.08	45.73	39.58	36.35
31501_CHICOTP1_115_31502_CHICO B _115_BR_1 _1						0.07	
31574_ANDERSON_60.0_31604_COTTONWD_60.0_BR_1 _1					0.03		
32214_RIO OSO _115_30330_RIO OSO _230_XF_1						0.20	
32214_RIO OSO _115_32225_BRNSWKT1_115_BR_1 _1				0.03			
32214_RIO OSO _115_32244_BRNSWKT2_115_BR_2 _1		0.35					
32218_DRUM _115_32244_BRNSWKT2_115_BR_2 _1		0.24	0.60	0.17			
32225_BRNSWKT1_115_32222_DTCH2TAP_115_BR_1 _1				0.21			
32314_SMRTSVLE_60.0_32316_YUBAGOLD_60.0_BR_1 _1	0.20	0.07	0.17				
32756_CHRISTIE_115_33010_SOBRANTE_115_BR_1 _1						0.03	

CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
32769_ELCTOTP1_115_33010_SOBRANTE_115_BR_1 _1						0.03	
32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1 _1		0.35					
33010_SOBRANTE_115_30540_SOBRANTE_230_XF_1	0.07						
33014_ALHAMTP1_115_33010_SOBRANTE_115_BR_1 _1		0.07					
33016_ALHAMTP2_115_32754_OLEUM _115_BR_1 _1		0.31					
33500_MELNS JA_115_33509_AVENATP1_115_BR_1 _1		0.14		10.21	14.78	3.86	2.30
33509_AVENATP1_115_33514_MANTECA _115_BR_1 _1		0.21					
33516_RIPON J _115_33514_MANTECA _115_BR_1 _1			0.10				
33541_AEC_TP1 _115_33540_TESLA _115_BR_1 _1		9.24	0.10	0.52			0.16
33914_MI-WUK _115_33917_FBERBORD_115_BR_1 _1		0.49	0.77	6.32	27.65	12.23	10.91
33916_CURTISS _115_33917_FBERBORD_115_BR_1 _1		2.15	1.88			2.05	
33932_MELONES _115_33500_MELNS JA_115_BR_1 _1		0.03		3.06	2.92	1.31	0.22
33932_MELONES _115_33936_MELNS JB_115_BR_1 _1		0.42	0.97				
33936_MELNS JB_115_33951_VLYHMTP1_115_BR_1 _1	0.03	3.51	0.87				
34101_CERTANJ2_115_34116_LE GRAND_115_BR_1 _1						0.03	
34112_EXCHEQUR_115_34116_LE GRAND_115_BR_1 _1		17.67		0.69	5.44	30.58	5.48
34366_SANGER _115_34370_MC CALL _115_BR_3 _1						0.03	
34396_PIEDRA 2_115_34397_KNGSRVR _115_BR_1 _1			0.37				
34454_RIVERROC_70.0_34464_COPPRMNE_70.0_BR_1 _1				0.83	0.20		
34471_SNJQJCT _70.0_34469_GFFNJCT _70.0_BR_1 _1			0.13				
34774_MIDWAY _115_34225_BELRDG J_115_BR_1 _1			0.03	0.07			
34930_MC FRLND_70.0_34932_WASCO _70.0_BR_1 _1					0.17		
35061_PSEMCKIT_115_34225_BELRDG J_115_BR_1 _1			0.17				
35201_VASCO _60.0_35202_USWP-WKR_60.0_BR_1 _1		0.28	0.50	0.03	0.20		
35602_ZNKER J2_115_36850_KIFER _115_BR_1 _1	0.03						
35618_SN JSE A_115_35616_SNJOSEB _115_BR_1 _1		0.03					
35621_IBM-HR J_115_35642_METCALF _115_BR_1 _1					0.54	0.64	0.11
35642_METCALF _115_35651_BAILY J3_115_BR_2 _1					0.17		
35646_MRGN HIL_115_35648_LLAGAS _115_BR_1 _1		0.28					
35648_LLAGAS _115_35650_GILROY F_115_BR_1 _1		0.07					
35656_PIERCY _115_35642_METCALF _115_BR_1 _1		0.03					
36075_COBURN _60.0_30760_COBURN _230_XF_1		0.14			0.84	0.54	
37563_MELONES _230_30800_WILSON _230_BR_1 _1		0.10	0.67		0.81		
38136_MARBLE _69.0_64281_MARBLSPP_60.0_XF_1		0.03	0.44				
38206_COTTLE A_230_37563_MELONES _230_BR_1 _1		2.15					
64228_SUMMIT 1_115_32218_DRUM _115_BR_1 _1					1.14	0.60	
64229_SUMMIT 2_115_32218_DRUM _115_BR_1 _1				1.35	0.34	0.57	0.05
99254_J.HINDS2_230_24806_MIRAGE _230_BR_1 _1						1.65	0.05
CONTRL-INYOTP_115_BR_1_1				3.44	2.49	0.47	
CONTRL-INYOTP_115_BR_2_1		0.03		0.38		0.03	
SILVERPK_BG				0.17			

Values are shown in percent of intervals binding for FRU per constraint.
Majority of constraints binding are lower voltage and more local in nature.

Base Flowgate constraints have been binding at relatively low frequency for FRD in CAISO area

CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
22208_EL CAJON_69.0_22408_LOSCOCHS_69.0_BR_1 _1					0.37	0.03	
22444_MESA RIM_69.0_22480_MIRAMAR _69.0_BR_1 _1						0.07	
22476_MIGUELTP_69.0_22456_MIGUEL _69.0_BR_1 _1							0.05
22480_MIRAMAR _69.0_22756_SCRIPPS _69.0_BR_1 _1					0.03	0.77	
22604_OTAY _69.0_22616_OTAYLKTP_69.0_BR_1 _1		0.21			0.03		
22644_PENSQTOS_69.0_22444_MESA RIM_69.0_BR_2 _1		0.10					
24155_VINCENT _230_24128_S.CLARA _230_BR_1 _1		0.14					
24420_NEENACH _66.0_24452_TAP 85 _66.0_BR_1 _1		1.46	0.87	0.49	1.14	0.03	
25406_J.HINDS _230_99254_J.HINDS2_230_BR_1 _1		0.03					
30055_GATES1 _500_30060_MIDWAY _500_BR_1 _1							0.05
30114_DELEVAN _230_30450_CORTINA _230_BR_1 _1					0.03		
30515_WARNERVL_230_30800_WILSON _230_BR_1 _1		0.24	0.67		0.17		
30900_GATES _230_30905_TEMPLETN_230_BR_1 _1			0.03				
31574_ANDERSON_60.0_31604_COTTONWD_60.0_BR_1					0.10		
32214_RIO OSO _115_30330_RIO OSO _230_XF_1					0.64	0.20	
32214_RIO OSO _115_30330_RIO OSO _230_XF_2				0.28			
32218_DRUM _115_32244_BRNSWKT2_115_BR_2 _1		0.56	0.03				
32225_BRNSWKT1_115_32222_DTCH2TAP_115_BR_1 _1				0.28			
32314_SMRTSVLE_60.0_32316_YUBAGOLD_60.0_BR_1 _1		0.10	0.10				
32332_PEASE _60.0_32333_PEASETP _60.0_BR_1 _1					0.07	0.17	
32756_CHRISTIE_115_33010_SOBRANTE_115_BR_1 _1						0.17	
32769_ELCTOTP1_115_33010_SOBRANTE_115_BR_1 _1						0.07	
32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1 _1		0.24					
33016_ALHAMTP2_115_32754_OLEUM _115_BR_1 _1		0.35					
33500_MELNS JA_115_33509_AVENATP1_115_BR_1 _1		0.14		0.10	0.40	0.37	0.16
33541_AEC_TP1 _115_33540_TESLA _115_BR_1 _1		0.17					

CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
32769_ELCTOTP1_115_33010_SOBRANTE_115_BR_1 _1				0.17		0.10	
32990_MARTINEZ_115_33014_ALHAMTP1_115_BR_1 _1		0.45	0.13				
33010_SOBRANTE_115_30540_SOBRANTE_230_XF_1		0.83	0.37				
33014_ALHAMTP1_115_33010_SOBRANTE_115_BR_1 _1						0.03	
33016_ALHAMTP2_115_32754_OLEUM _115_BR_1 _1					1.48	0.07	
33500_MELNS JA_115_33509_AVENATP1_115_BR_1 _1					0.07		
33509_AVENATP1_115_33514_MANTECA _115_BR_1 _1				0.14			
33516_RIPON J _115_33514_MANTECA _115_BR_1 _1		0.03					
33541_AEC_TP1 _115_33540_TESLA _115_BR_1 _1					0.07		
33914_MI-WUK _115_33917_FBERBORD_115_BR_1 _1			0.07	0.10	0.07	0.07	
33916_CURTISS _115_33917_FBERBORD_115_BR_1 _1					0.10		
33932_MELONES _115_33500_MELNS JA_115_BR_1 _1			0.07				
33932_MELONES _115_33936_MELNS JB_115_BR_1 _1		0.07					
33936_MELNS JB_115_33951_VLYHMTP1_115_BR_1 _1		0.03					
34101_CERTANJ2_115_34116_LE GRAND_115_BR_1 _1					0.94	1.08	
34112_EXCHEQUR_115_34116_LE GRAND_115_BR_1 _1					0.10		
34366_SANGER _115_34370_MC CALL _115_BR_3 _1					0.13		
34396_PIEDRA 2_115_34397_KNGSRVR _115_BR_1 _1			0.03		0.17		
34454_RIVERROC_70.0_34464_COPPRMNE_70.0_BR_1 _1				0.07			
34471_SNJQJCT _70.0_34469_GFFNJCT _70.0_BR_1 _1					0.50	0.30	
34774_MIDWAY _115_34225_BELRDG J_115_BR_1 _1				0.59	0.50	0.30	
34930_MC FRLND_70.0_34932_WASCO _70.0_BR_1 _1						1.21	
35061_PSEMCKIT_115_34225_BELRDG J_115_BR_1 _1				10.76	2.49	2.42	
35201_VASCO _60.0_35202_USWP-WKR_60.0_BR_1 _1				0.35		0.03	
35602_ZNKER J2_115_36850_KIFER _115_BR_1 _1			0.13				
35618_SN JSE A_115_35616_SNJOSEB _115_BR_1 _1							

Values are shown in percent of intervals binding for FRU per constraint.
Majority of constraints binding are lower voltage and more local in nature.

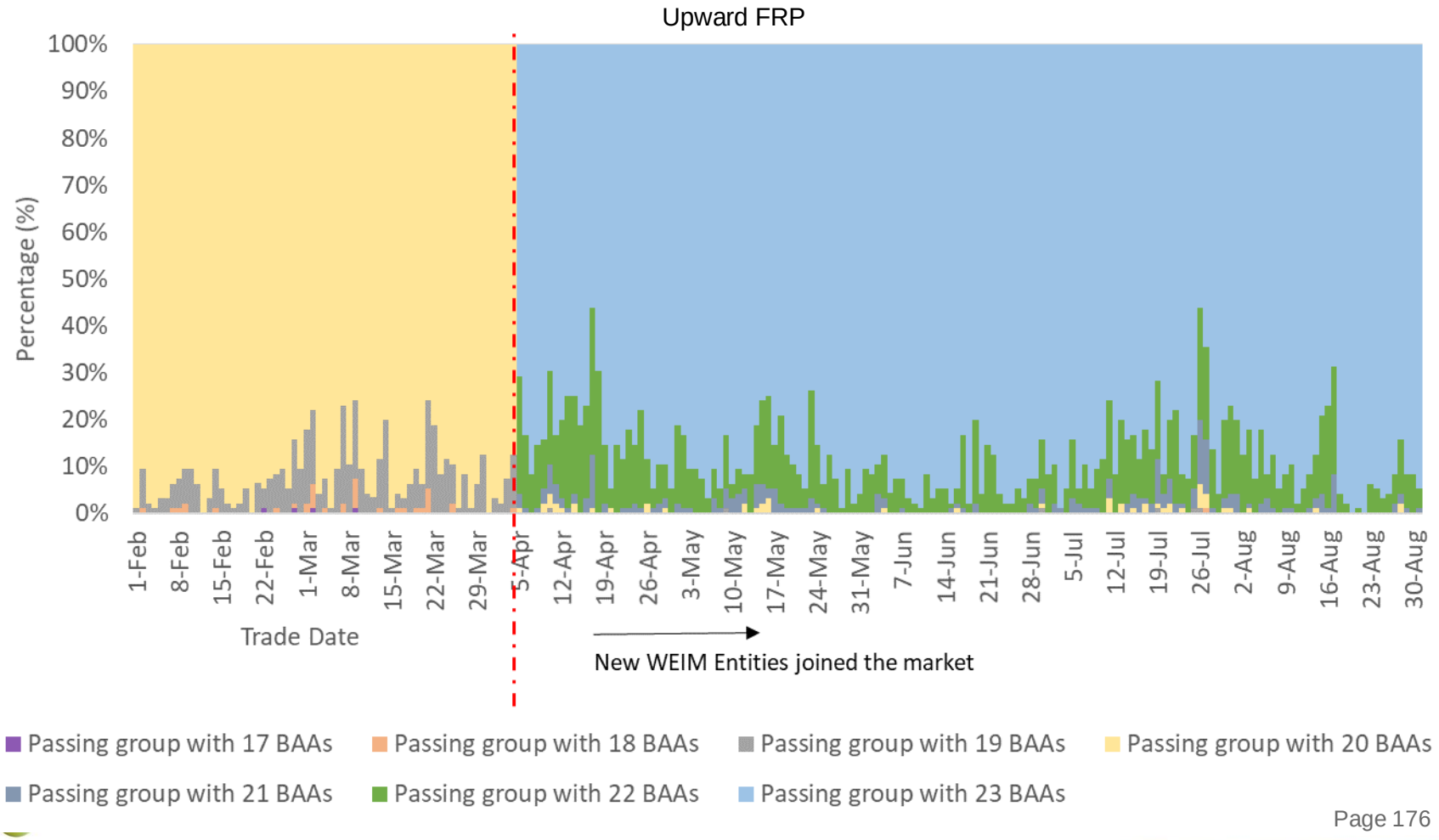
Congestion on flowgate constraints in other WEIM areas has been sporadic and *de minimis*

BAA	CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
AZPS	Line_CC-ME_230KV					1.48		
AZPS	Line_DV-WW_230KV					0.13		
AZPS	Line_PP-CX_230KV					0.13		
AZPS	Line_SG-OJX_115KV					0.03		
BANC	ORG_WLD			0.03				
BANC	Txfmrh1 230.KES		0.03		0.07			
BANC	Txfmrh2 230.KES	0.03						
EPE	12800_NWM_CHA			0.24				
EPE	15100_NWM_SHT			0.10				
IPCO	BLPR-HCPR1_A			0.27				
IPCO	PATH_14			0.13				
IPCO	PATH_55		0.14		0.07	0.13	0.07	
LADWP	SYL_SS BK G			0.20				
LADWP	TAR BK E				0.03			
NEVP	BOR PS#1					0.17		
NEVP	HACC GSU_XF5				0.10			
NEVP	HACC GSU_XF6				0.17		0.17	
NEVP	NTR-DRM_1 120						0.34	
PACE	AMASA_DIFFICUL_230			0.03				
PACE	BONANZA$_MONA_345					0.17		
PACE	EAST_WYO_EXP		0.10					
PACE	TOTAL_WYOMING_EXPORT					0.37	0.03	0.22
PACE	WINDSTAR EXPORT TCOR	0.60	1.25	0.03		0.07	0.20	
PGE	MCL_PE_SHW_V682					0.03	0.37	
PNM	115kv DL_Mi_Wm						0.24	
PNM	115kv EB Fron				0.45		0.13	
PNM	115kv LK		0.07		0.24			
PNM	115kv ML					0.10	0.27	0.66
PNM	345kV CLCR-DMND1					0.07		
PNM	ABO S_COMP_WESP1					0.60		
PNM	LunaPNM345_115X					0.17		
PNM	PAJA_ABO S_COMP					0.20		
WALC	Line_SG-OJX_115KV					0.03		

BAA	CONSTRAINT	Mar	Apr	May	Jun	Jul	Aug	Sep
AZPS	LSS XFMR10 A 230KV					0.03		
AZPS	Line_CC-ME_230KV					0.74		
AZPS	Line_DV-WW_230KV					0.17		
AZPS	Line_PP-CX_230KV					1.04		
IPCO	BLPR-HCPR1_A			0.03				
IPCO	PATH_14					0.03		
IPCO	PATH_55		0.14		0.07	0.13	0.07	
LADWP	SYL_SS BK G			0.10				
NEVP	BOR PS#1					0.03		
PACE	BONANZA$_MONA_345					0.17		
PACE	WINDSTAR EXPORT TCOR	1.01	0.73			0.10		0.1
PGE	MCL_PE_SHW_V682					0.03	0.81	
PNM	115kv DL_Mi_Wm						0.30	
PNM	115kv EB Fron				1.84		0.37	
PNM	115kv LK				0.14			
PNM	115kv ML					0.13	0.37	0.5
PNM	ABO S_COMP_WESP1					0.64		
PNM	LunaPNM345_115X					0.10		

Values are shown in percent of intervals binding for FRU per constraint

Most of the time the majority of areas pass the test and are part of the passing group, which is the only requirement enforced in the real-time market



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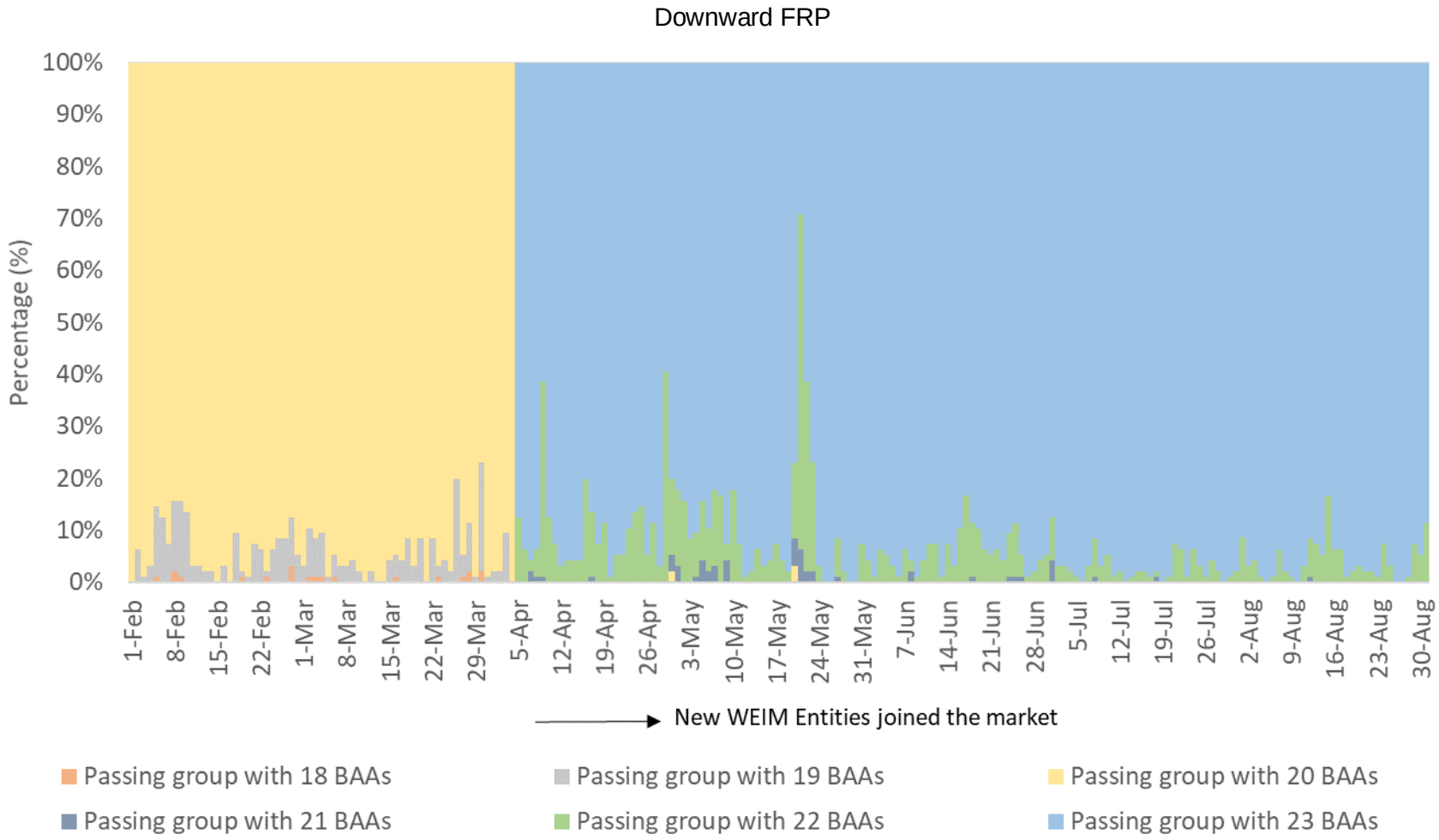
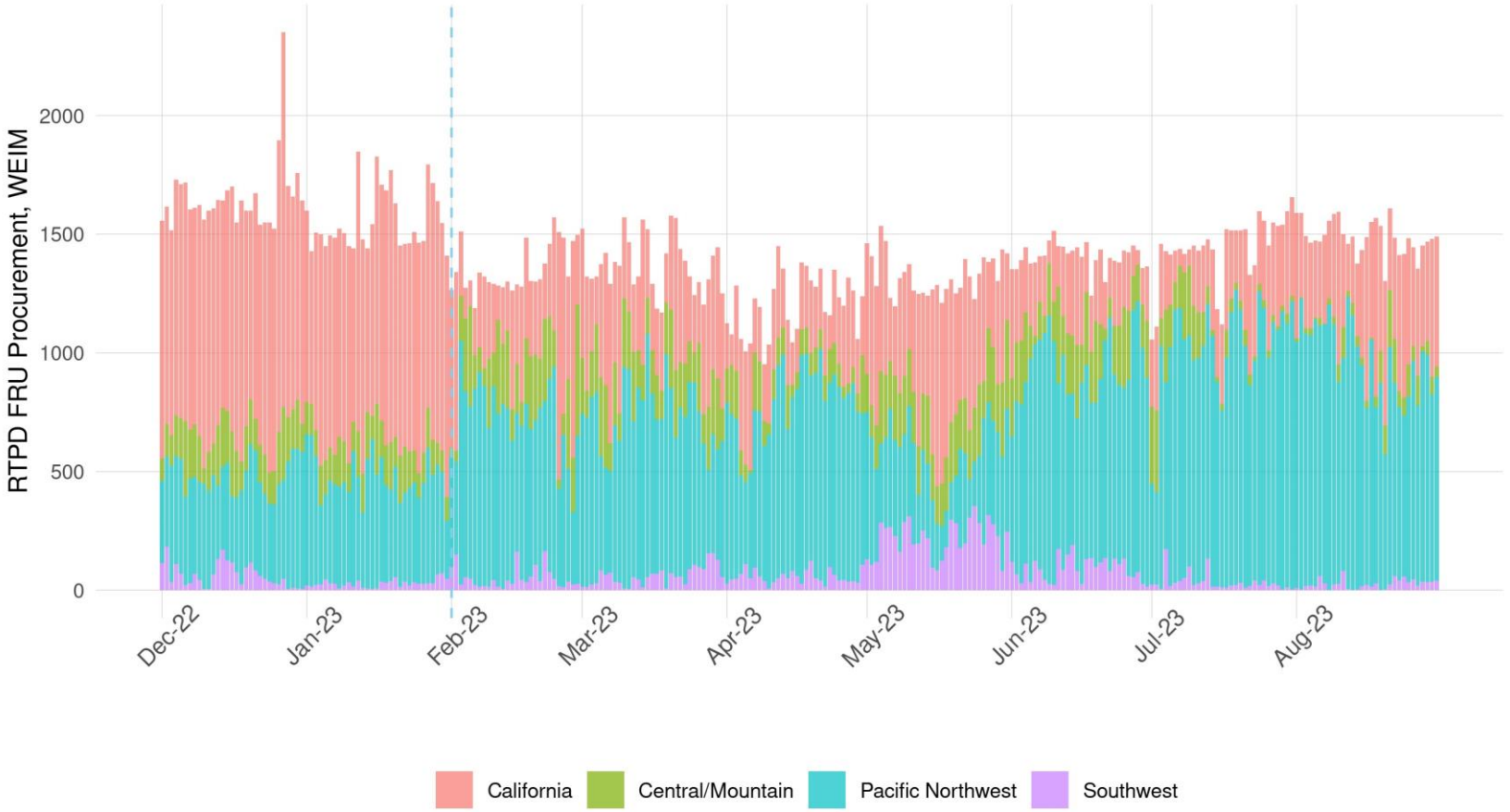
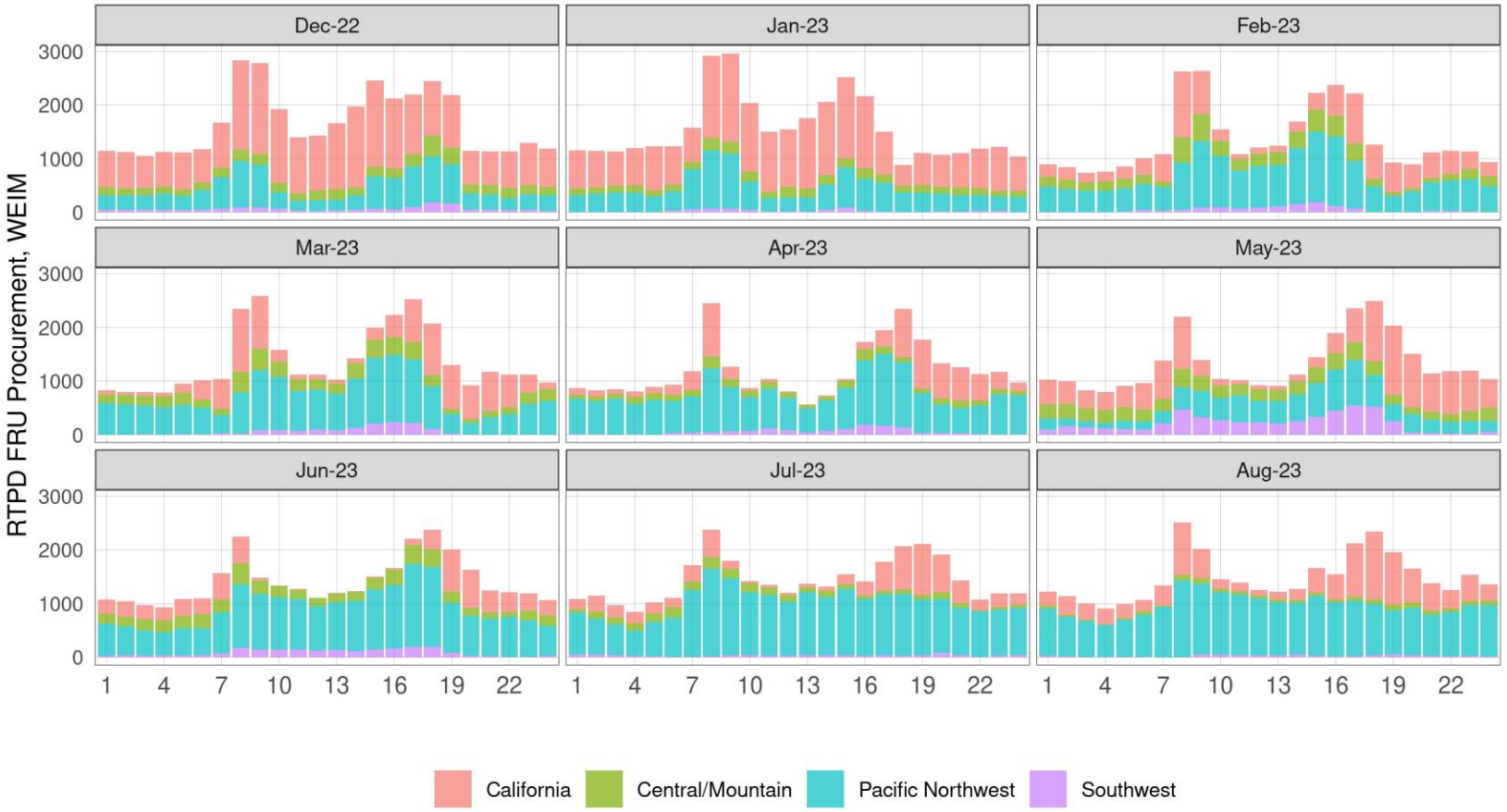


With the introduction of nodal formulation, upward FRP procurement from CAISO area reduced significantly

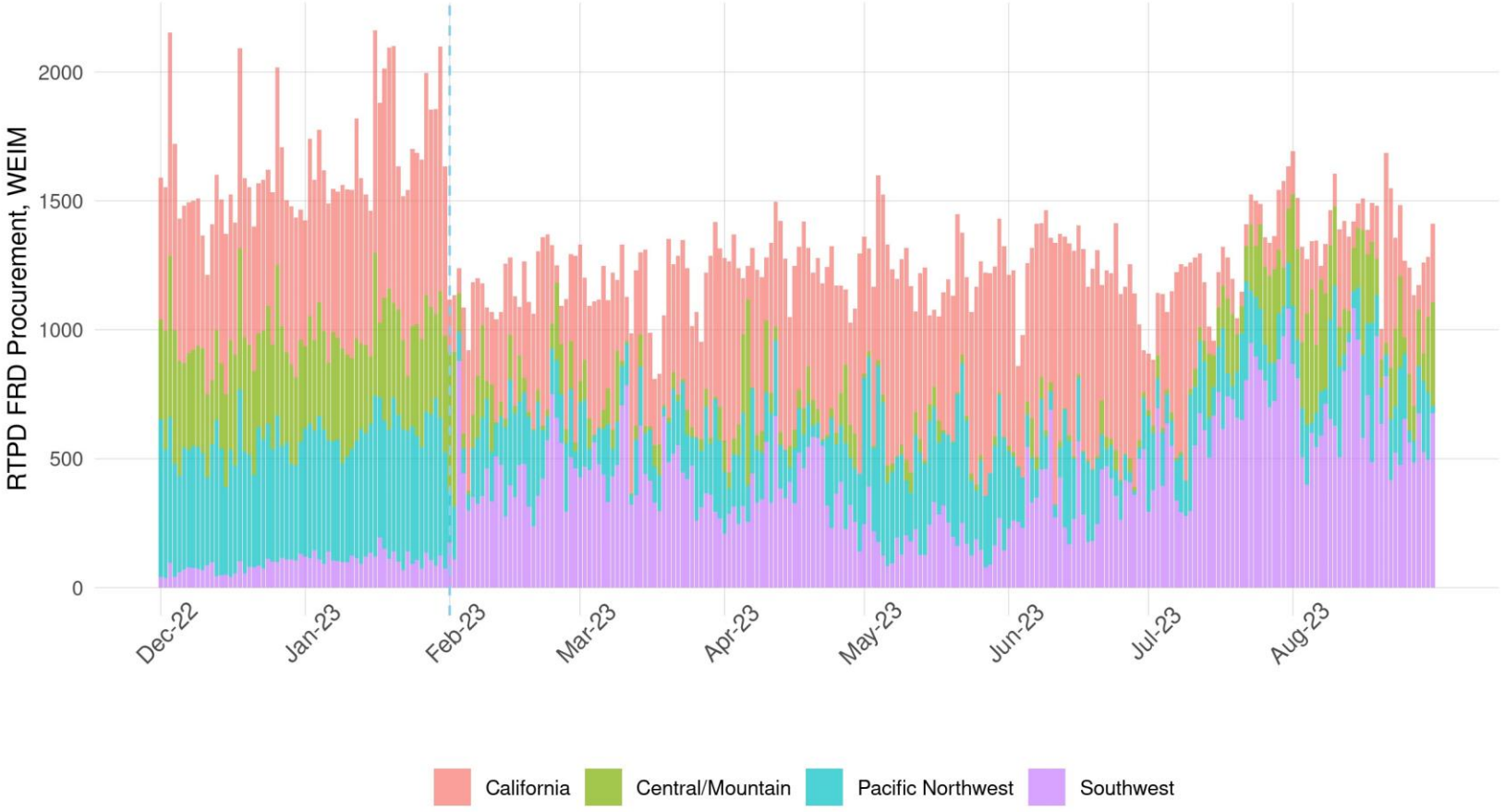


Prior to February 2023, CAISO area had a minimum FRP requirement, which forced FRP procurement from internal resources. With the nodal implementation, this minimum requirement is no longer in place. Procurement from CAISO area is driven by overall economics

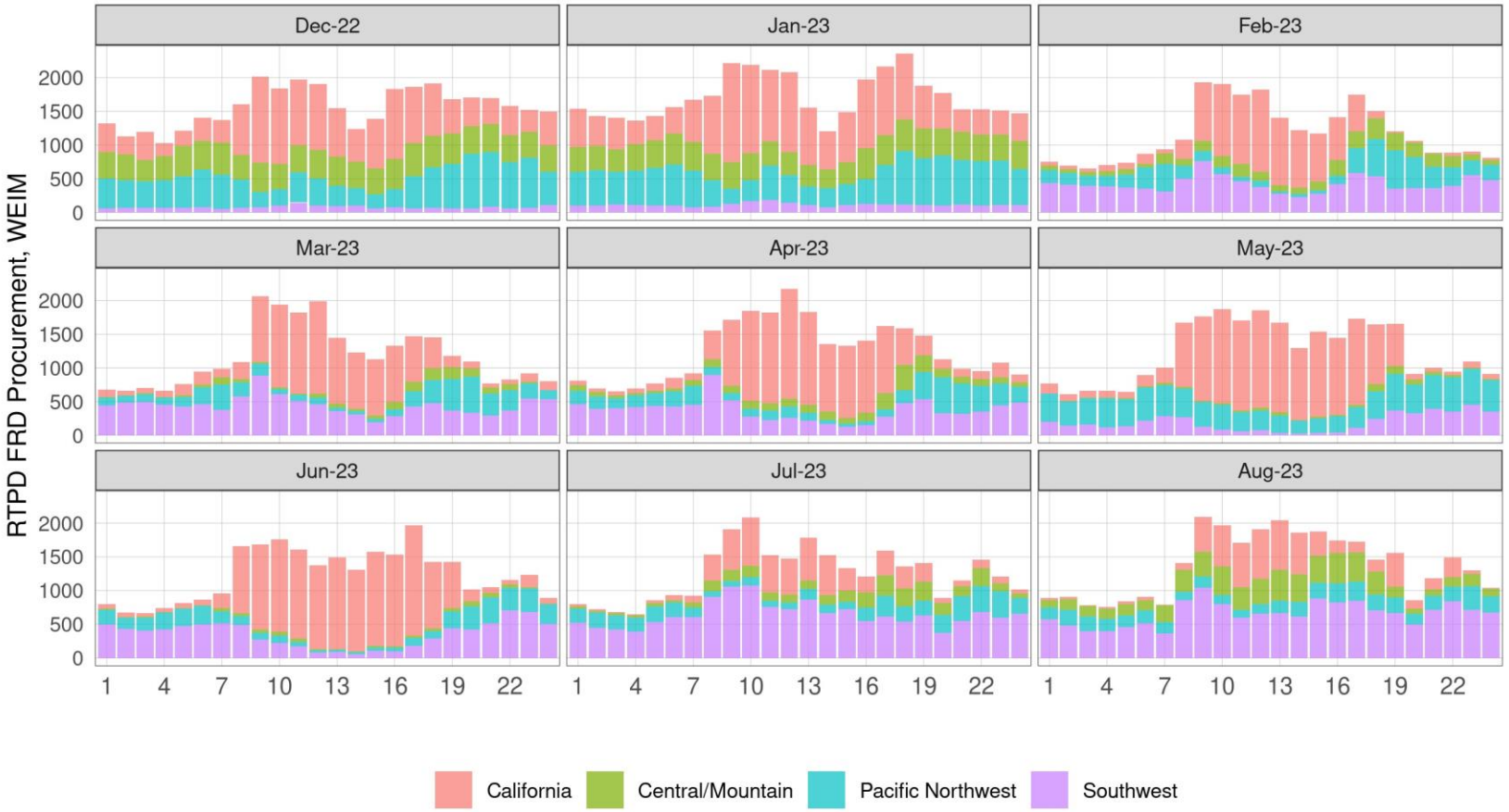
Upward FRP procurement is largely supported by areas from the Pacific Northwest



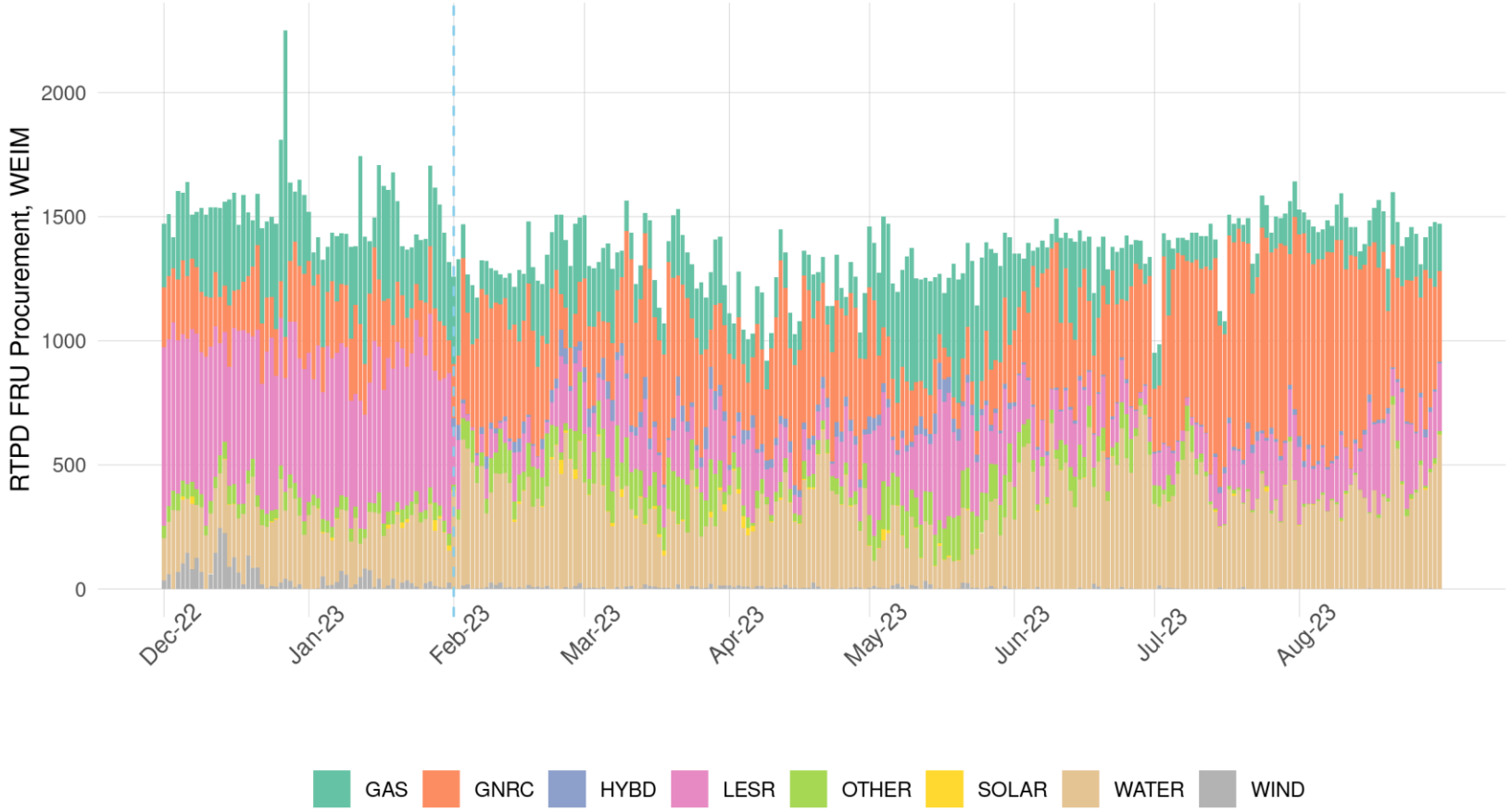
With the introduction of nodal procurement, downward FRP is largely procured from areas in the southwest and California



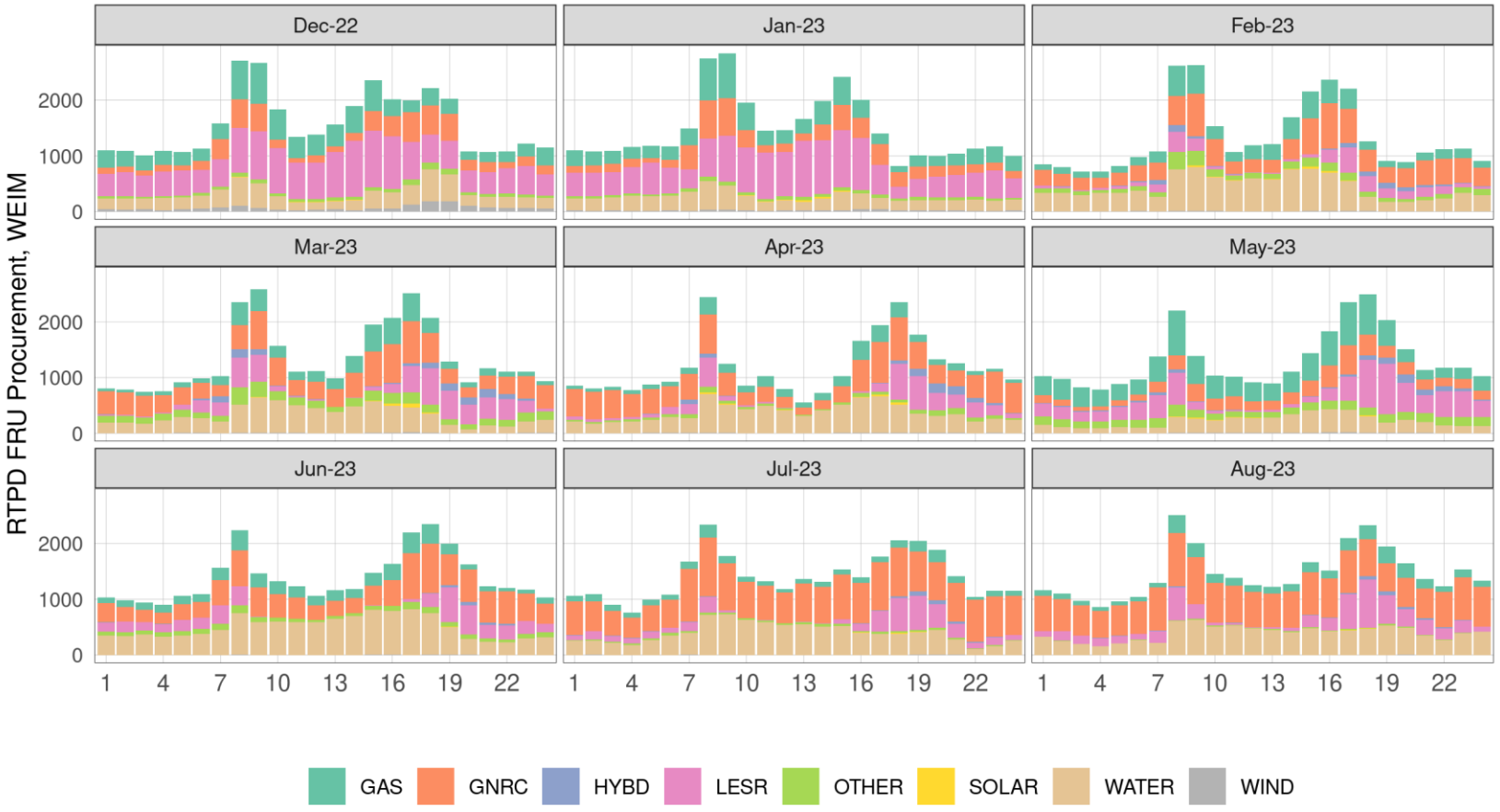
Downward FRP procurement from CAISO area is largely occurring in midday hours when solar production is plentiful and months with modest demand level



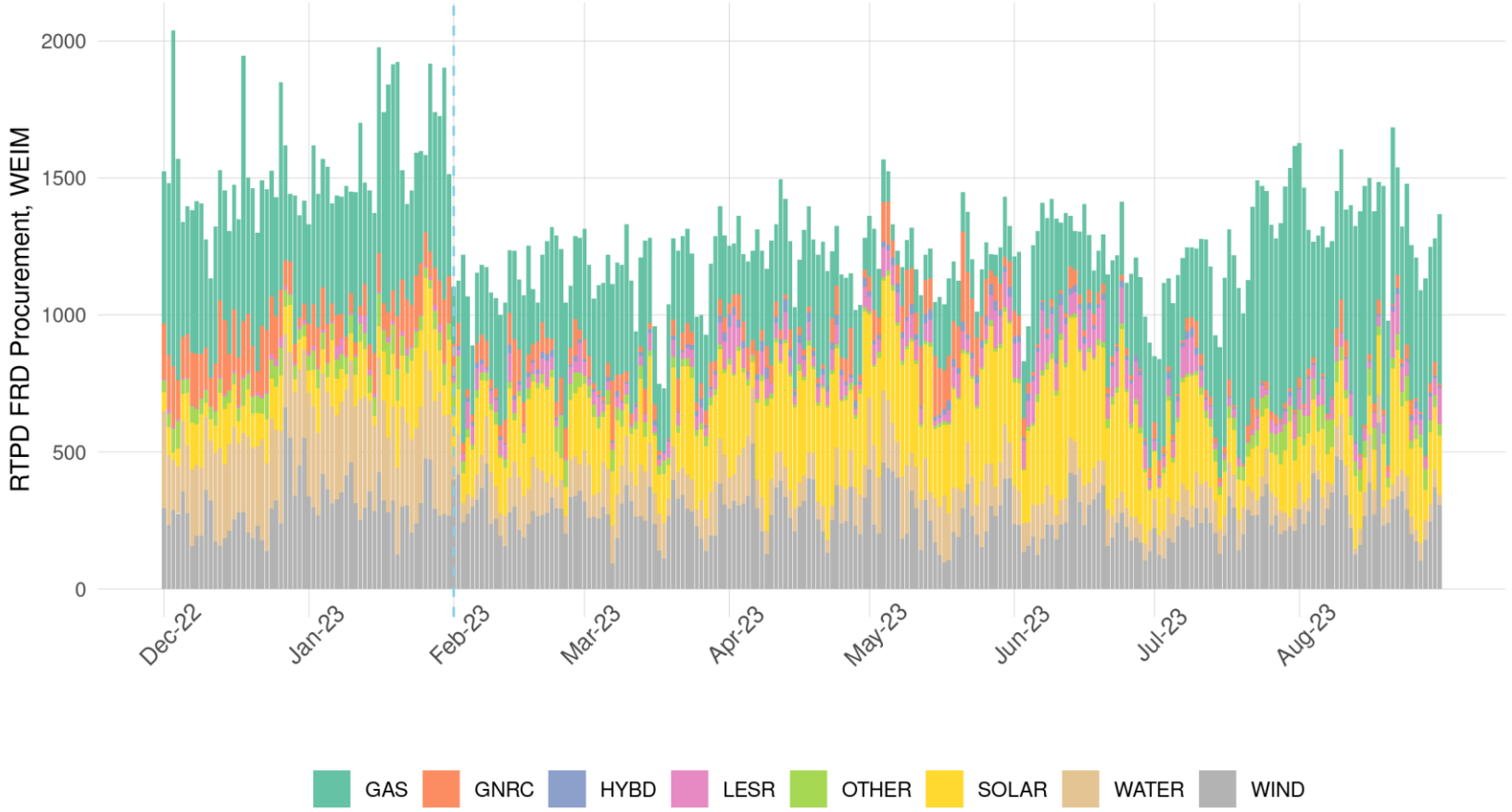
Upward FRP procurement is supported by various types of technologies



With nodal formulation, storage resources tend to support upward FRP procurement for evening ramping hours



Downward FRP procurement is supported by various types of technologies



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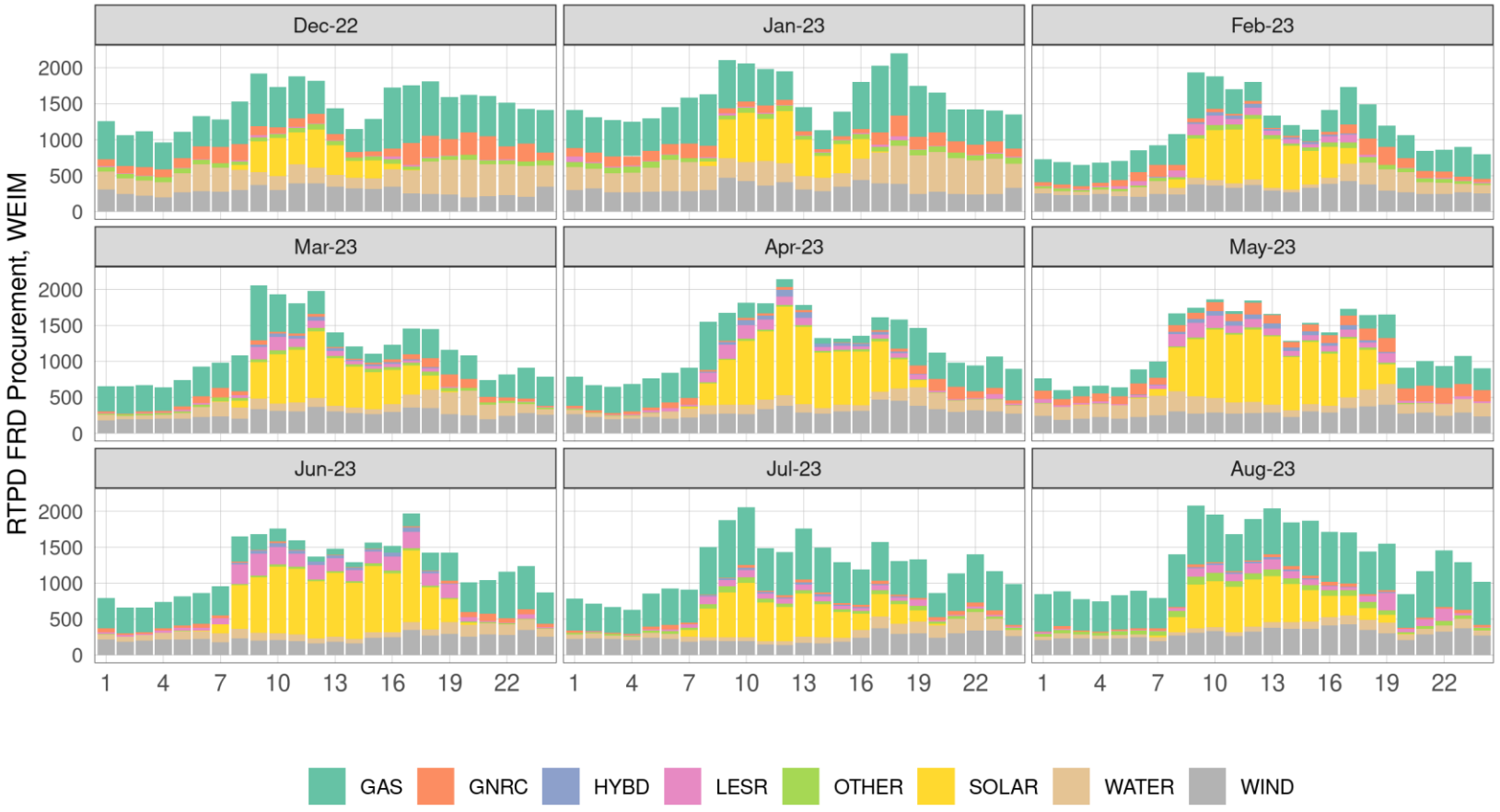
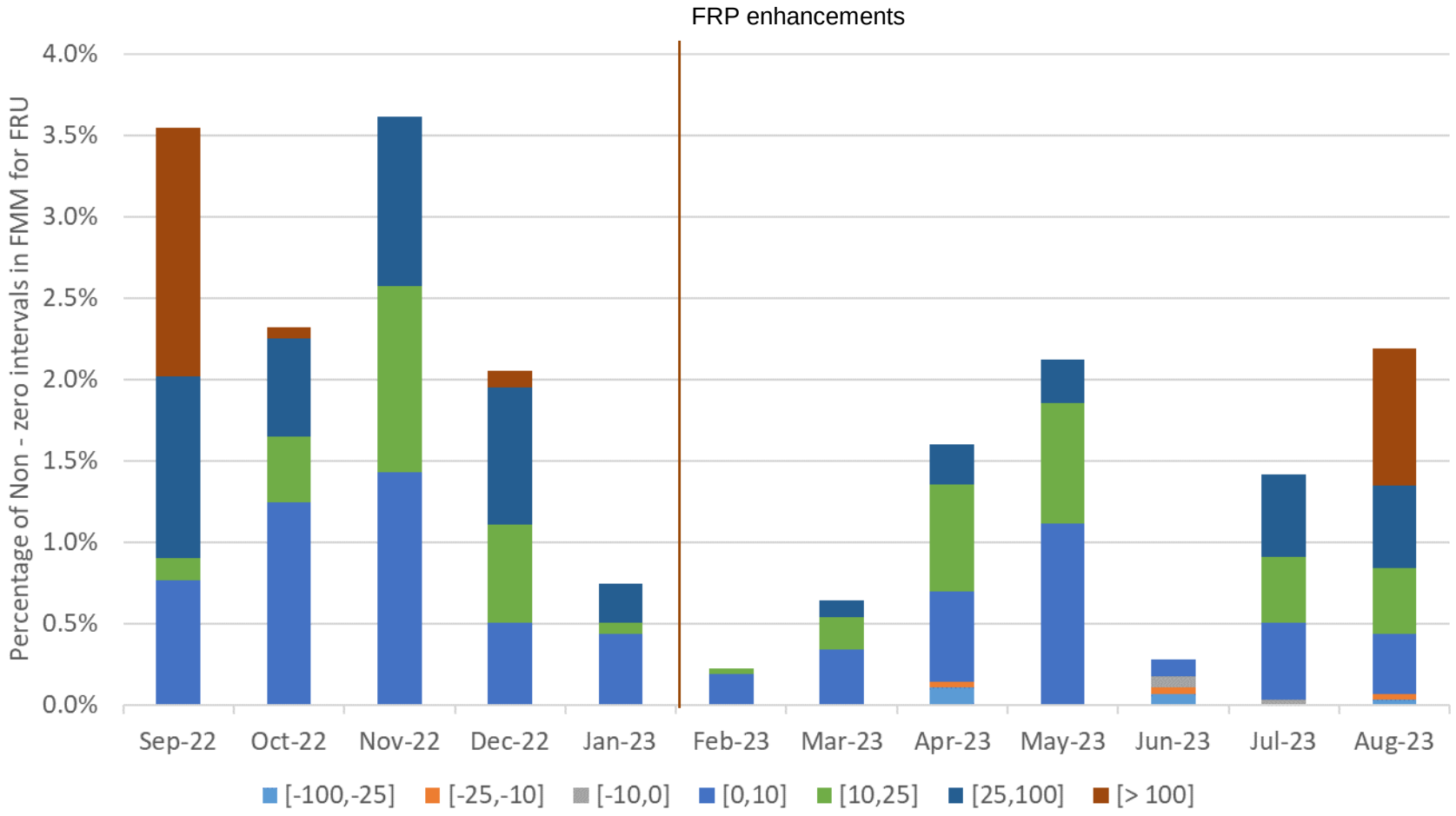
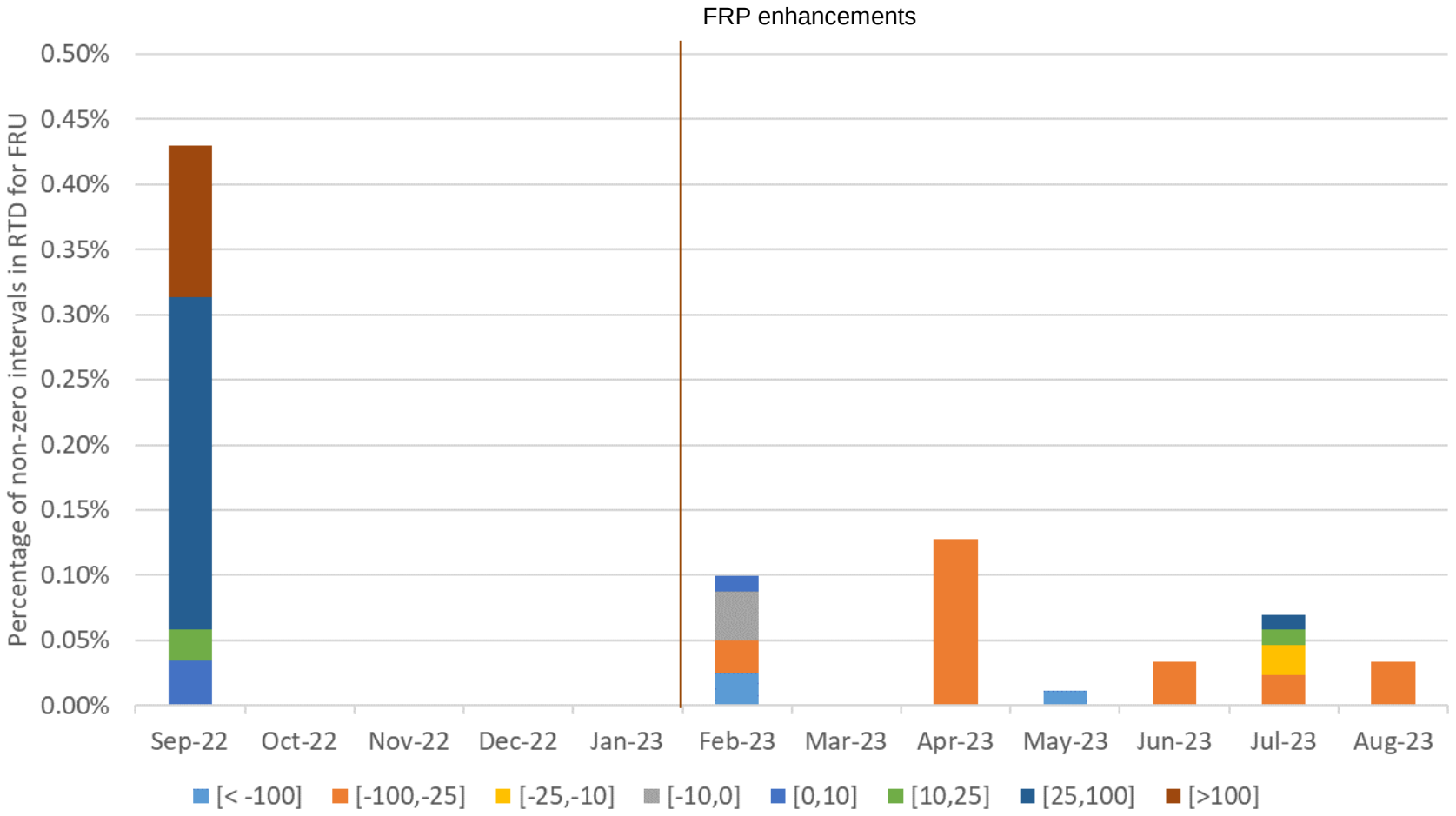


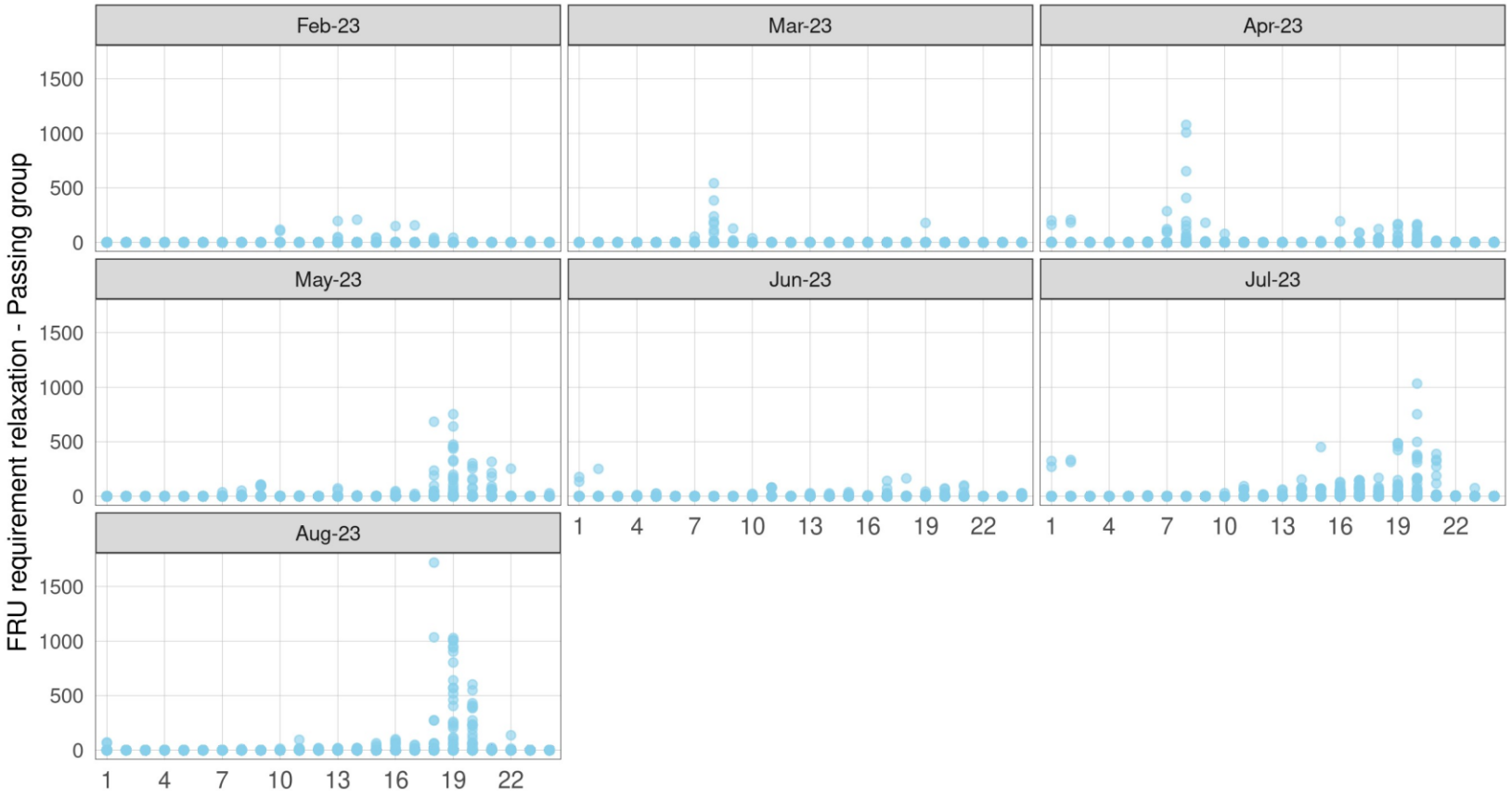
Frequency of intervals with non-zero FMM prices for upward FMM continues to be low after nodal implementation



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



The frequency of FRP procurement relaxation is low and tends to be concentrated for peak hours



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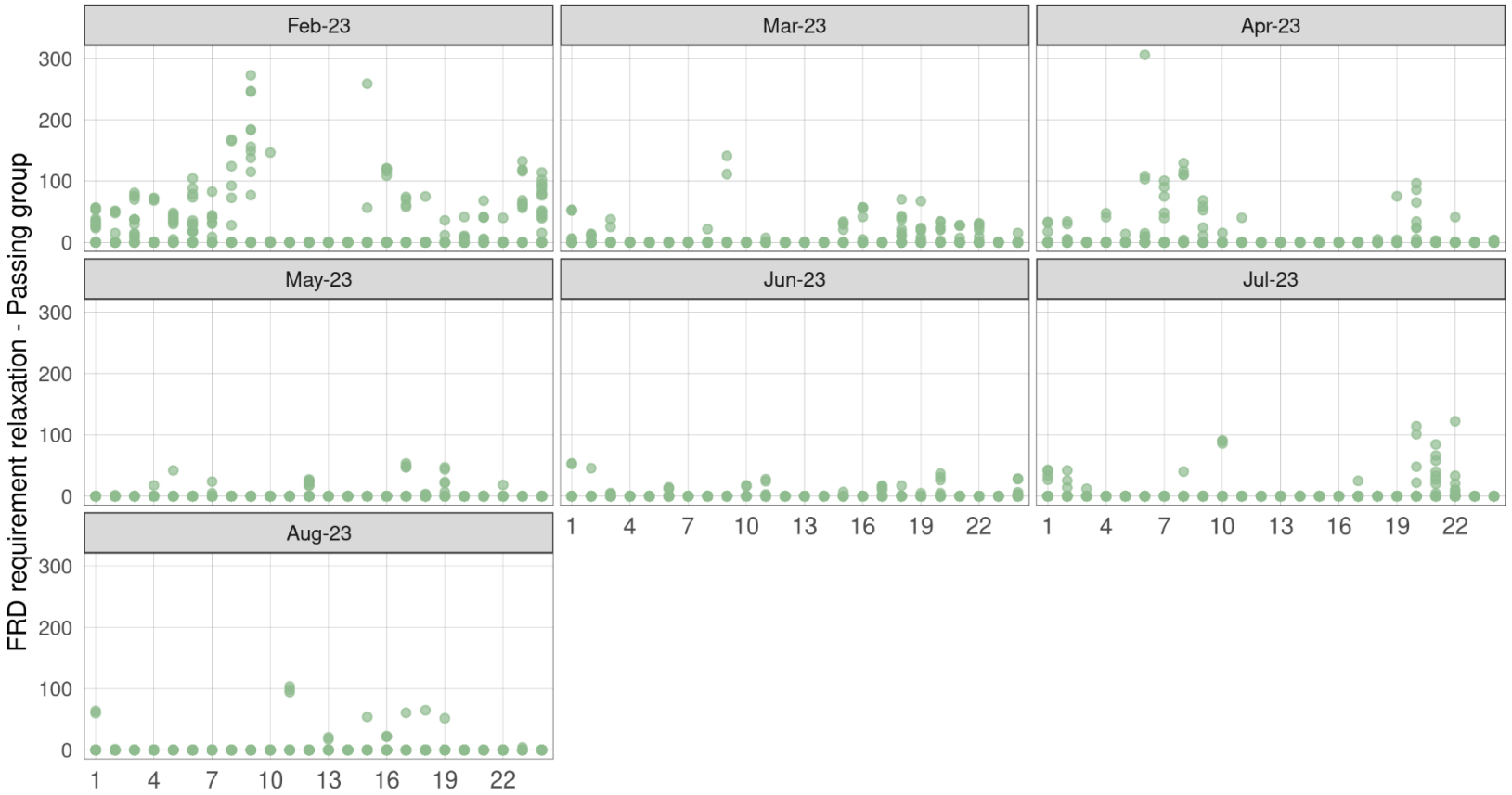


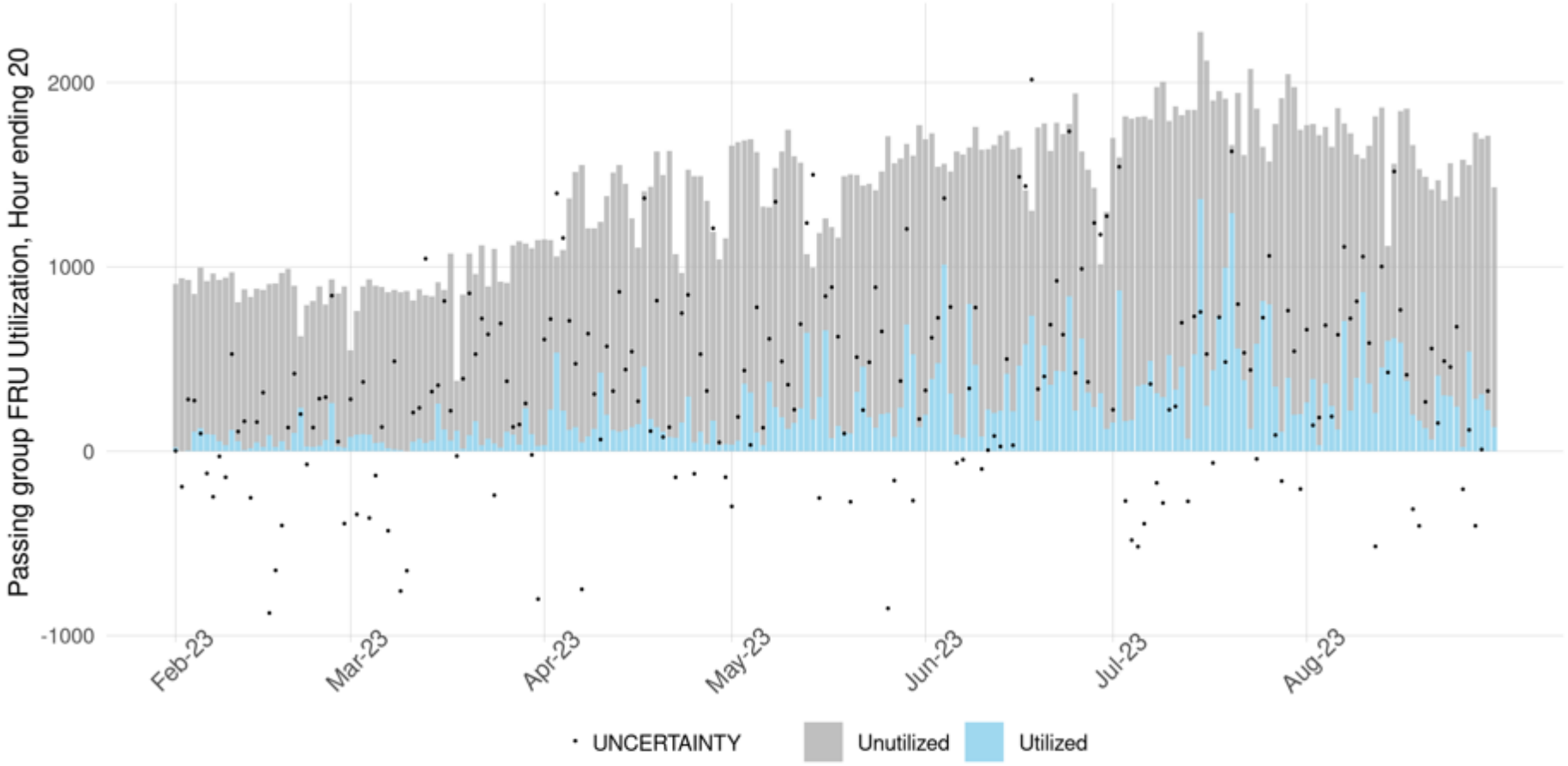
The effectiveness of the FRP product can be assessed with how FRP is utilized when uncertainty realizes

- Estimate utilization

$$Utilized\ FRU = \min\begin{Bmatrix} FRU\ Award, \\ \max(Realized\ uncertainty, 0) \end{Bmatrix}$$

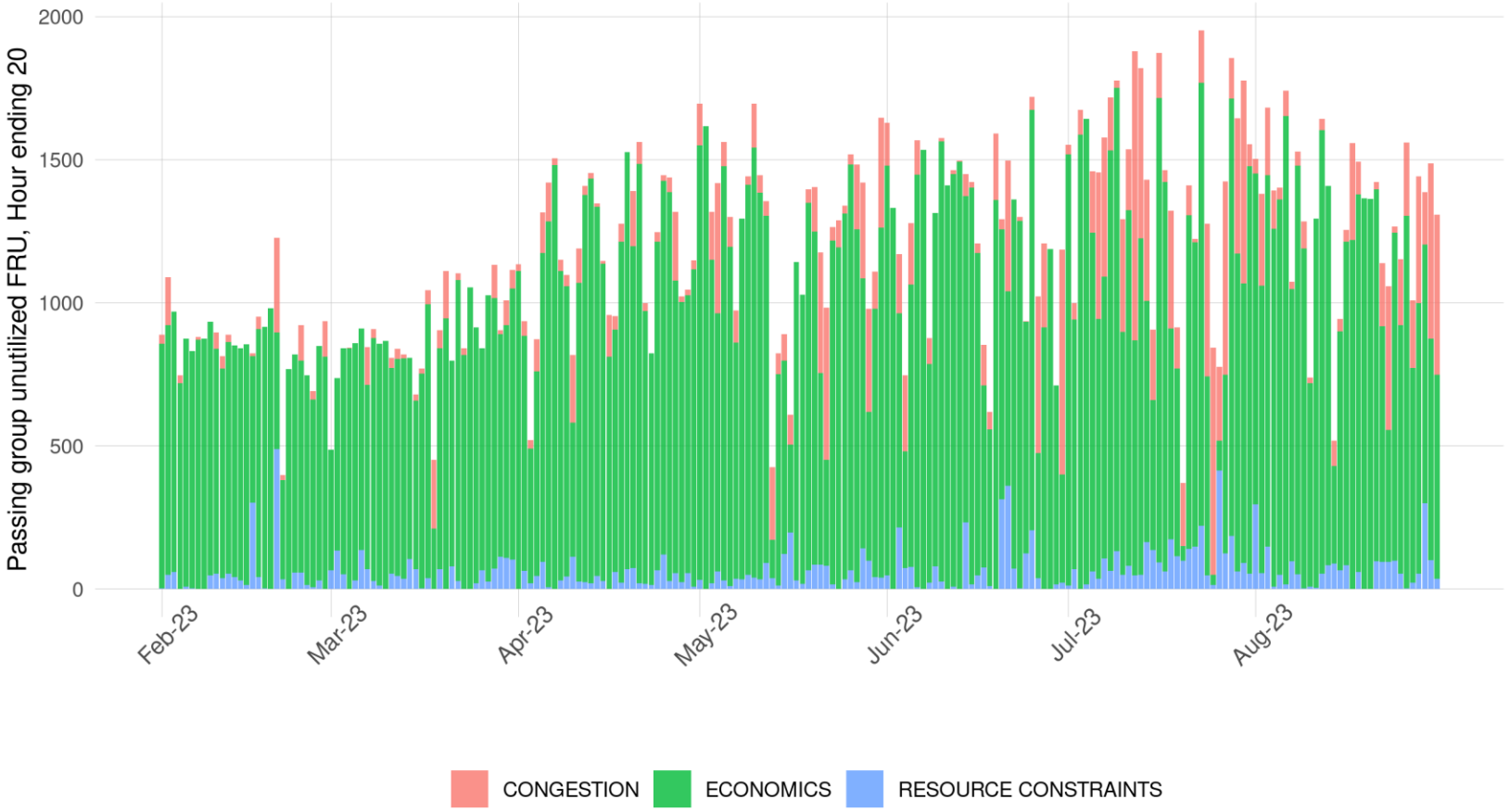
- There are here main reason for which FRP may not be utilized
  - Economics. Capacity is available but not dispatched yet because it is not in merit
  - Congestion. Capacity is not deliverable due to being stranded behind transmission constraints. This led to the nodal approach
  - Resource constraints. Any resource limitation that may prevent the deployment or availability of FRP

HE20 example of FRP utilization showcases a variety of scenarios



Cases where FRP utilization is greater than actual uncertainty.
Cases where actual uncertainty is in the downward direction but FRU is utilized
Cases where FRP is utilized below the level of actual uncertainty and requirement
Cases where actual uncertainty is higher than FRP requirements

Passing group unutilized FRU by Reason



Areas for improvement and further assessment

- The results of the T-55 test are now used to determine if an entity pass or not the test for consideration in the run of the first interval of the hour in the real-time market. Tariff language has been revised and available at http://www.caiso.com/Documents/Mar31-2023-Tariff-Amendment-ResourceSufficiencyEvaluationEnhancements-ER23- 1534.pdf

- Treatment of negative but negligible FRP requirement shadow prices

- Consideration of energy limits in the FRP procurement for certain energy-limited resources

- FRP demand curve erroneous calculation

Areas for improvement and further assessment

- Enhance logic to account for exceptional dispatches of storage resources in the FRP procurement
- Further assessment of storage resources supporting FRP due to complexities in managing its state of charge, mainly for resources on regulation. FRP procurement does not project SOC utilization if deployed.
- July events show that non-FRP-related variability (non-VER deviations, outages/derates, imports/exports underperformance) can realize concurrent with FRP-related uncertainty and thus FRP is not designed to absorb this type and level of variability

Assistance Energy Transfer

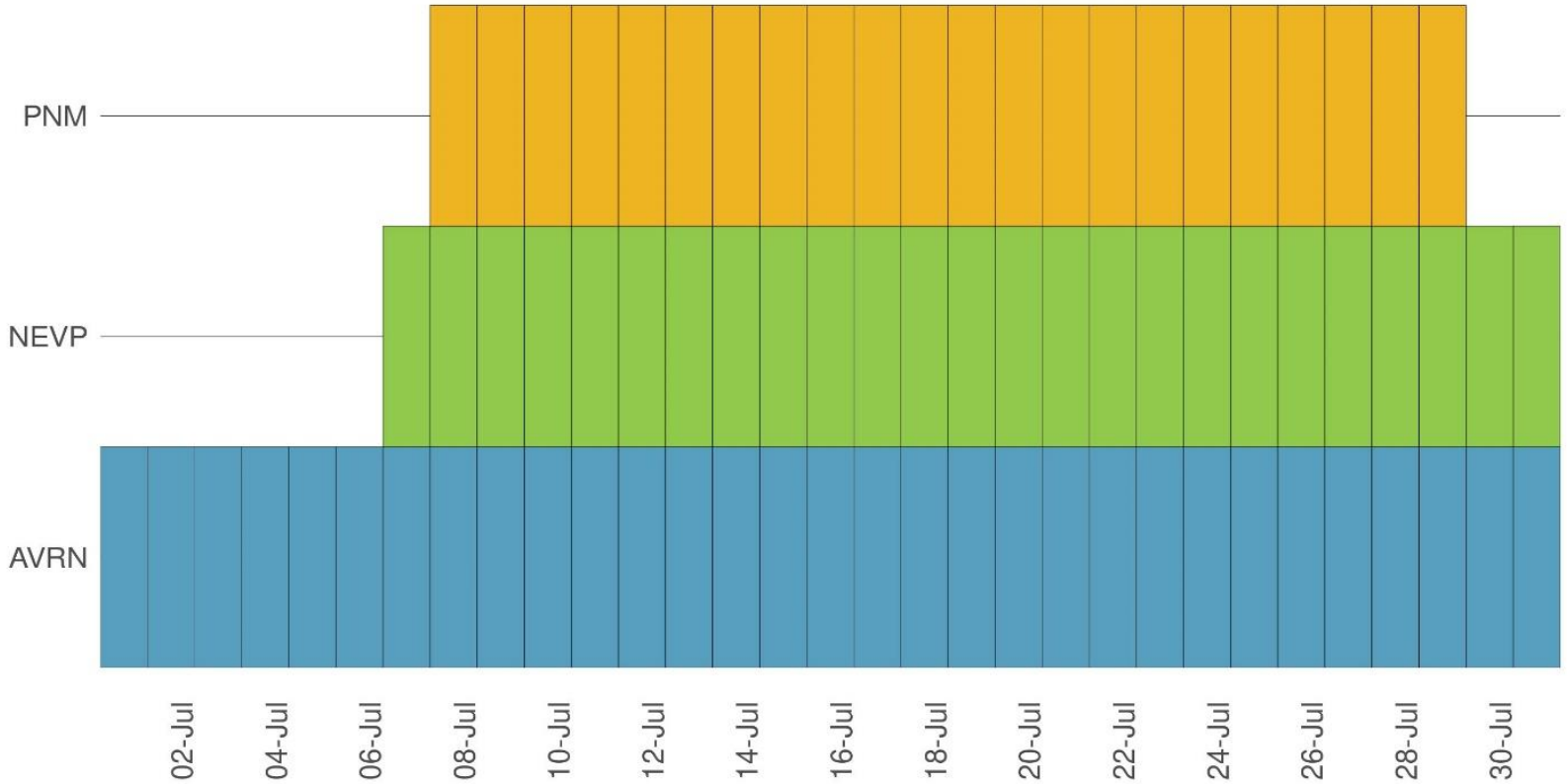
Assistance Energy Transfer process kicked off for trading date July 1, 2023

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

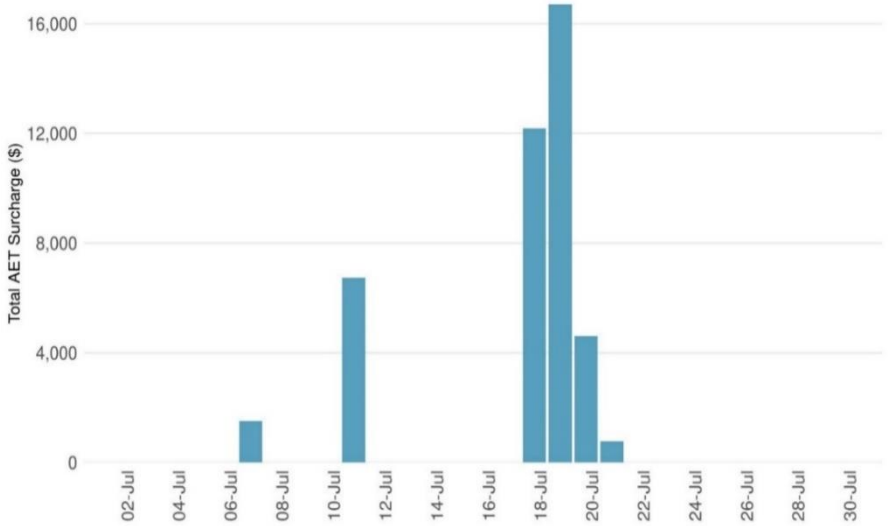
CAISO assesses for CAISO BAA on a daily basis whether to OPT IN or not

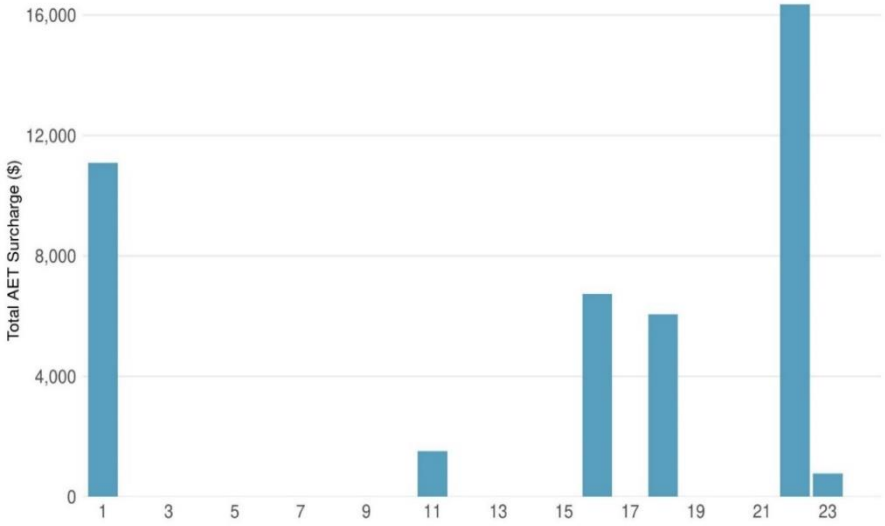
- Criteria for CAISO to OPT in is based on
  - Supply sufficiency based on gross load
  - Supply sufficiency based on net load
  - Operators criteria
- CAISO posts a market message when it OPTS IN
- CAISO started this process on June 23 for trade date July 1, 2023
- CAISO did not OPT'ed for the month of July

The assistance energy transfer program was utilized by three WEIM entities in July



The total amount of AET surcharge assessed during the month of July 2023 was approximately $42,510 across three WEIM BAAs.



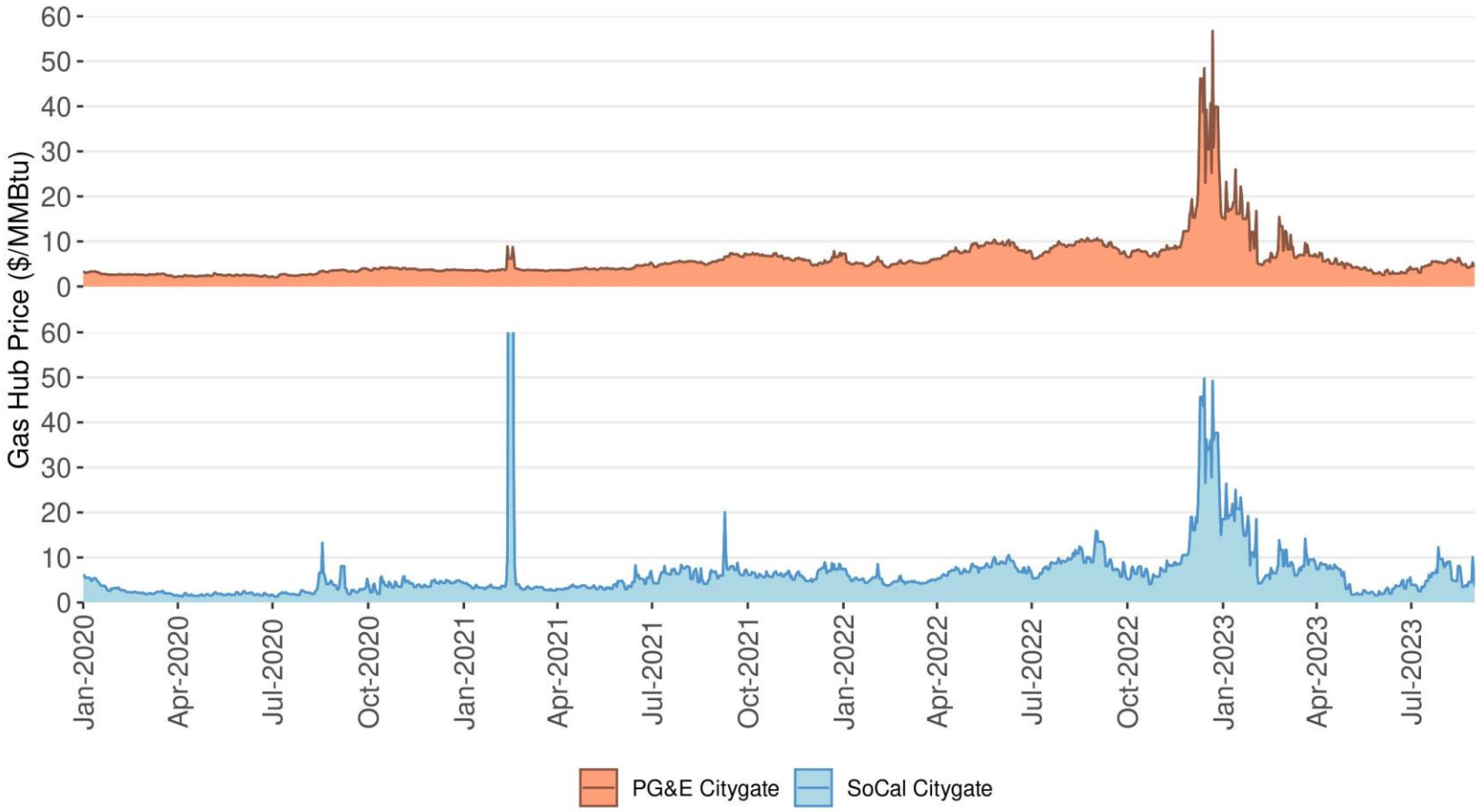


Surcharges are assessed only when the entity failed the test

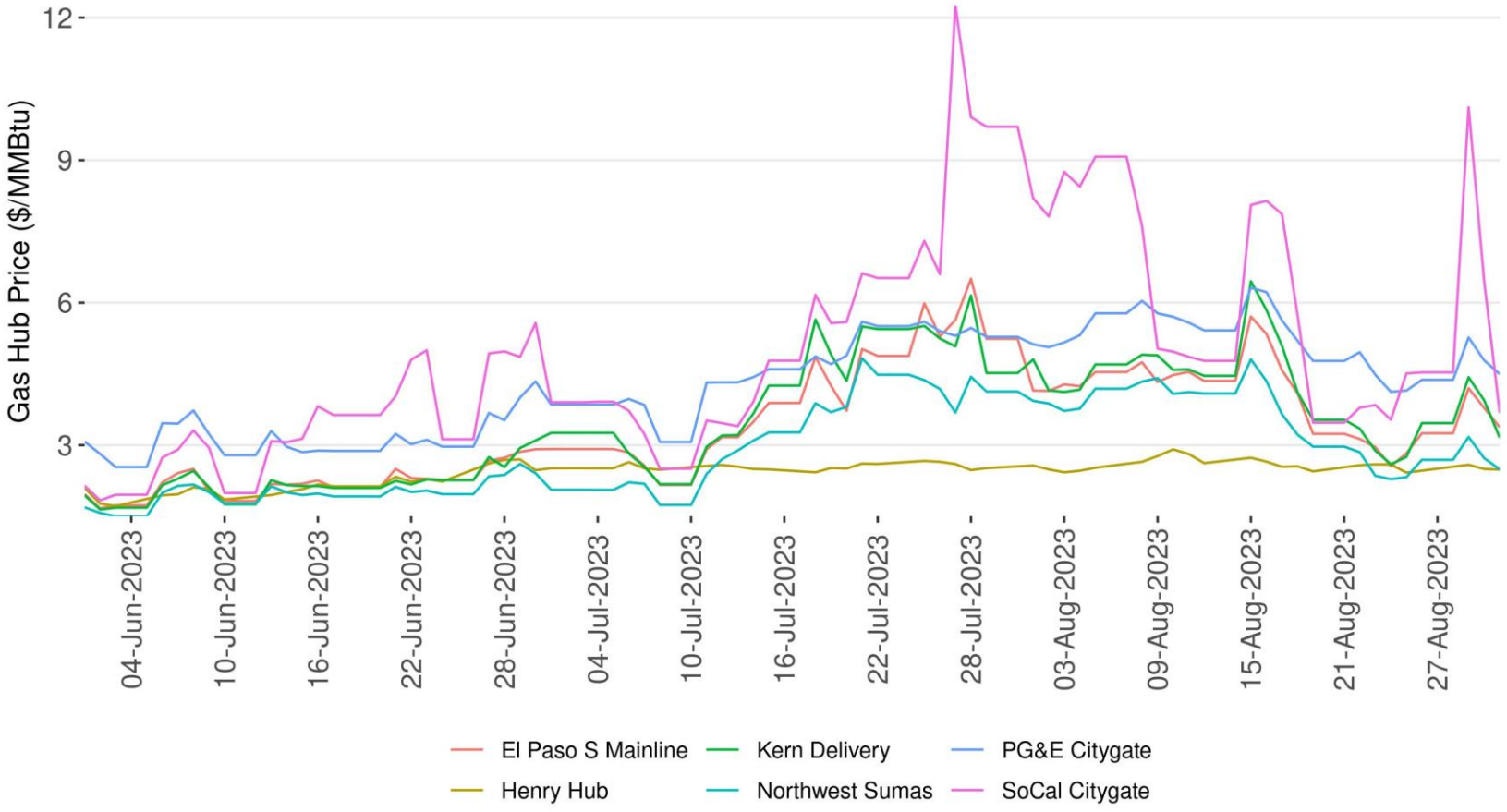
During the days of the surcharges the bid cap remained at $1,000

Gas/Power index prices and CAISO's market costs in summer 2023

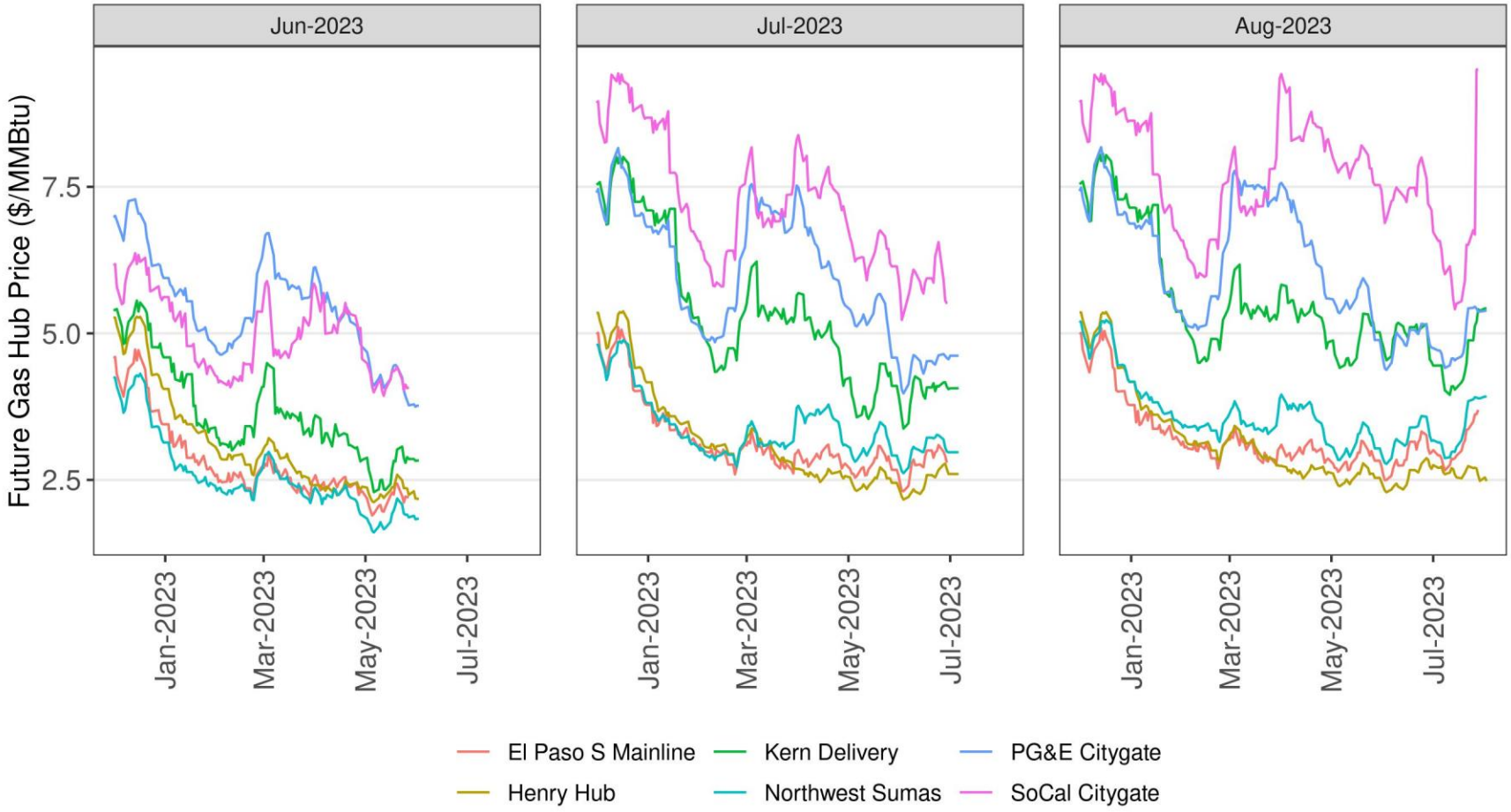
California next-day gas prices saw lower levels in summer 2023 trading compared to summer 2022



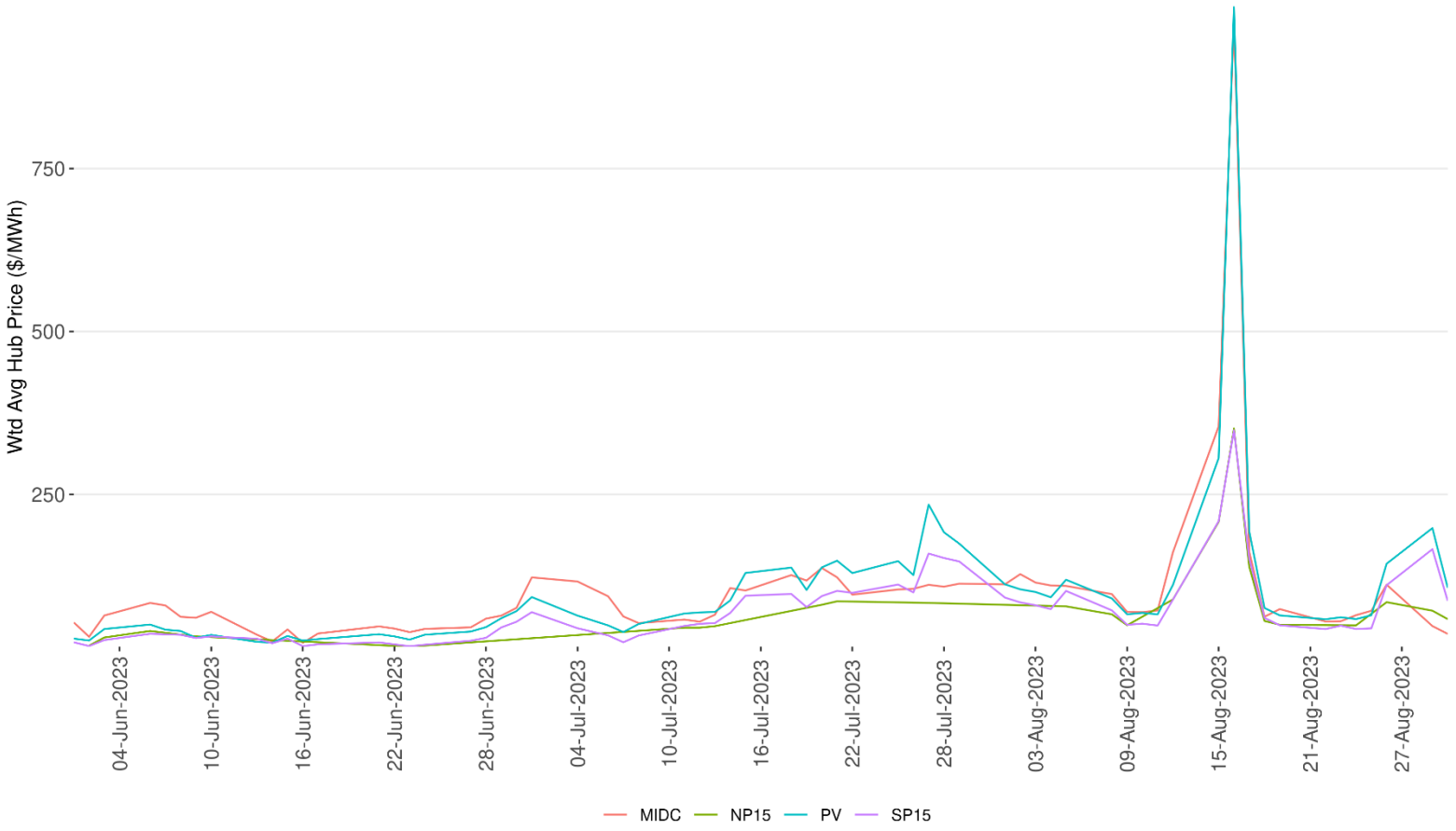
Western next-day gas prices were elevated throughout July and August 2023 with highest prices recorded at SoCal Citygate



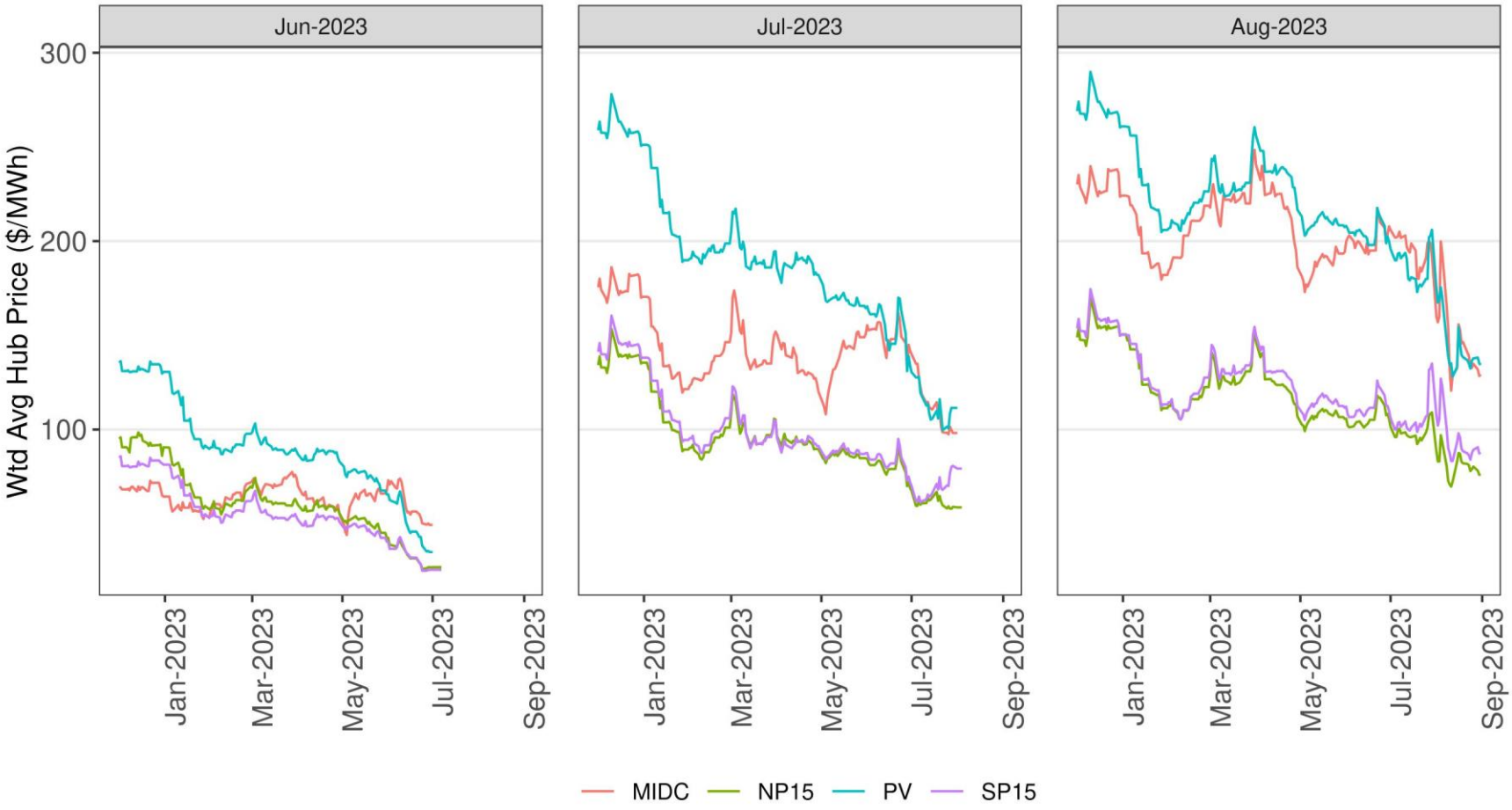
Future gas prices for summer 2023 followed a downward trend throughout the year with some spikes during mid-summer trading



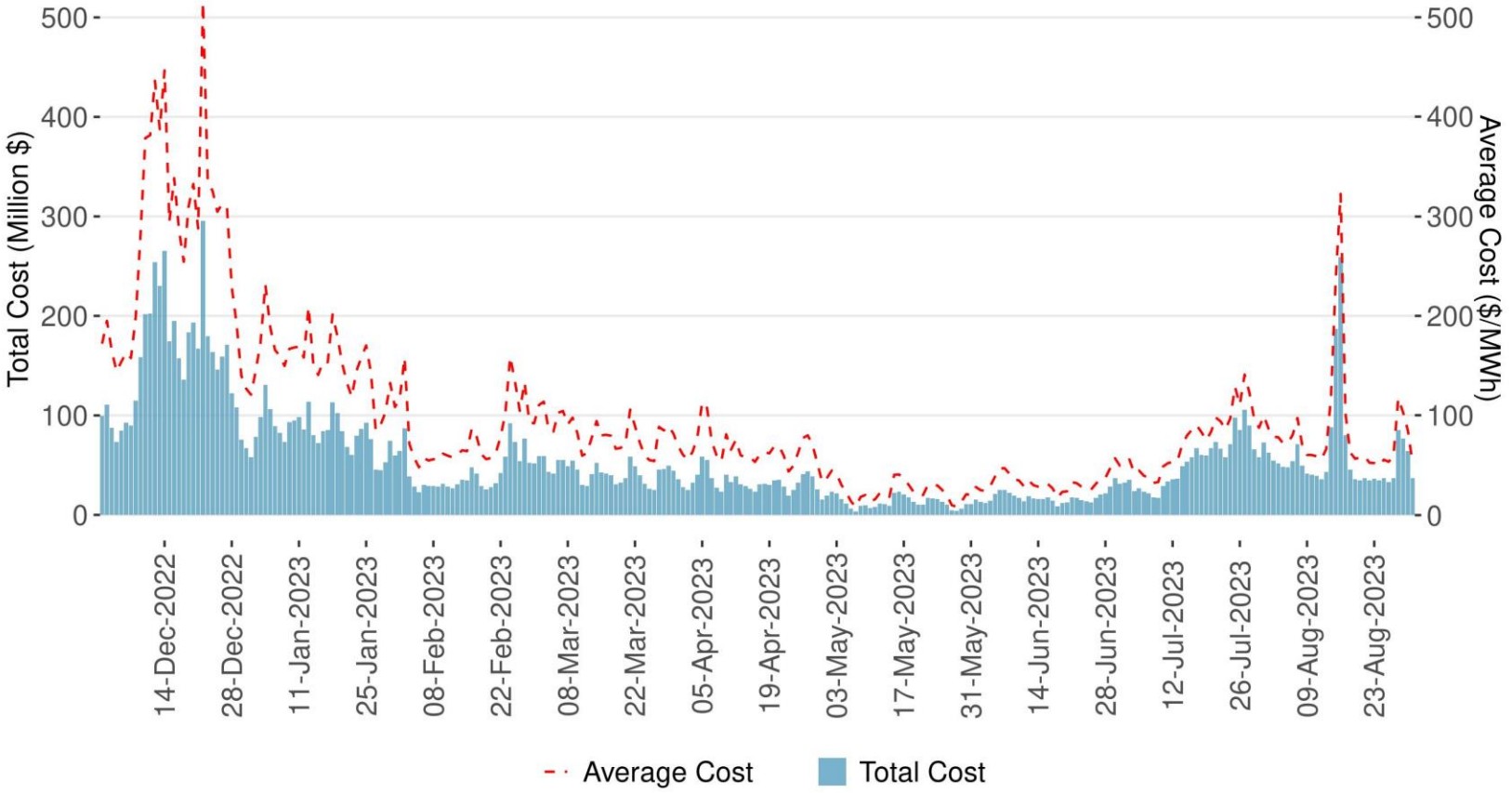
Next-day peak bilateral power prices experienced some volatility in July and August with significant spikes at Mid-C and PV on August 16



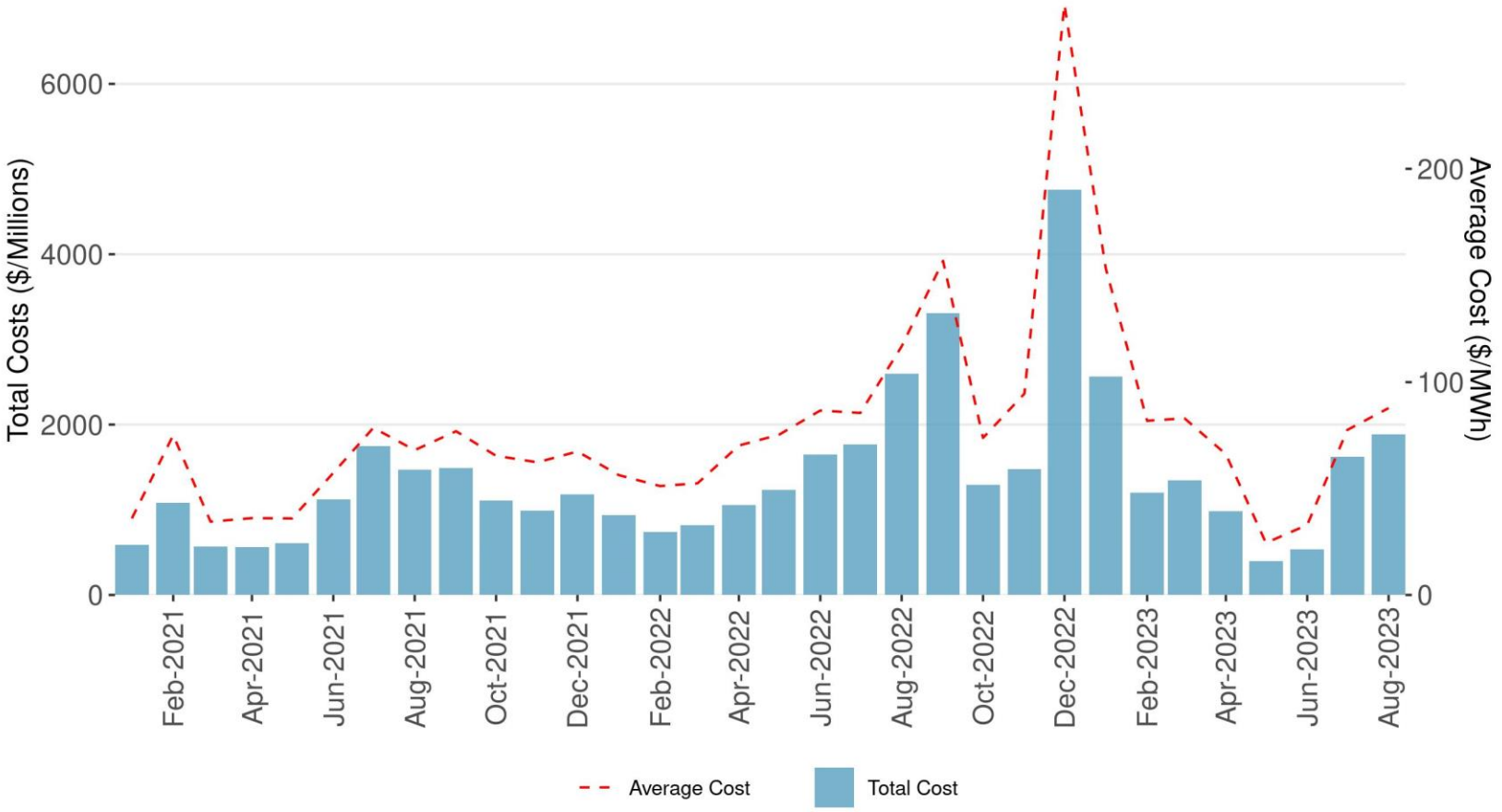
Future bilateral peak power prices follow similar seasonal trends with declines in recent trading



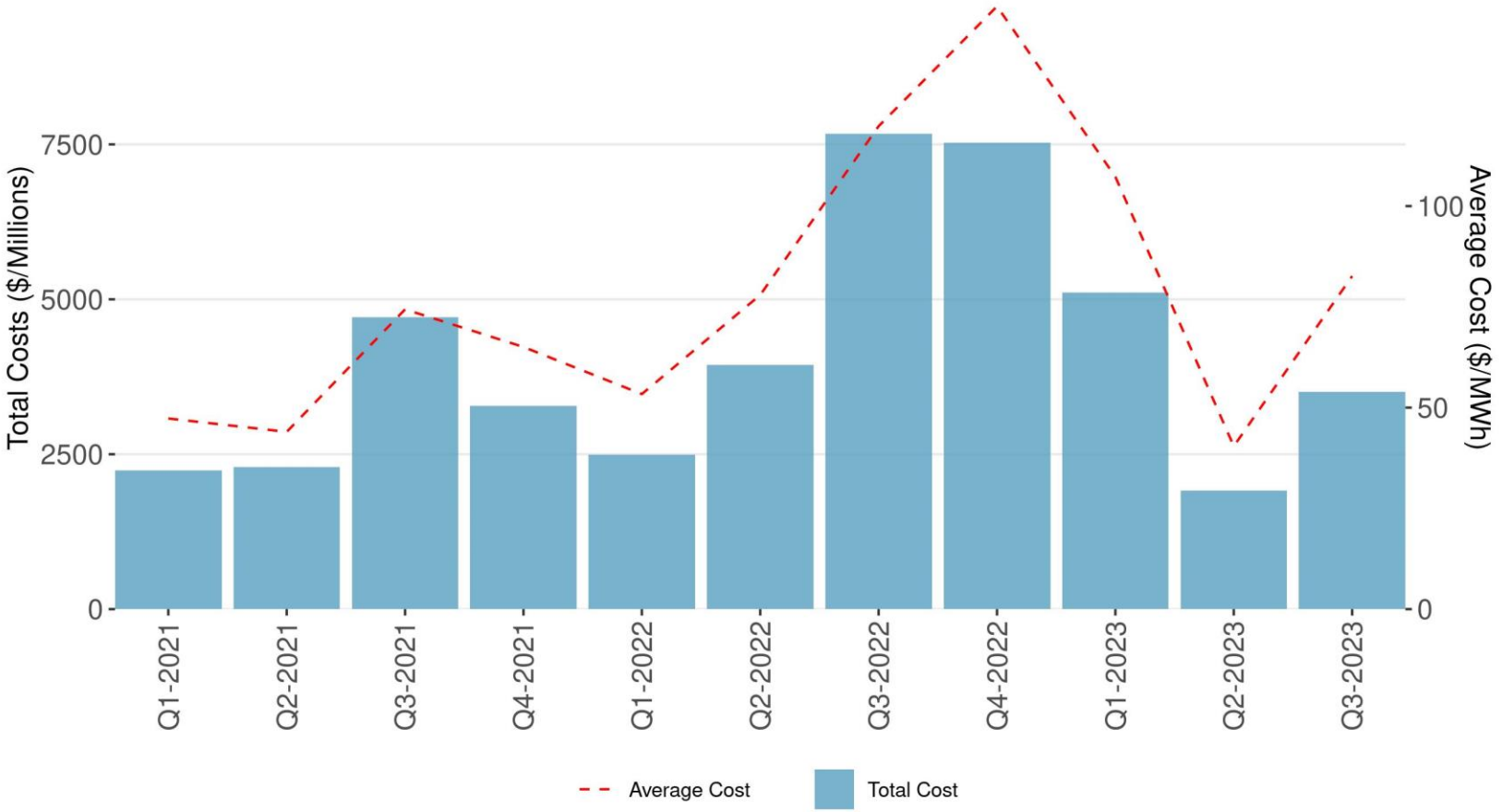
Daily market costs rise during summer months and peak between August 15-16



Monthly totals for summer 2023 were lower than those of summer 2022, as well as those of December 2022

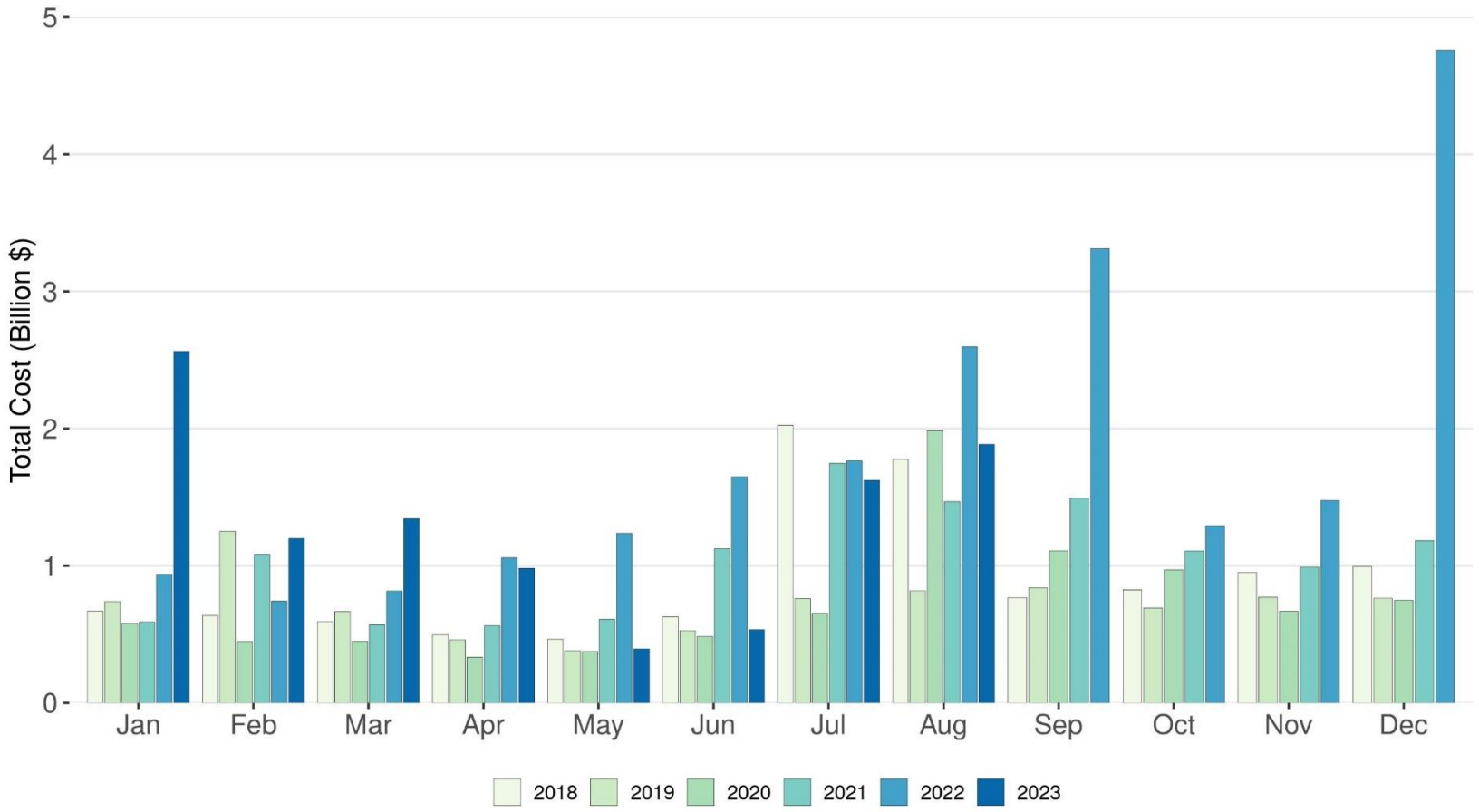


Q2 2023 total costs are $2B lower than Q2 2022 total costs, or $37.56/MWh lower on average



Note: Q3 2023 includes data for July and August only

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



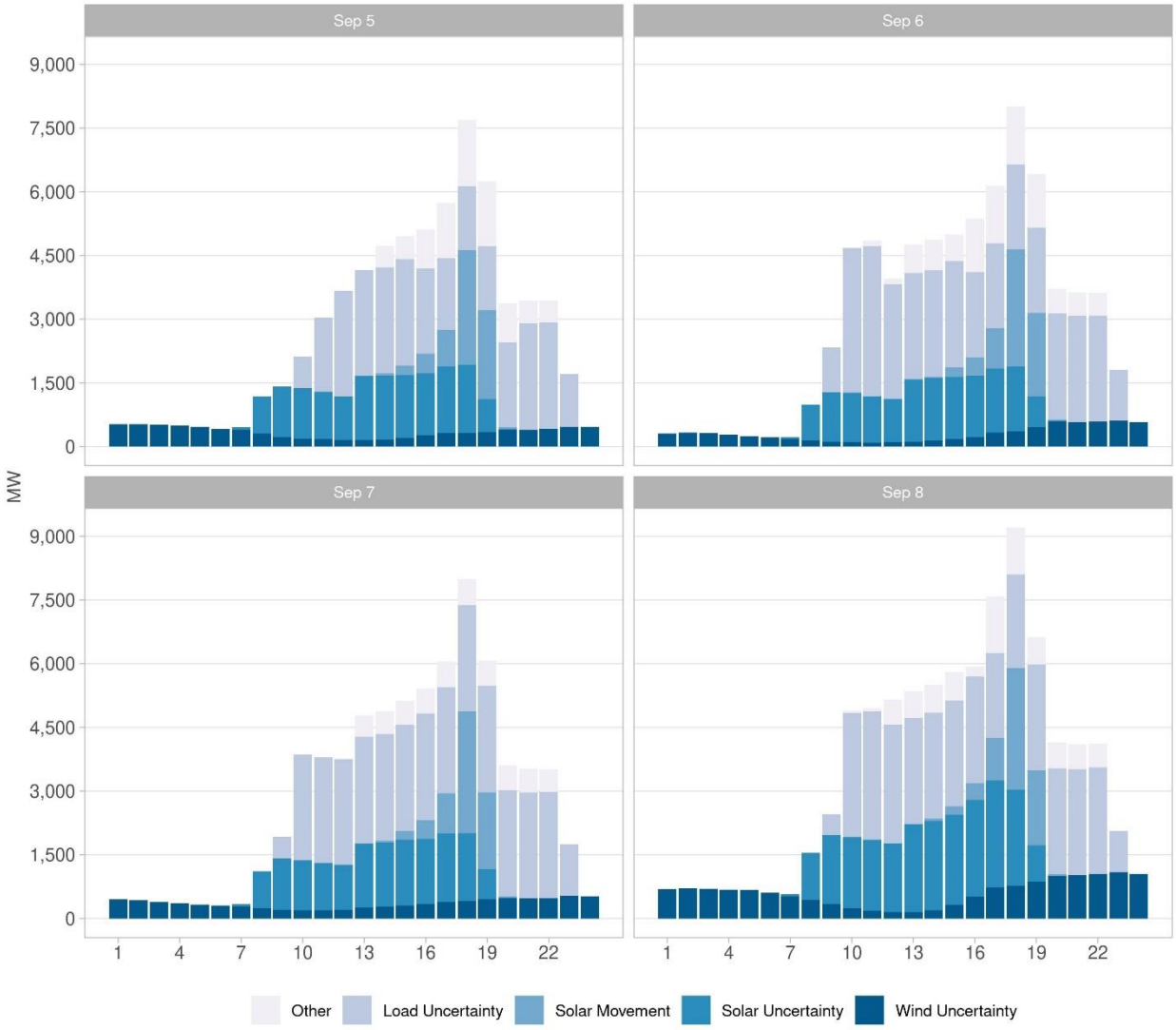
Load Conformance

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 to10,000MW

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

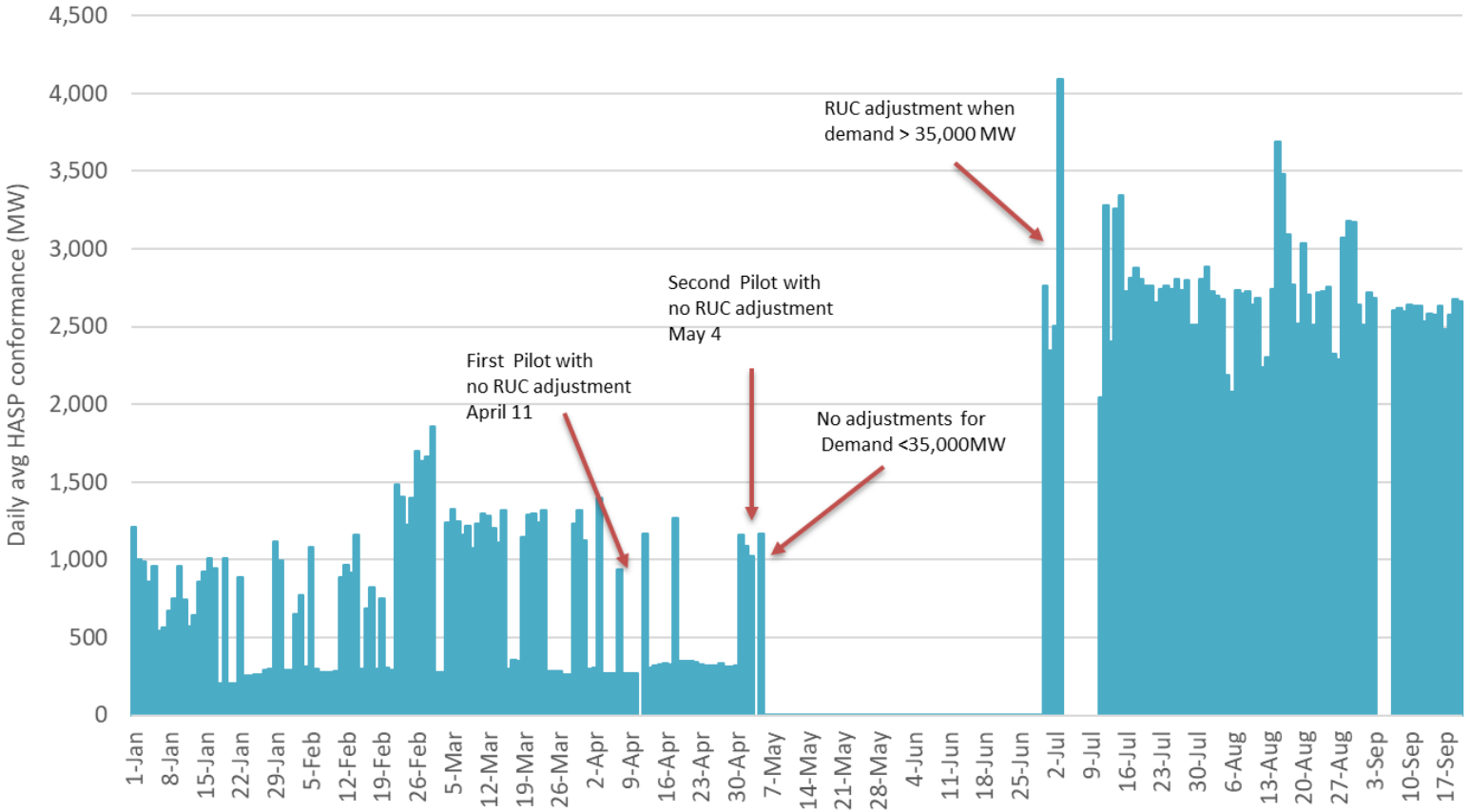
Load conformance in HASP market was also used heavily with values of up to 5,000MW



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

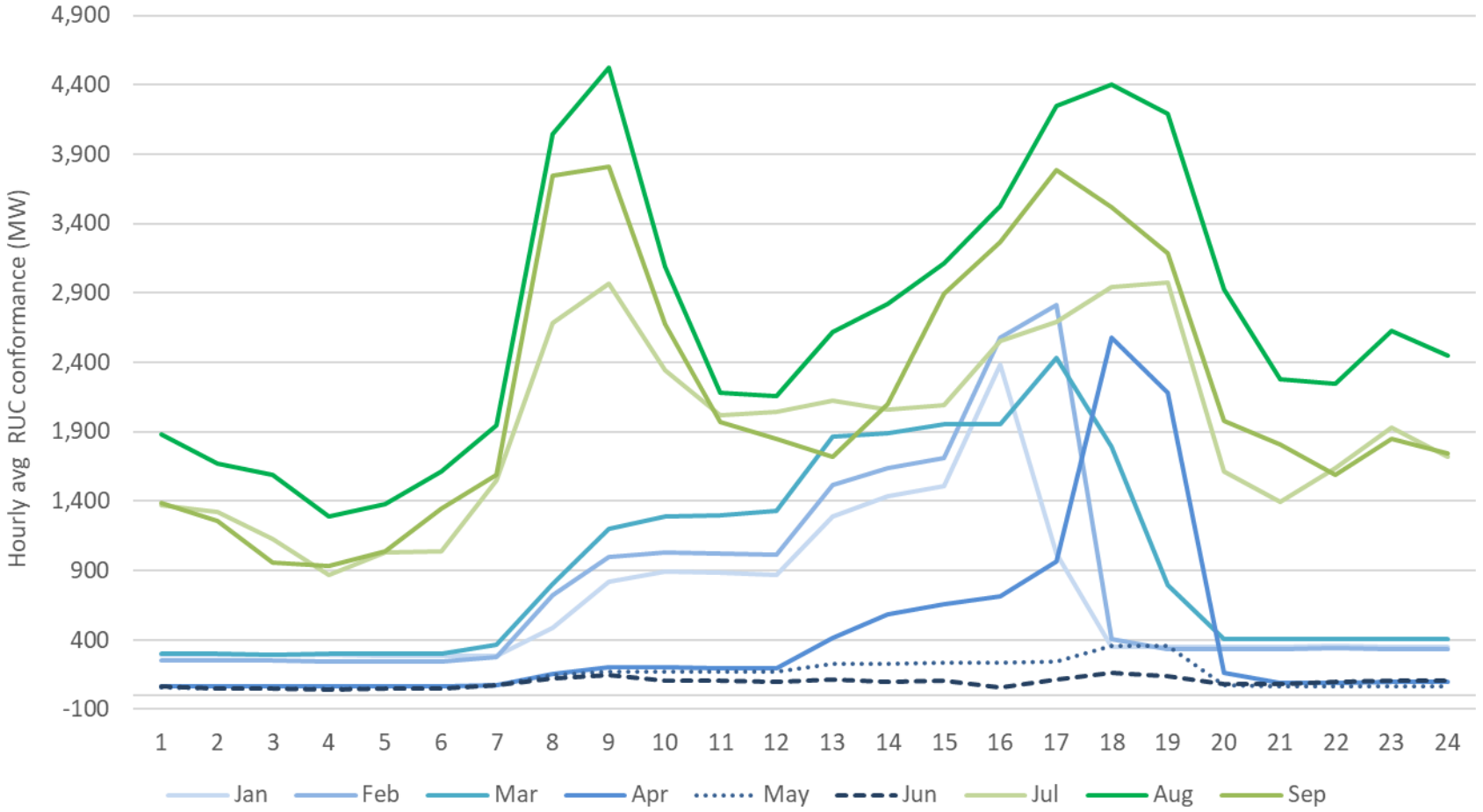
- Based on the performance of September 2023, CAISO committed to
  - Enhance the guiding logic for RUC adjustments by using a logic similar to the proposed Imbalance Reserve
  - Assess the use of load conformance in real-time markets
- CAISO has implemented a change to the logic for guiding the RUC adjustments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

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 adjustment=0



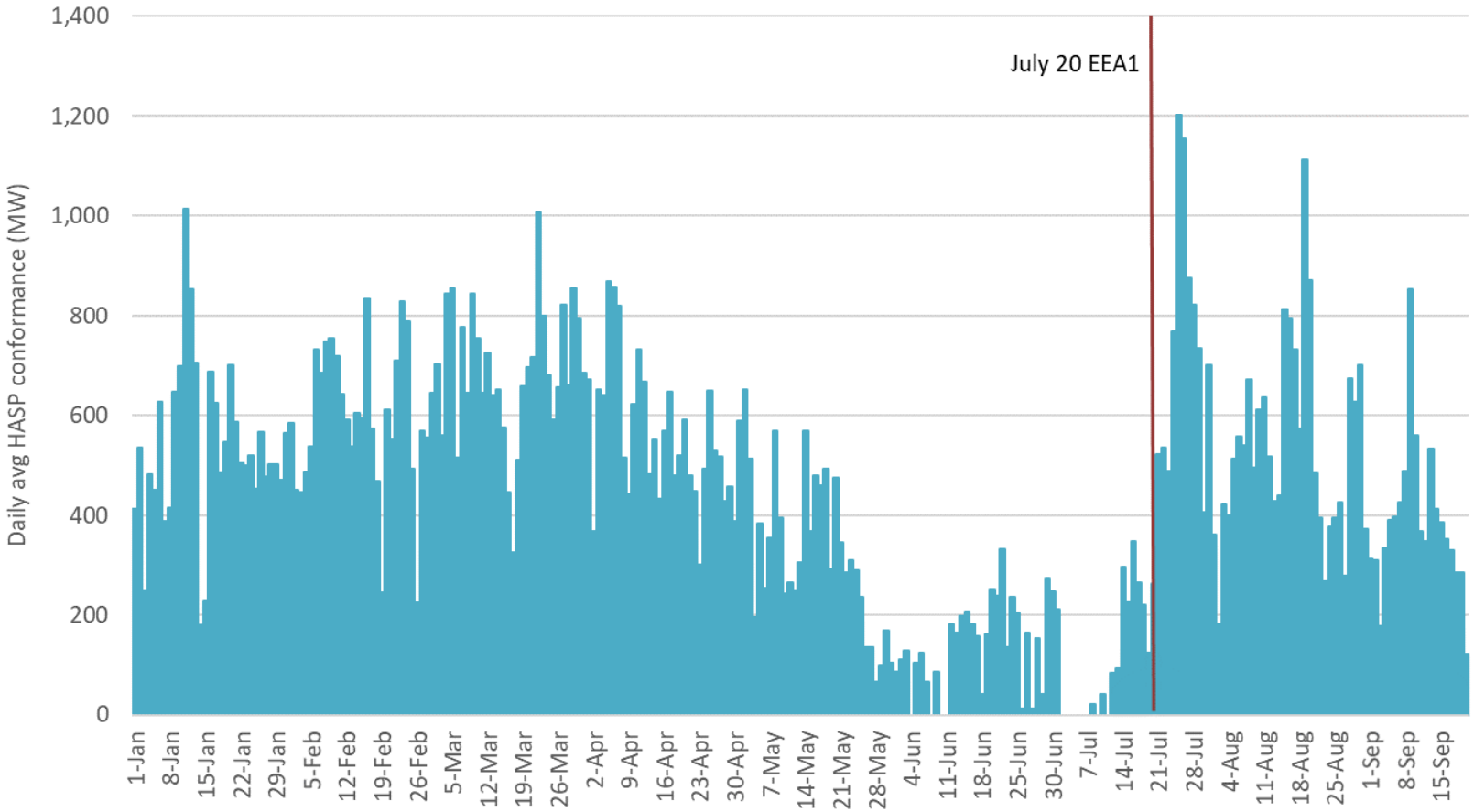
Results of pilot case study provided preliminary insights on the merits of RUC adjustments

Hourly profile of RUC adjustments saw a reduction with the run of the pilot program

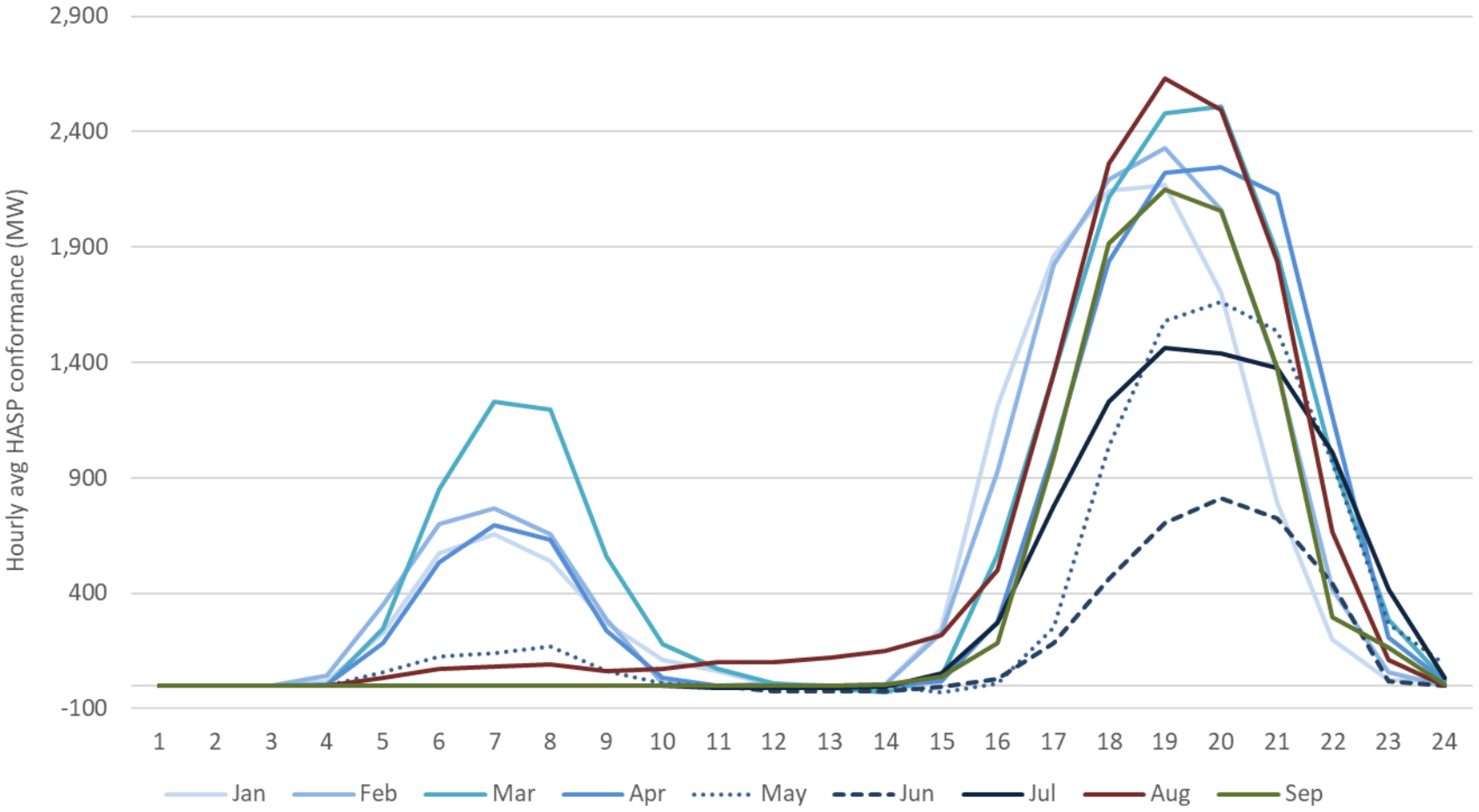


Profiles for July-September are different once the guiding methodology switched to use Imbalance reserve logic

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

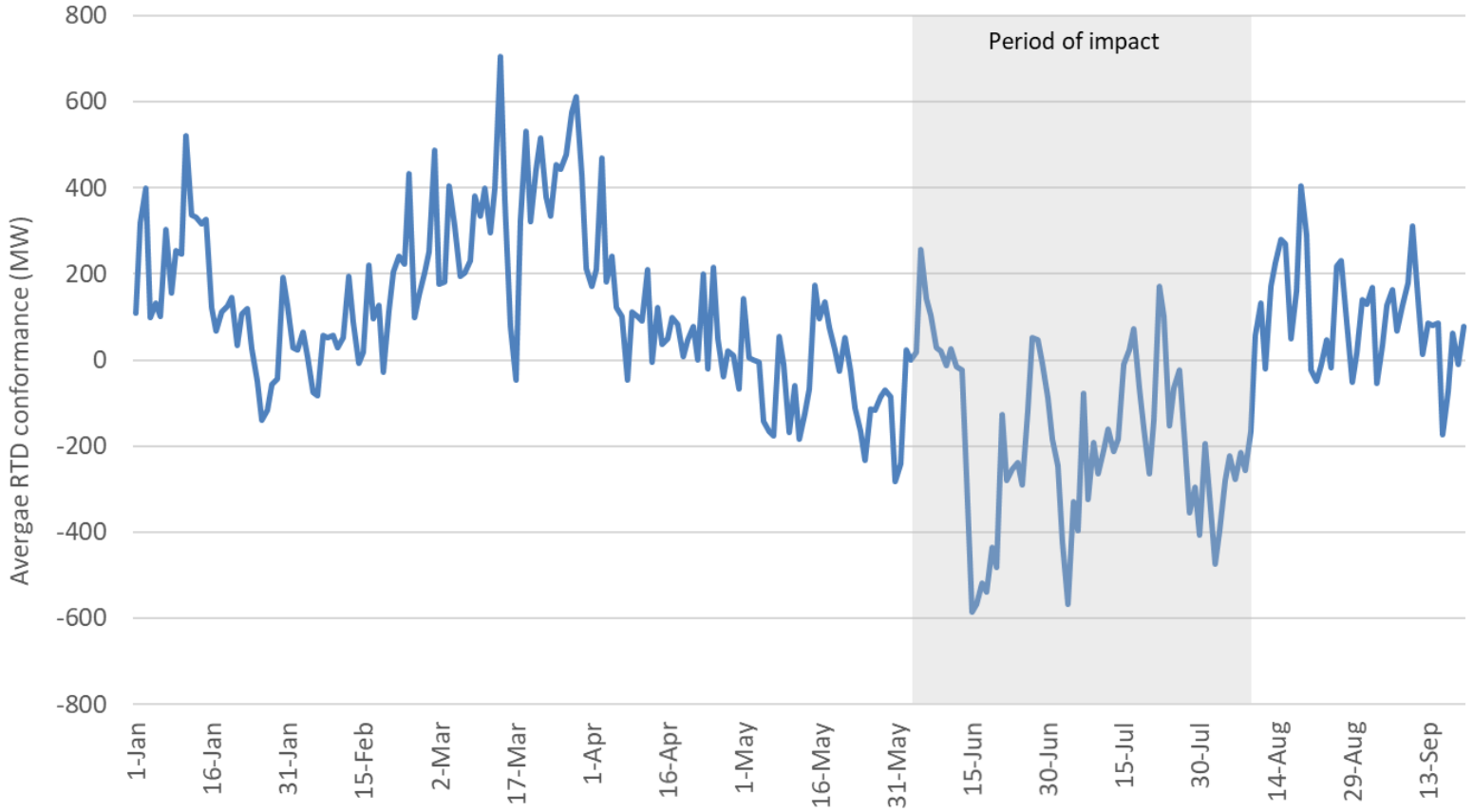


With the pilot program, HASP conformance was assessed and reduced through mid July



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

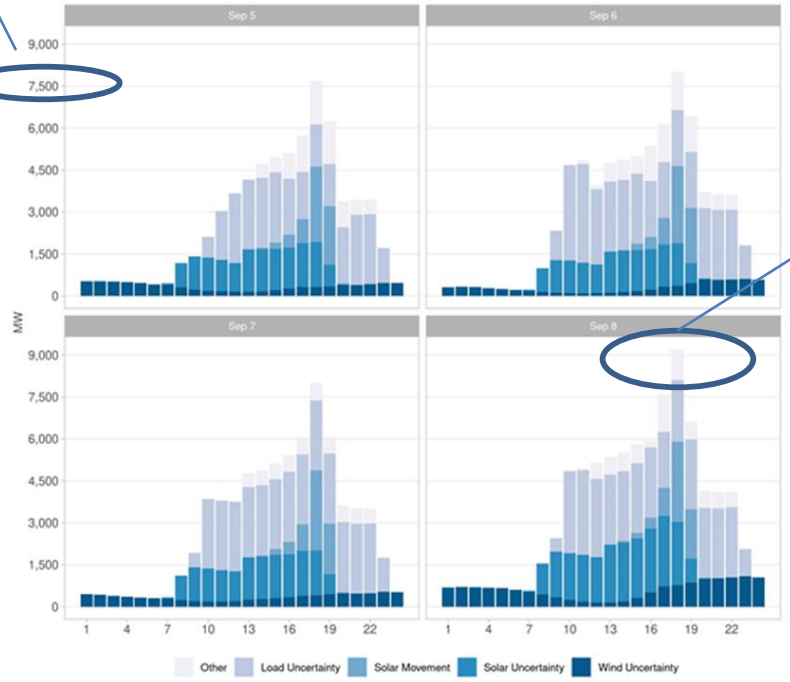
Change of methodology for guiding RUC adjustments

- Review actual performance of RUC guiding from Summer 2022
- 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

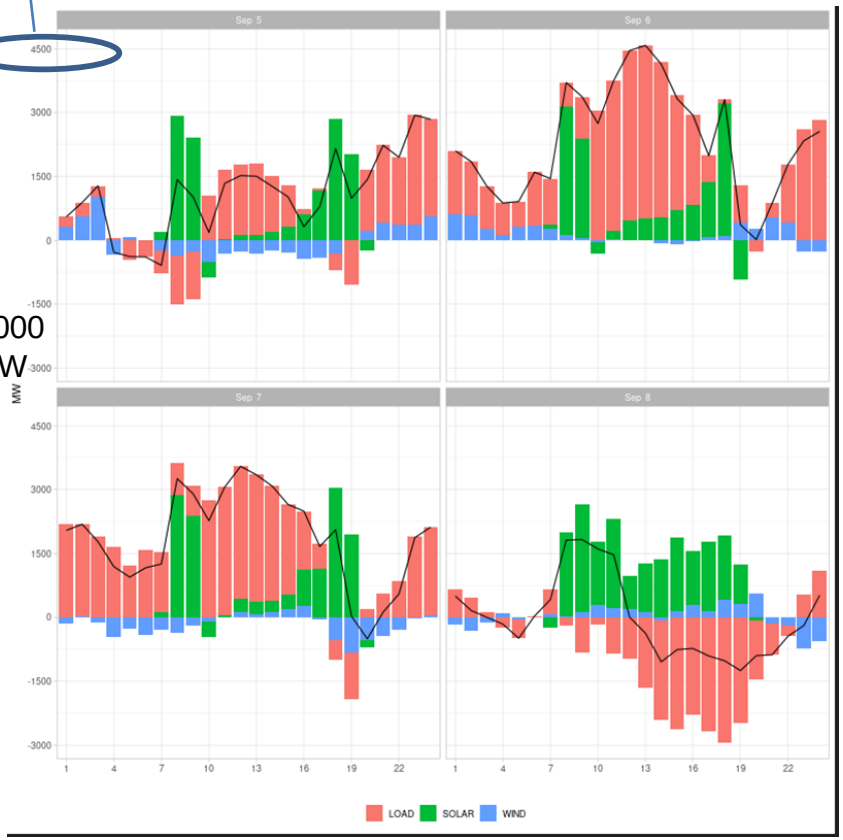
7500 MW



Realized Uncertainty Observed

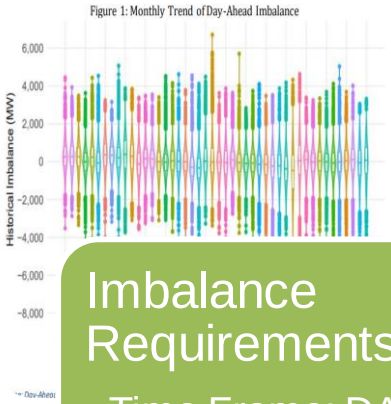
4500 MW

>9000 MW



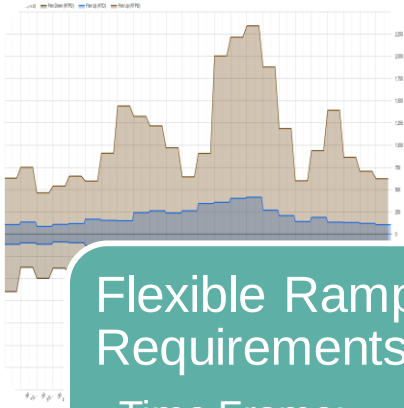
http://www.caiso.com/Documents/SummerMarketPerformanceReportforSeptember2022.pdf

Net-Load Uncertainty Requirements



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

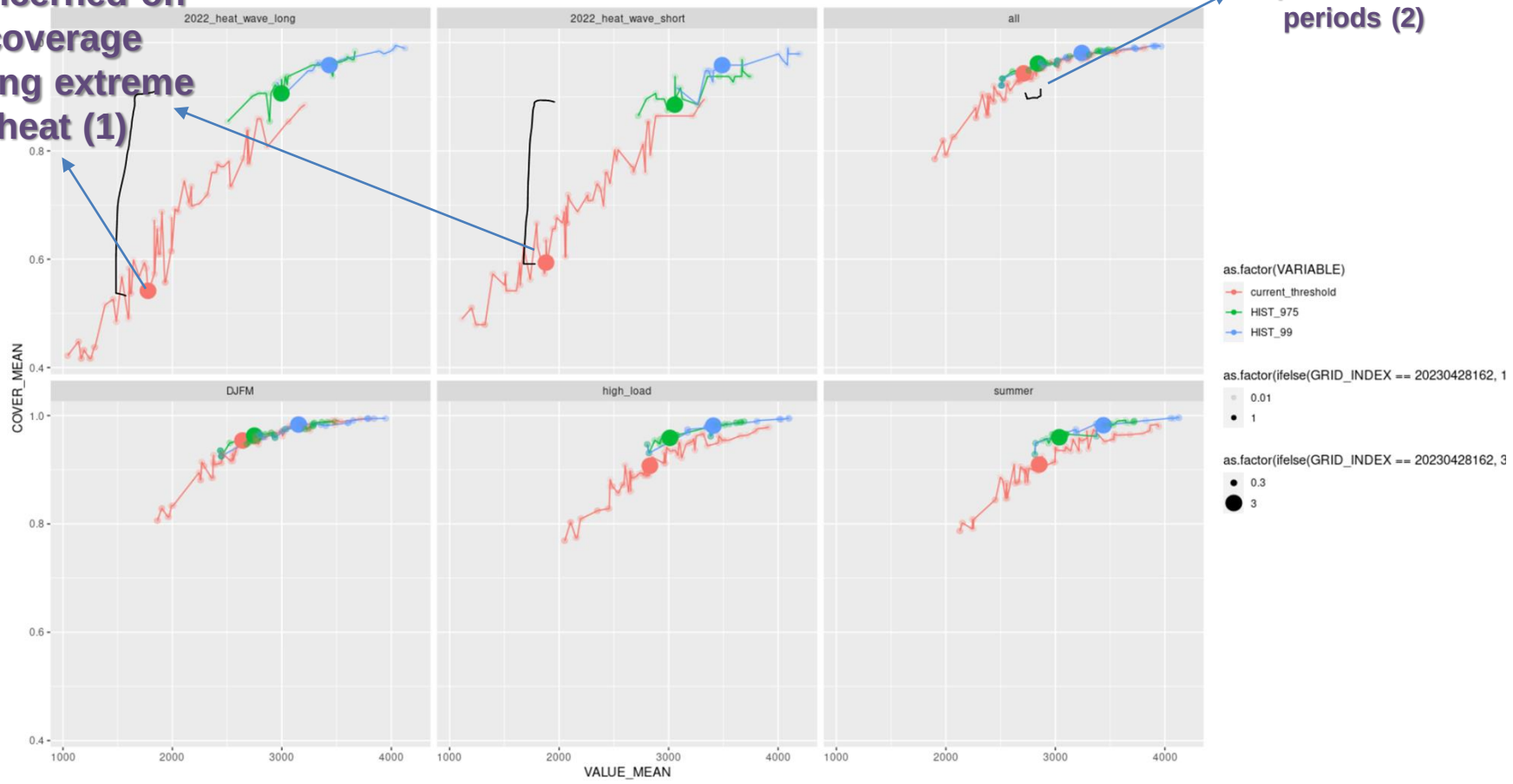
Summer 2023: Utilize Imbalance Requirements (*similar* to DAME approved design)

- 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)

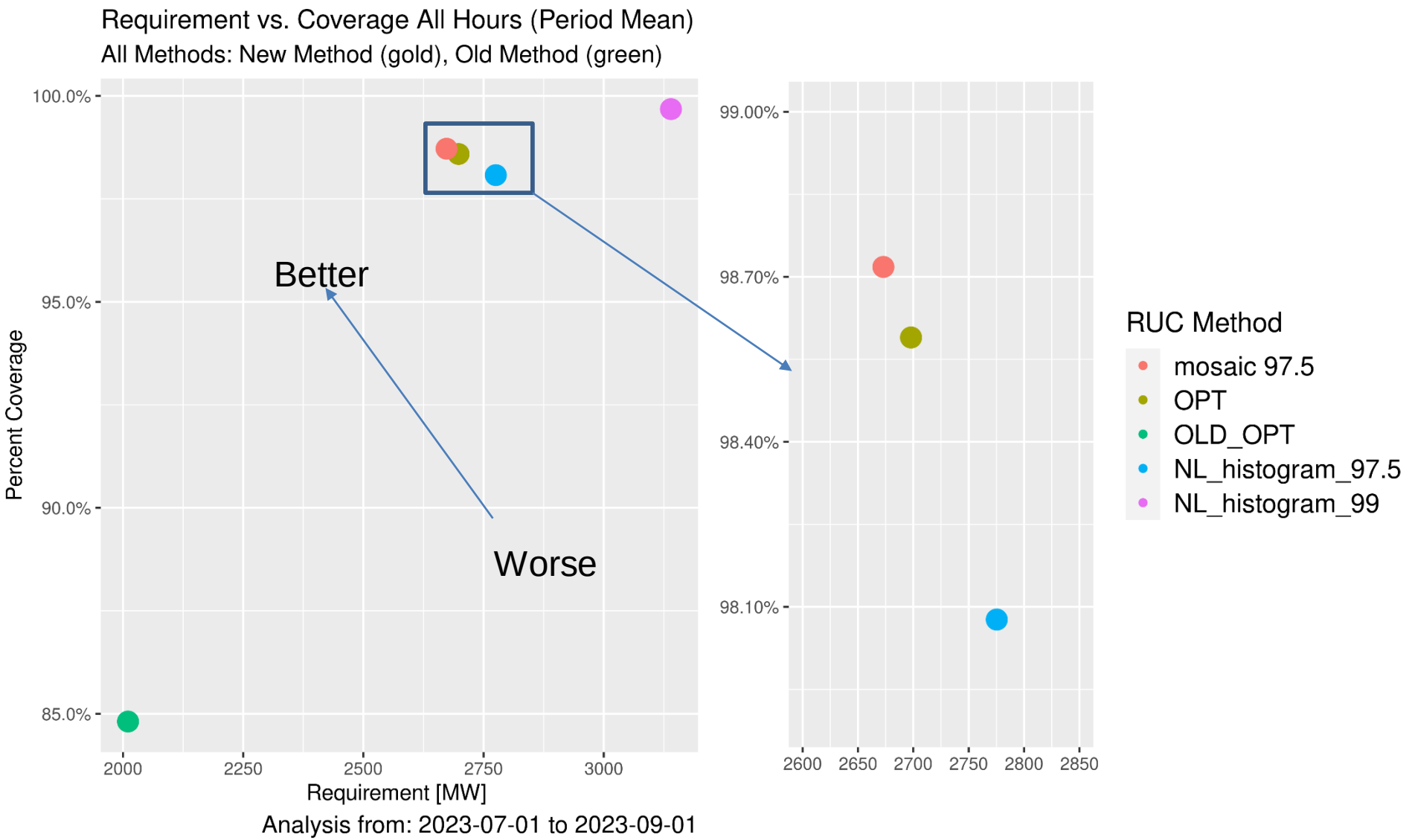


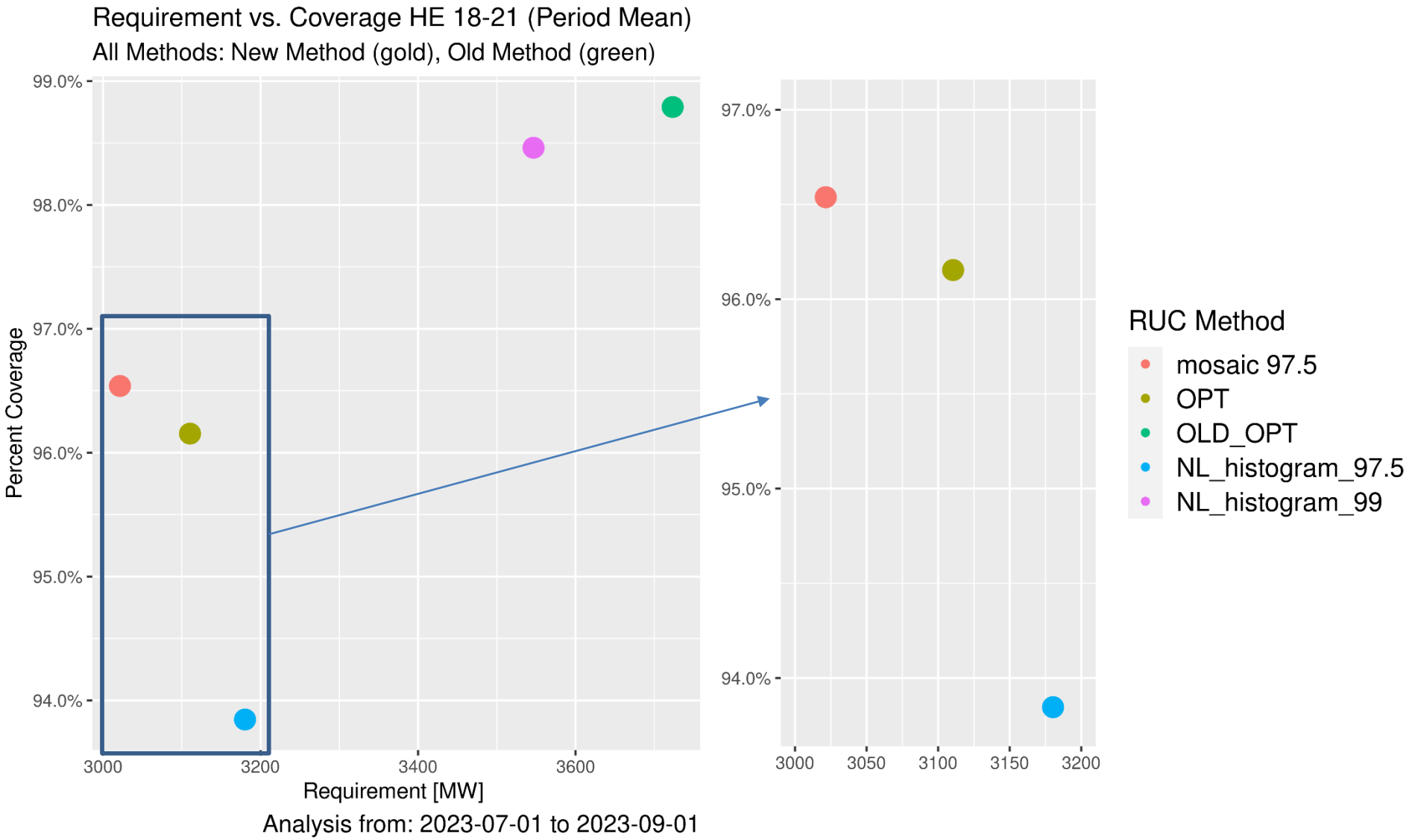
Trialing Multiple Options: Broad takeaways

- 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 1st, 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)
Percent Coverage
100.0%
95.0%
90.0%
85.0%
Better
Worse
2000
2250
2500
2750
3000
Requirement [MW]
99.00%
98.70%
98.40%
98.10%
2600
2650
2700
2750
2800
2850
RUC Method
mosaic 97.5
OPT
OLD_OPT
NL_histogram_97.5
NL_histogram_99
Analysis from: 2023-07-01 to 2023-09-01

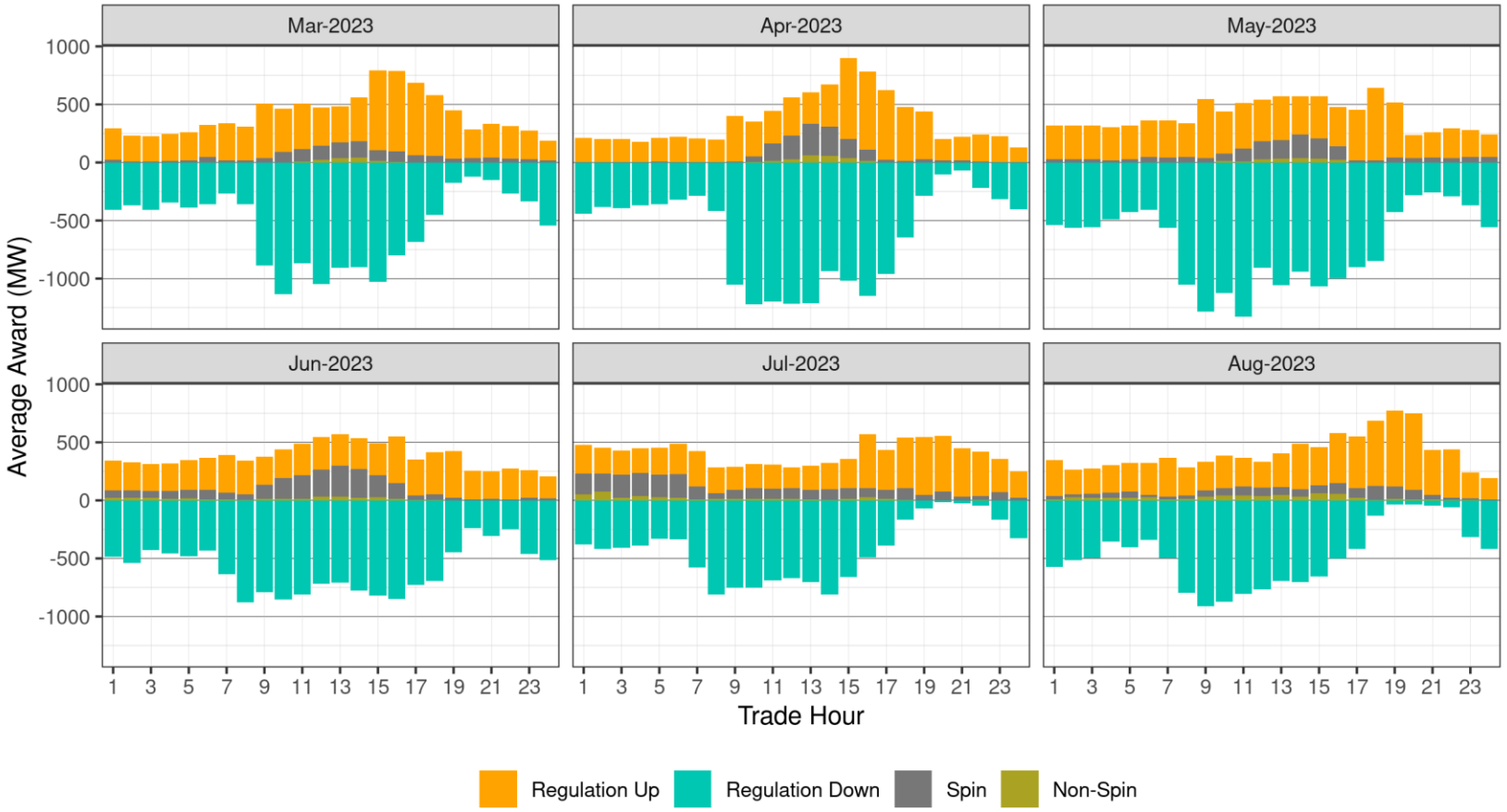

Requirement vs. Coverage HE 18-21 (Period Mean)
All Methods: New Method (gold), Old Method (green)
Percent Coverage
99.0%
98.0%
97.0%
96.0%
95.0%
94.0%
3000
3200
3400
3600
Requirement [MW]
97.0%
96.0%
95.0%
94.0%
3000
3050
3100
3150
3200
RUC Method
mosaic 97.5
OPT
OLD_OPT
NL_histogram_97.5
NL_histogram_99
Analysis from: 2023-07-01 to 2023-09-01

RUC Net Load Uncertainty Takeaways July 1st – Sept 1st , 2023

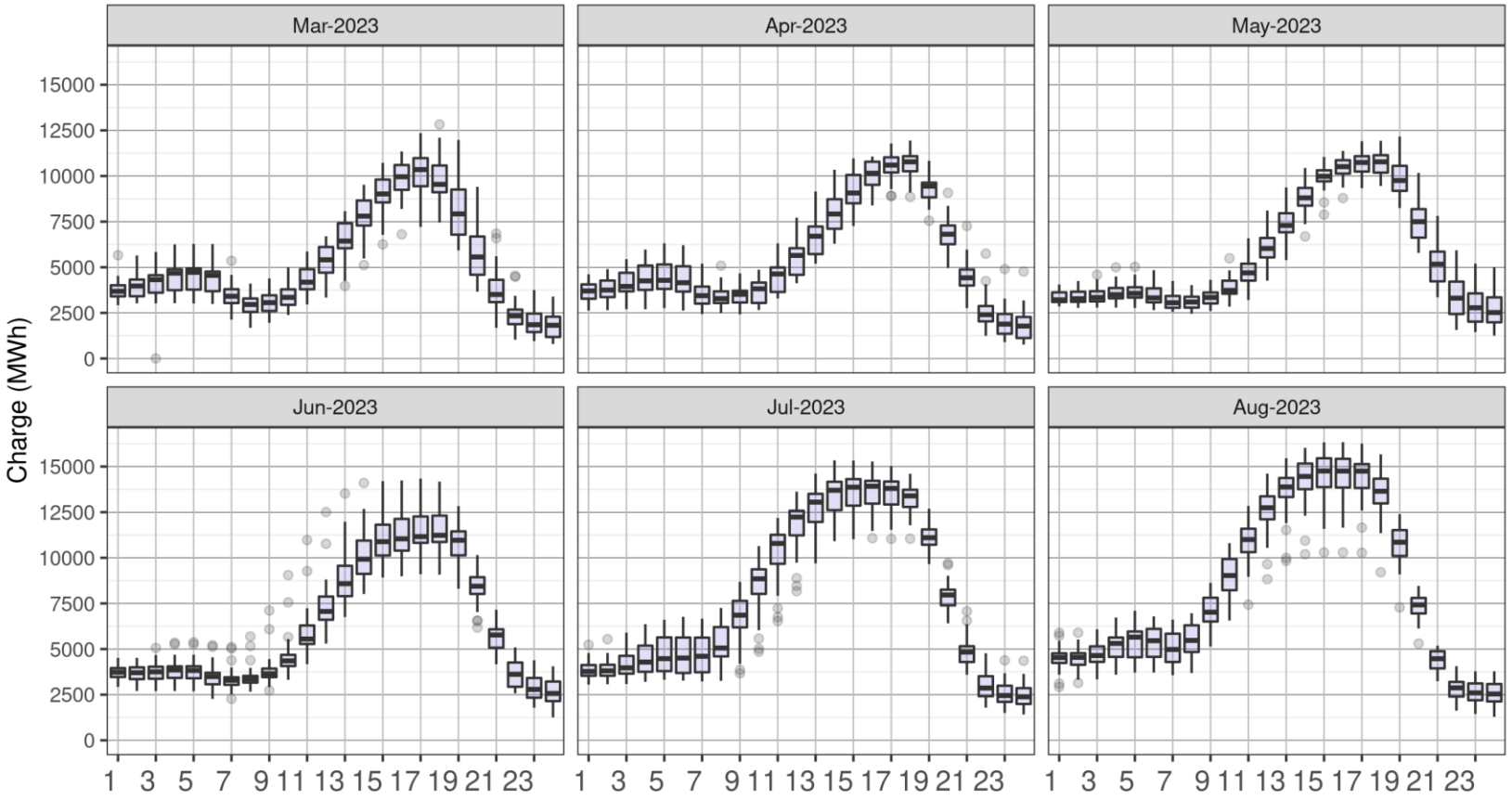
- New RUC approach provided **higher coverage** (**98.6%**) than net load histogram approach (**98.1%**). When just considering HE 18-21 this gap increases to > 2%
- New RUC approach maintained **lower average requirement** (**2697 MW**) than net load histogram approach (**2775 MW**).
- 2023 Results 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

Batteries

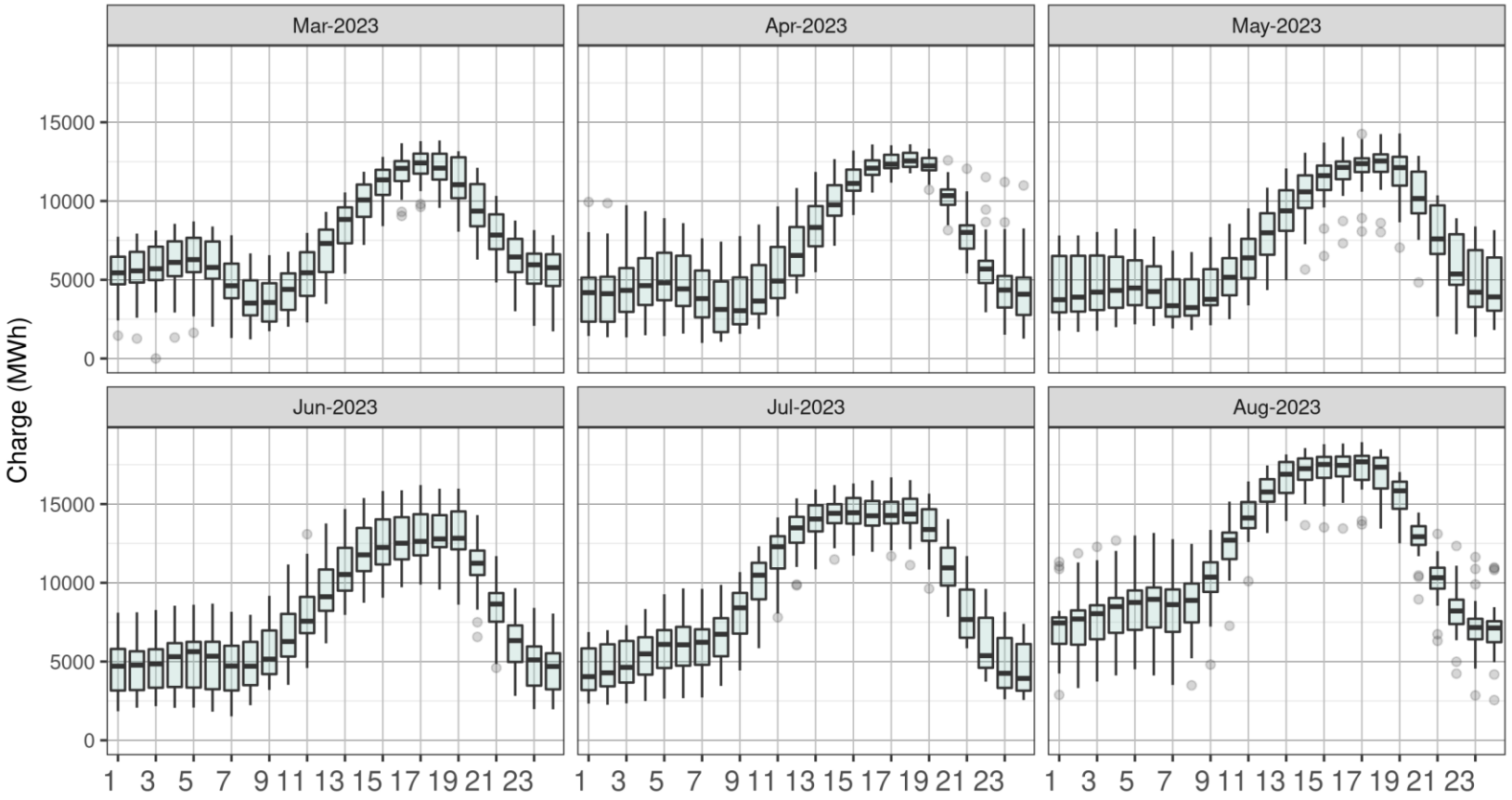
Batteries continue to provide a significant share of both Regulation up and Regulation down



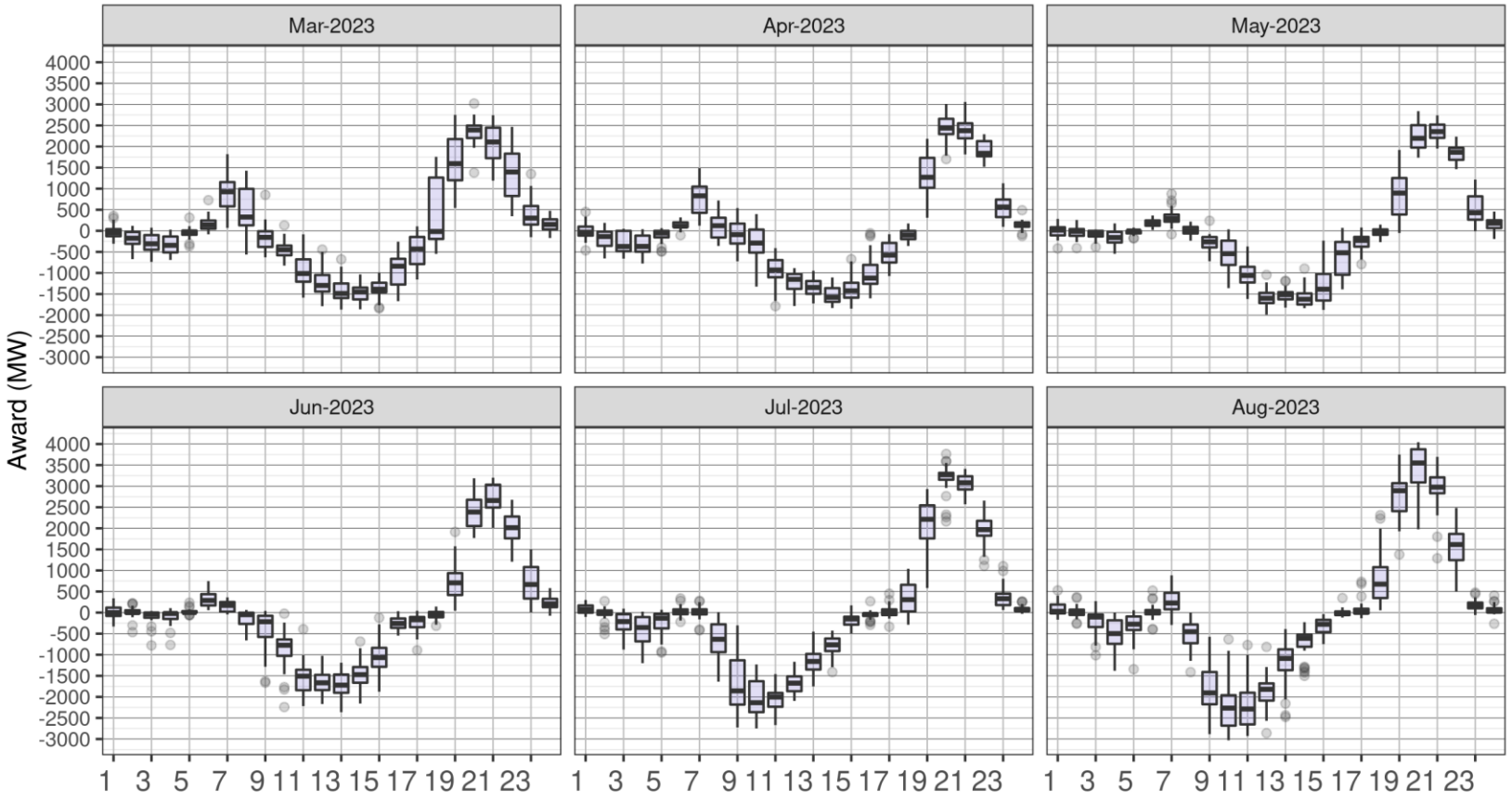
Day-Ahead state of charge for storage resources was the highest in hour ending 14 through 17



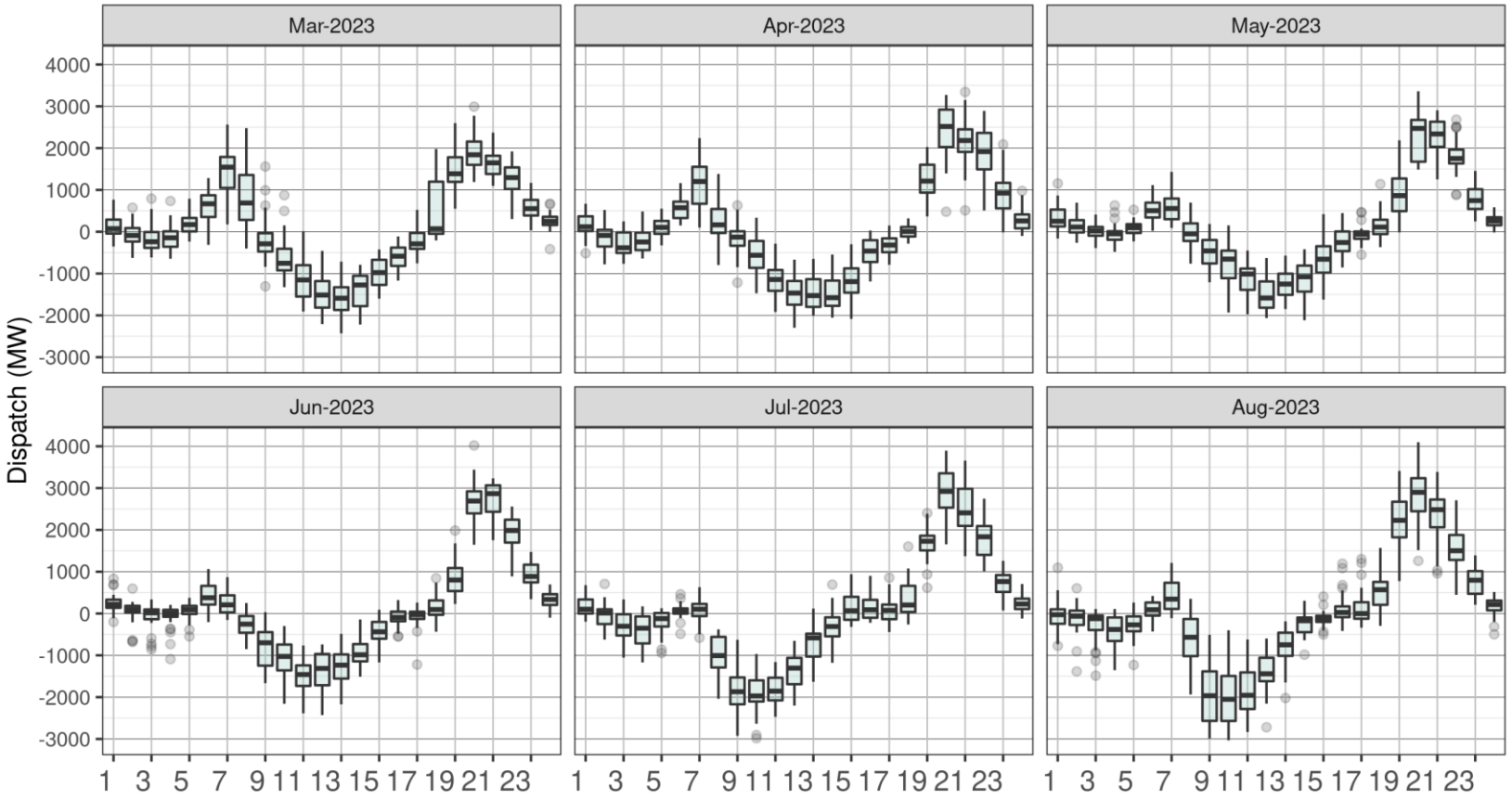
Real-Time State of charge for storage resources was in line with the day-ahead state of charge



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

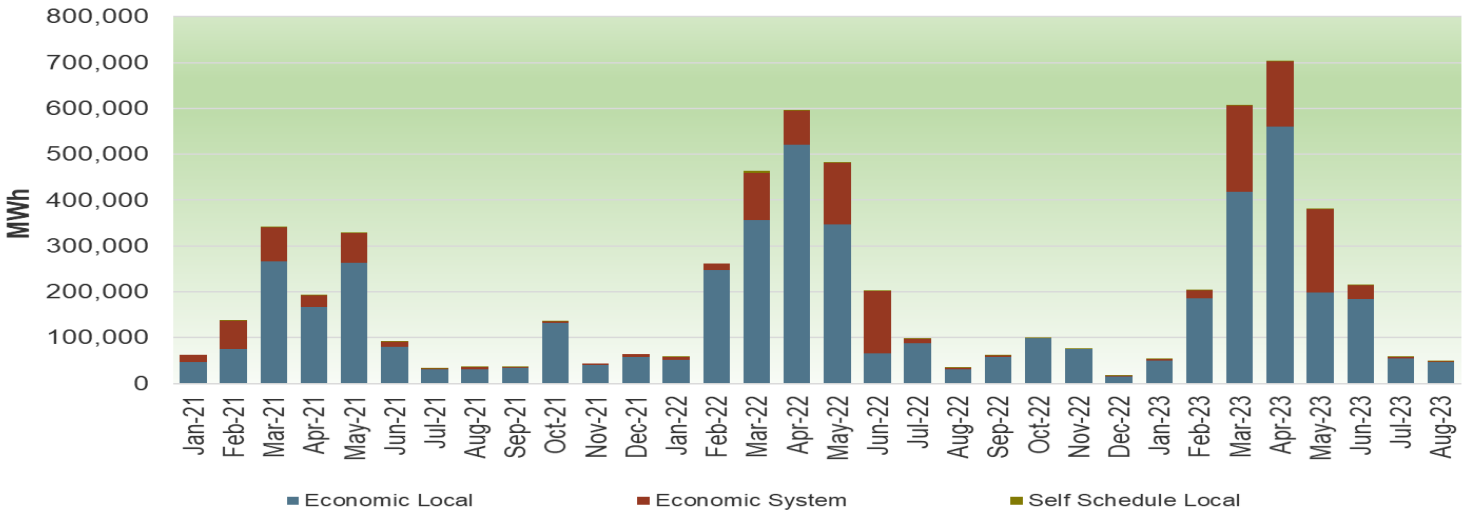


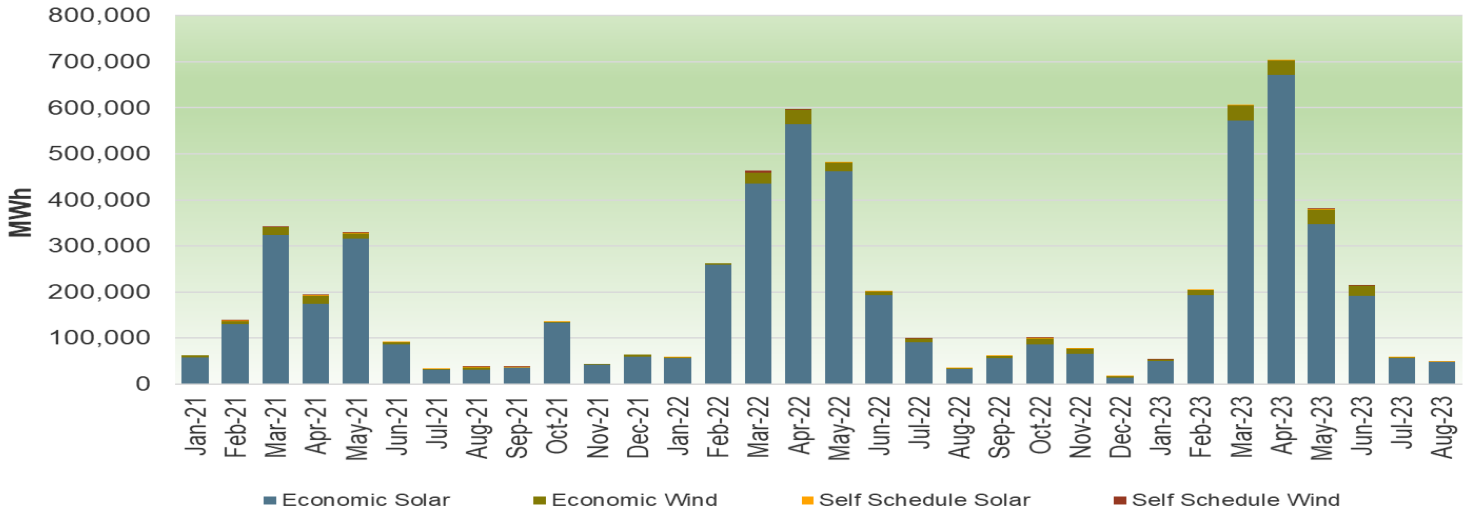
Storage resources were consistently charging during solar hours and discharging during net load peaks



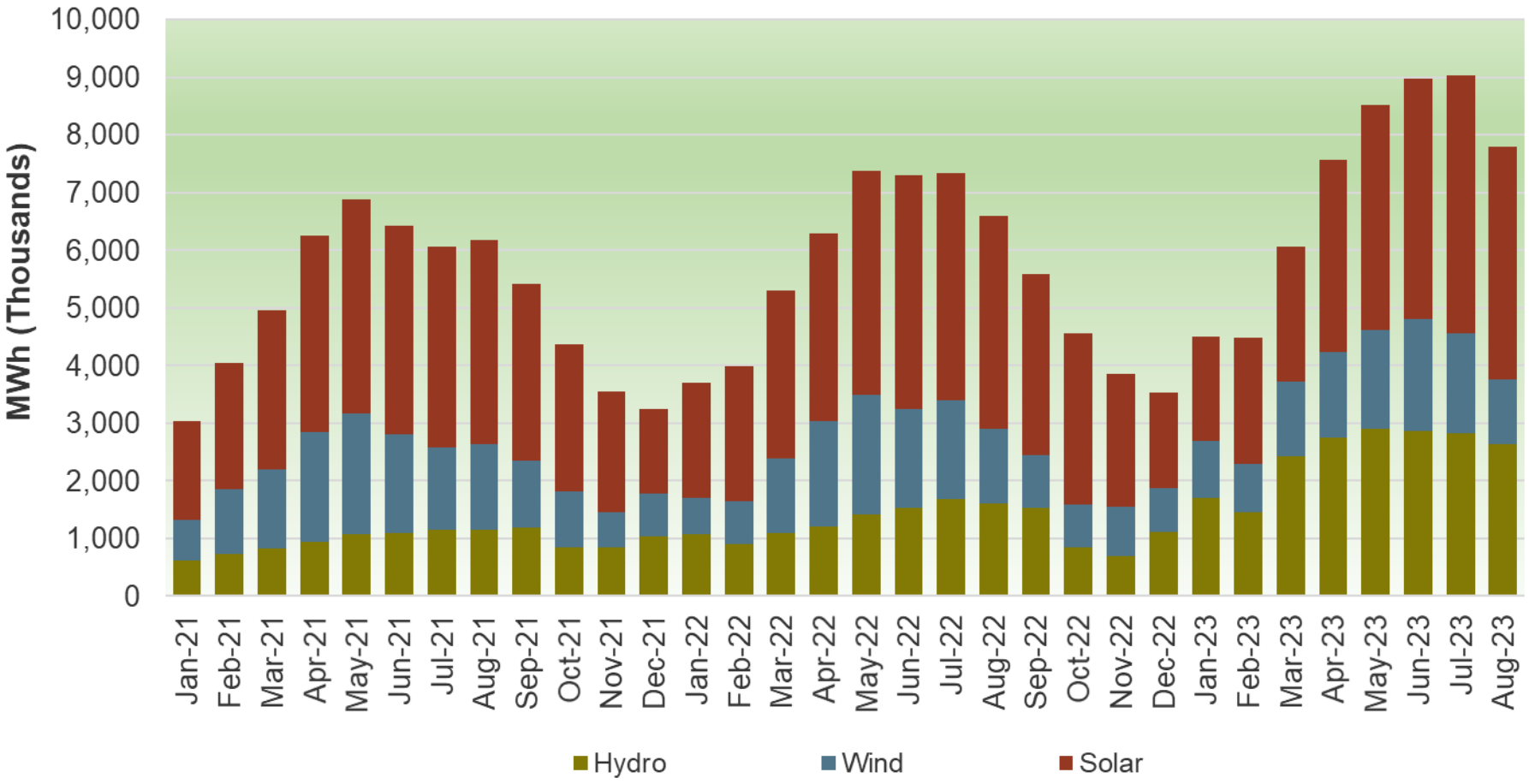
Market Performance Metrics

RTD renewable (VERs) curtailment fell since April

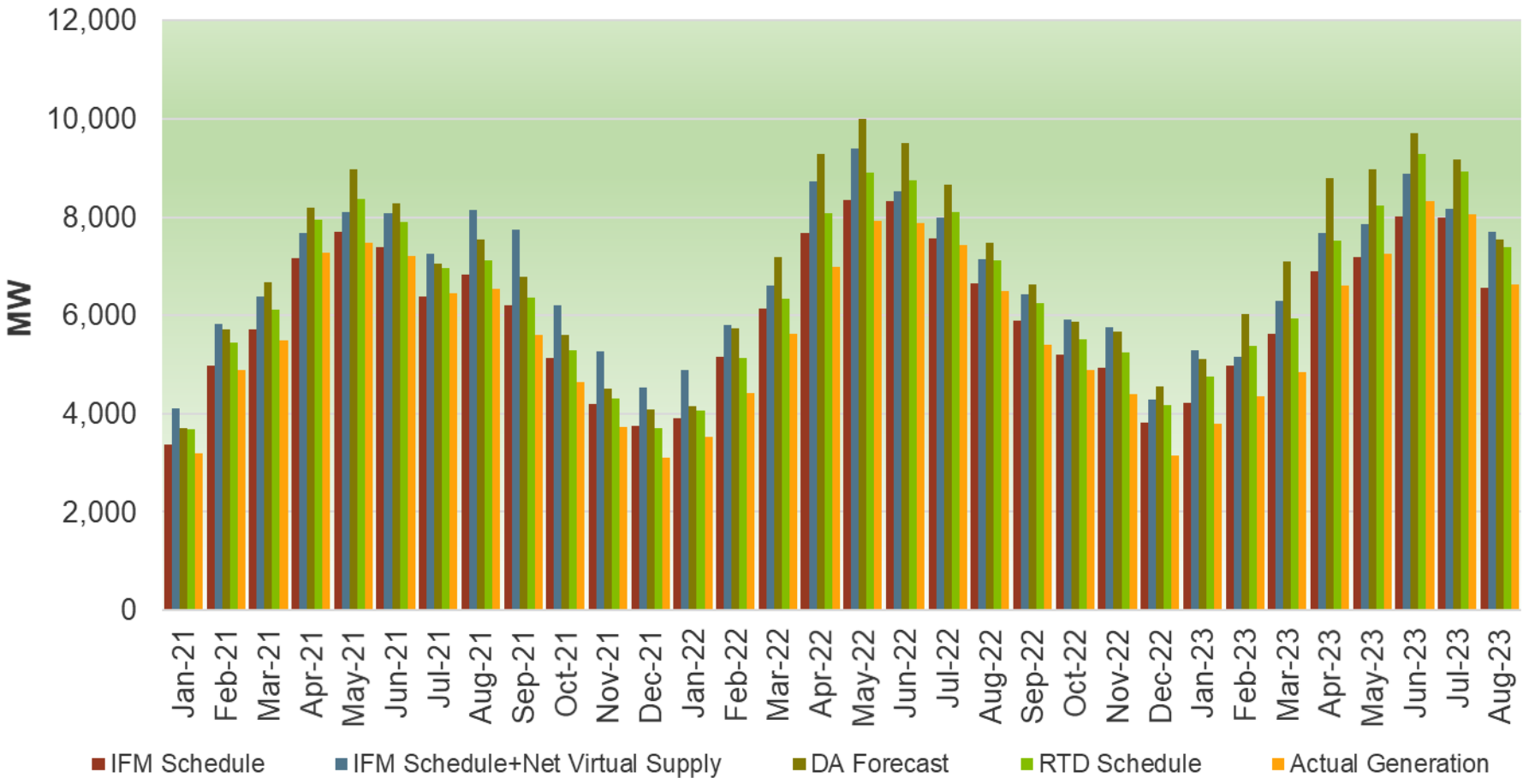




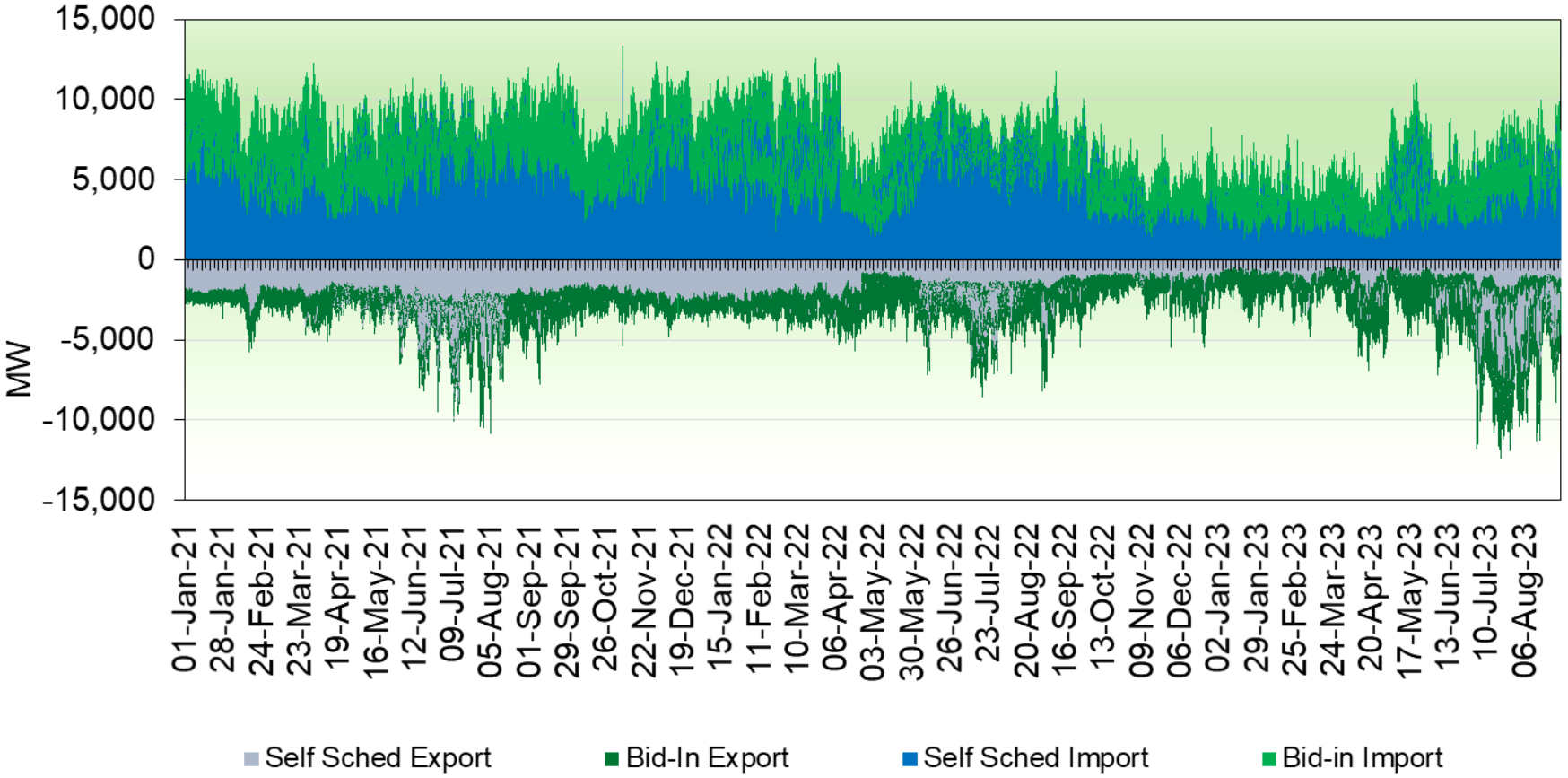
Hydro production higher than previous years



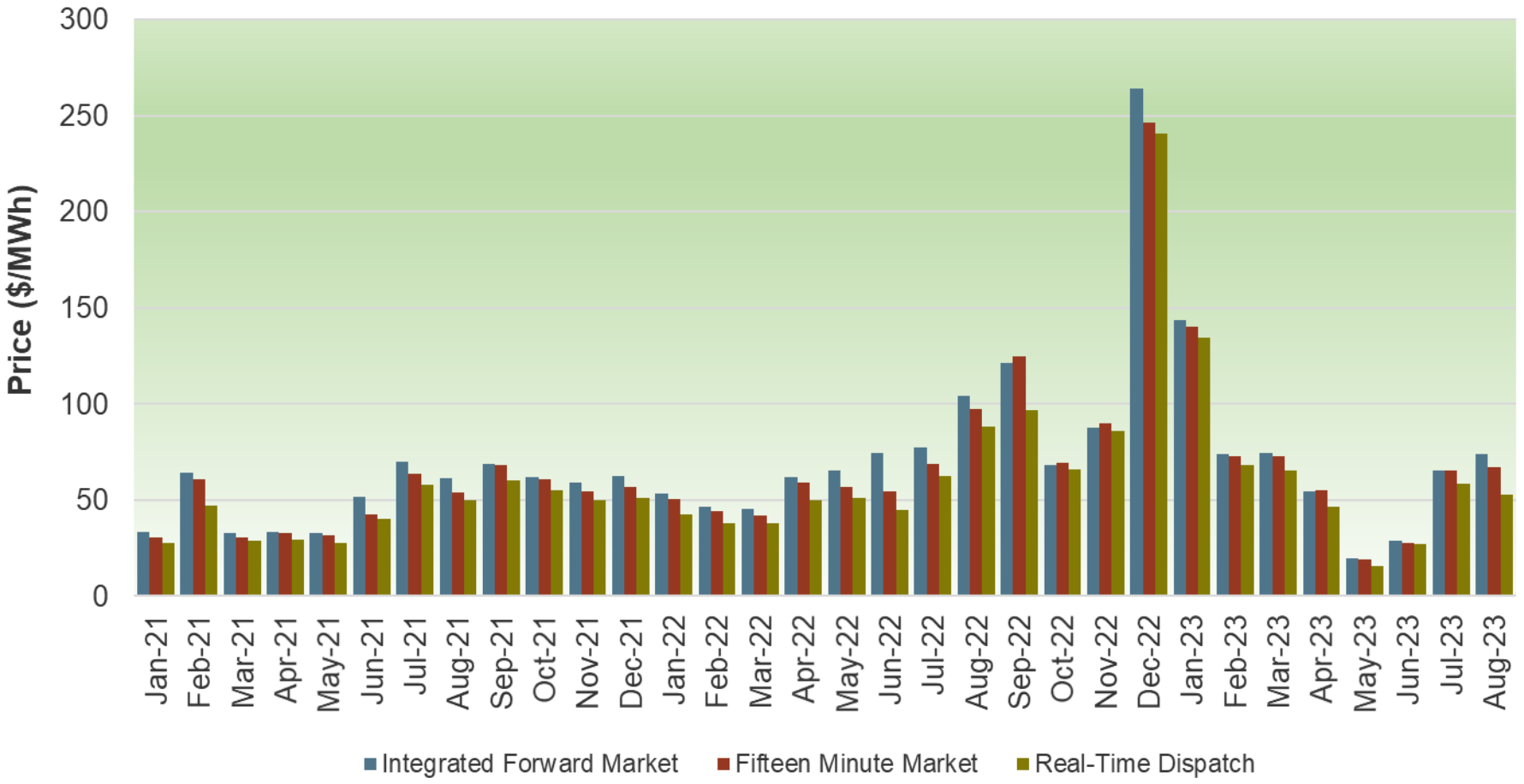
ISO total monthly VERS schedules and forecasts compared to actuals



Self scheduled exports started to rise since June

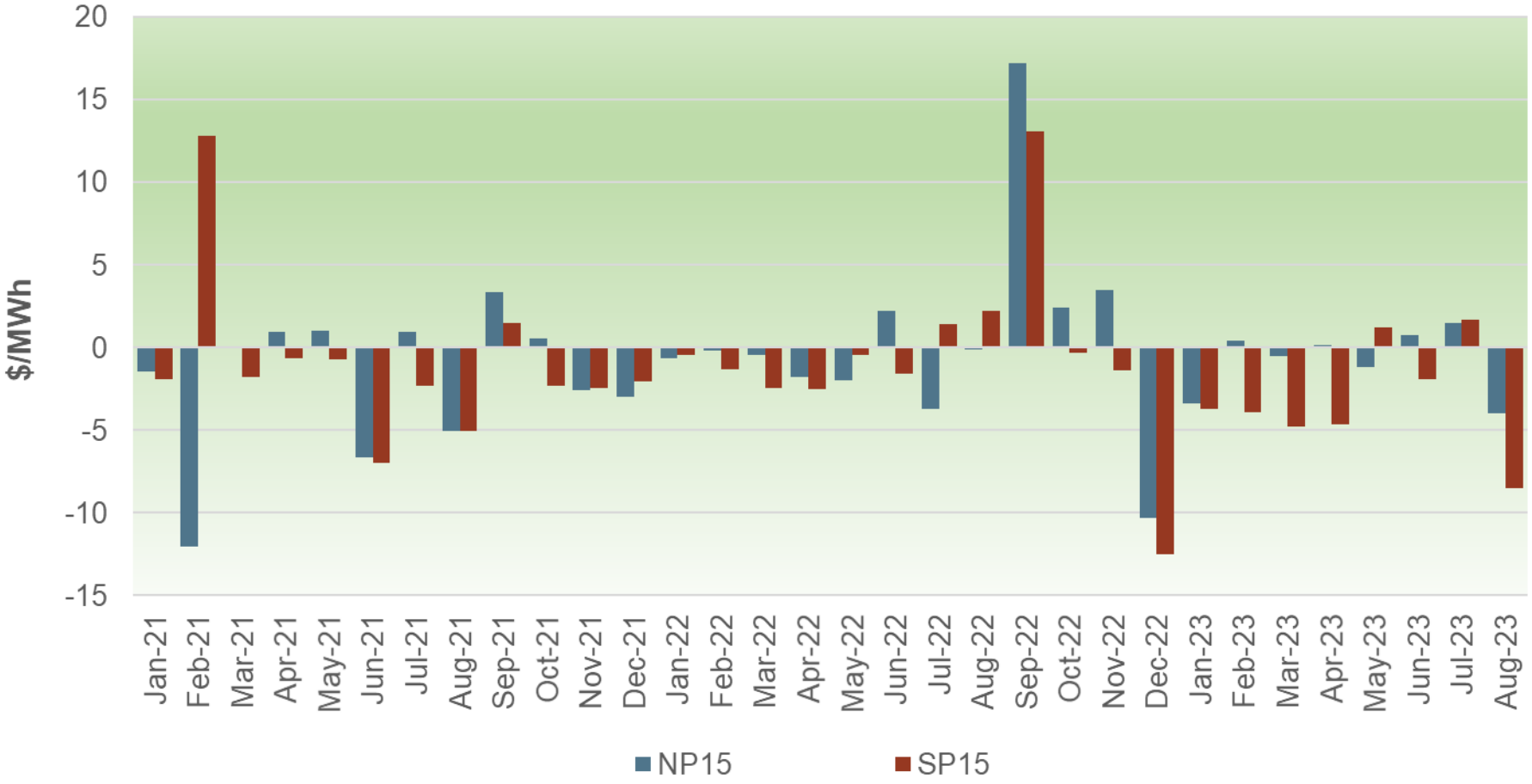


Prices increased in July and August when demand was higher

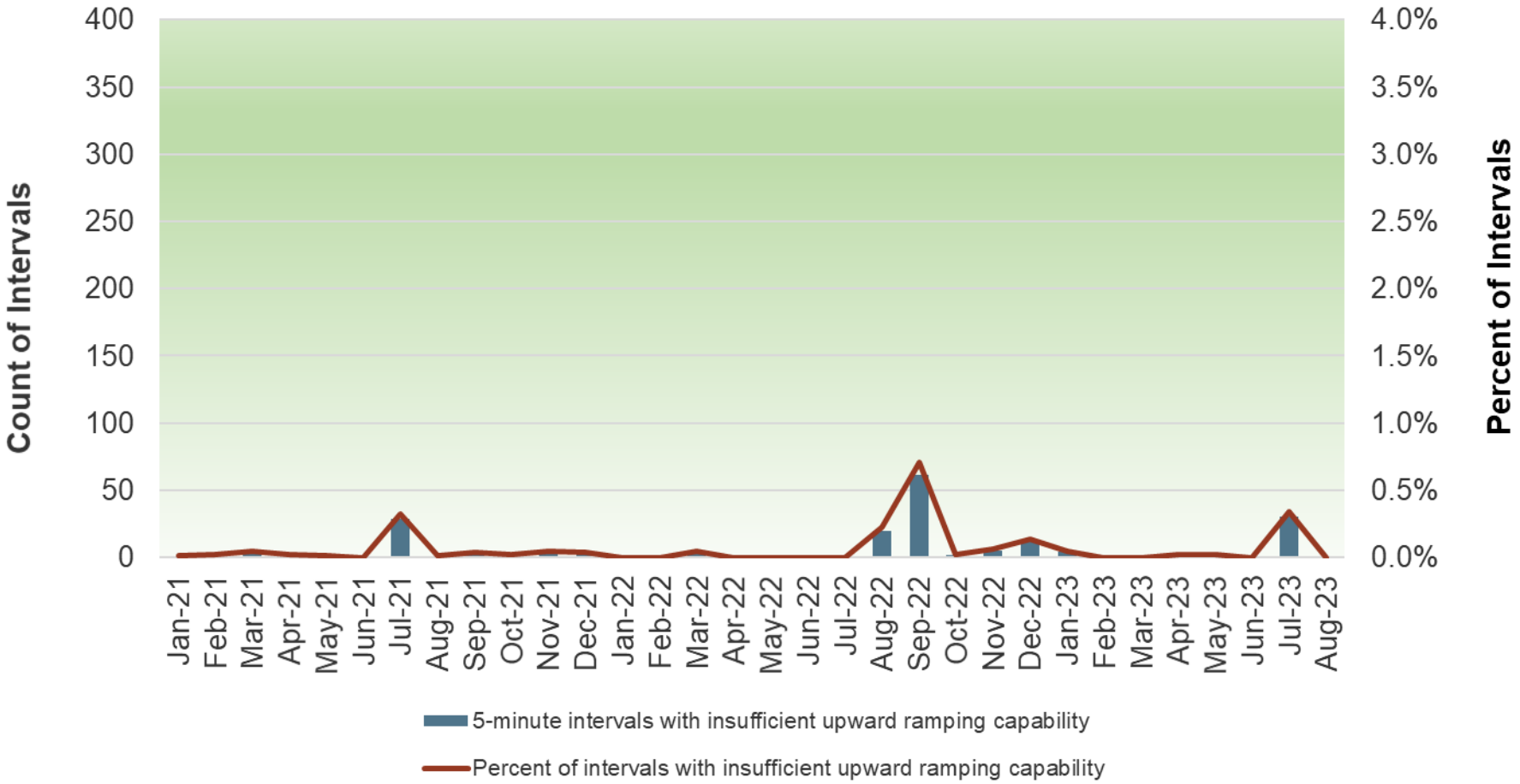


Note: Metric Based on System Marginal Energy Component (SMEC)

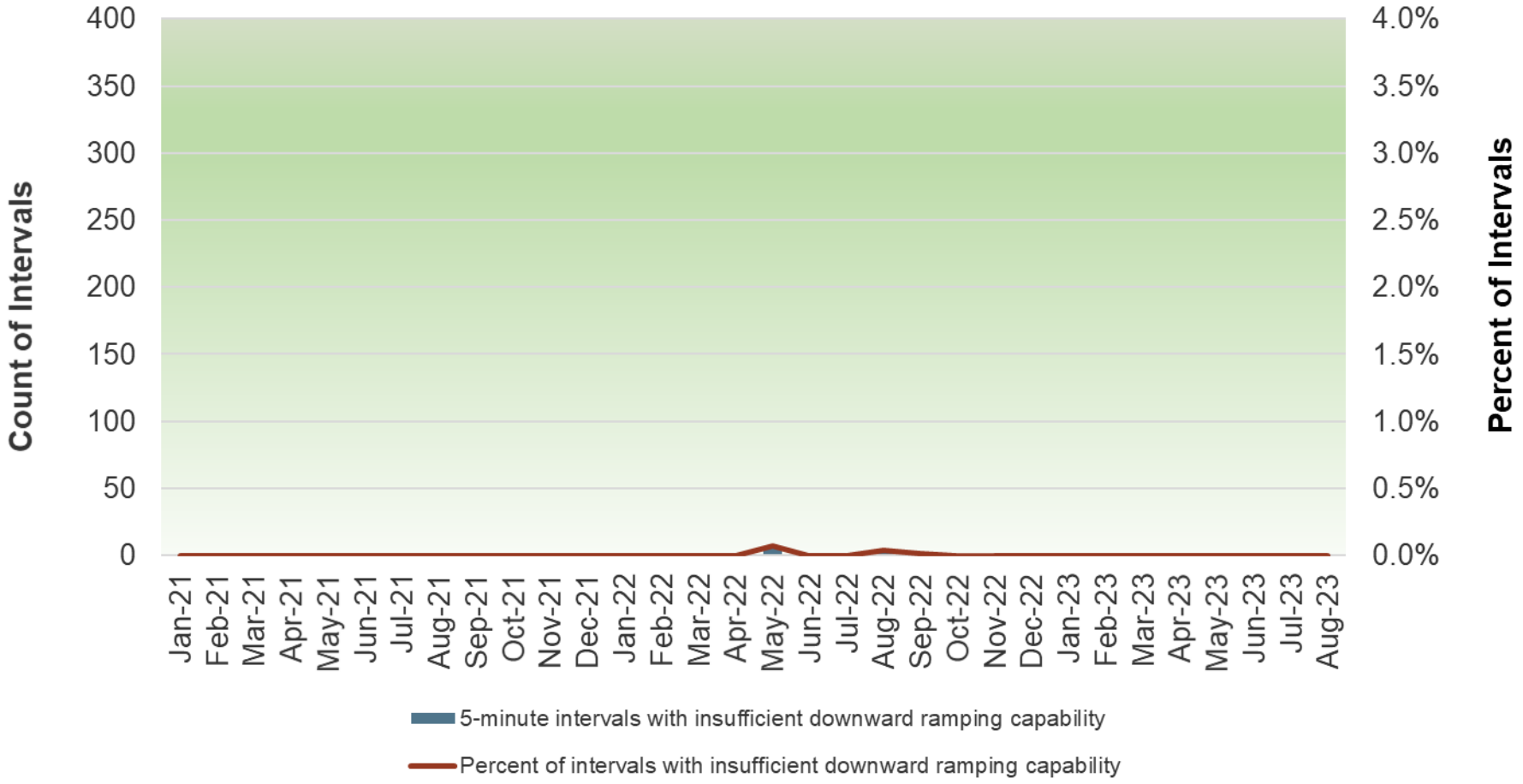
Real-time prices lower than day-ahead prices for both NP15 and SP15 in August



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

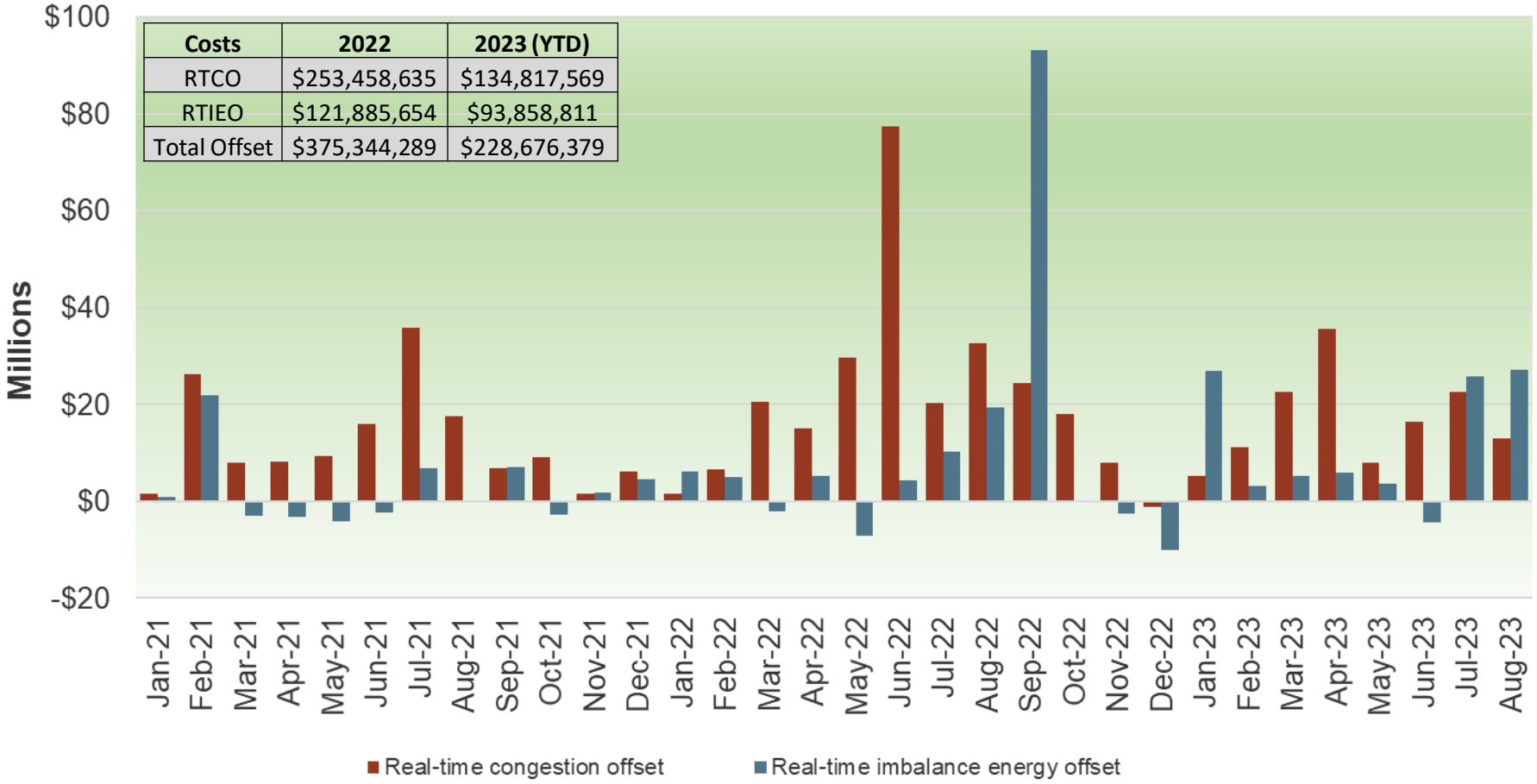


Insufficient downward ramping capacity in real-time stayed low

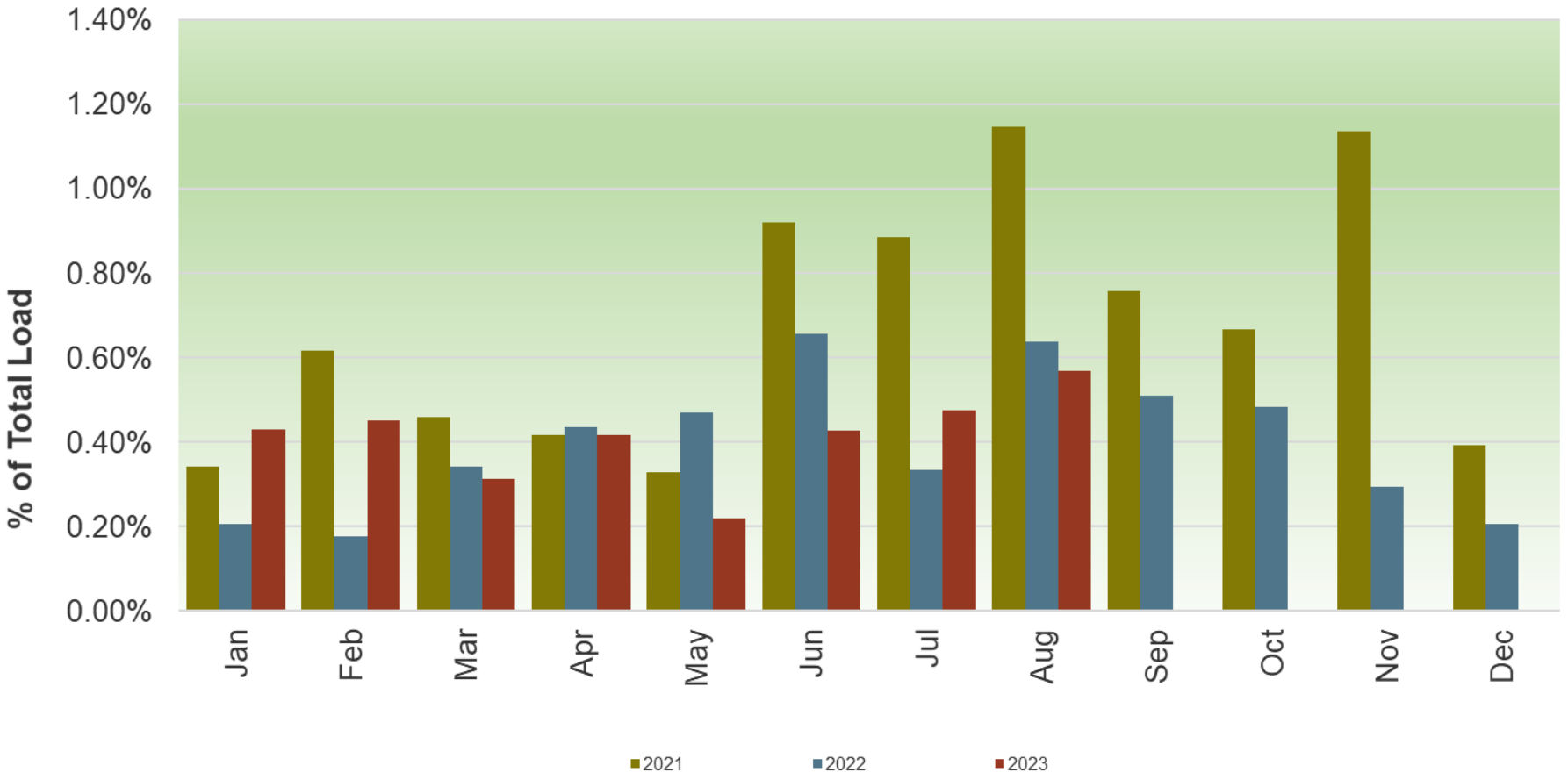


ISO area real-time energy offset increased in July and August

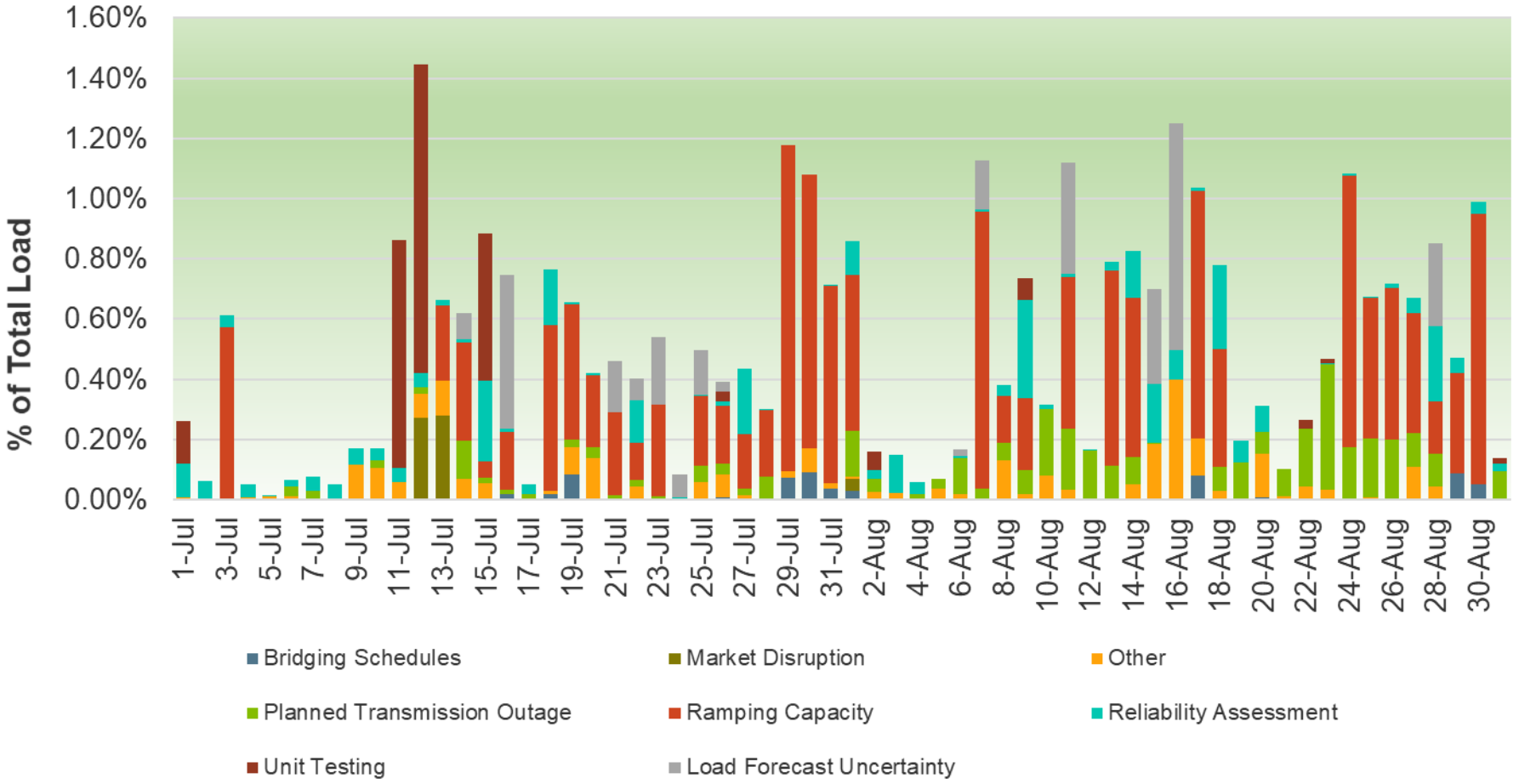
Costs	2022	2023 (YTD)
RTCO	$253,458,635	$134,817,569
RTIEO	$121,885,654	$93,858,811
Total Offset	$375,344,289	$228,676,379



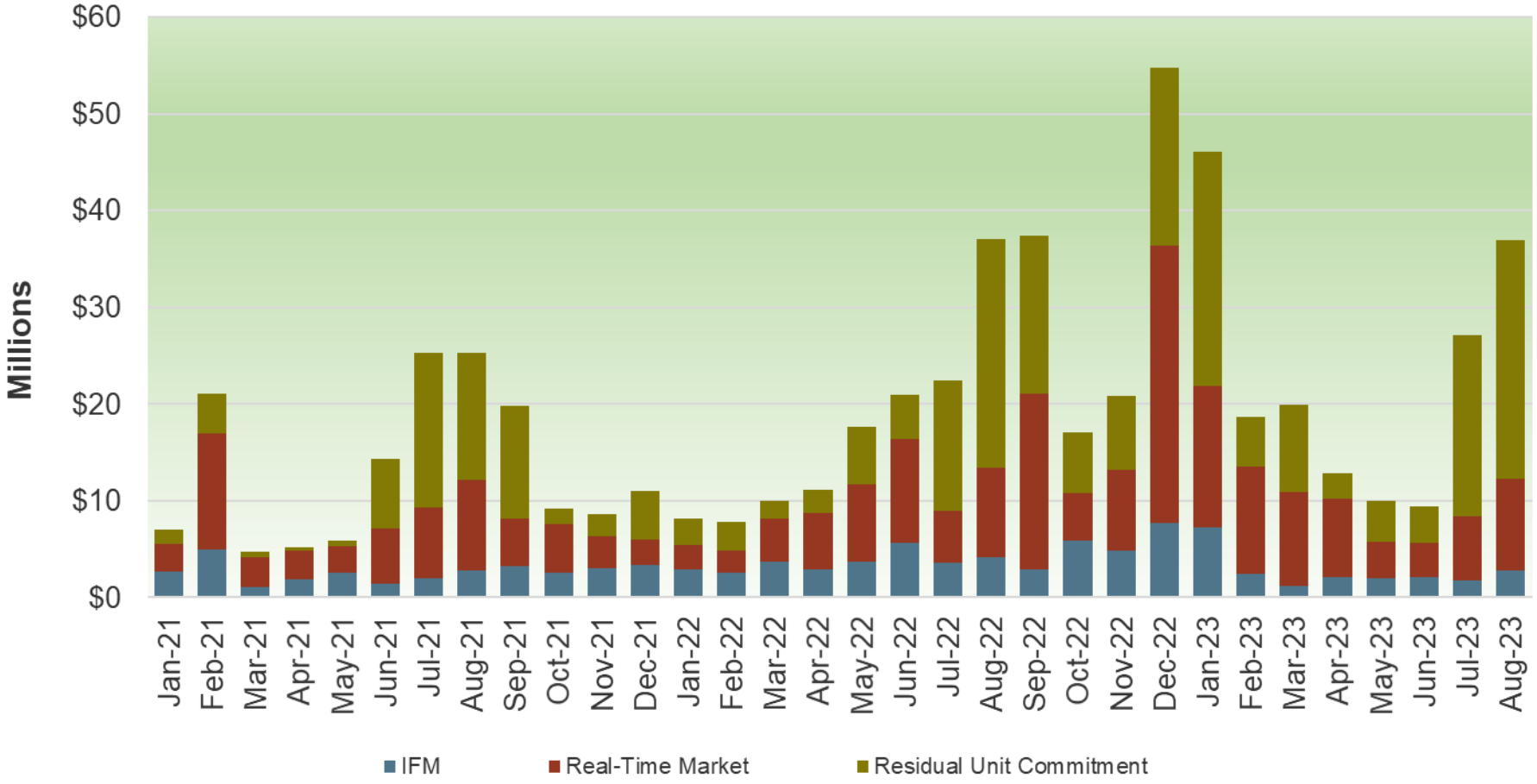
Exceptional dispatch volume in the ISO area are at low levels



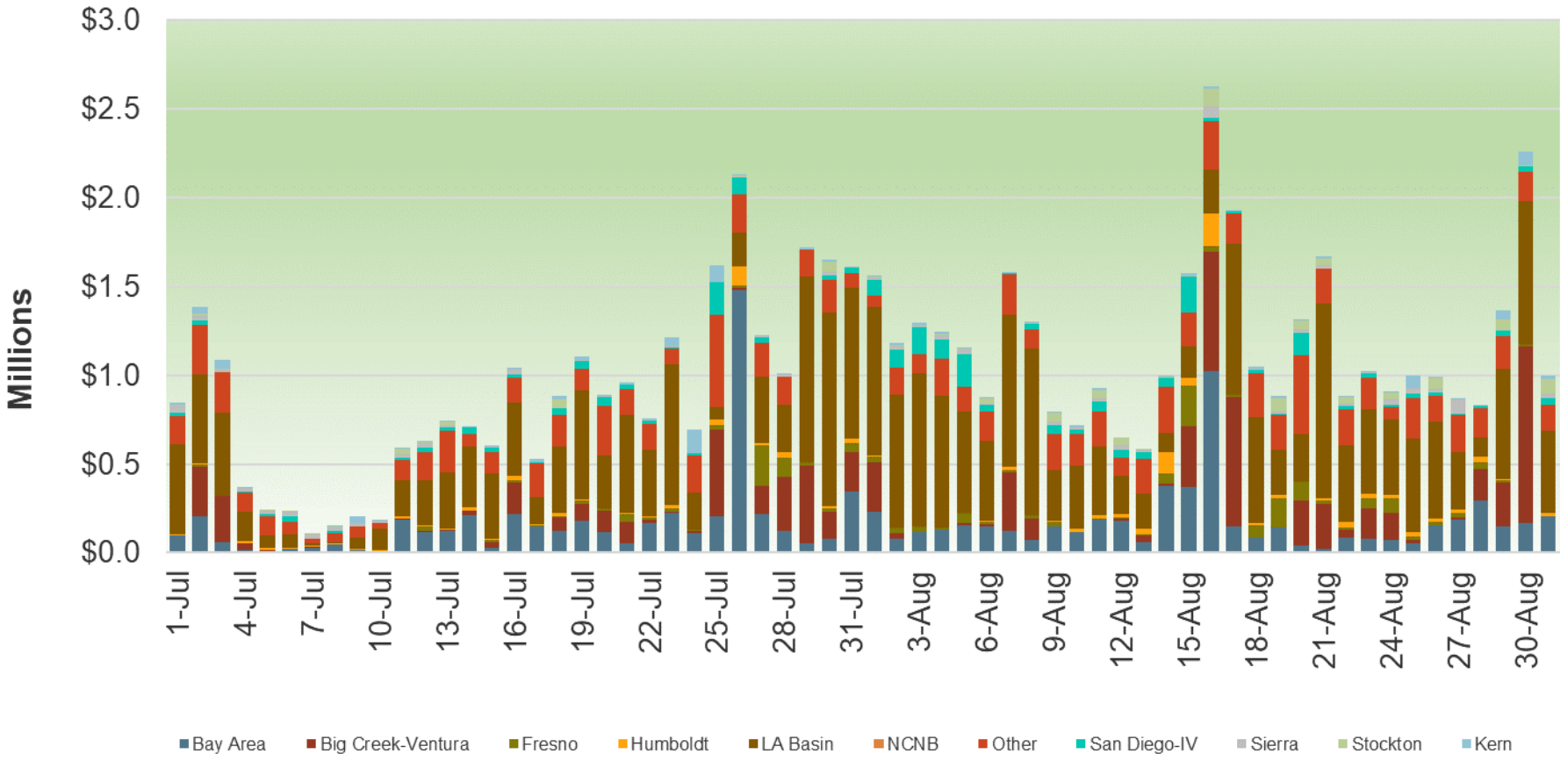
Exceptional dispatches volume driven by a variety of reasons



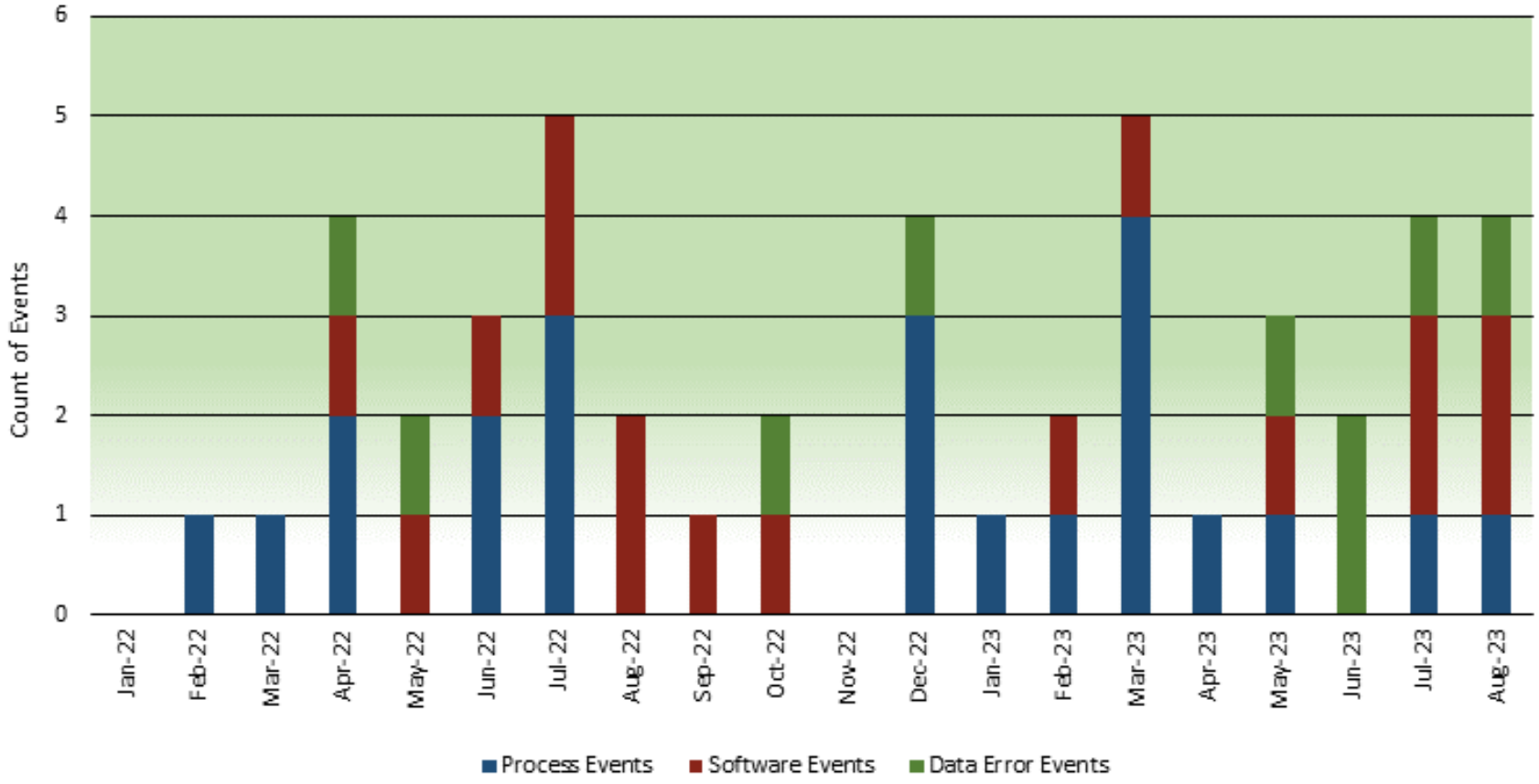
Bid cost recovery rose in July and August



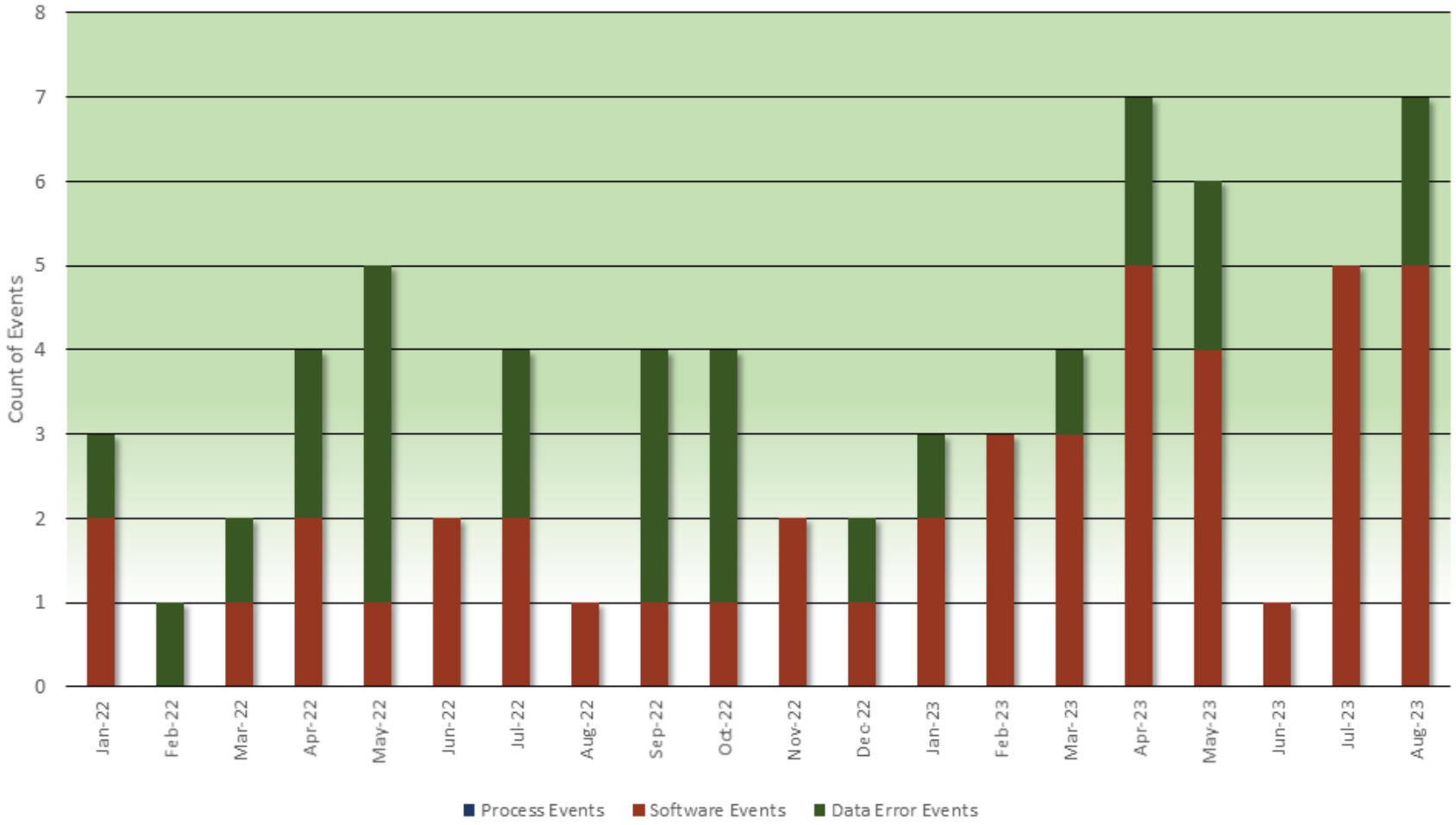
Bid cost recovery (BCR) by Local Capacity Requirement area



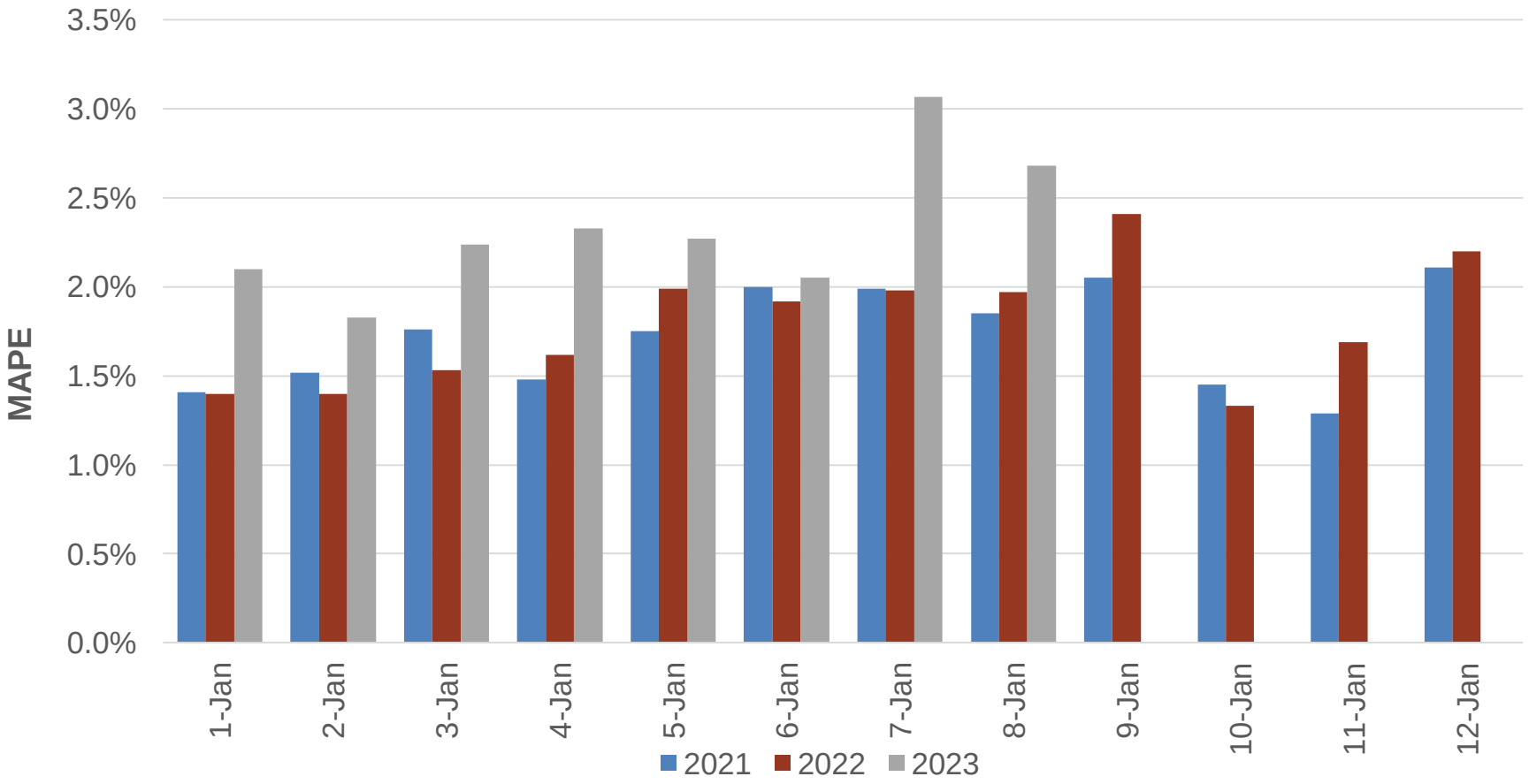
CAISO price correction events increased in July and August



EIM-related price corrections increased in July and August

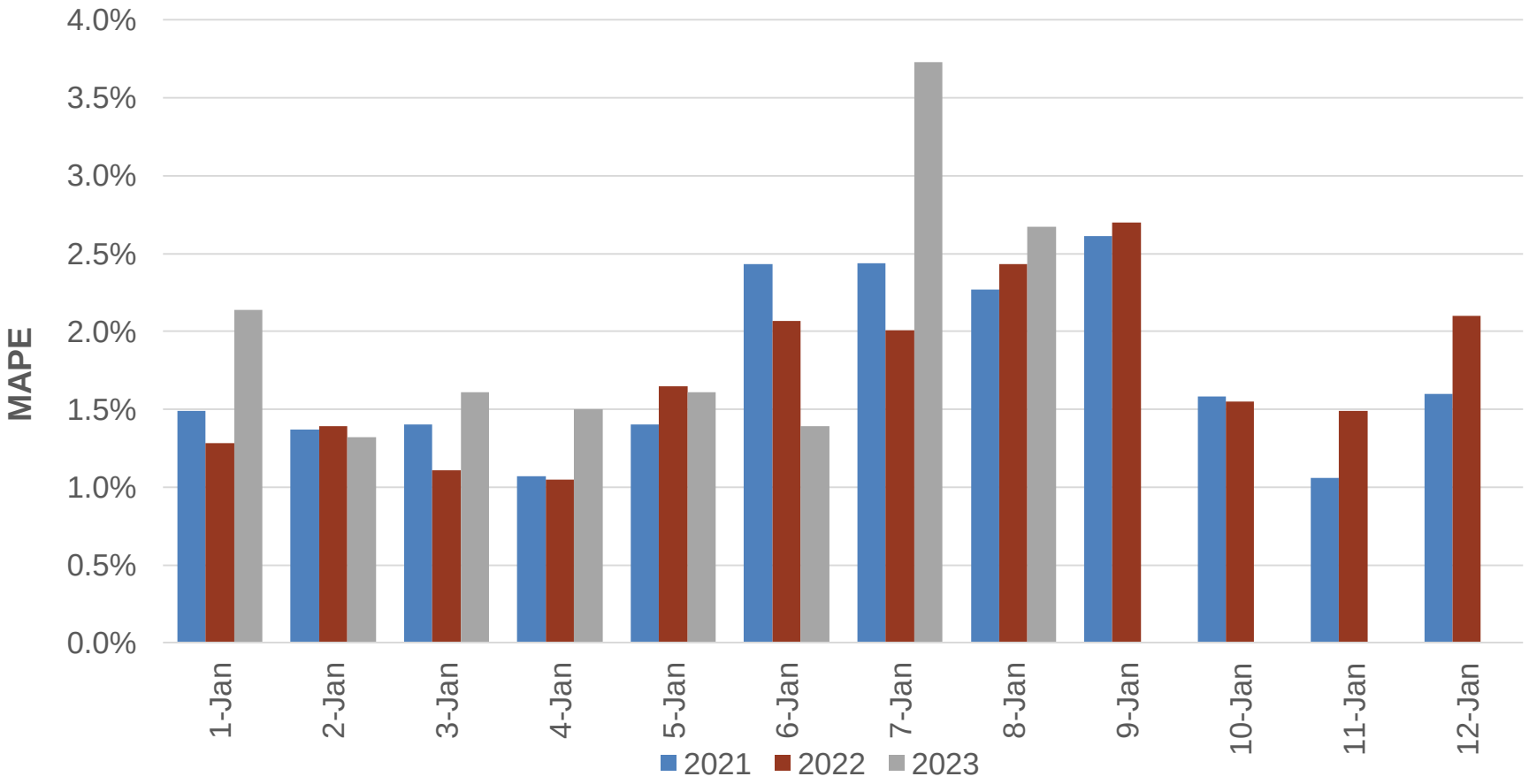


Day-ahead load forecast



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

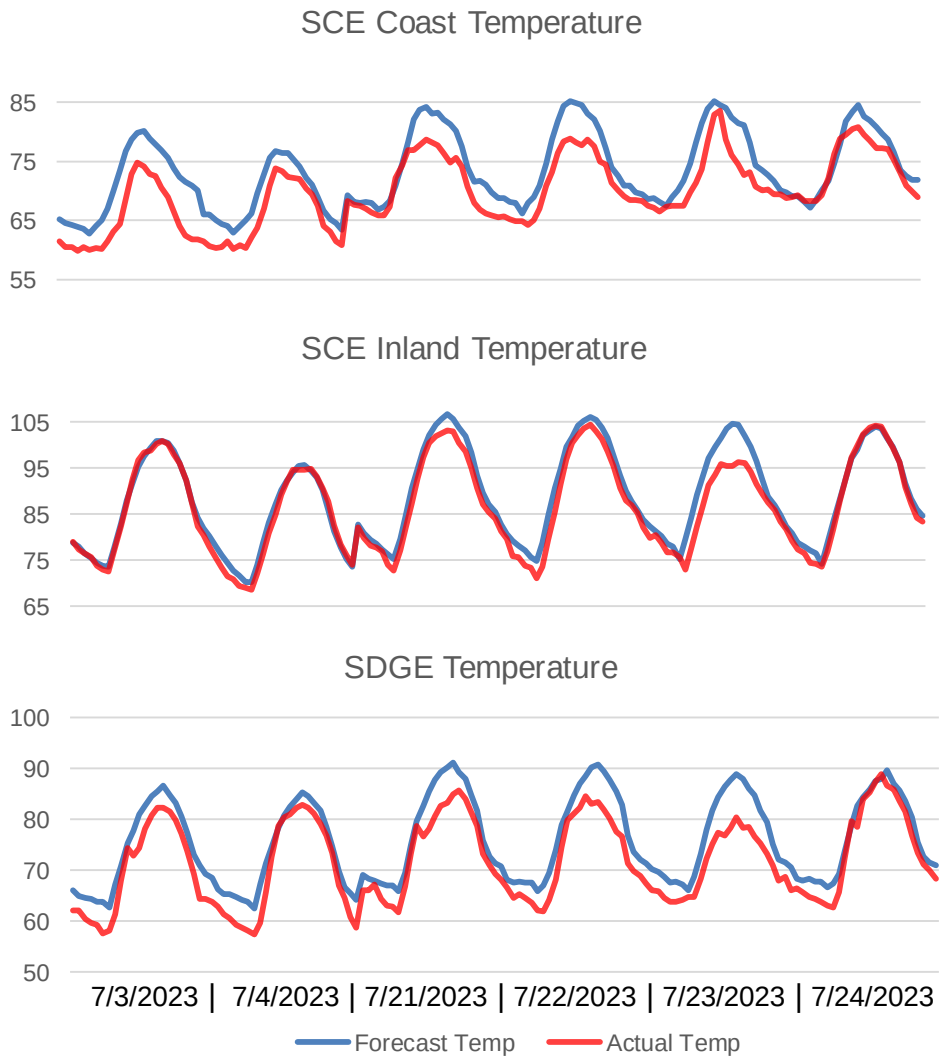
Day-ahead peak forecast



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

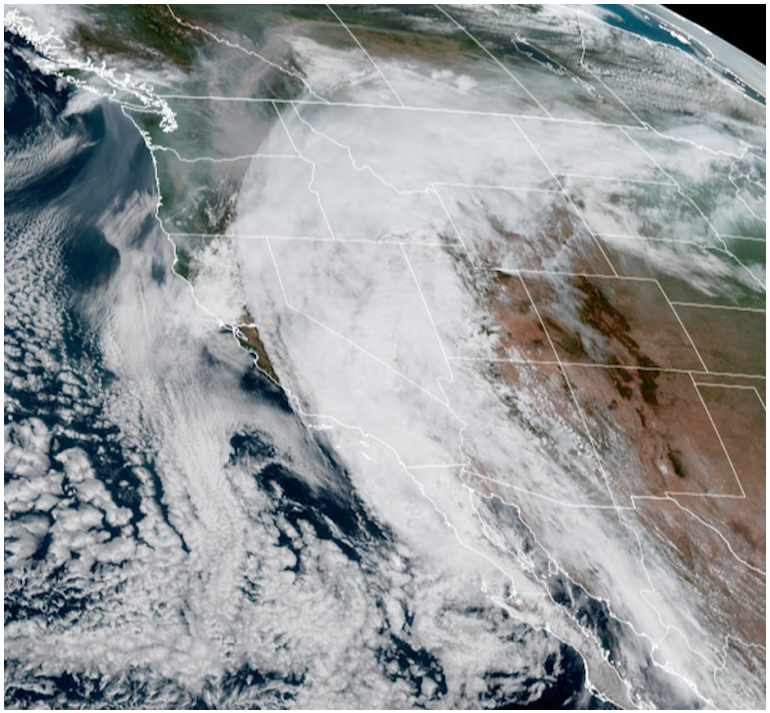
Increased Forecast Error July/August

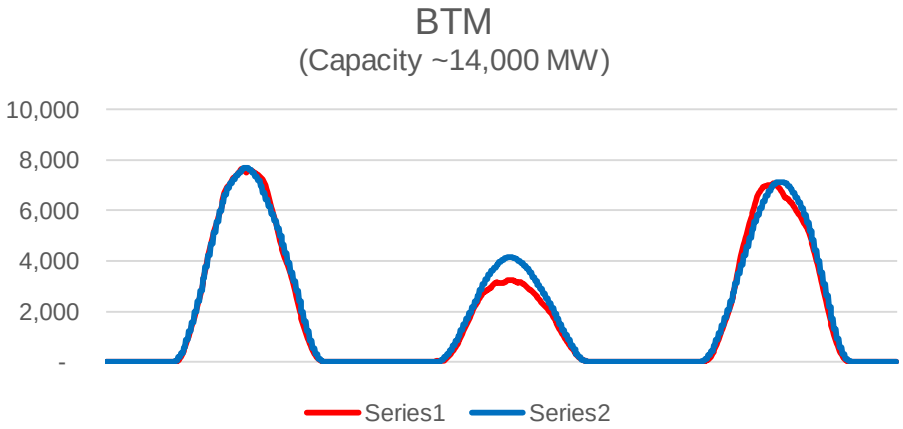
- July 3rd – 4th
  - Floating holiday impacts along with temperatures coming in cooler than expected resulted in over-forecasting loads
- July 21st – 24th
  - Cloud cover, especially across southern California, led to cooler temperatures and lower loads



Increased Forecast Error July/August

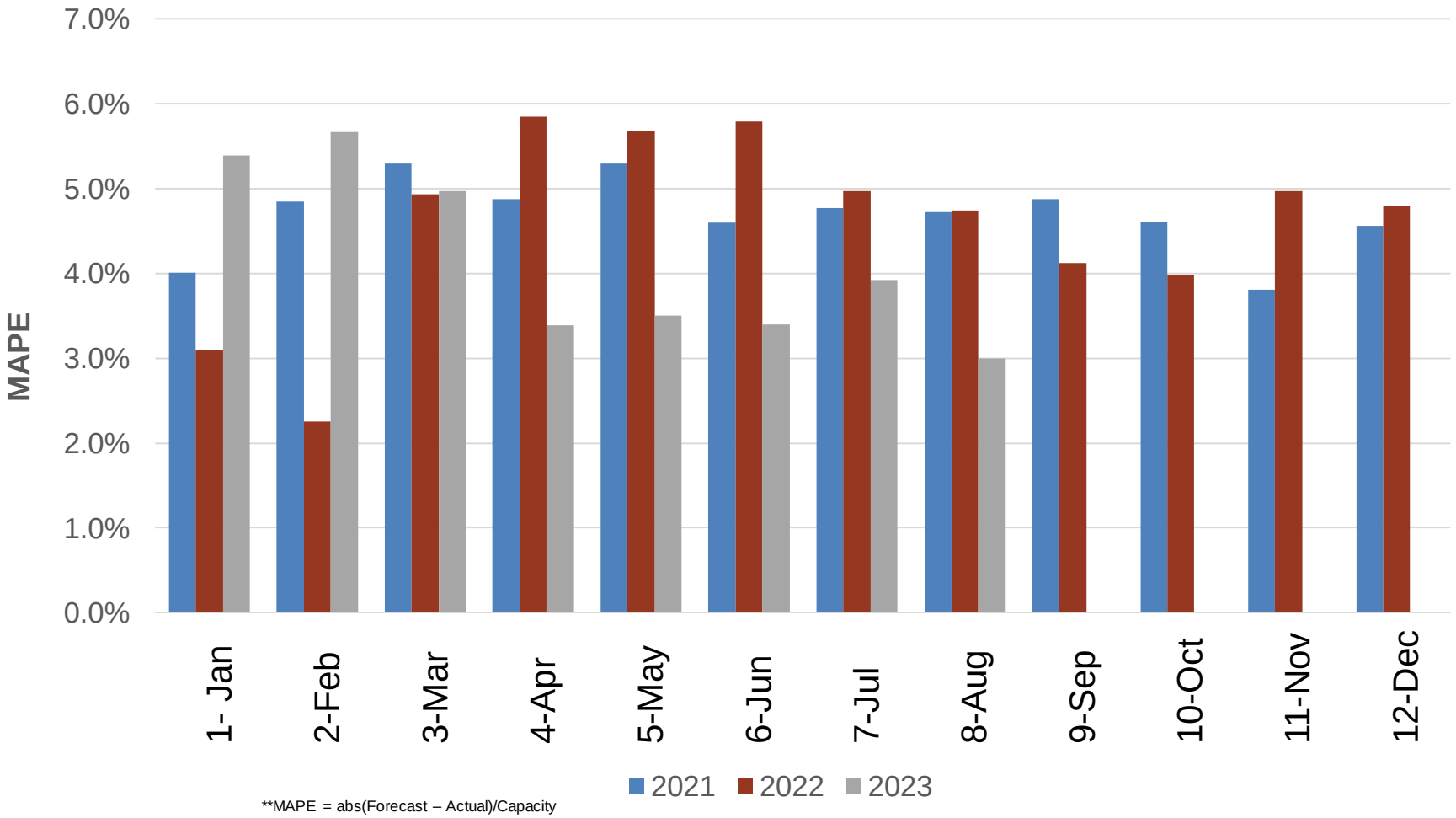
- August 19th – 21st
  - Hurricane Hilary led to cool temperatures, heavy rainfall, changed behavior and impacts to generation





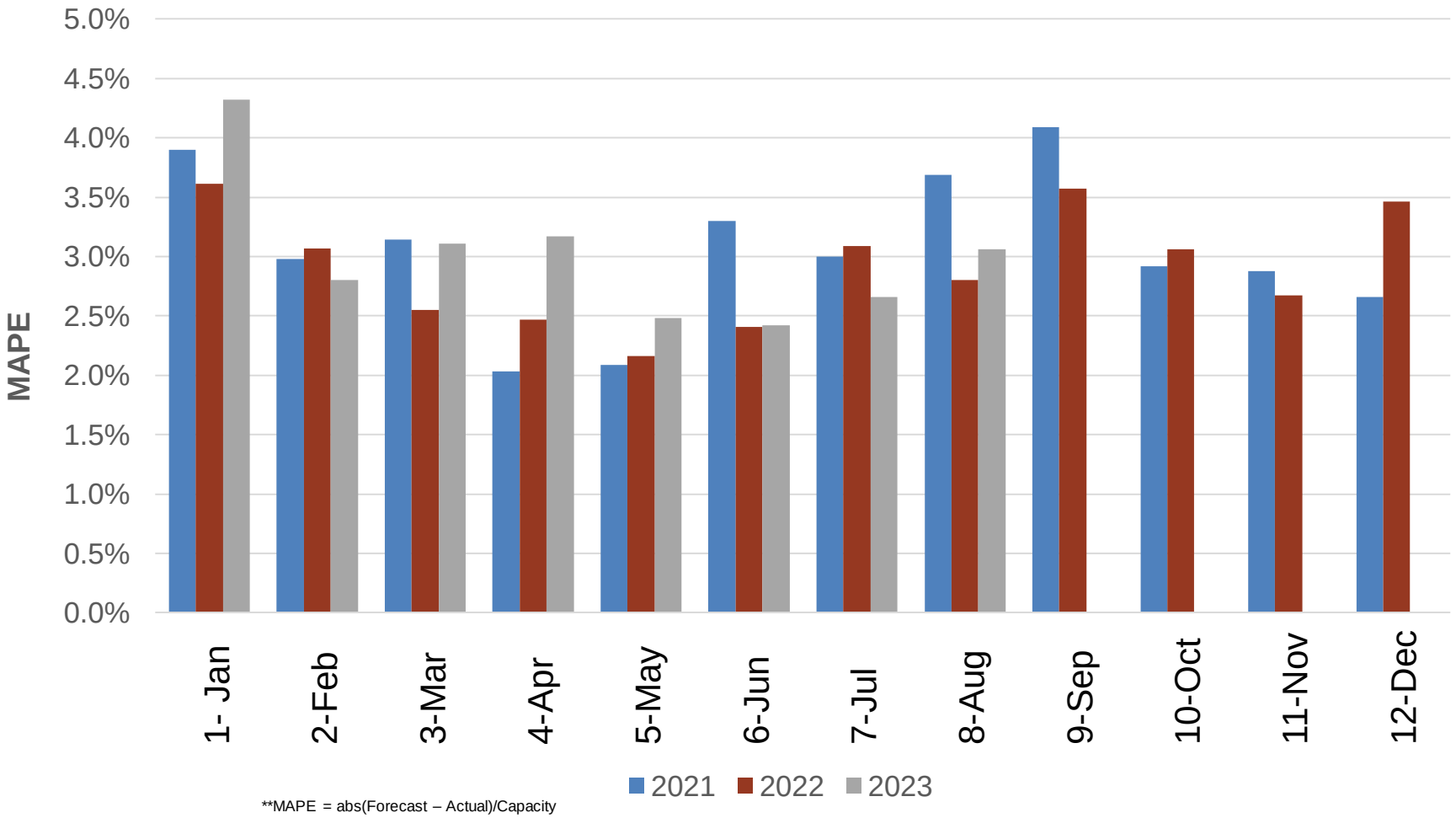
	Region Max Temp over 3 days	Departure from Climo Norms
PGE Bay	76° to 91°	-6° below to 9° above
PGE NonBay	83° to 94°	-10° to 0° below
SCE Coast	75 to 79°	-7° to -3° below
SCE Inland	74 to 90°	-25° to -9° below
SDGE	74 to 80°	-11° to -6° below

Day-ahead wind forecast



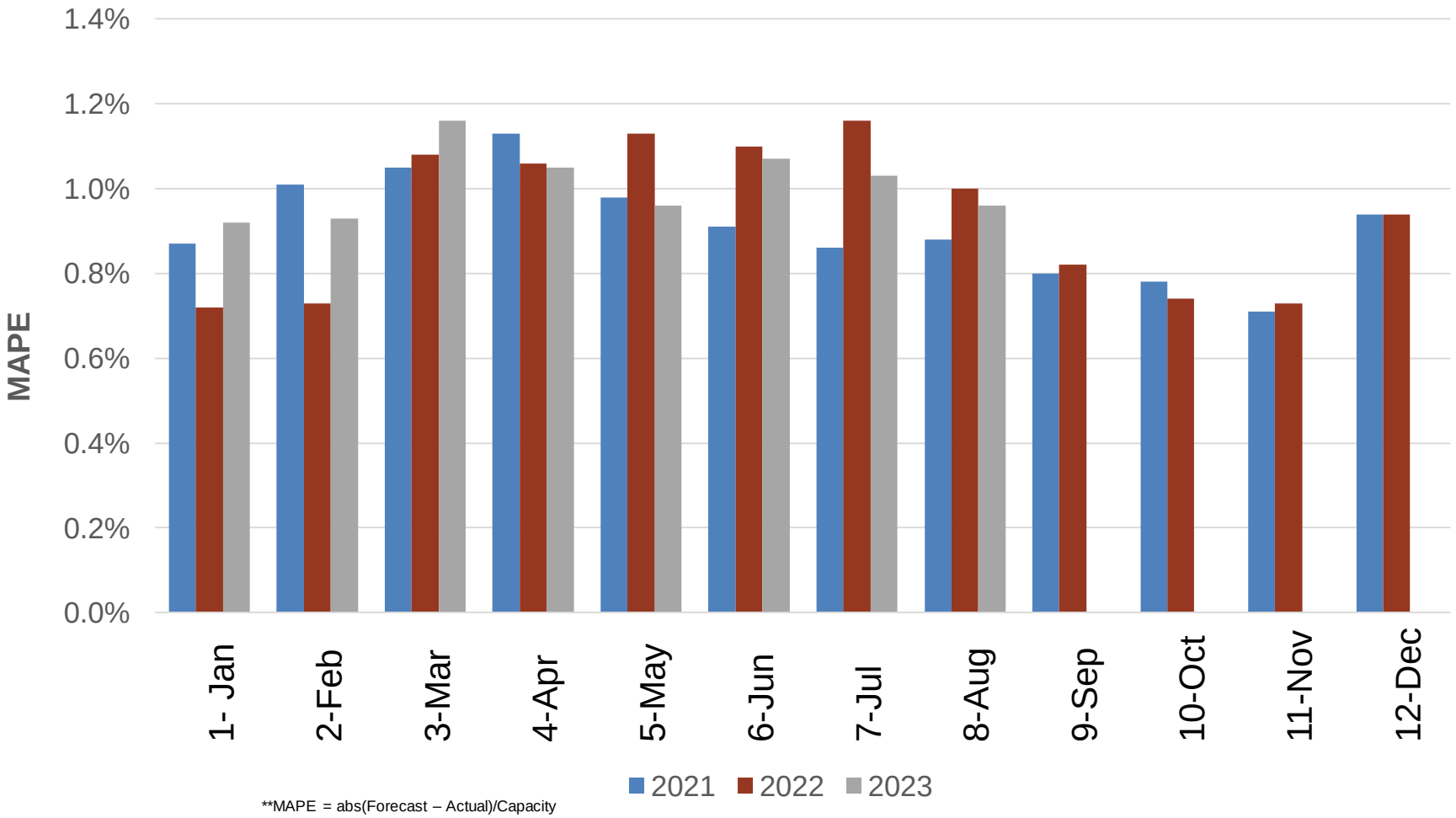
**MAPE = abs(Forecast – Actual)/Capacity

Day-ahead solar forecast



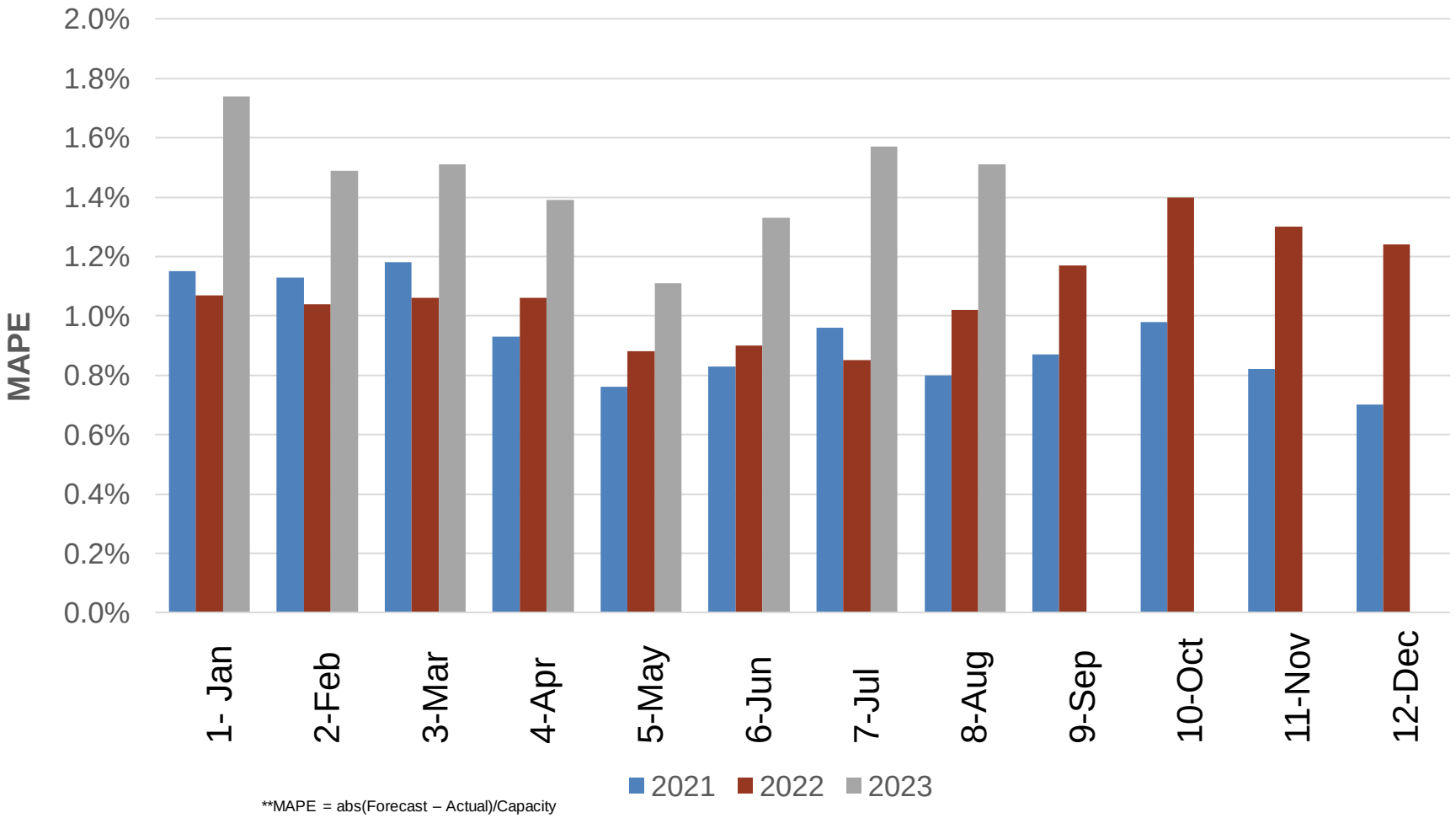
**MAPE = abs(Forecast – Actual)/Capacity

Real-time wind forecast



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

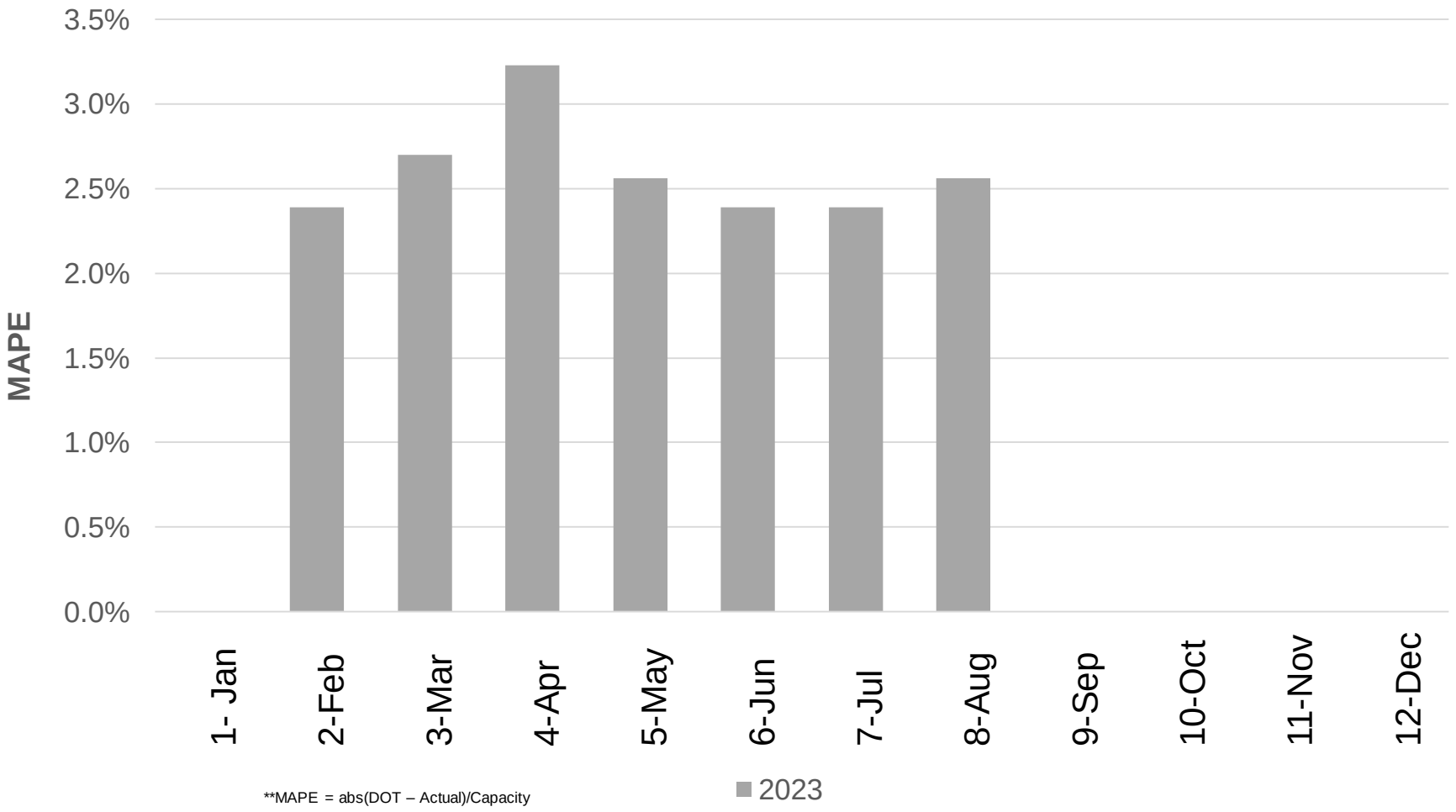
Real-time solar forecast



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

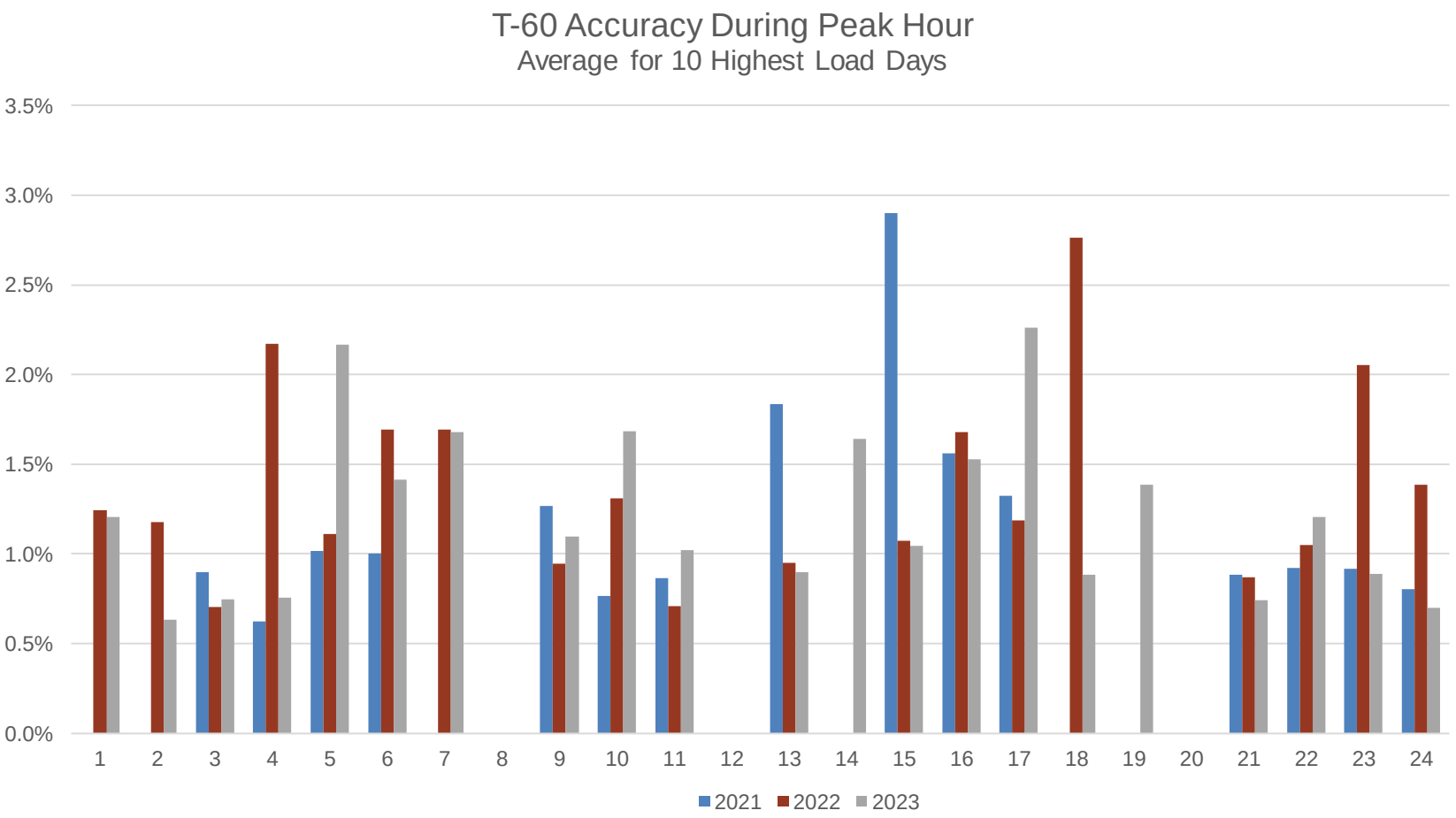
Real Time Solar Hybrid Performance

**Comparison of DOT to MW Production



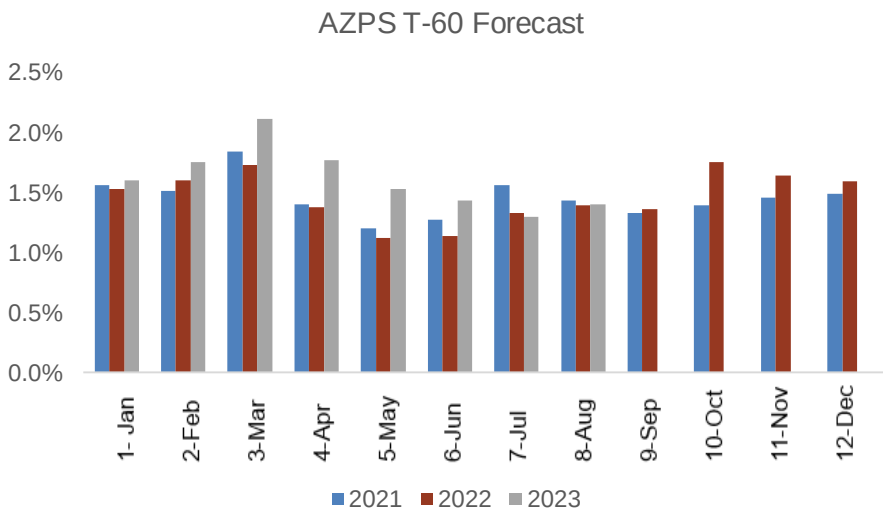
**MAPE = abs(DOT – Actual)/Capacity

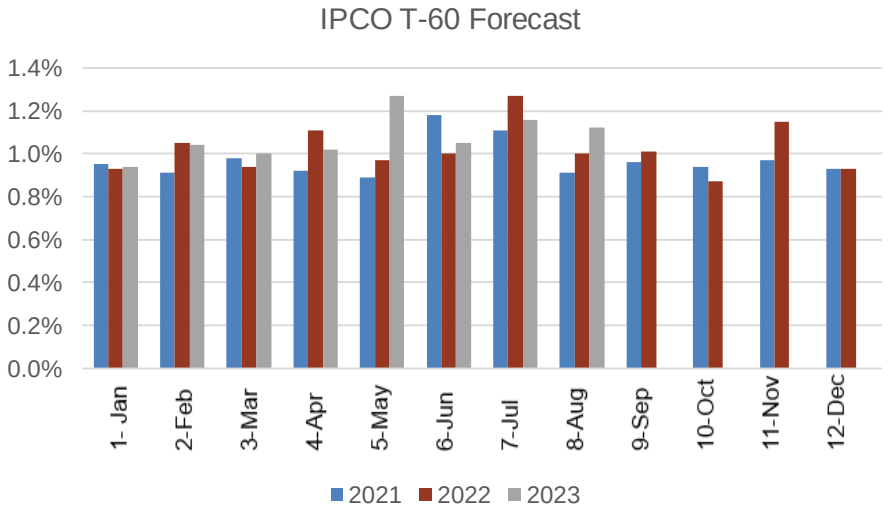
Peak Day Accuracy

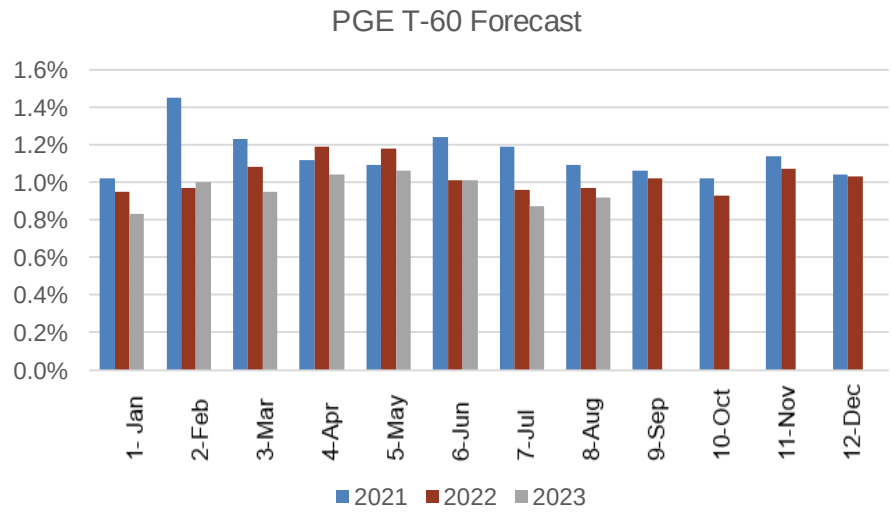


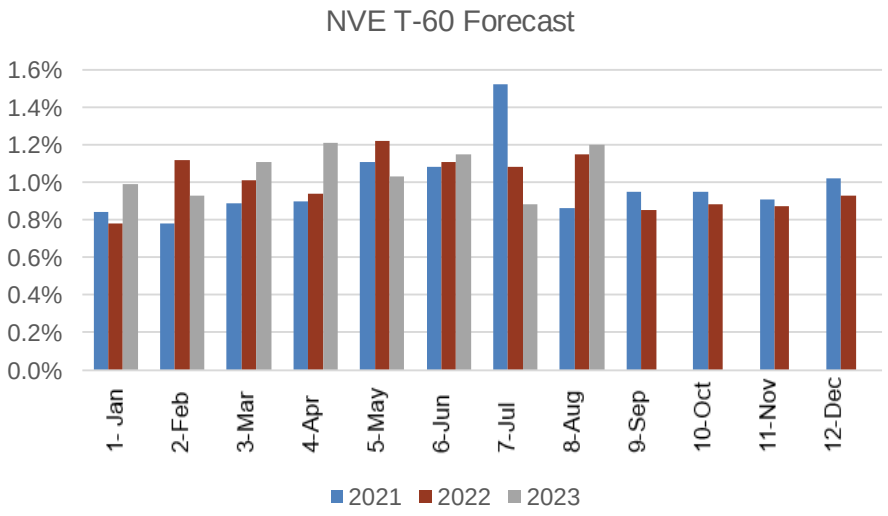
*MAPEs are calculated based on observed actuals; demand response is not reconstituted back into load

EIM T-60 forecast

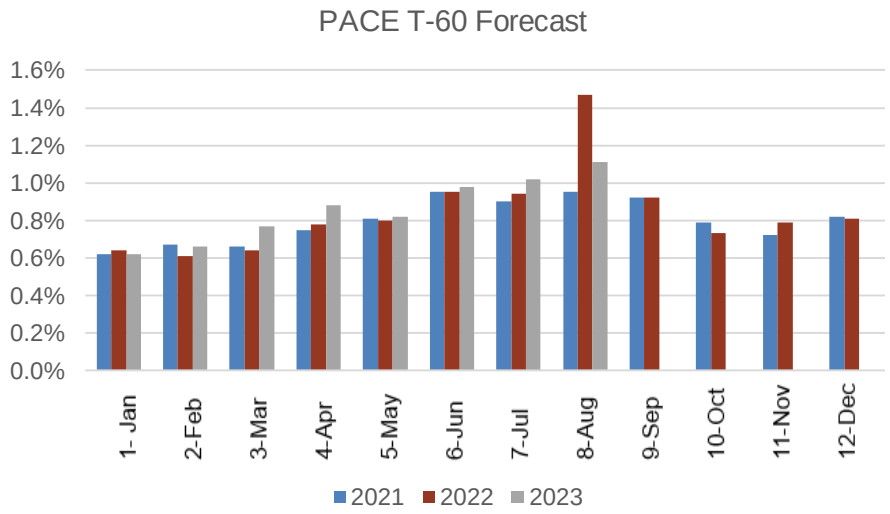


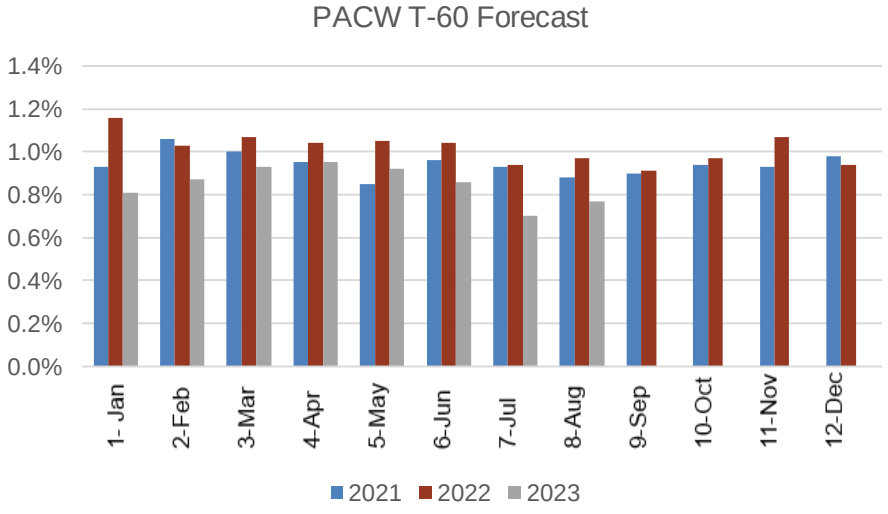


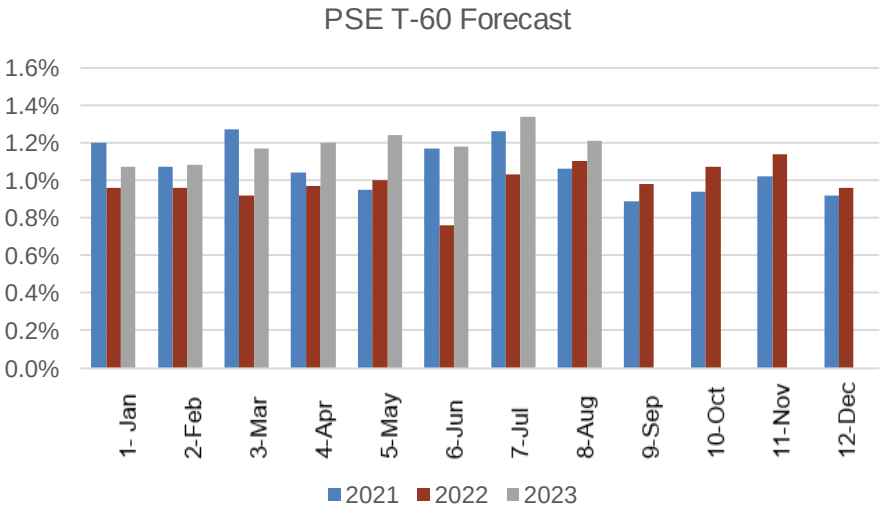


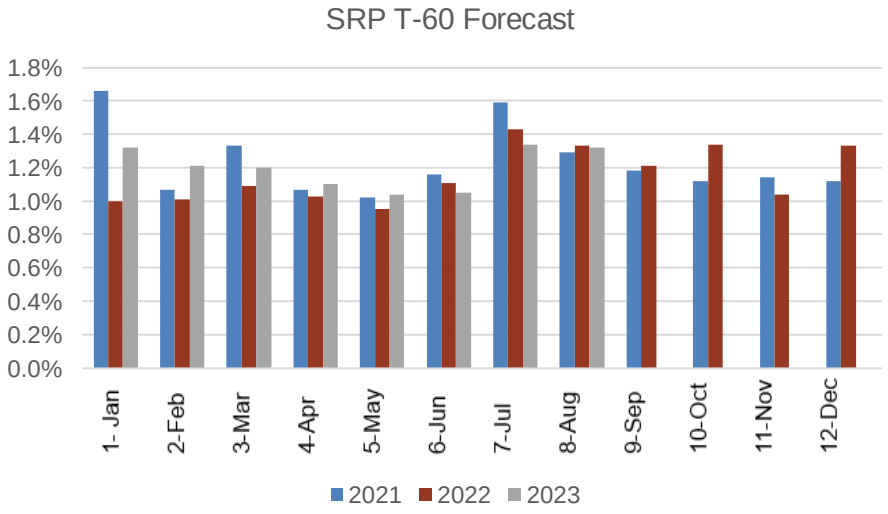


EIM T-60 forecast

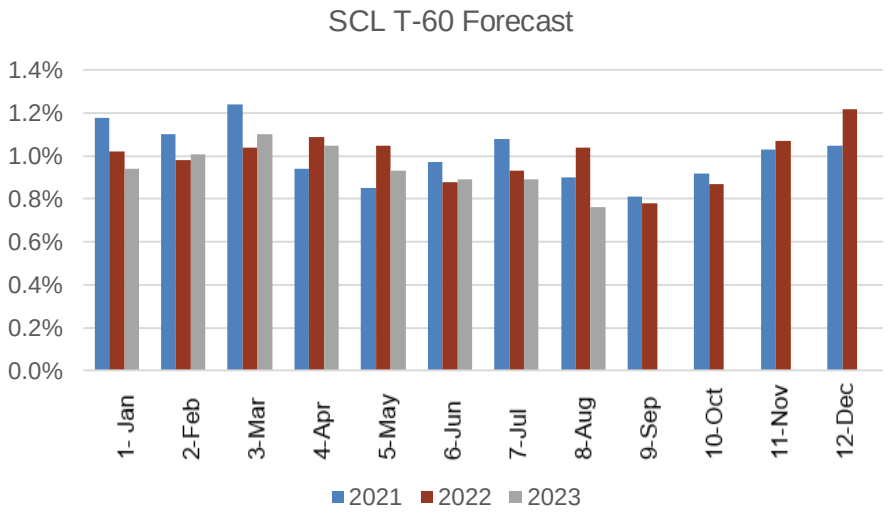


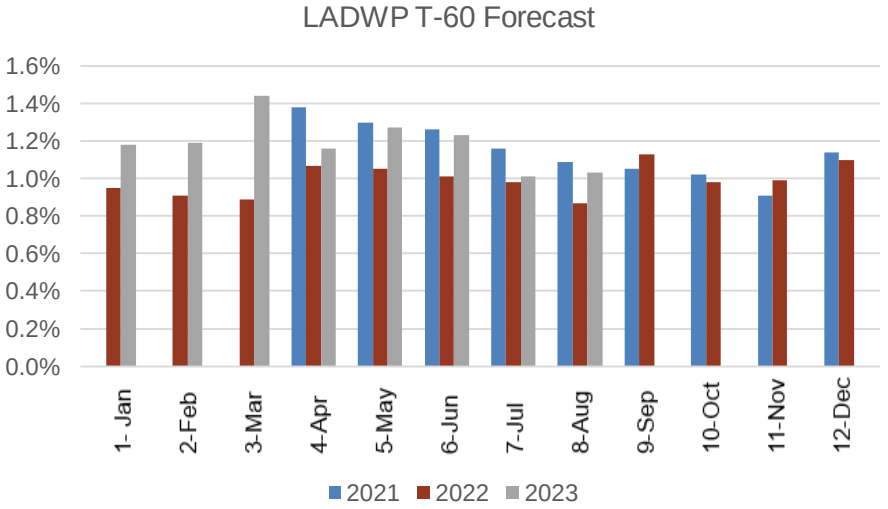


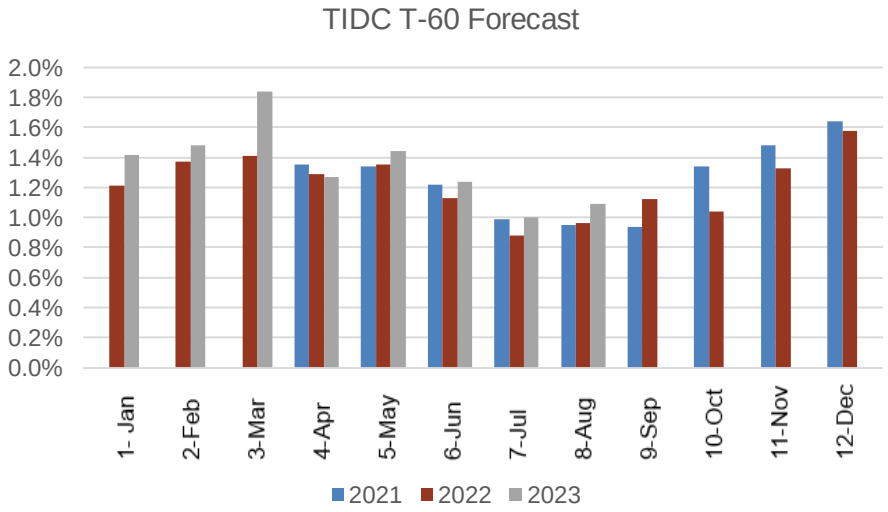


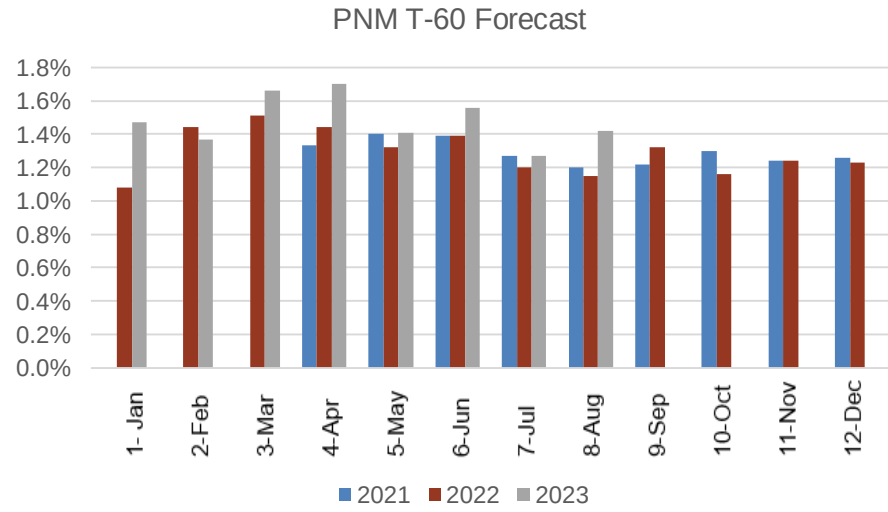


EIM T-60 forecast

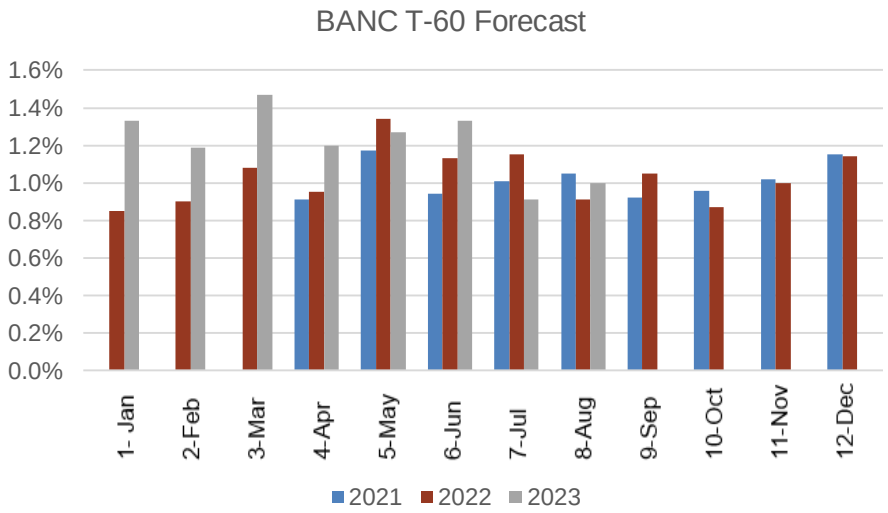


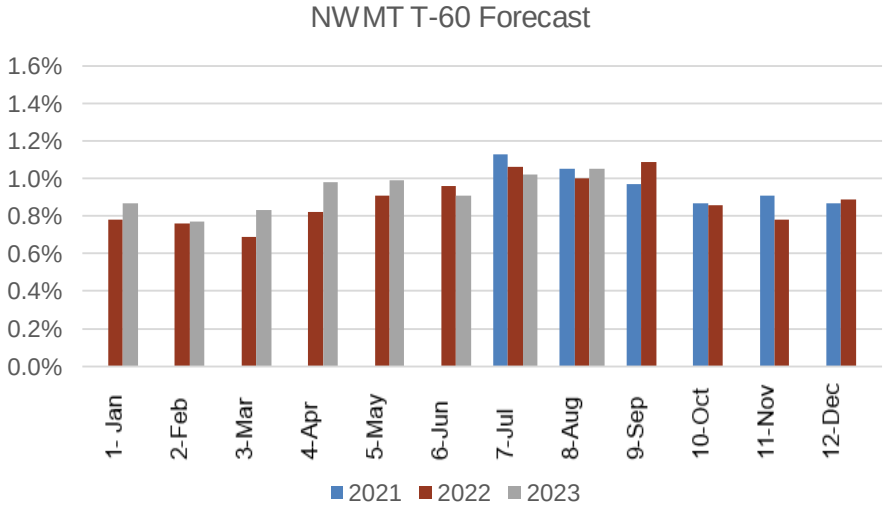


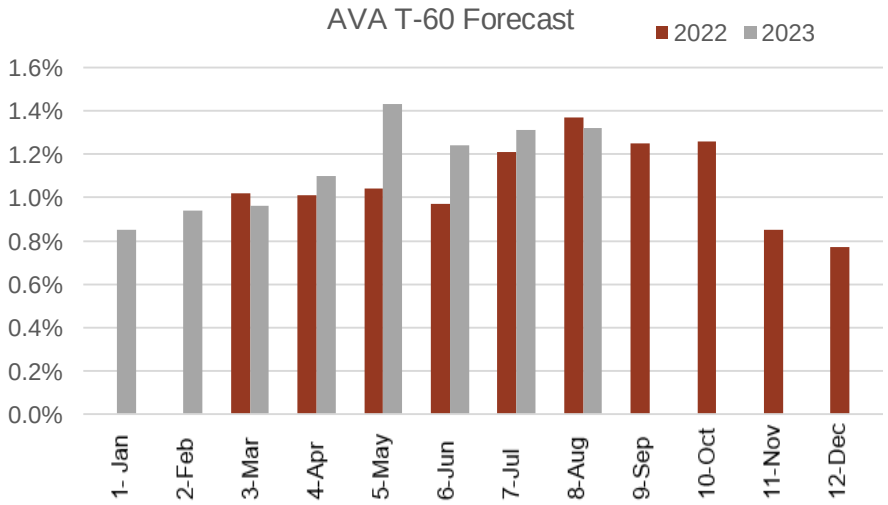


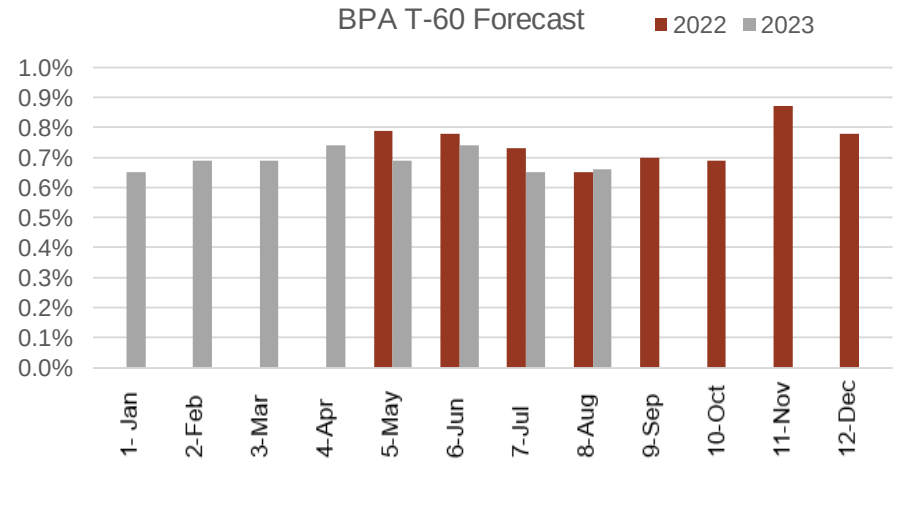


EIM T-60 forecast

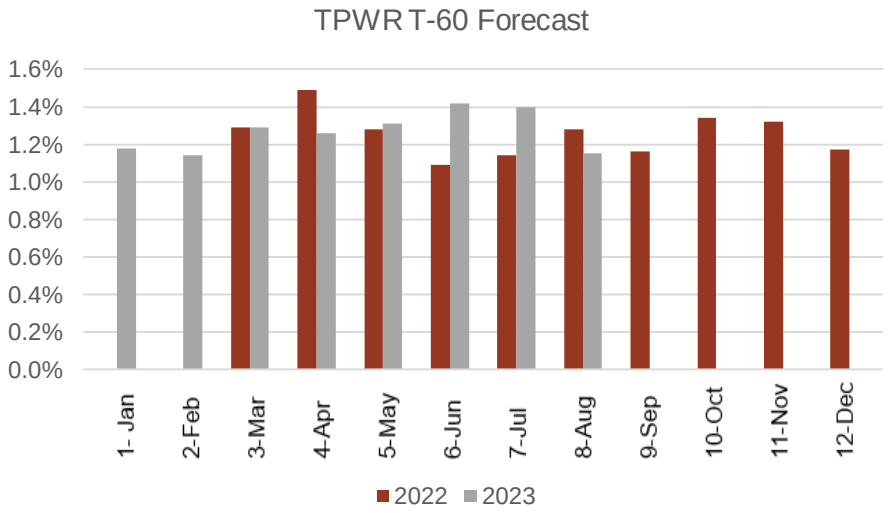


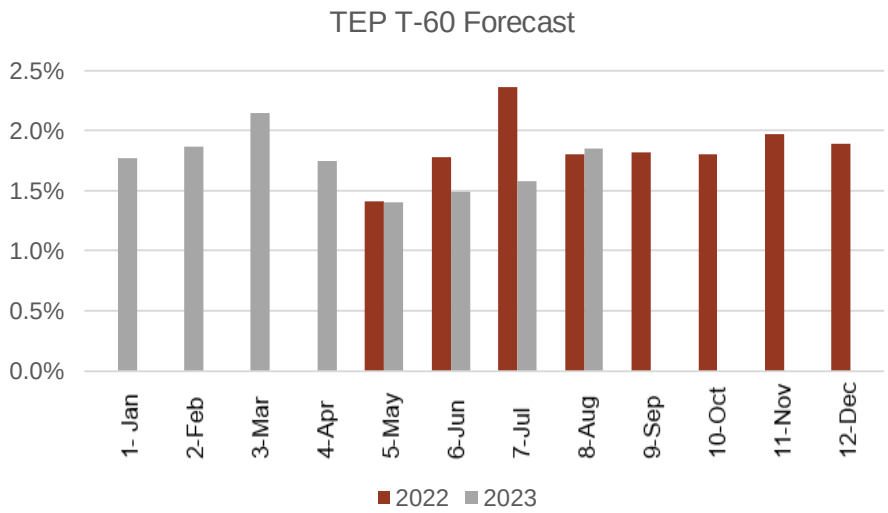






EIM T-60 forecast





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 or isostakeholderaffairs@caiso.com

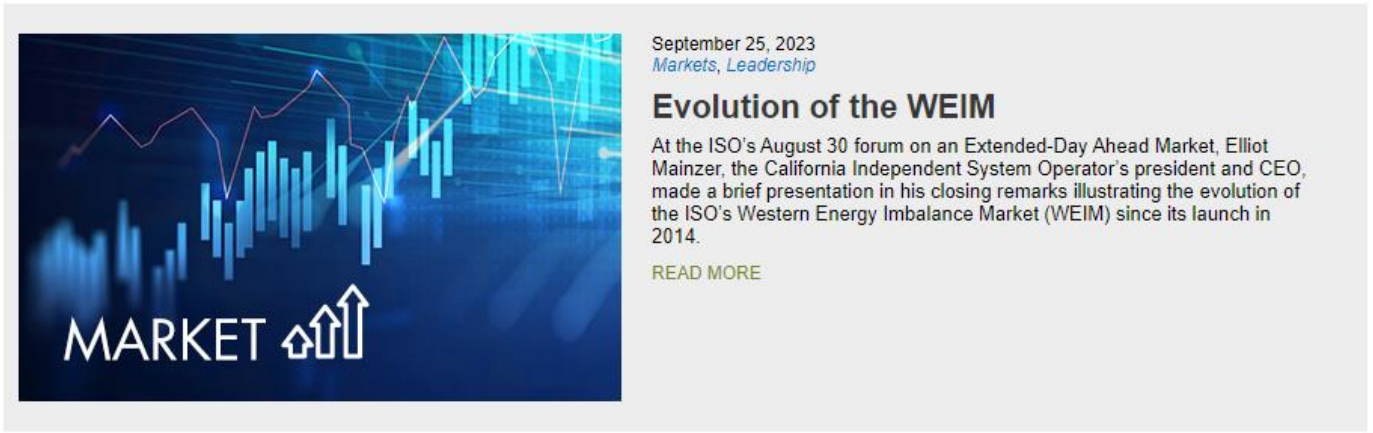
- October Eclipse Scheduling Coordinator and resource expectations Call – Oct 3rd at 1pm
- Policy Roadmap Update – Oct 24th at 1pm

- *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.

Listen to a short video and see the slides tracing WEIM's evolution and the expected benefits for California and the West from expanding into the day-ahead timeframe on the ISO's YouTube channel

Read a recent article featured in the blog:



- Subscribe to Energy Matters blog monthly summary

Upcoming MPPF meeting

The next MPPF is scheduled on December 14, 2023.

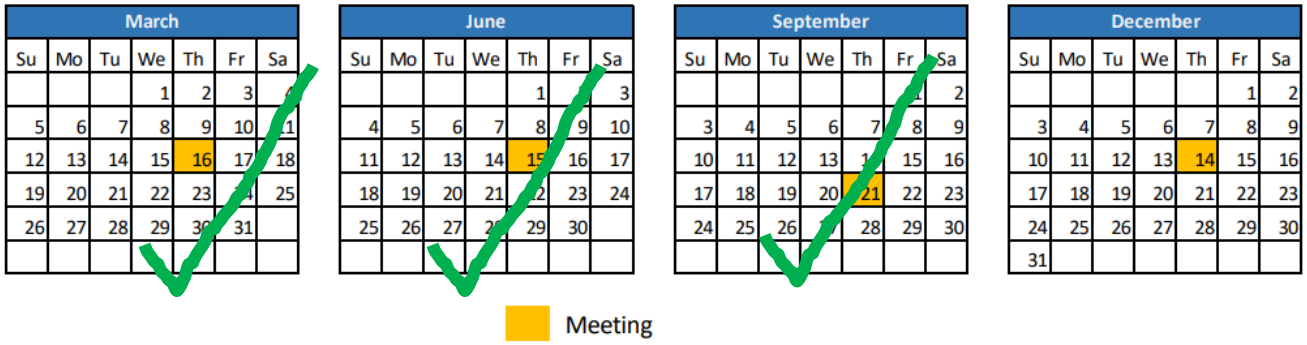
User groups and recurring meetings > Market performance and planning forum > 2023

California ISO

2023

Market Performance and Planning Forum Meetings

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



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