California ISO

Market Performance and Planning Forum

March 31, 2022

Objective: Enable dialogue on implementation planning and market performance issues

- Review key market performance topics
- Share updates to 2022 release plans, resulting from stakeholders inputs
- Provide information on specific initiatives
  - –to support Market Participants in budget and resource planning
- Focus on implementation planning
  - – Clarify timelines
  - – Discuss external impacts
  - – Policy discussions should occur in the initiative stakeholder process

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
- Please raise your hand if you have a question or comment at any time during the meeting and the facilitator will call on you
  - Please start by stating your name and affiliation
- Meetings are recorded and video files posted on

  User groups and recurring meetings > Market performance and planning forum > 2022

Market Performance and Planning Forum

Agenda – March 31, 2021
9 a.m. – 12 p.m.

Time:	Topic:	Presenter:
9:00 – 9:05	Introduction, Agenda	Brenda Corona
9:05 – 10:45	Market Performance Update	Kun Zhao Abhishek Hundiwale Guillermo Bautista Alderete
10:45 – 11:00	Policy Update	Brad Cooper John Goodin
11:00 – 11:45	Release Update	Trang Vo

Market Performance Update

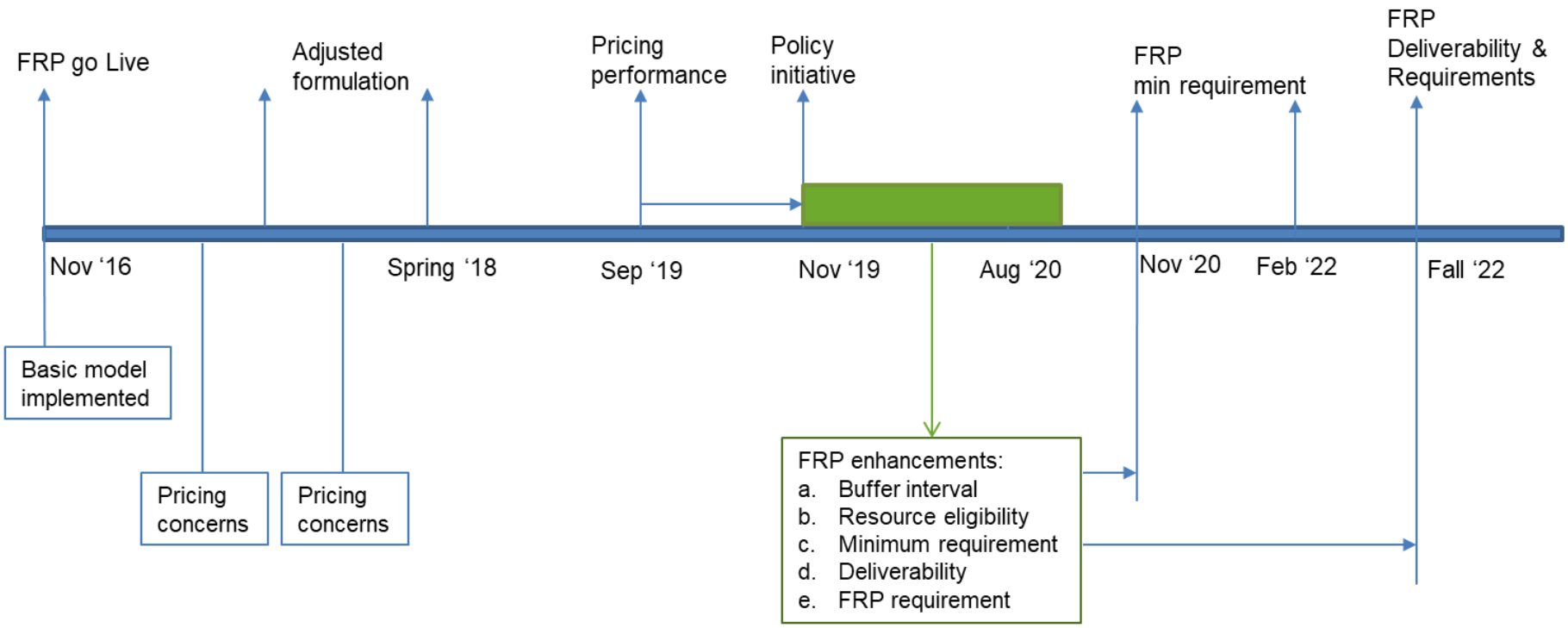
Market Analysis and Forecasting

Flexible Ramping Product Analysis

Background Flexible Ramping Product (FRP)

- FRP is used in the Western Imbalance Energy Market to manage ramp capability to address uncertainty that materializes between market runs
- FRP secures additional ramping capability that can be dispatched in subsequent market runs to cover uncertainty in forecasted net load
- Resources providing FRP are compensated at the marginal opportunity cost (which is related to the cost of energy)

Evolution of the FRP



The ISO discussed the FRP pricing concerns with the Market Surveillance Committee on the February 11 meeting.
http://www.caiso.com/Documents/FlexibleRampProduct-Presentation-Feb11_2022.pdf

Four main concerns with FRP performance

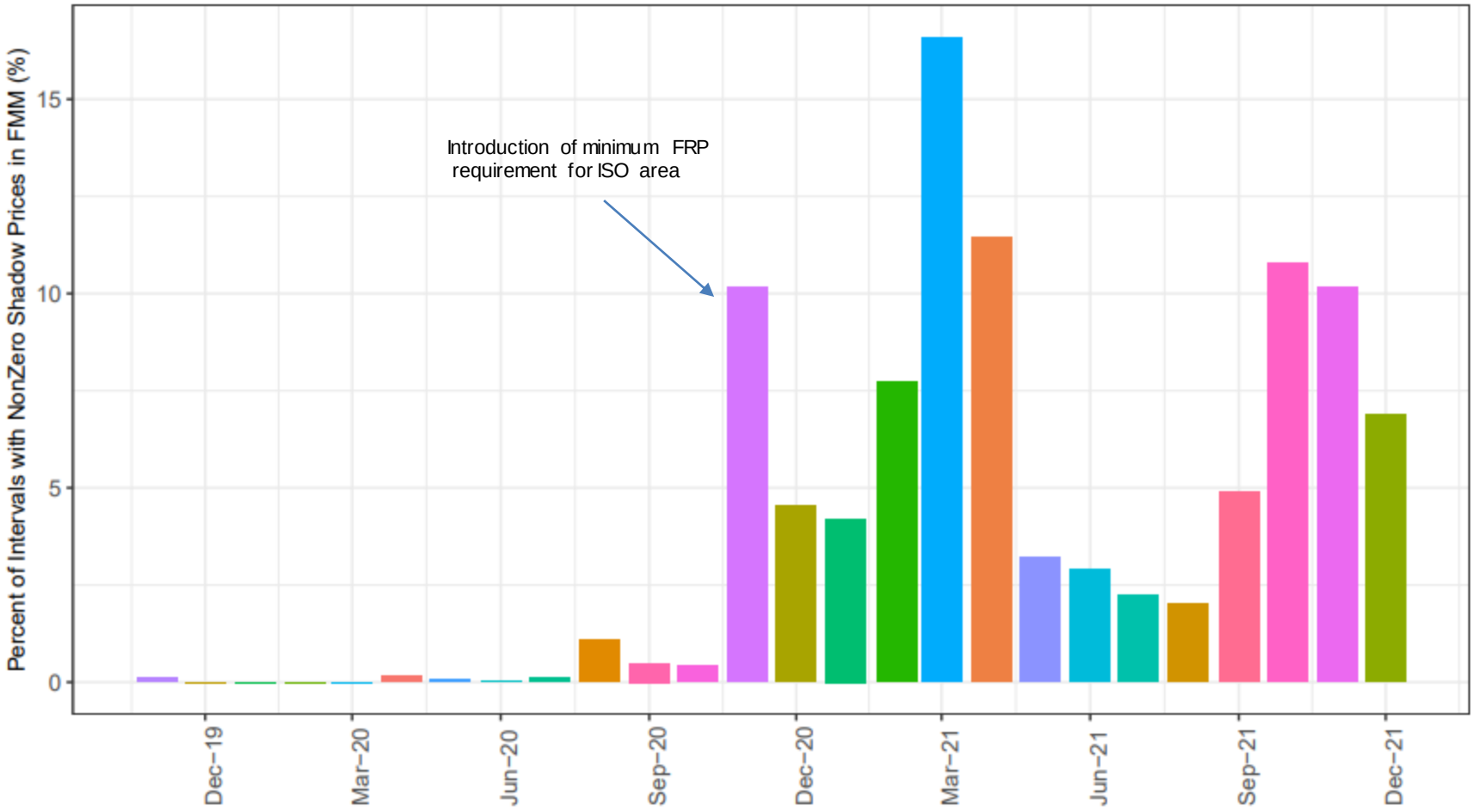
- Price formation
  - FRP prices have been generally low or at $0 when there is surplus capacity and constraints are not binding
- Deliverability and utilization
  - Awarded capacity may be stranded or not utilized
- Requirements
  - Requirements may not accurately reflect uncertainty all the time
- Need for manual actions
  - Limited efficacy of the product results in operators taking manual actions

1. Price-formation: Low frequency of non zero prices

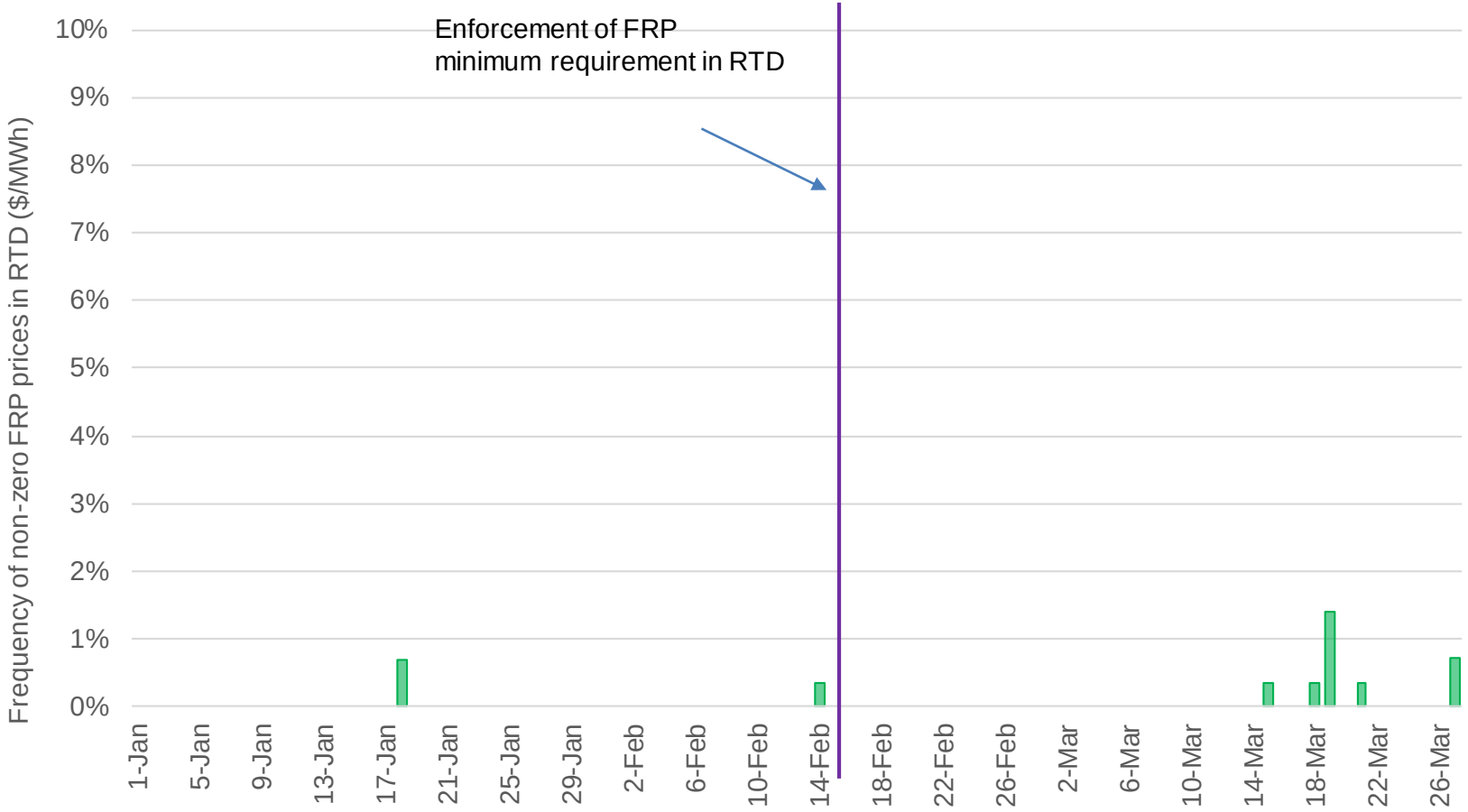
Month	AZPS	BANC	CISO	EIM	IPCO	LADWP	NEVP	NWMT	PACE	PACW	PGE	PNM	PSEI	PWRX	SCL	SRP	TIDC
Feb-20	1	0	0	0.8	0		0.5		0	0.1	0.1		0.6	0.5			
Mar-20	1.4	0	0	1.8	0		0.2		0.1	0.2	0.2		0	1.4			
Apr-20	0.1	0	0.2	0.2	0		0.8		0	0	0		0.1	0.2	0	4.9	
May-20	0.8	0	0.1	0.4	0.1		2.4		0.1	0	0.2		0	0.7	0	0.1	
Jun-20	0.2	0	0	1	0.3		2.4		0.1	0.1	0.6		0.4	1.1	0	0.5	
Jul-20	0	0	0.1	2	0.1		4.4		0.2	0.1	4.2		0.6	1.8	0.1	0.7	
Aug-20	0.1	0.4	1.1	2	0.2		7.3		0.4	0.2	1.5		0.7	2	0	1.6	
Sep-20	0.2	0.2	0.5	1.7	0		2.5		0.2	0.3	1.4		0.2	0.6	0.1	1	
Oct-20	1.2	0.2	0.4	2.2	0		1.6		0.5	0.2	0.7		0.3	0.9	0.1	1.8	
Nov-20	0.5	0	10.2	1	0.1		0.8		0	0.1	1.5		0.1	0.5	0.2	0.7	
Dec-20	0.3	0.1	4.5	1	0		0		0	0.1	0.2		0	0.4	0.2	0.3	
Jan-21	0.3	0	4.2	0.4	0		0.1		0.1	0.1	0.3		0	0.3	0	0.2	
Feb-21	0.6	0	7.7	0.1	0.1		0.3		0.1	0.1	0.4		0.1	0.1	0.1	8.9	
Mar-21	0.3	0.1	16.6	0.3	0.1		0.7		0.2	0.2	0.3		0.4	0.3	0.1	0.5	0.7
Apr-21	0	0	11.4	0.3	0	0.1	0.3		0.1	0.1	0.4	6.8	0.1	0.1	0	0.5	0.3
May-21	0.7	0	3.3	0.6	0	0.1	0.9		0.1	0.3	0.3	0.1	0.5	0.5	0	0.2	0.2
Jun-21	0	0	2.9	0.2	0	0.1	1.3	0.8	0.4	0	1.5	0.4	0.9	0.3	0	1	0
Jul-21	0.1	0.1	2.3	0.1	0.3	0.1	0.8	3	0.3	0.1	1.1	0.5	0.2	0.2	0.1	2.9	0.1
Aug-21	0.2	0	2	0.4	0.6	0	0.6	1.2	0.1	0.1	1.5	0.1	0.2	0.5	0	2.8	0.2
Sep-21	0.3	0	4.9	0.4	0.1	0	0.4	23.8	0.3	0.1	0.8	0.2	0	0.4	0.2	1.8	0.1
Oct-21	0	0	10.8	0.5	0	0.3	0.5	44.3	0.1	0	0.8	0.3	0.2	0.9	0.1	0.3	0.3
Nov-21	0.5	0	10.2	1.7	0	0.1	0	1.4	0.1	0.6	0.2	0.3	0.2	1.7	0.1	1.7	0
Dec-21	0	0	6.9	1.1	0	0.3	0.1	1.9	0.6	0.1	0.4	0.3	0.2	1.4	0.1	0.2	0
Jan-22	0	0	9.3	1.2	0.2	0	0	0.5	1.8	0.3	0.3	0.2	0	1.4	0	0.2	0.1

Values are in percentage

Frequency of non-zero prices increased in the ISO after implementing minimum requirements



The enforcement of the FRP minimum requirement constraint for CAISO since February 16, 2022 for RTD market had negligible impact on RTD prices so far

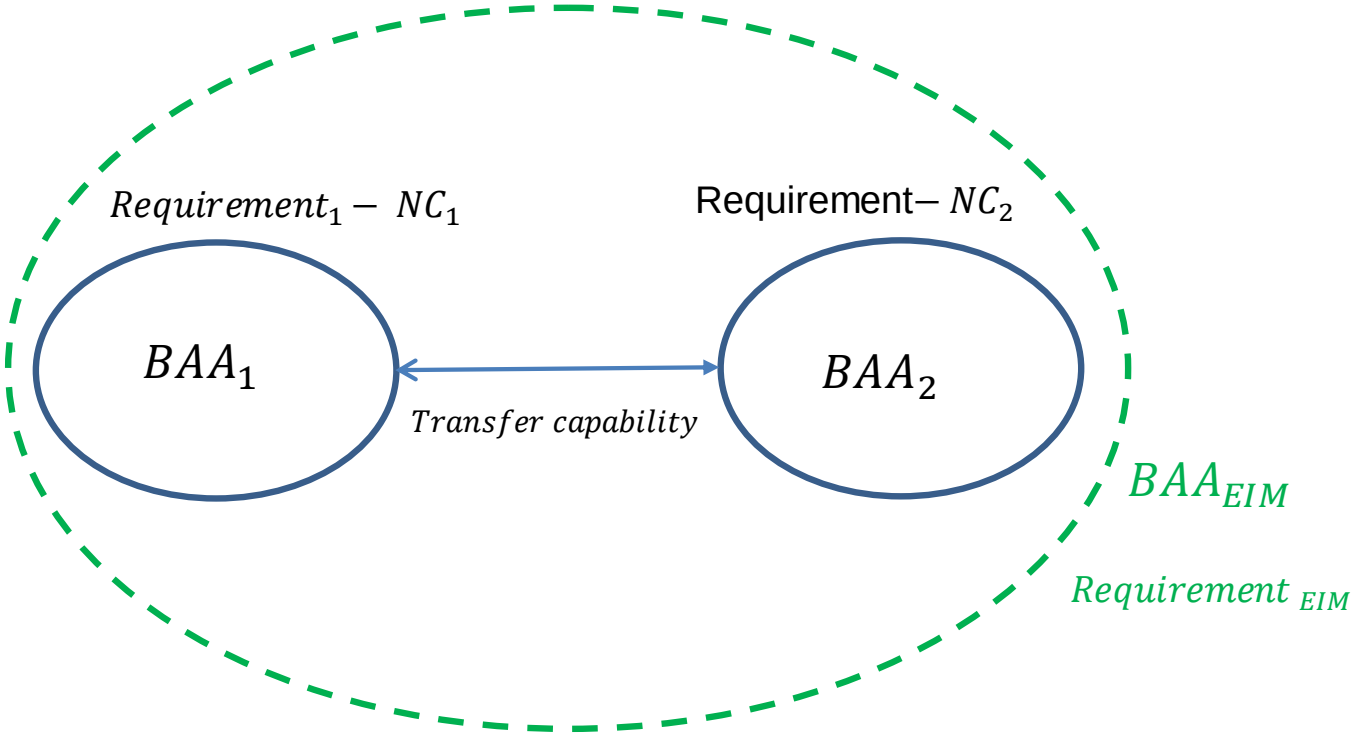


FRP prices are formed mainly by four design features

- FRP price is based on opportunity cost for energy and not on bid-in price for FRP
- Accounting of transfer capability among the various balancing authority areas typically results in an effective FRP requirement of 0MW for most of the areas
- Flexible ramping capacity is fungible (non locational) across the balancing authority areas, *i.e.,* one area can procure it for another area's need
- Individual areas are part of the overall WEIM area; local procurements or shortfalls carry over the WEIM area

Flexible ramping requirement *vs.* effective requirement

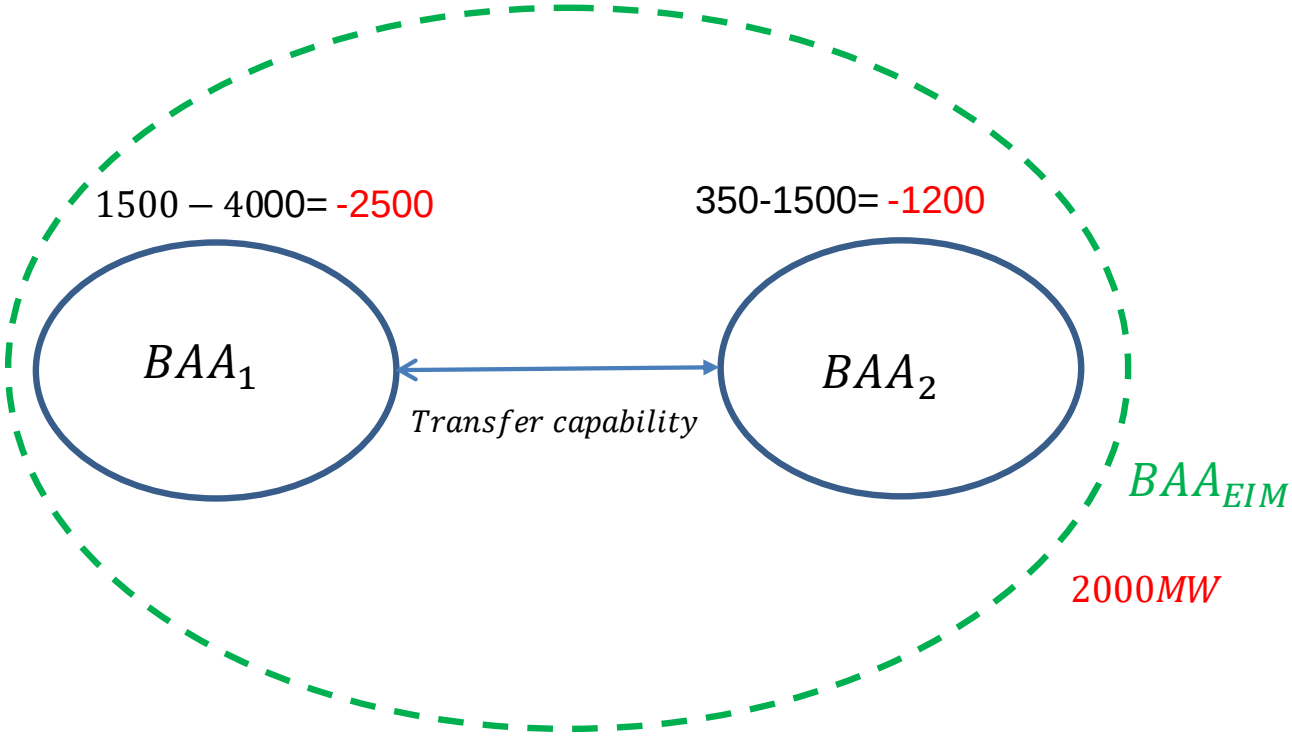
Transfer capability is a key piece in the price formation puzzle



Transfer capability (NC) will effectively reduce the requirement an individual area has to meet.

Areas with large transfer capabilities will not have FRP requirements to procure flex ramp

Illustration: When transfer capability results in 0MW requirements, only the WEIM area will drive the overall procurement.



When procuring for the overall WEIM area, there is no consideration of location to procure

Each individual area is part of the overall WEIM area; thus, procurement to meet one area's requirement also counts towards meeting the overall WEIM area

2. Deliverability: Current design lacks locational procurement

- Flex ramp capacity may not be delivered due to
  - internal area congestion
  - congestion among area transfers
  - resource constraints
- Flex ramp capacity may not be utilized when procurement is on highly-price energy bids
- ISO quantified the extent of non-deliverability in its 2019 pricing performance report
- That analysis resulted in setting the 2019 policy initiative to consider FRP enhancements and use nodal procurement

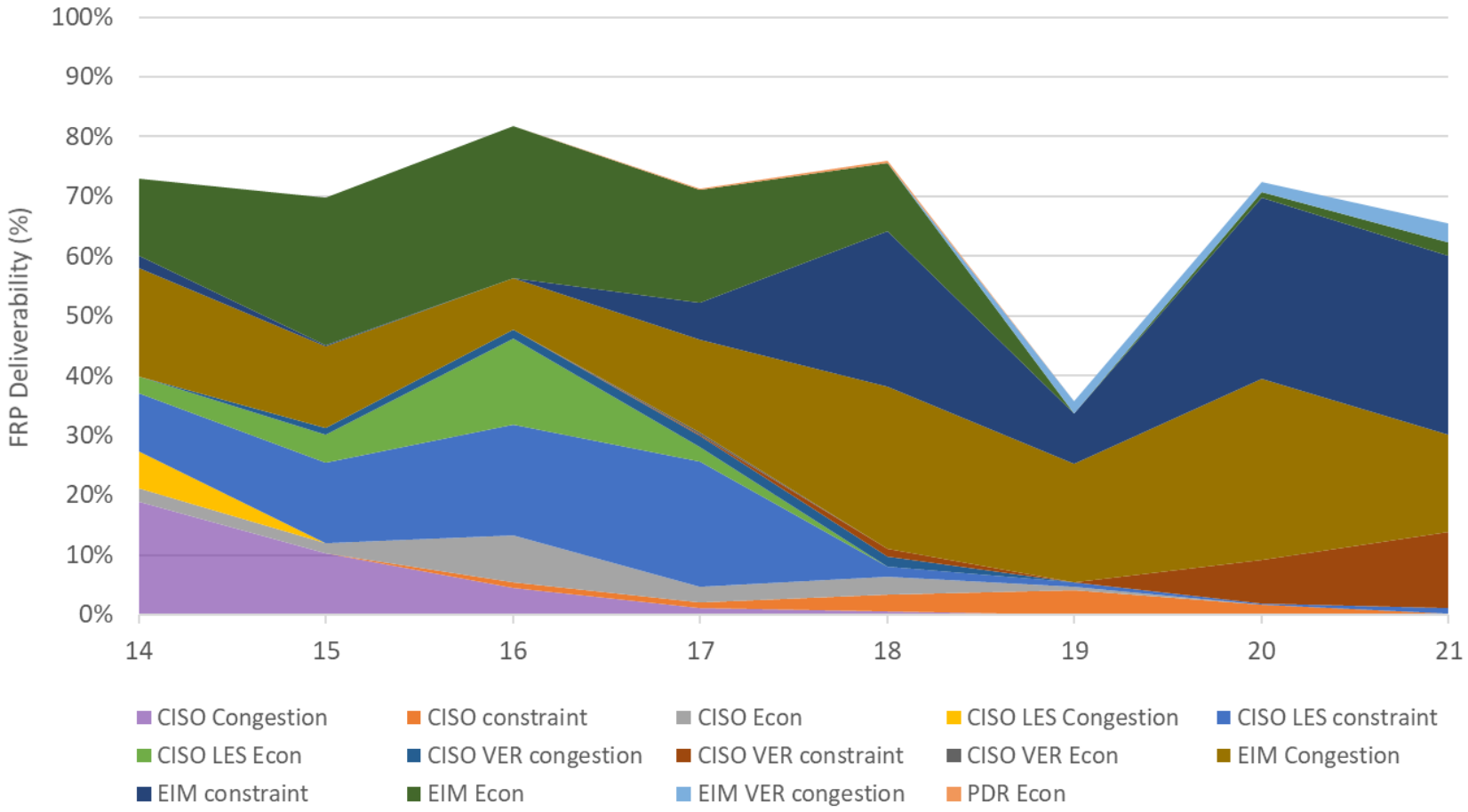
On July 9, flex ramp prices were frequently at $0 in spite of tight supply conditions

BAA	Uncertainty Req (MW)	Effective Req (MW)	Min Req (MW)	Procurement (MW)	Relaxation (MW)	Flex Price ($)	Energy Price ($)
AZPS	169	0	0	0	0	0	762
BANC	51	51	0	196	0	0	1,000
CISO	1,810	925	925	581	344	78	855
IPCO	149	0	0	0	0	0	312
LADWP	191	0	0	0	0	0	751
NEVP	303	0	0	30	0	0	731
NWMT	78	0	0	19	0	0	192
PACE	377	0	0	250	0	0	442
PACW	117	0	0	102	0	0	335
PGE	158	0	0	148	0	0	85
PNM	183	0	0	0	0	0	714
PSEI	91	0	0	130	0	0	113
PWRX	161	0	0	161	0	0	53
SCL	19	0	0	78	0	0	116
SRP	124	0	0	0	0	0	761
TIDC	9	0	0	0	0	0	960
EIM	2,038	2,038	0	1,694	344	0	

- Multiple areas procure flex to meet the WEIM requirement
- All areas but ISO met its requirements, thus had no flex ramp prices
- Six areas procure no flex ramp since they exhausted their capability

- All areas but ISO had a 0MW requirement
- Overall WEIM area met its requirement

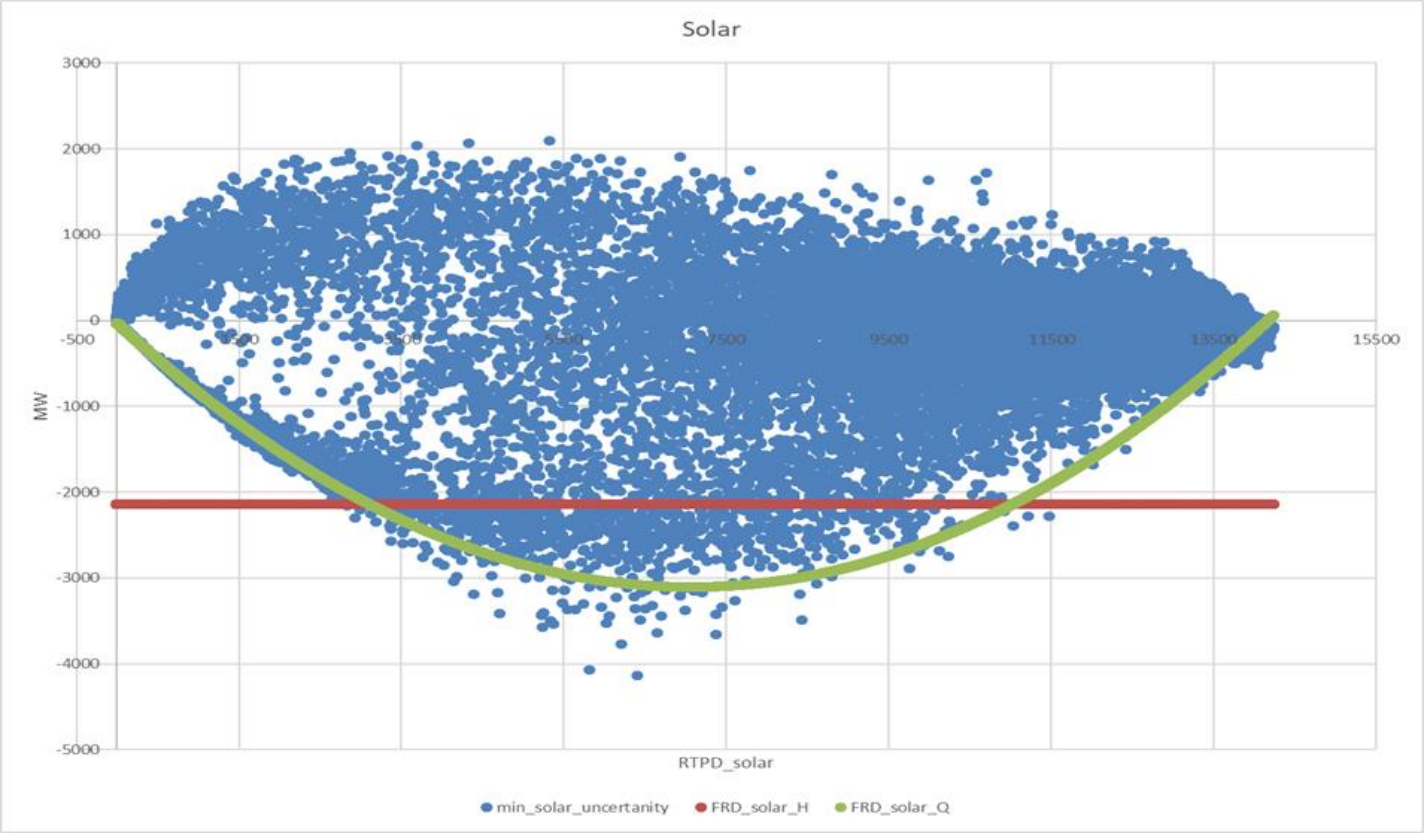
On July 9, 2021 FRP was not deliverable/utilized due to either economics, congestion or resource constraints



3. Requirements: historical based requirements may not sufficiently reflect realized uncertainty

- Uncertainty requirement is used in the WEIM resource sufficiency evaluation and in the FRP procured in the real-time market
- Estimation of uncertainty is inherently not a precise science and relies on historical uncertainty and statistical methods
- Current methodology:
  - Relies on a finite historical data set
  - Uses a predefined confidence interval
  - Does not consider current conditions (forecast level of load/wind/solar)
- In 2019 the ISO proposed a more sophisticated methodology to consider both historical data but also forecast conditions for load/wind/solar

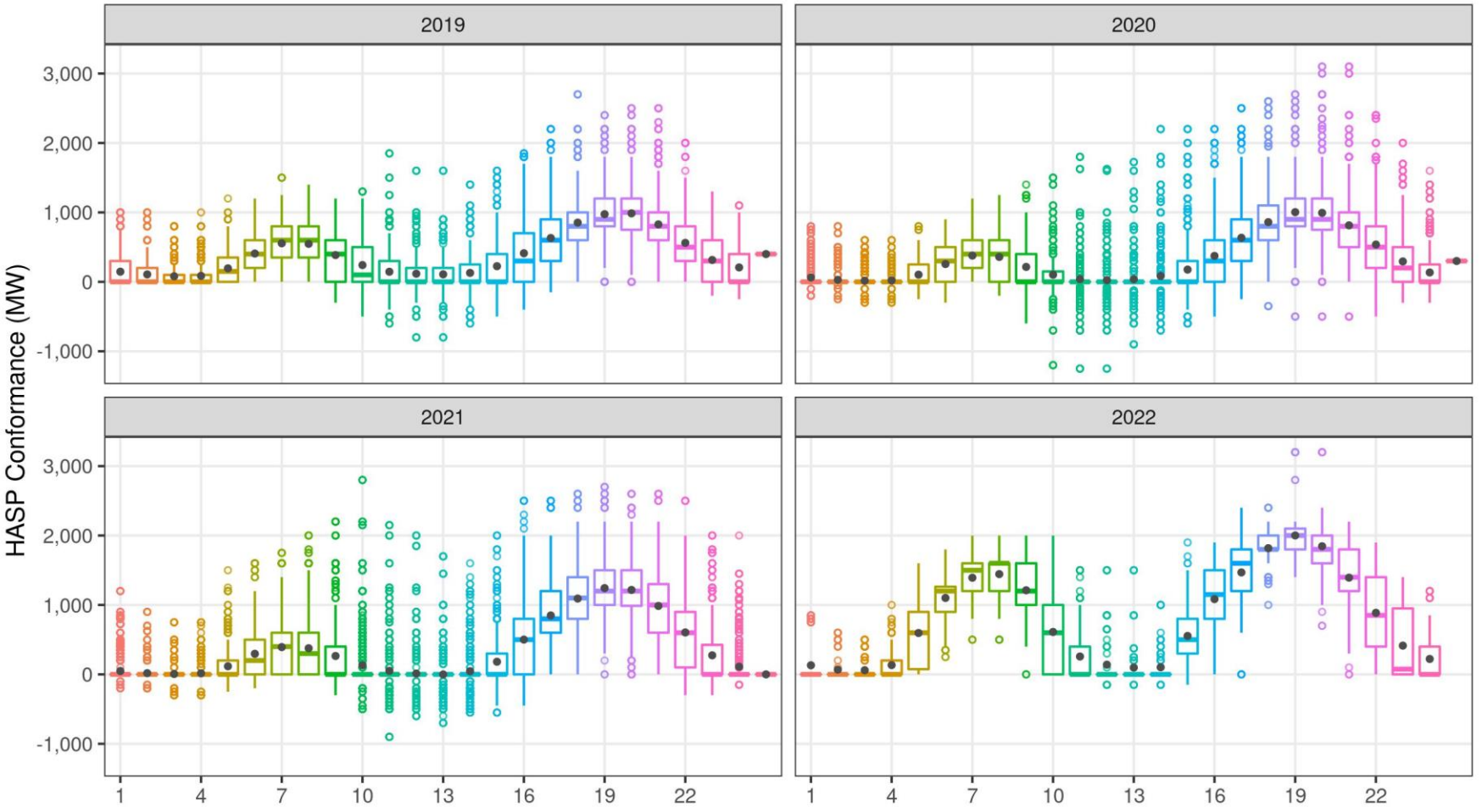
The proposed methodology for requirement calculation will improve the estimation of uncertainty



Proposed methodology (green line) tracks more closely the solar production conditions, while current methodology (red line) is constant at any level of solar production

CAISO has posted an analysis report on the Quantile methodology; report is available at http://www.caiso.com/InitiativeDocuments/Analysis-FlexibleRampingUncertaintyCalculationintheWesternEnergyImbalanceMarket.pdf

4. Manual Actions: Efficacy of the flexible ramping product results in operator manual actions



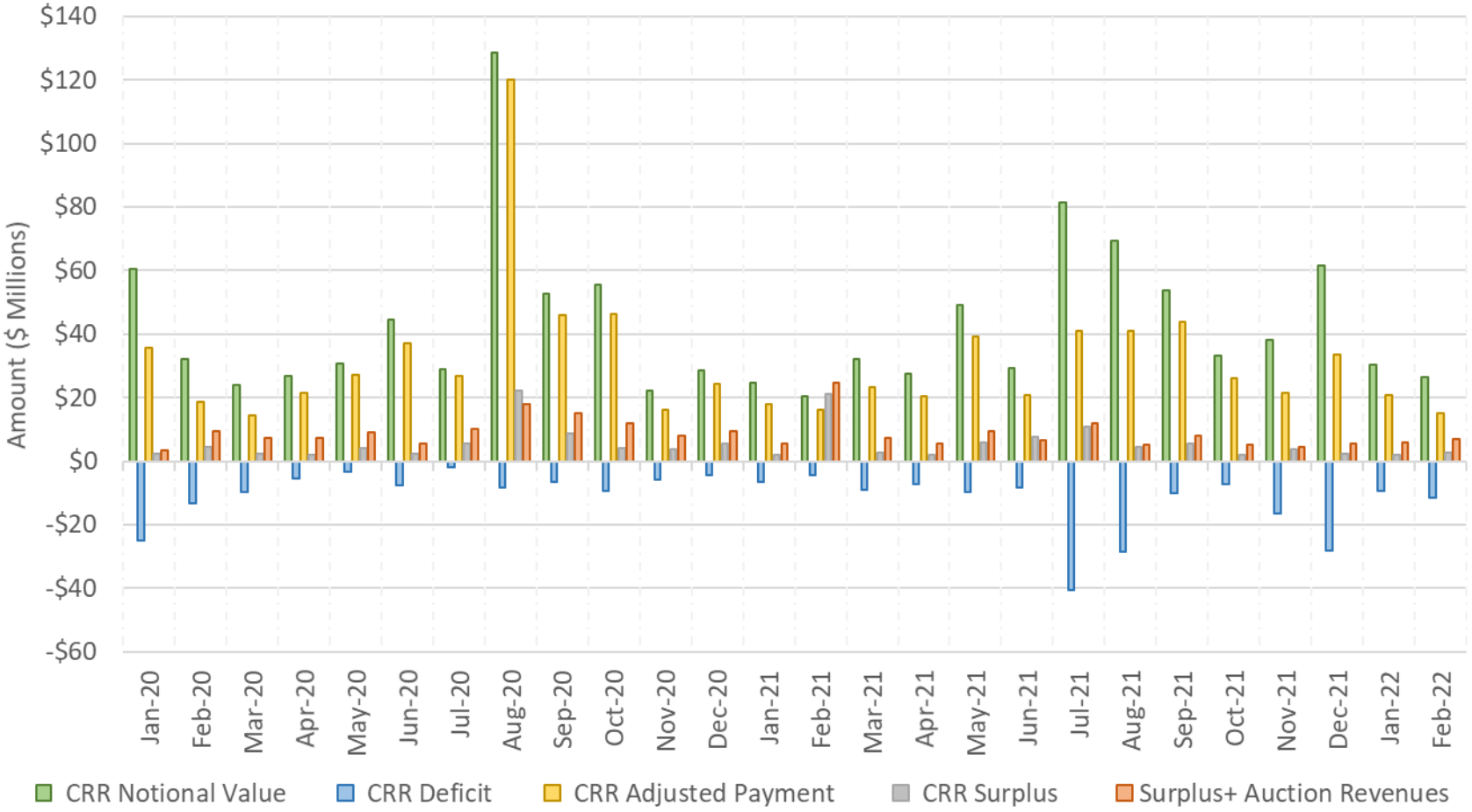
Current status of flexible ramping product concerns

Issue	Solution Implemented
Lack of pricing at the WEIM level	Design enhancement to bound local procurement
Excessive procurement from local areas	Design enhancement to limit local procurement
Negative pricing for local areas	Reformulation of requirement constraints
Stranded capacity due to transfers	Implementation of minimum requirements for sizeable areas
Ramp management between markets	Locked awarded capacity in subsequent runs
Flex capacity not utilized	Limit eligibility for resources to procure flex ramp
Inaccuracy of requirement calculation	Incremental enhancement to existing methodology

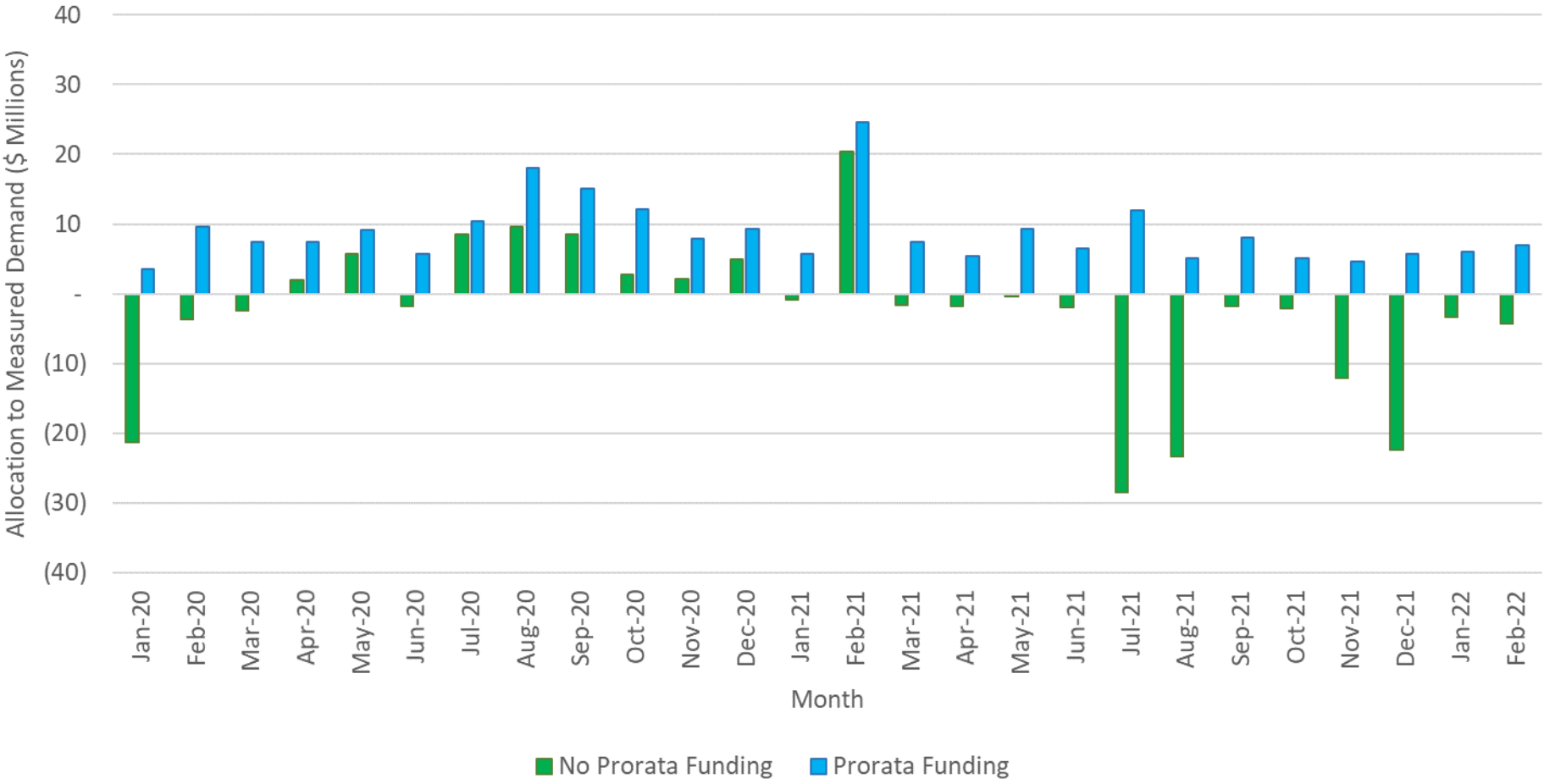
Issue	Solution to be implemented
Flex capacity is non deliverable	Reformulation to have nodal procurement
Limitations of requirement calculation	Use of a brand-new regression methodology
Accounting of transfer capability	Reformulation to have a nodal procurement
Pricing concerns	Reformulation to have a nodal procurement

Congestion Revenue Rights

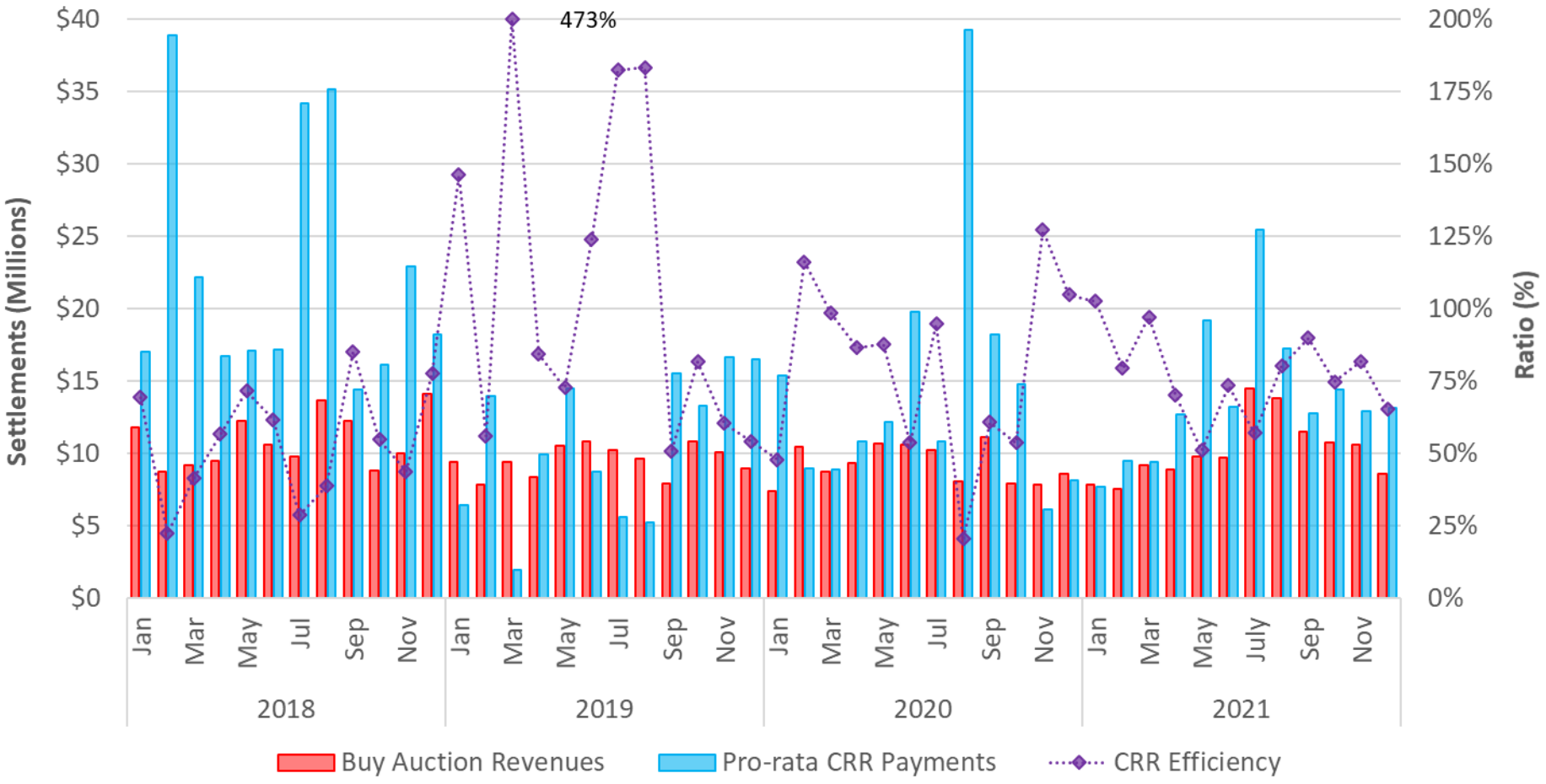
The magnitude of the overall CRR settlements has decreased after summer



Implementation of pro-rata funding continues to improve revenue adequacy in 2021



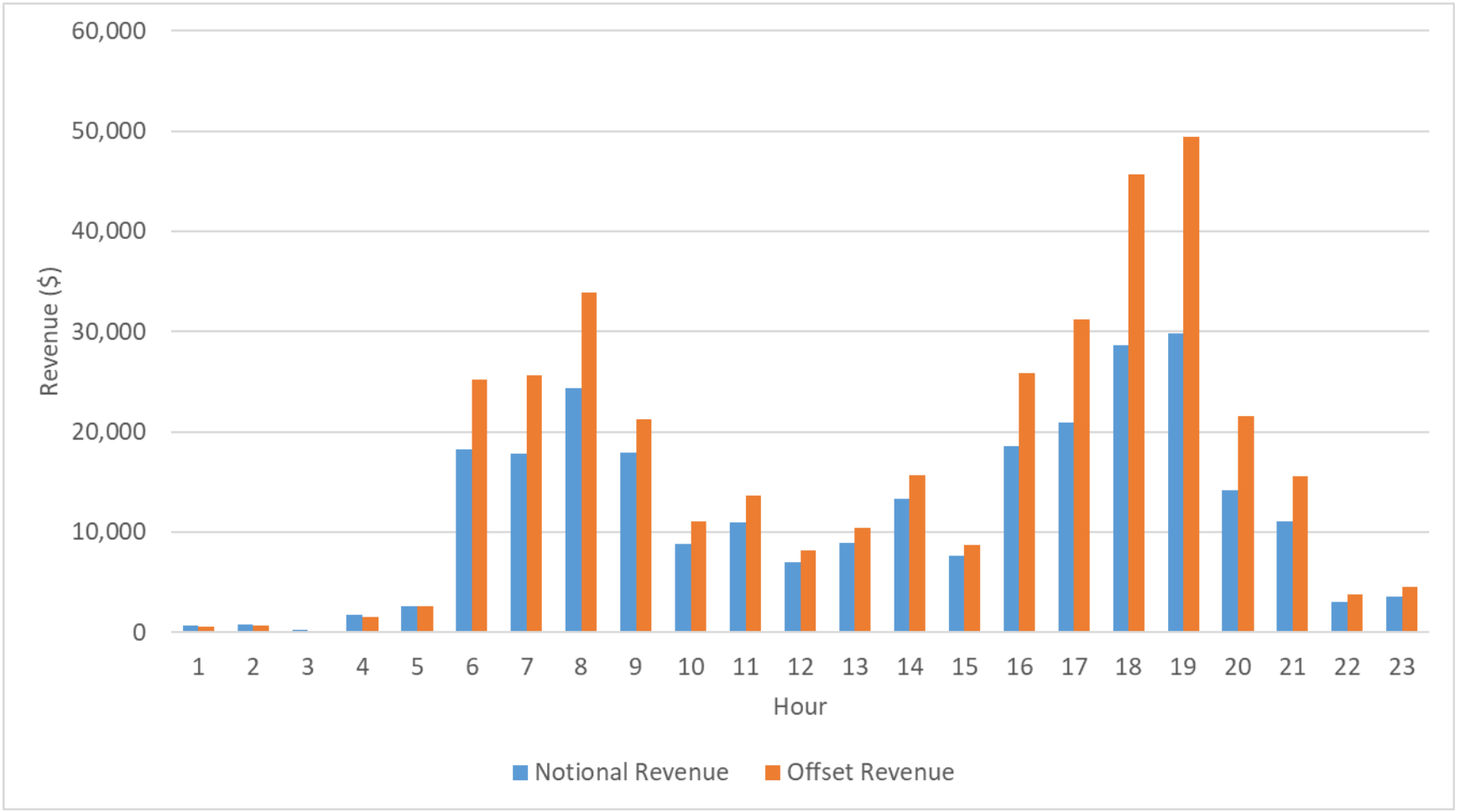
Auction efficiency performance within typical range



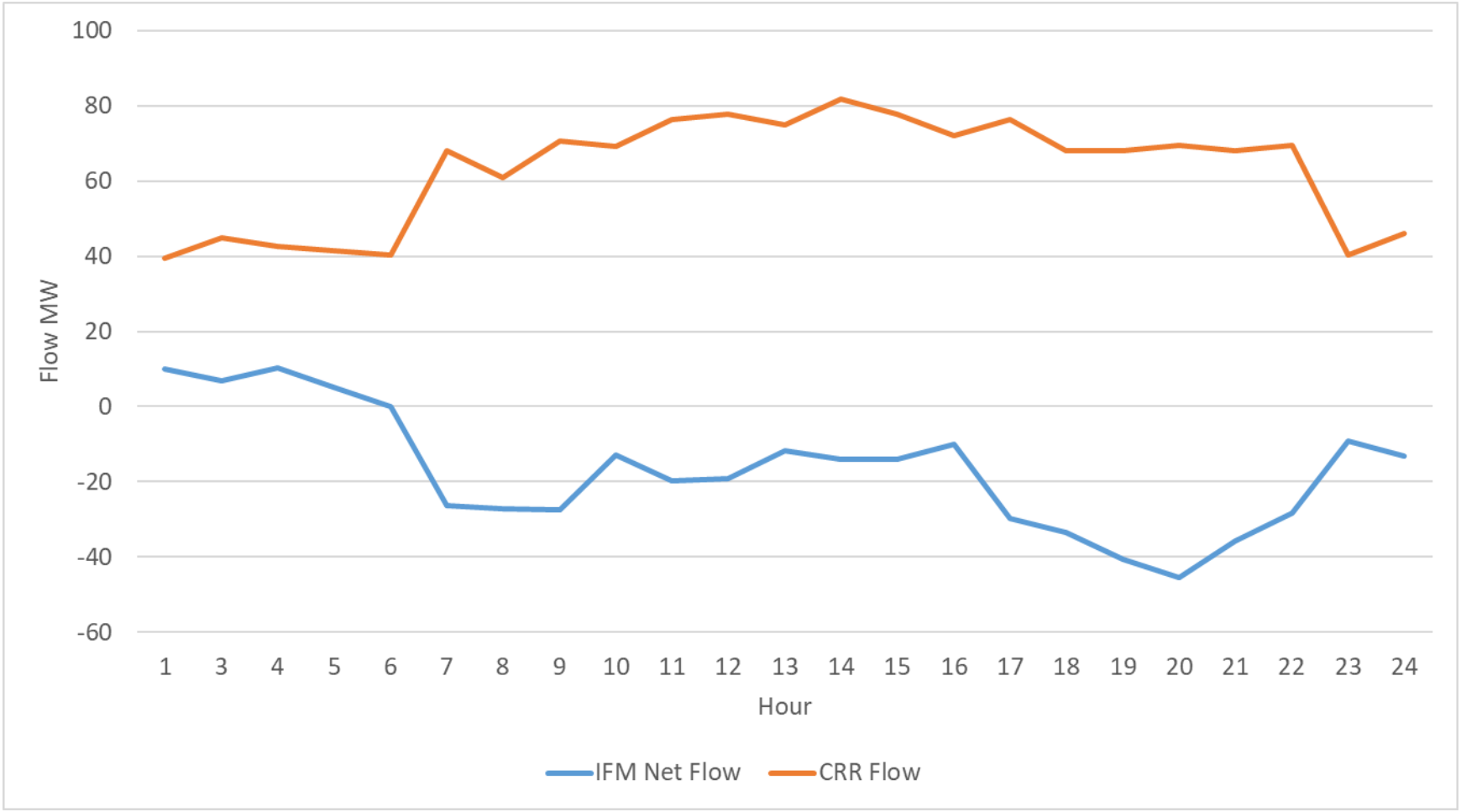
Shift factor threshold may have implications in the CRR settlements

- One issue was identified when transmission element 33020_MORAGA _115_32780_CLARMNT _115_BR_1 _1 had offset revenues higher than notional revenues in the month of February 2022, due to the 2% shift factor threshold effect.
- The DLAP shift factors were below the 2% shift factor threshold and hence were not contributing to the IFM net flow.
- Due to the shift factor threshold effect, congestion revenues collected with the IFM net flow is significantly different from the CRR flow.

Offset revenue is higher than Notional revenue showing one sample trade date

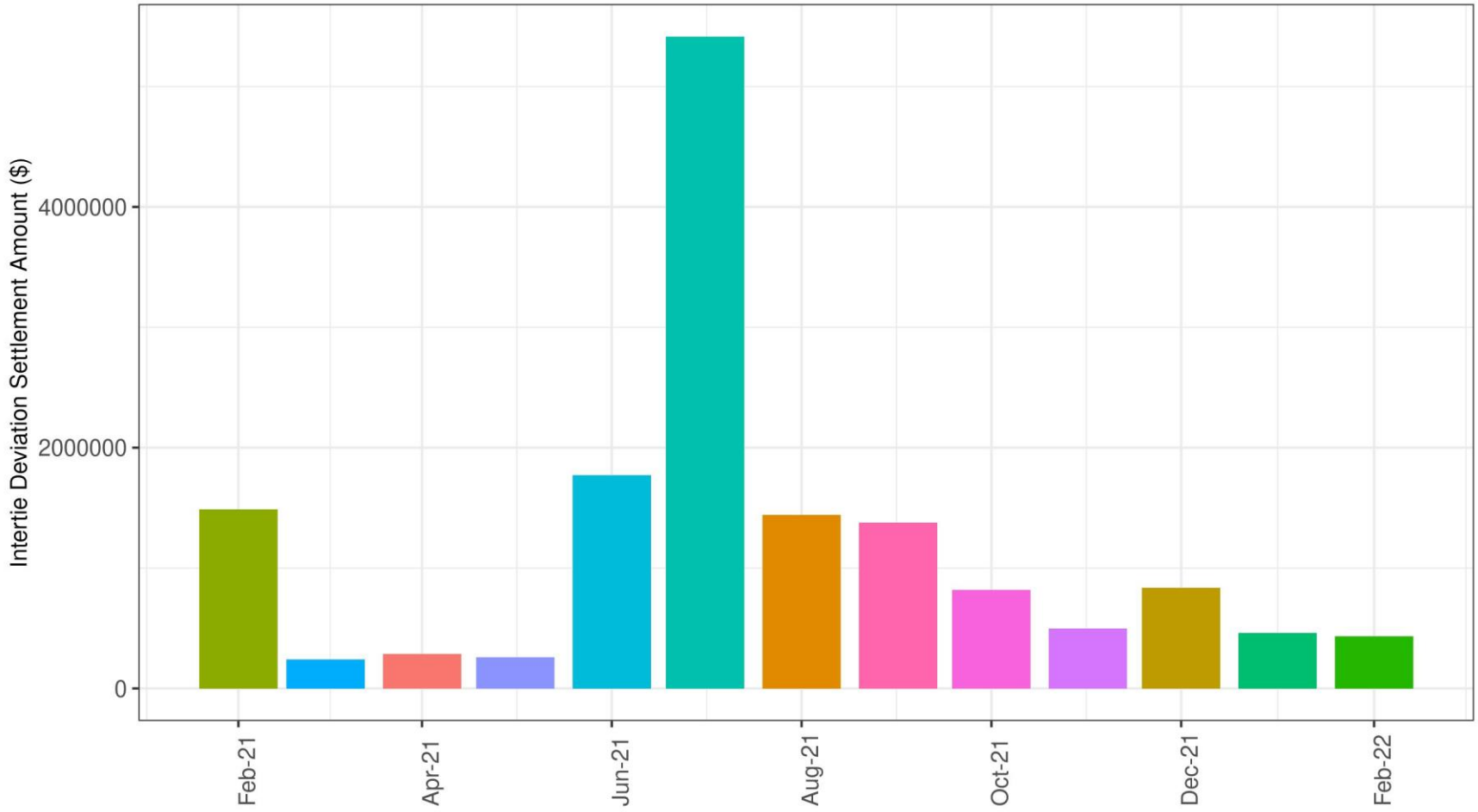


Comparison of IFM net flow with the CRR flow showing one sample trade date

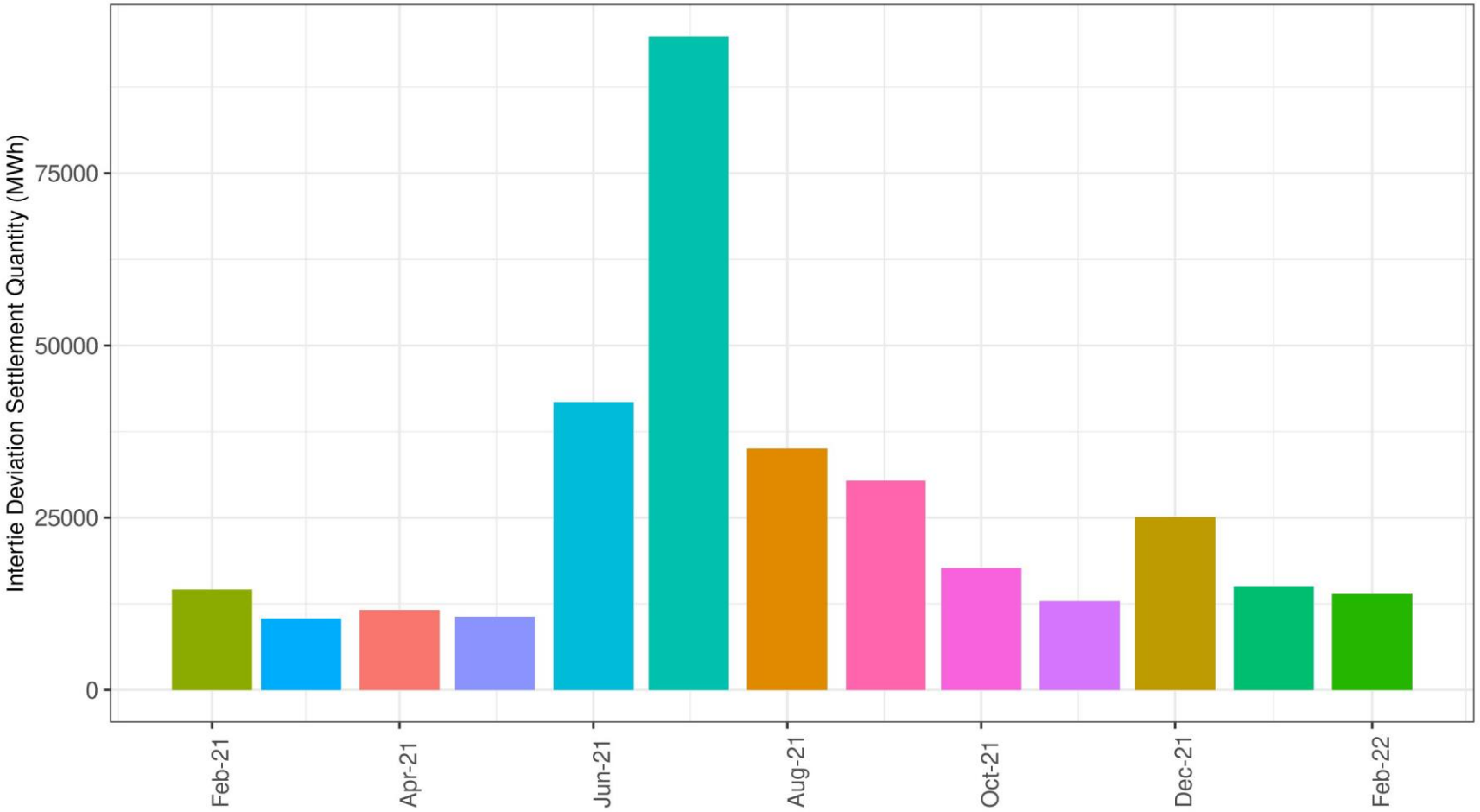


Intertie Deviation Settlement

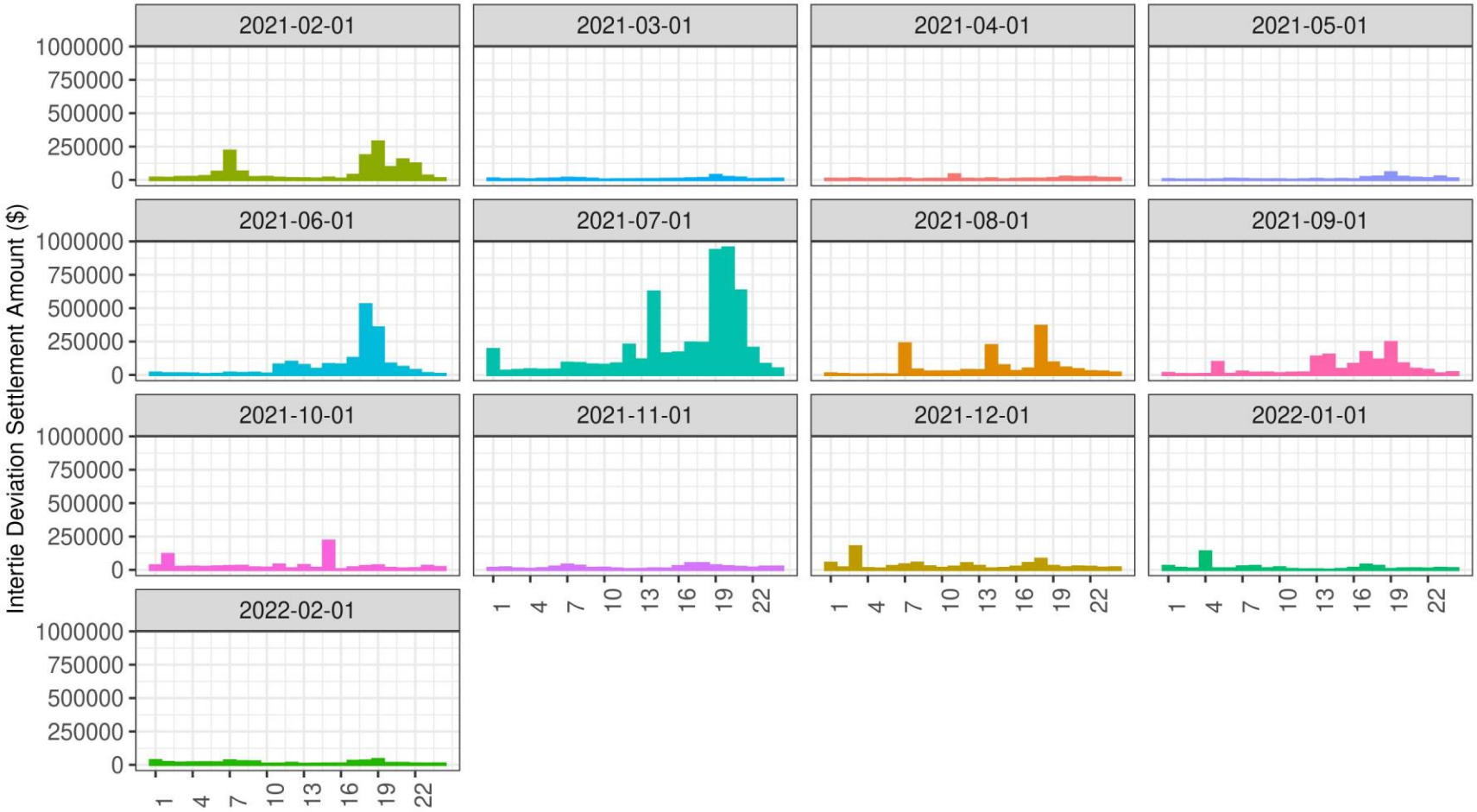
Intertie Deviation Settlement Amount since go live in February 2021



Intertie Deviation Quantity shows an increase in the month of July 2021 (peak summer)



Hourly pattern of Intertie deviation settlement for every month

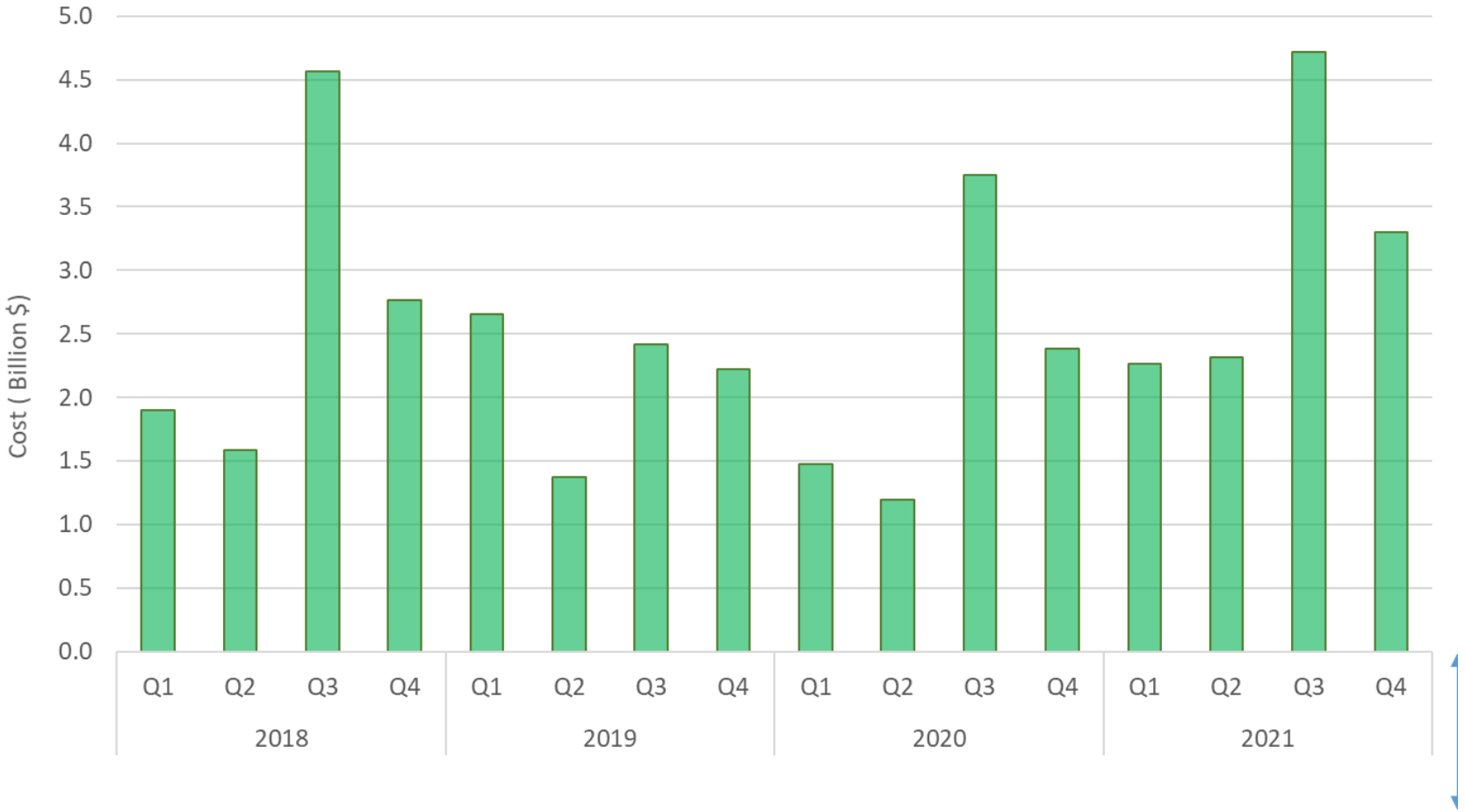


CAISO's Market Costs

CAISO markets costs have multiple components, and 90 percent of overall energy costs are transacted in day-ahead market

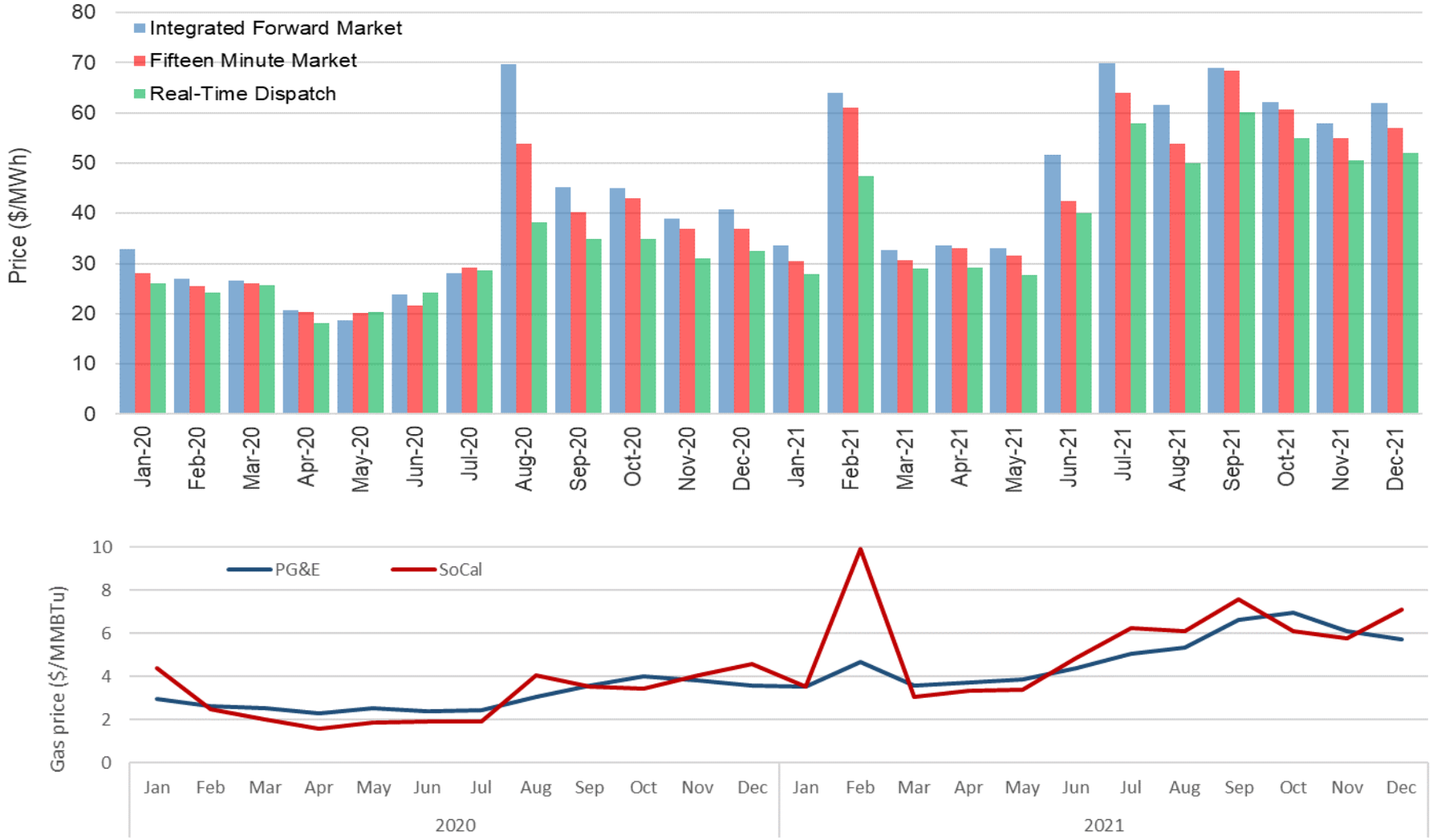
- Main cost components include:
  - Day-ahead energy costs
  - Real-time energy costs
  - Ancillary Service costs
  - Bid cost recovery
  - Reliability Must Run
  - GMC

Wholesale market costs in 2021 were about $12.6 Billion, a 43% increase of the $8.8 Billion in 2020

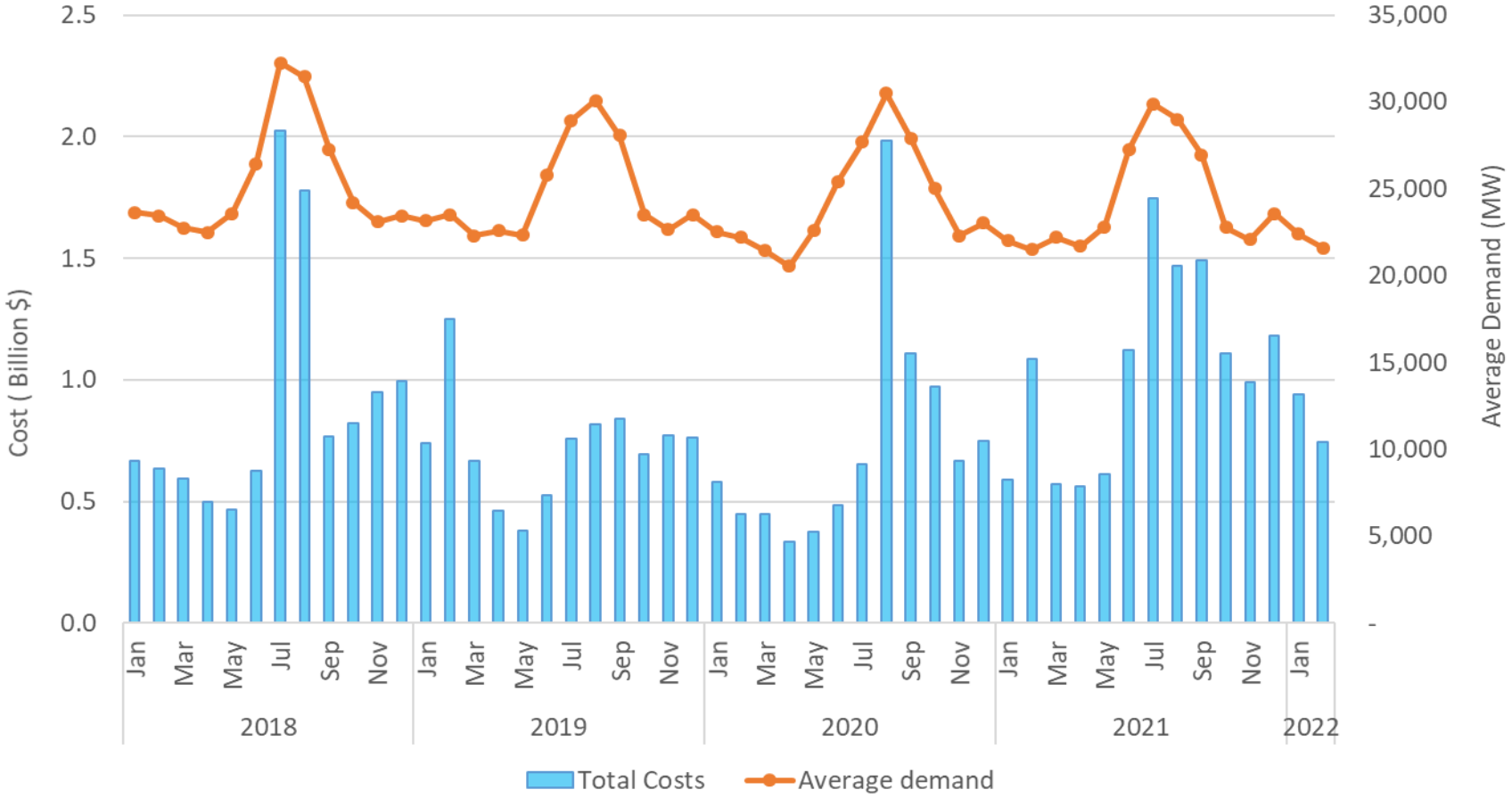


Settlements data is preliminary and subject to changes

Higher costs in the second part of 2022 were driven by higher energy costs and gas prices



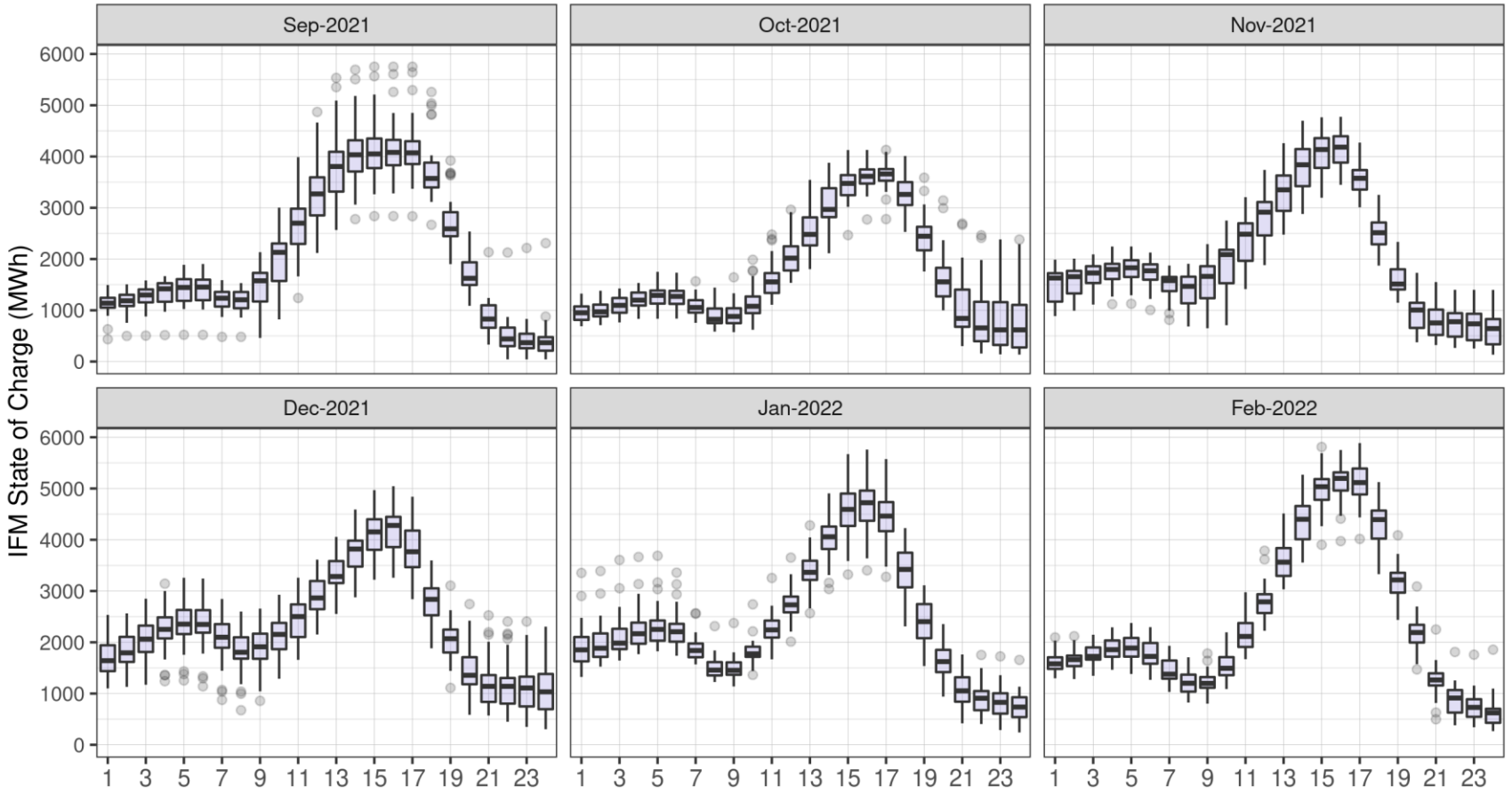
Costs depend on both market clearing prices and demand transacted



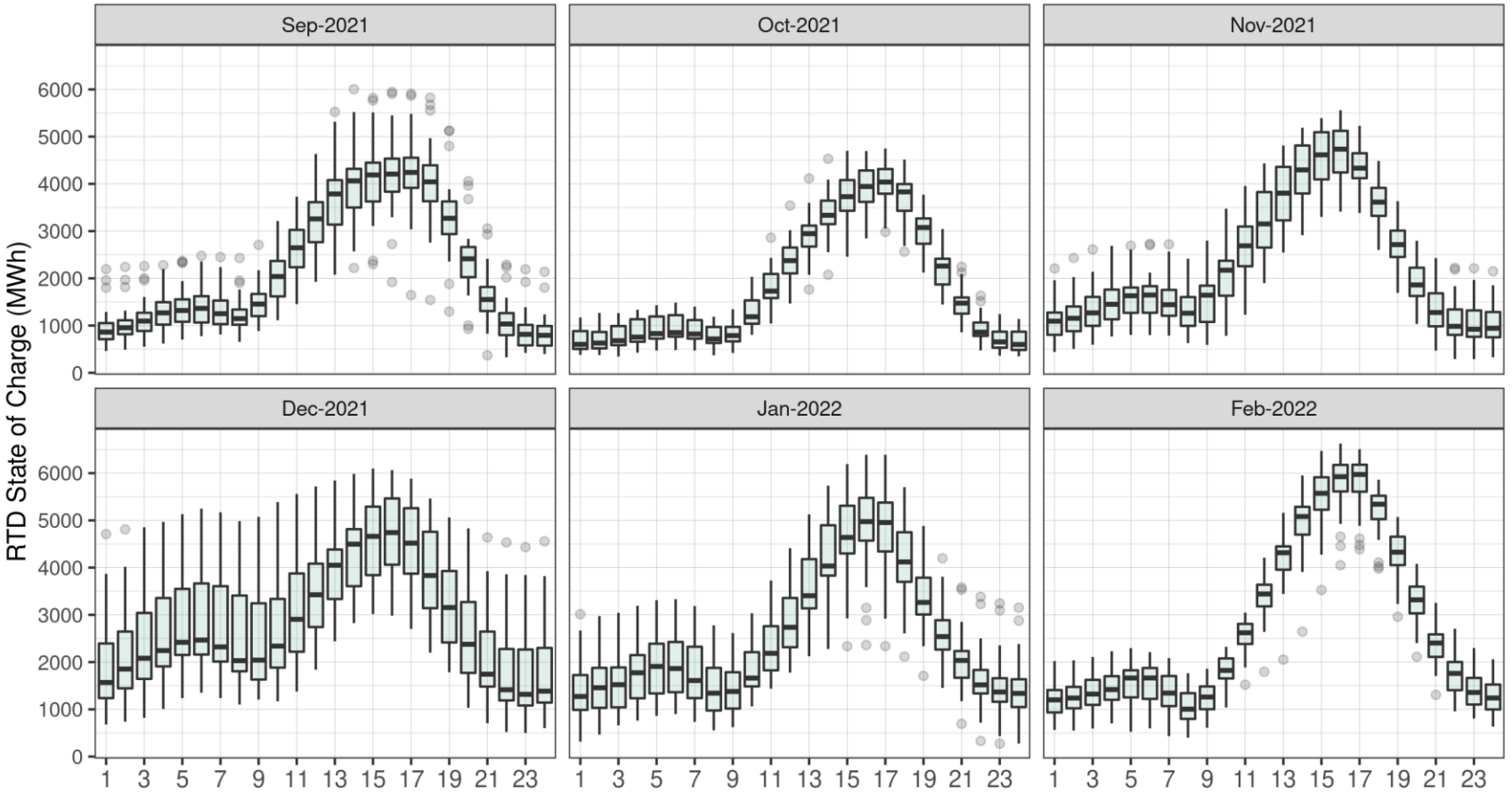
- Energy settled in the CAISO's market during summer conditions was in the typical ranges in the last three years

Storage Resources

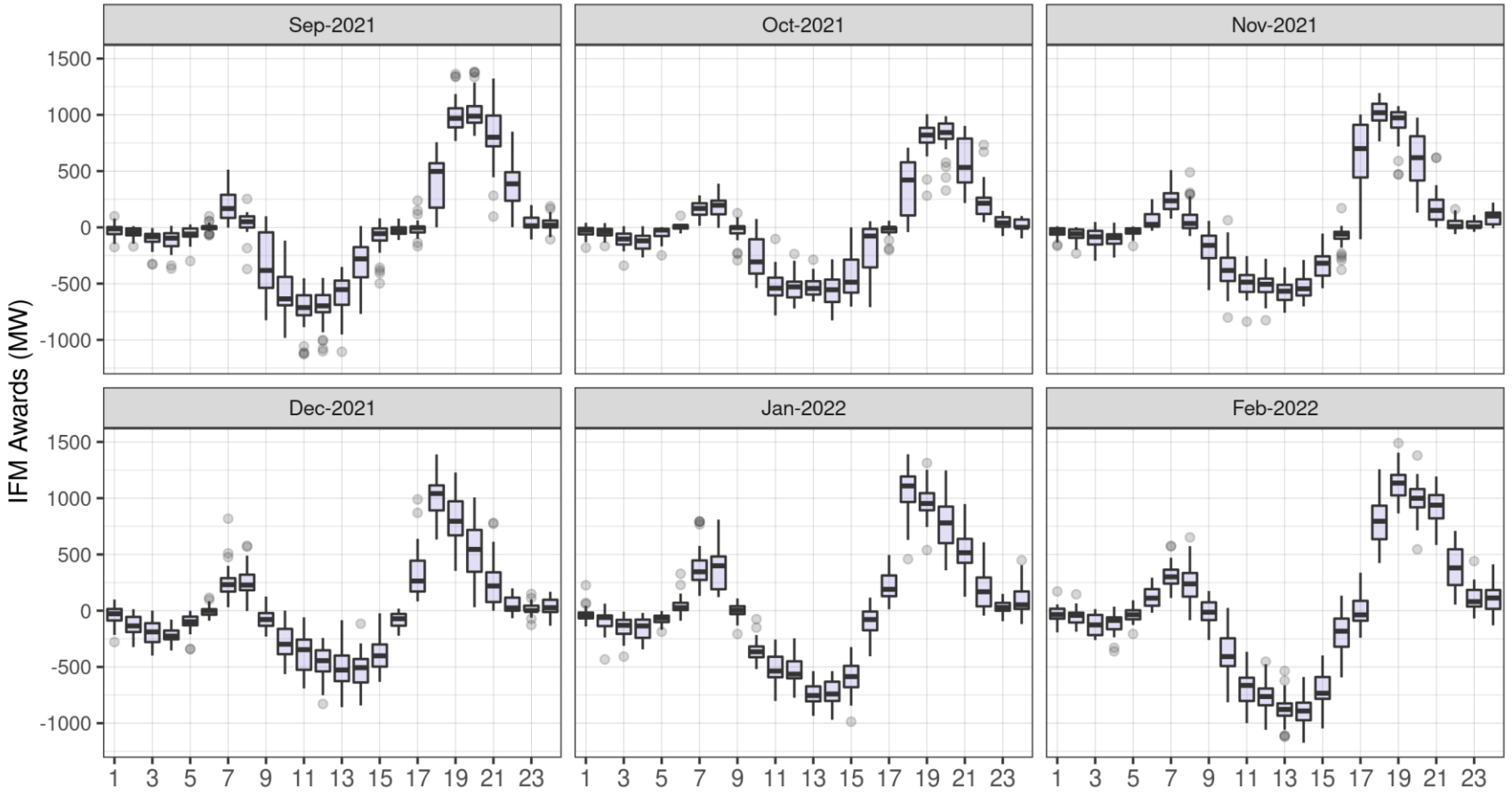
Day-Ahead state of charge for storage resources was the highest in hour ending 14 through 17



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



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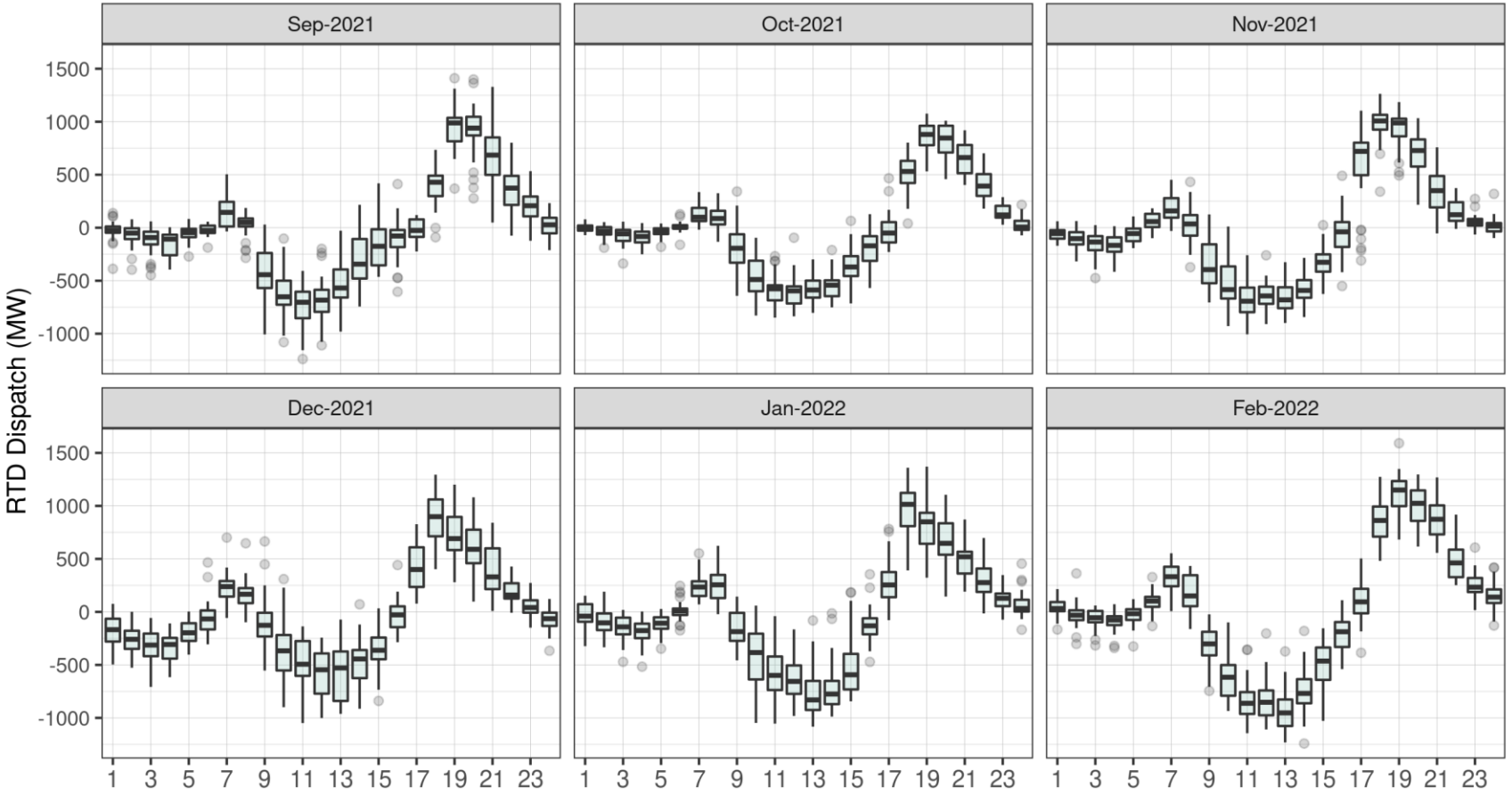
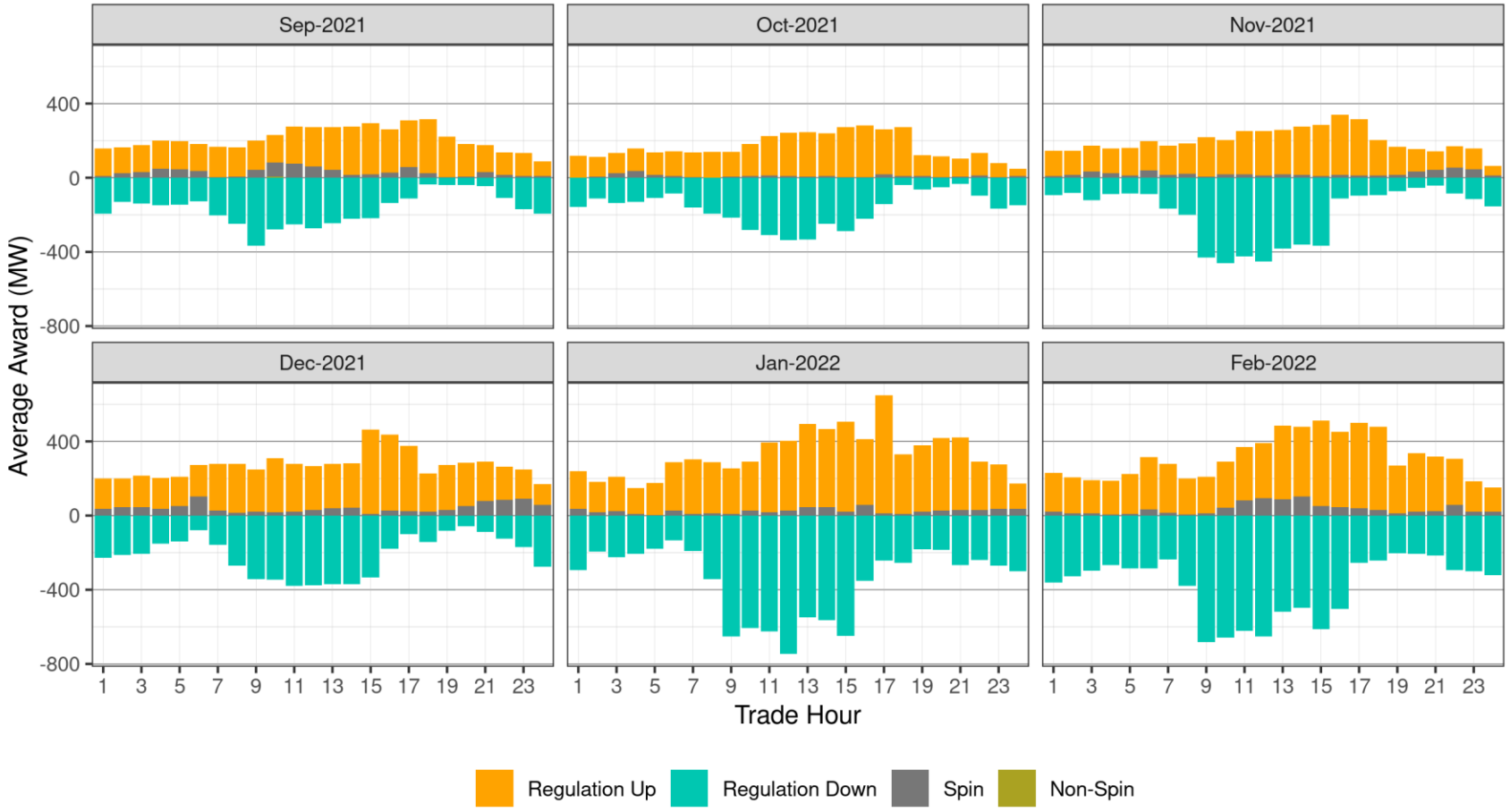
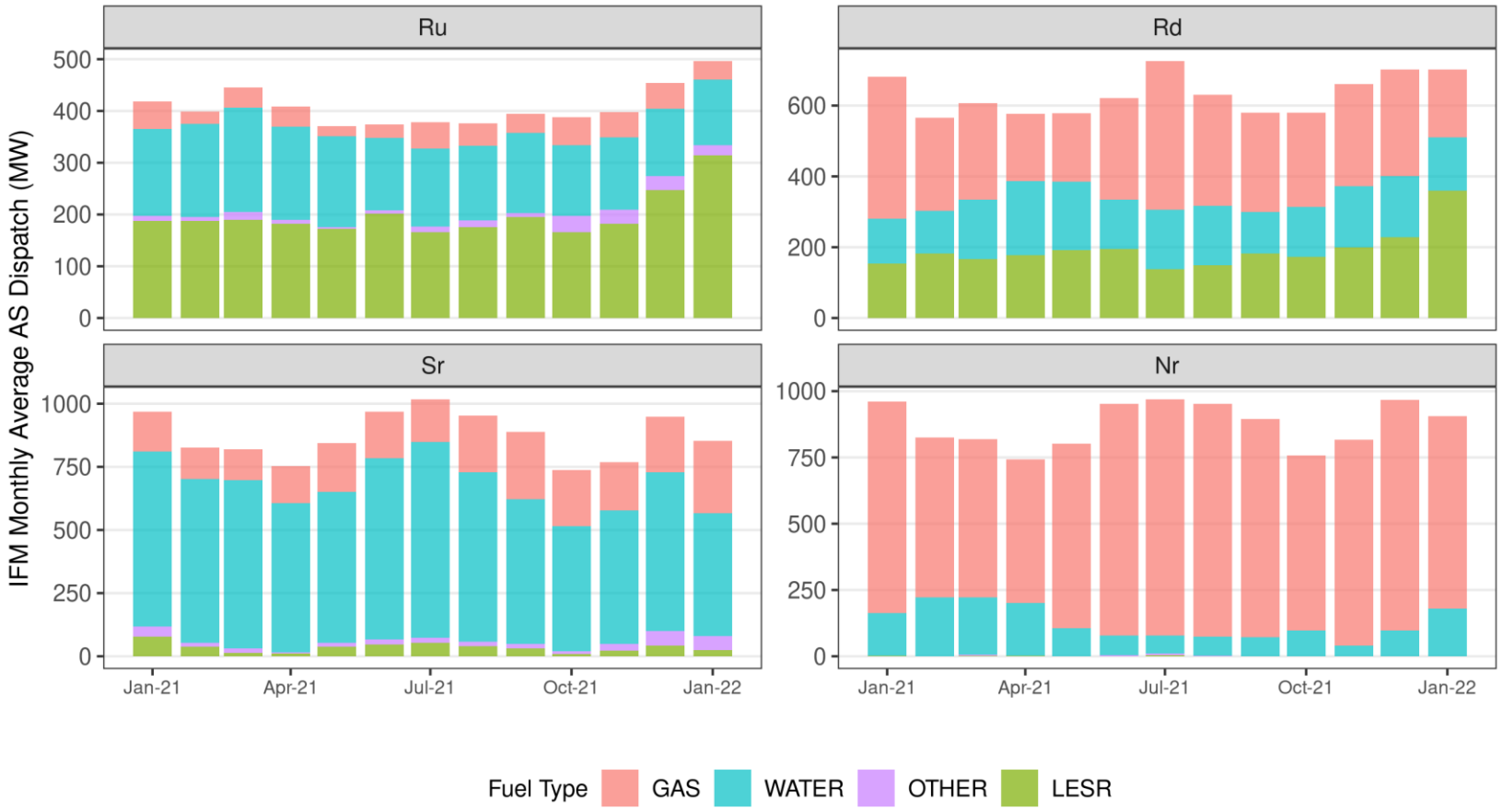


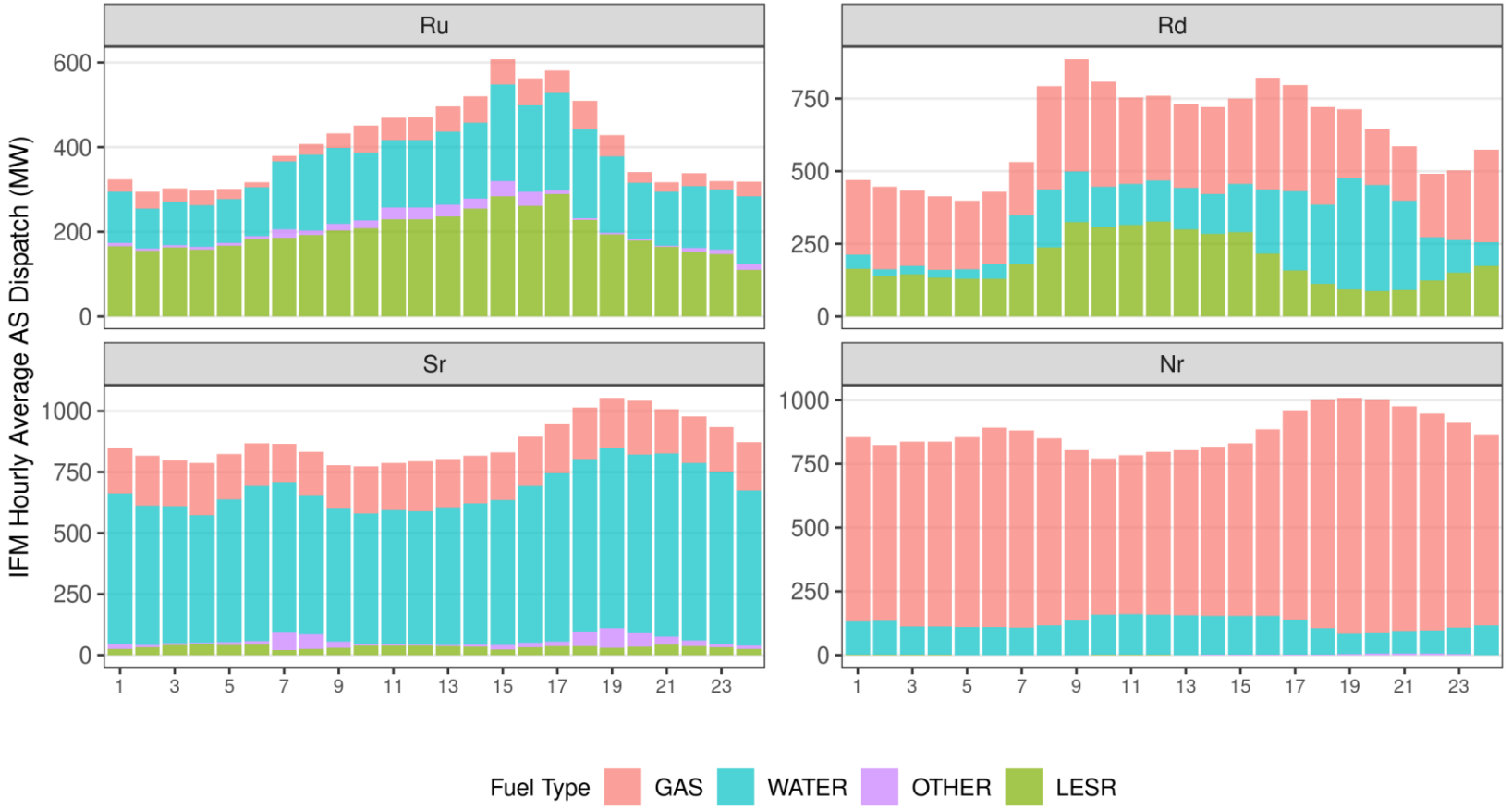
Batteries continued to provide both Regulation up and Regulation down



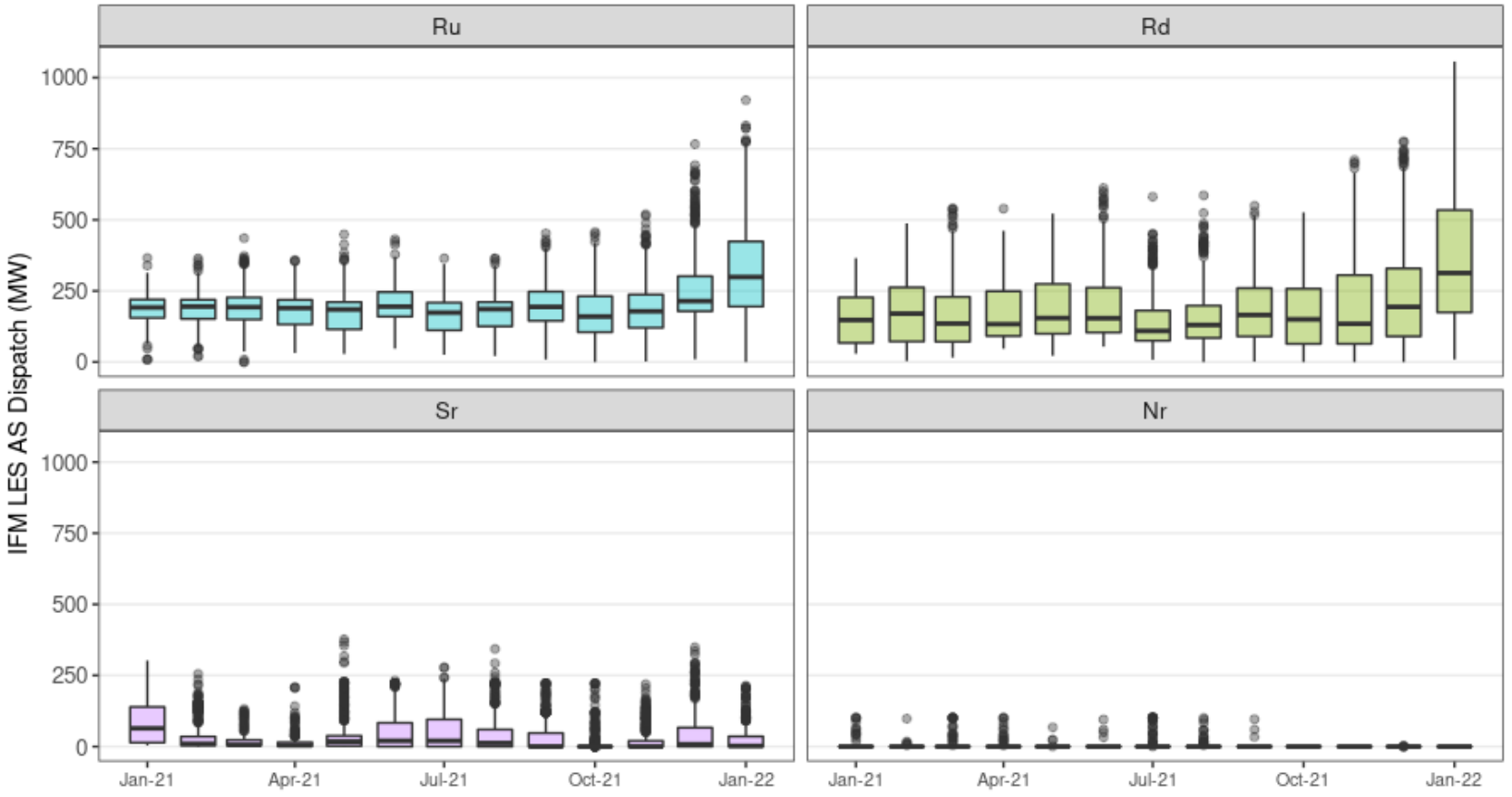
Average monthly AS dispatch by resource type shows an increasing volume of regulation supported by storage resources



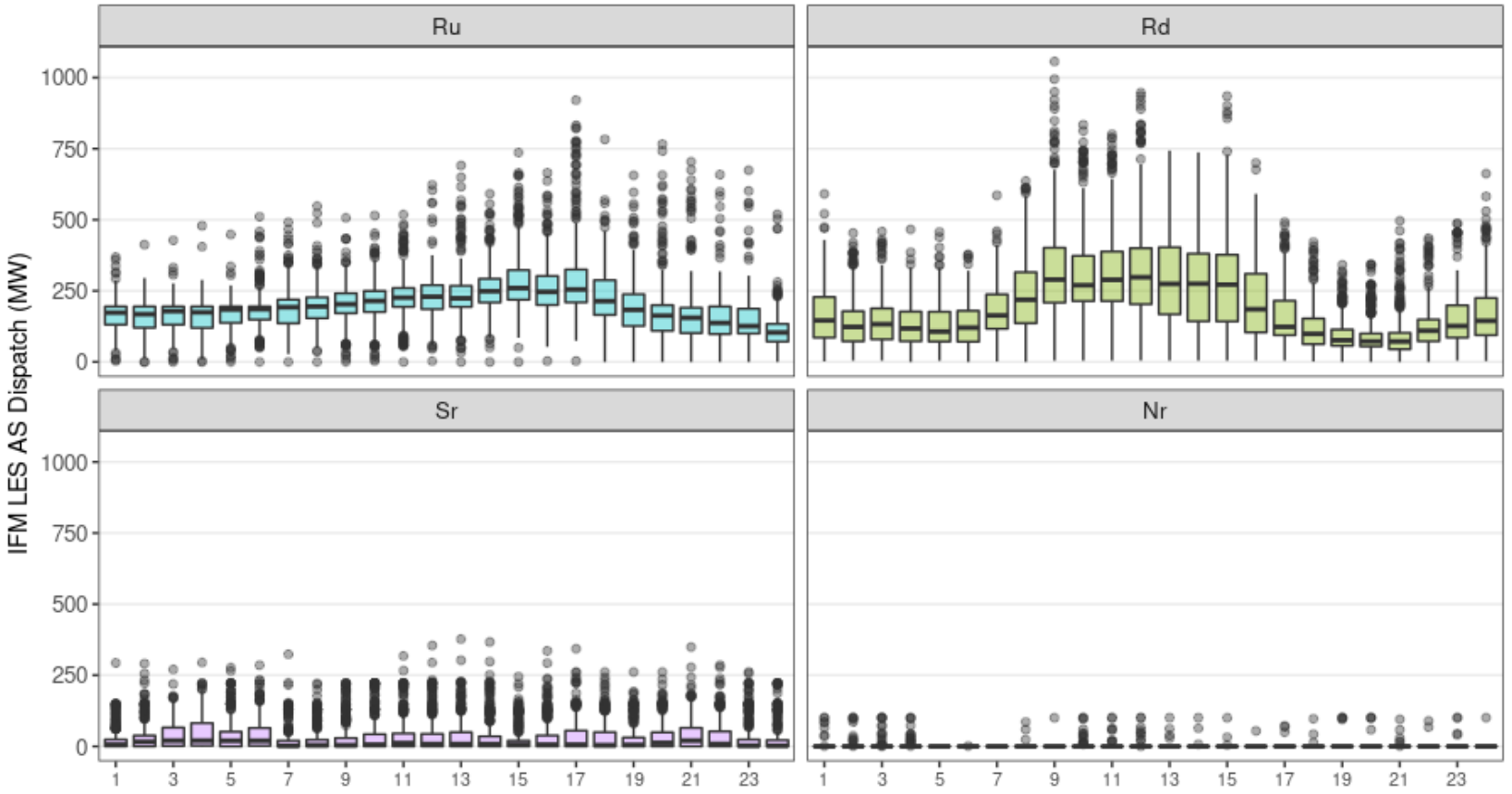
Average hourly AS dispatch by resource type shows the maximum regulation up is provided in afternoon hours



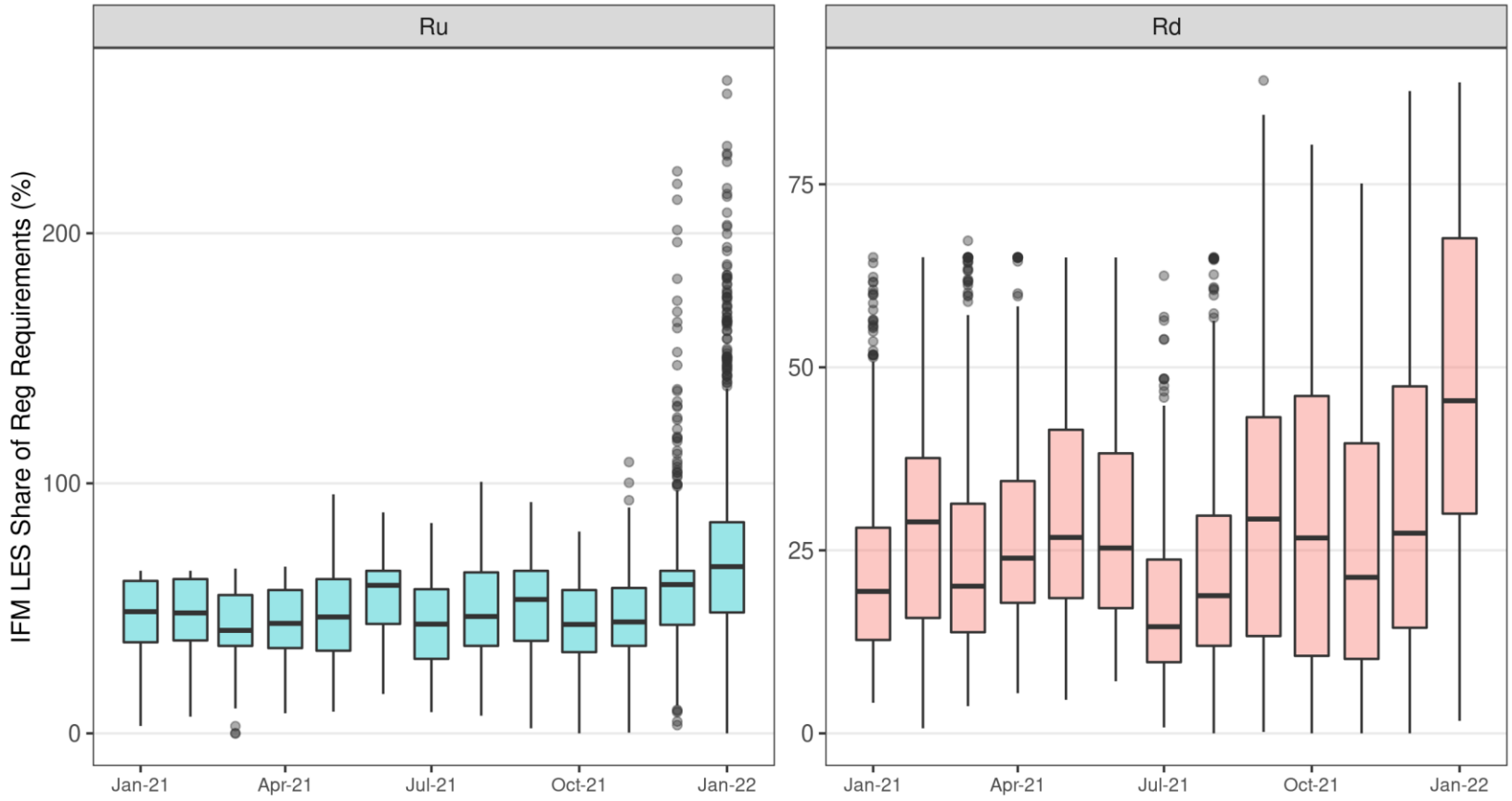
Monthly AS dispatch for storage resources show an increasing trend of regulation procurement



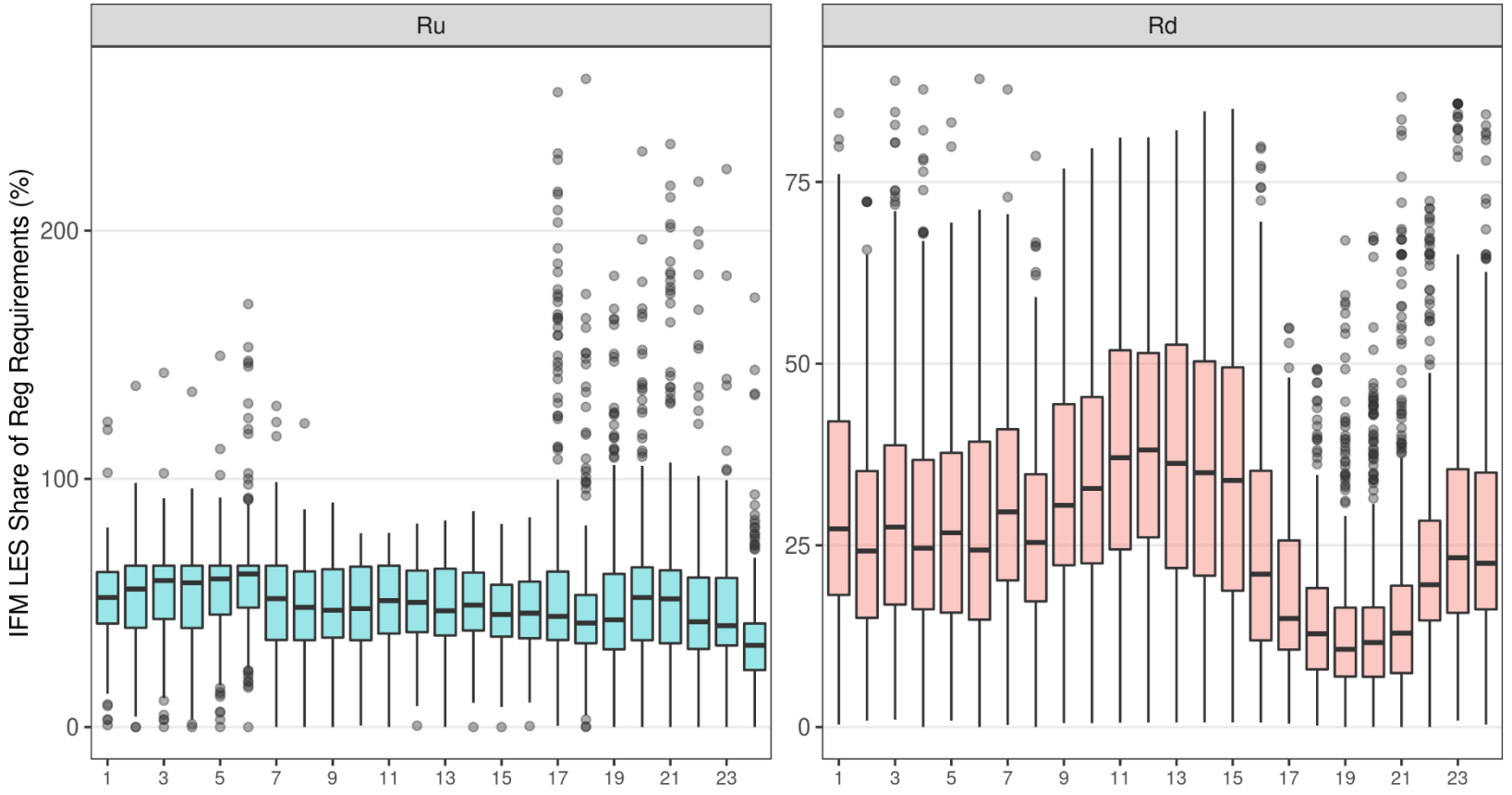
Hourly AS dispatch – LES only



Storage resources have saturated at times the regulation market by providing capacity in excess of regulation requirements

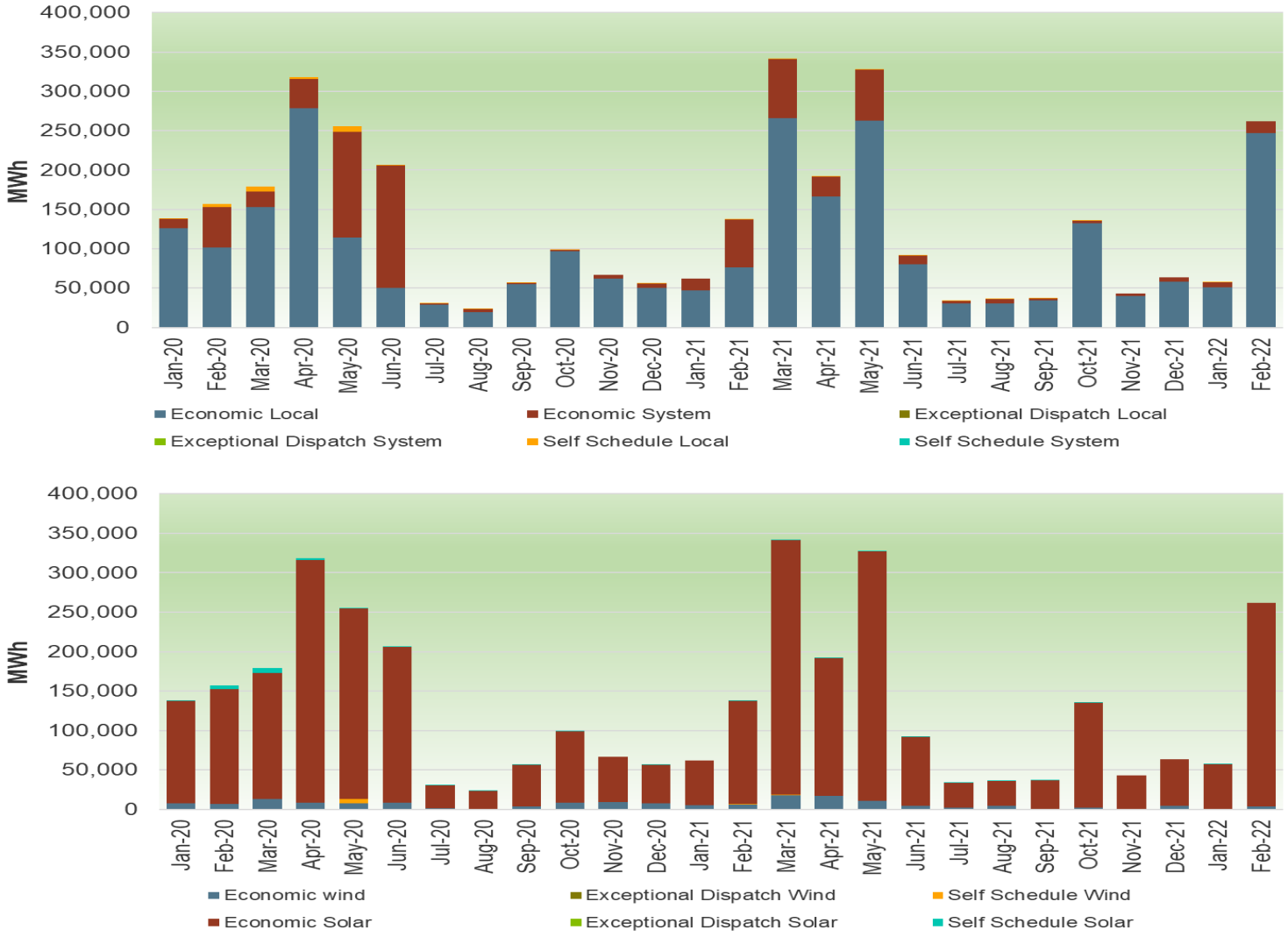


The saturation of the regulation market is more pronounced in late hours of the day

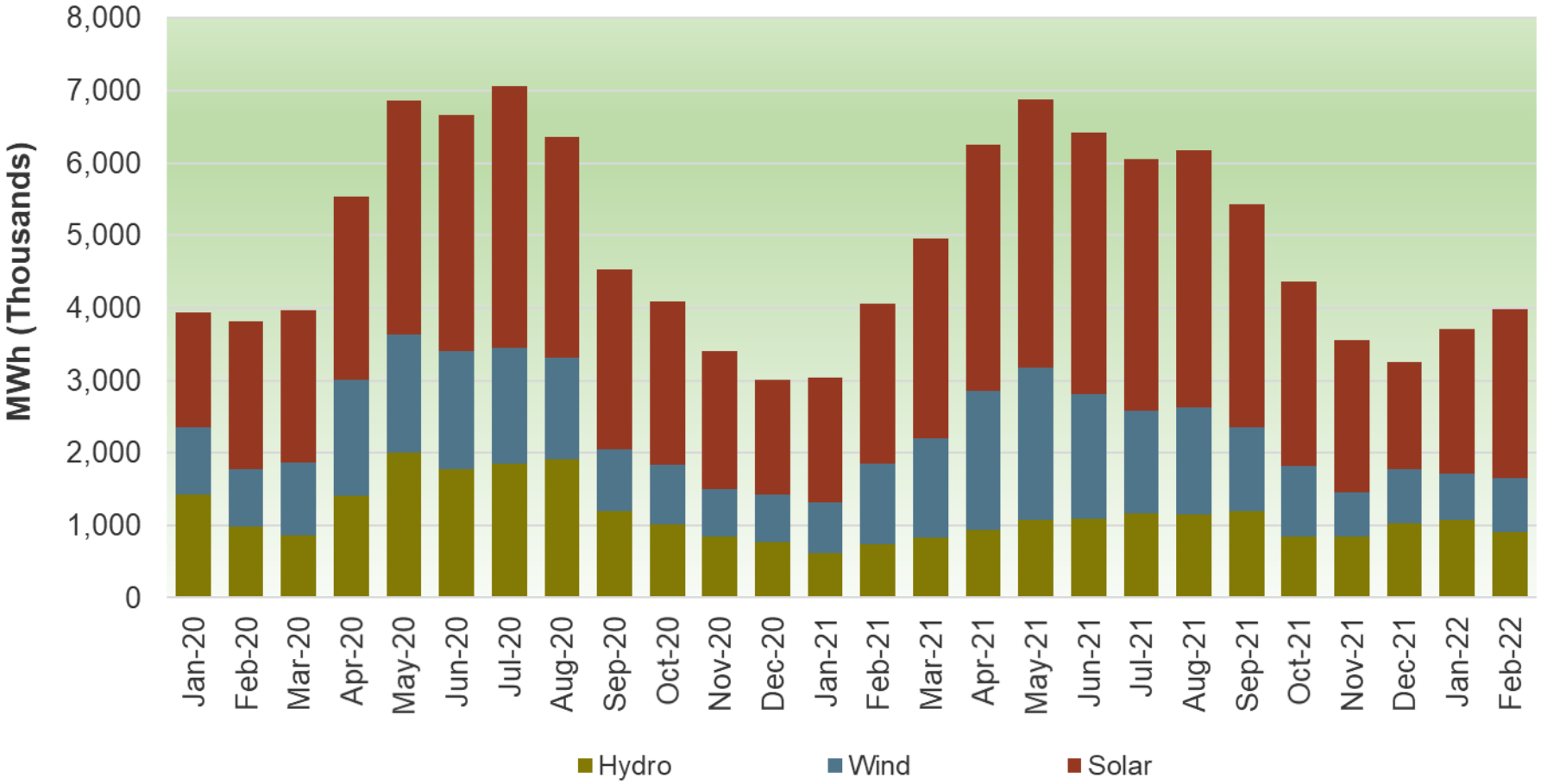


Market Performance Metrics

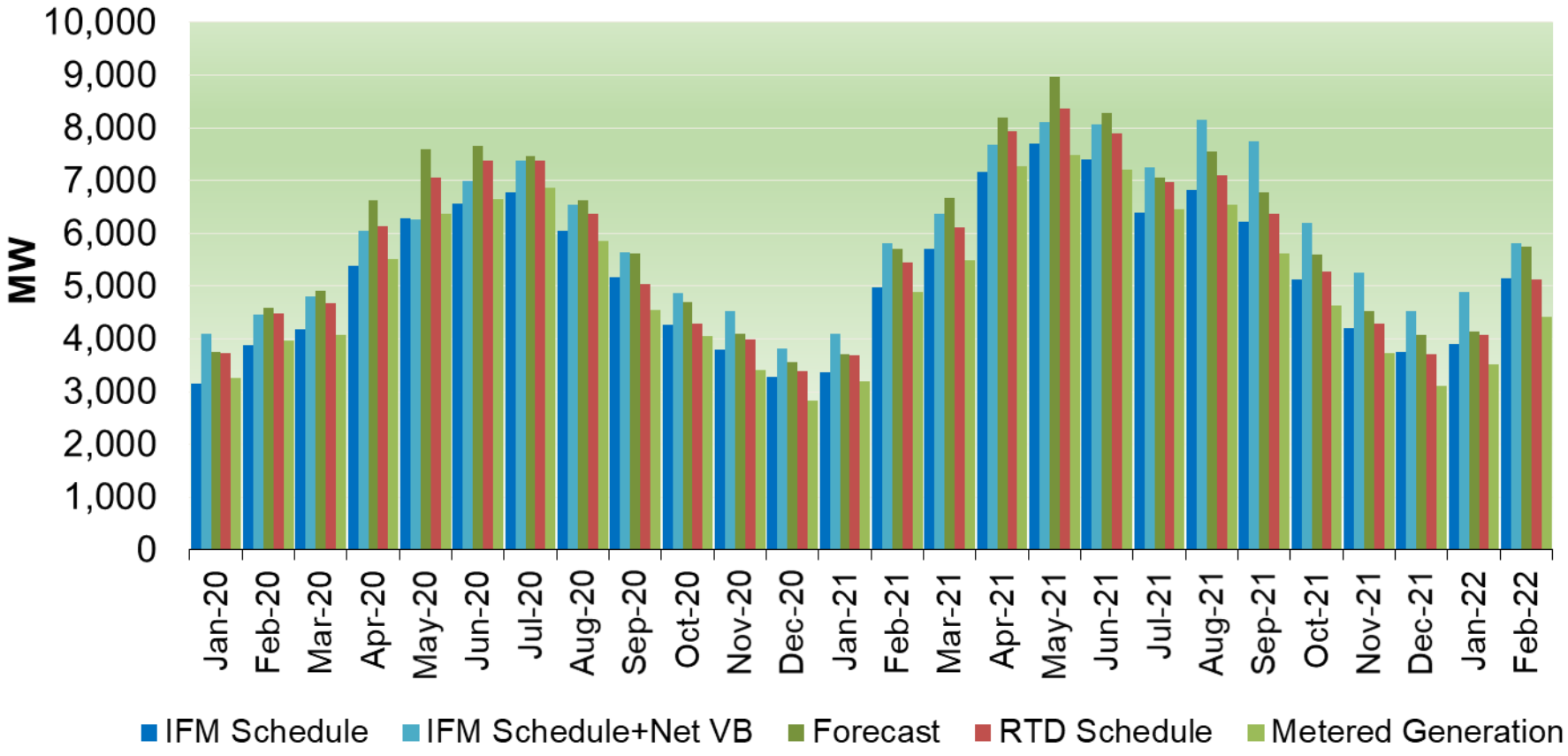
RTD renewable (VERs) curtailment rose in February



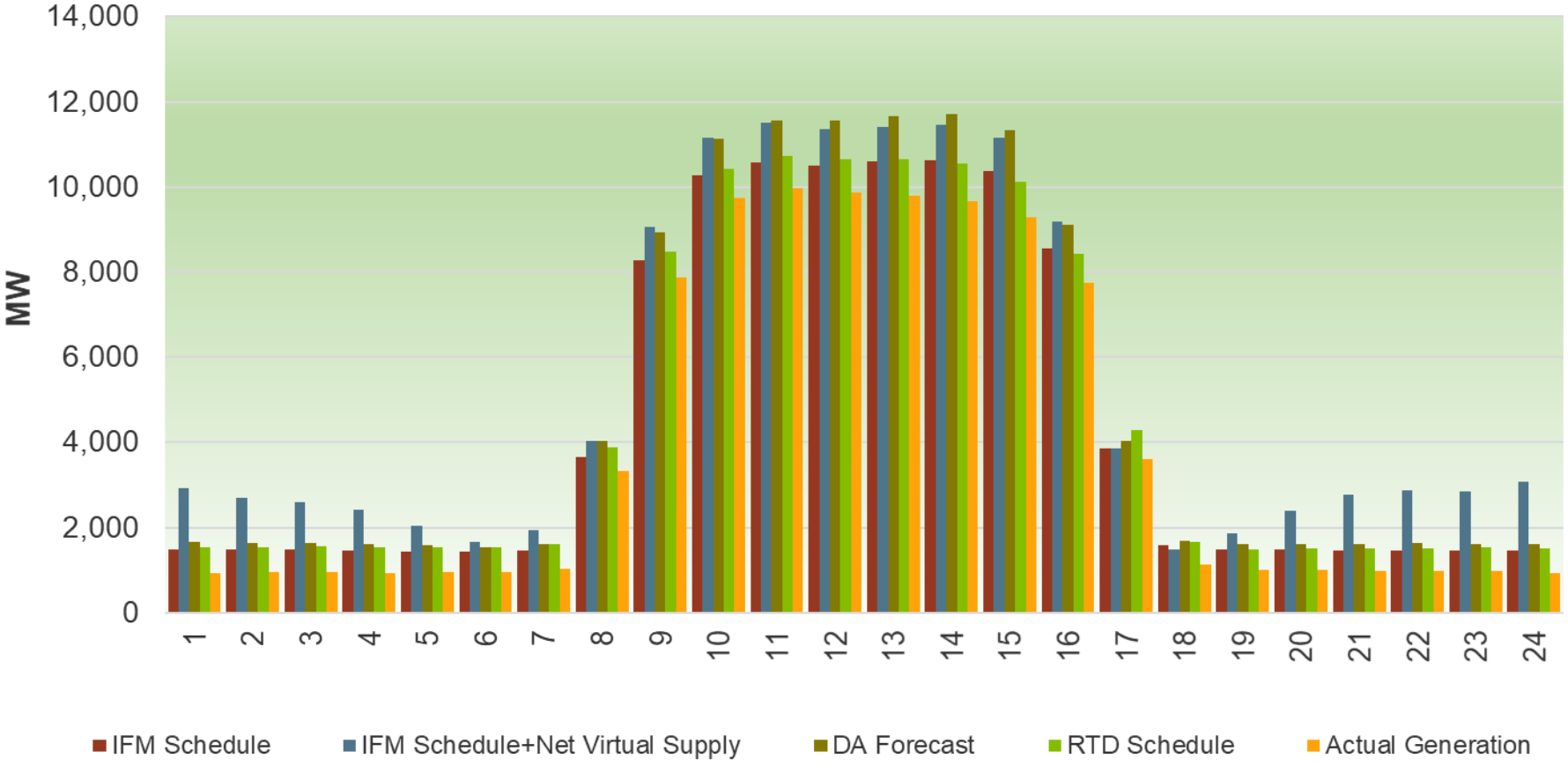
Hydro production at low levels



ISO total monthly VERS schedules and forecasts compared to actuals

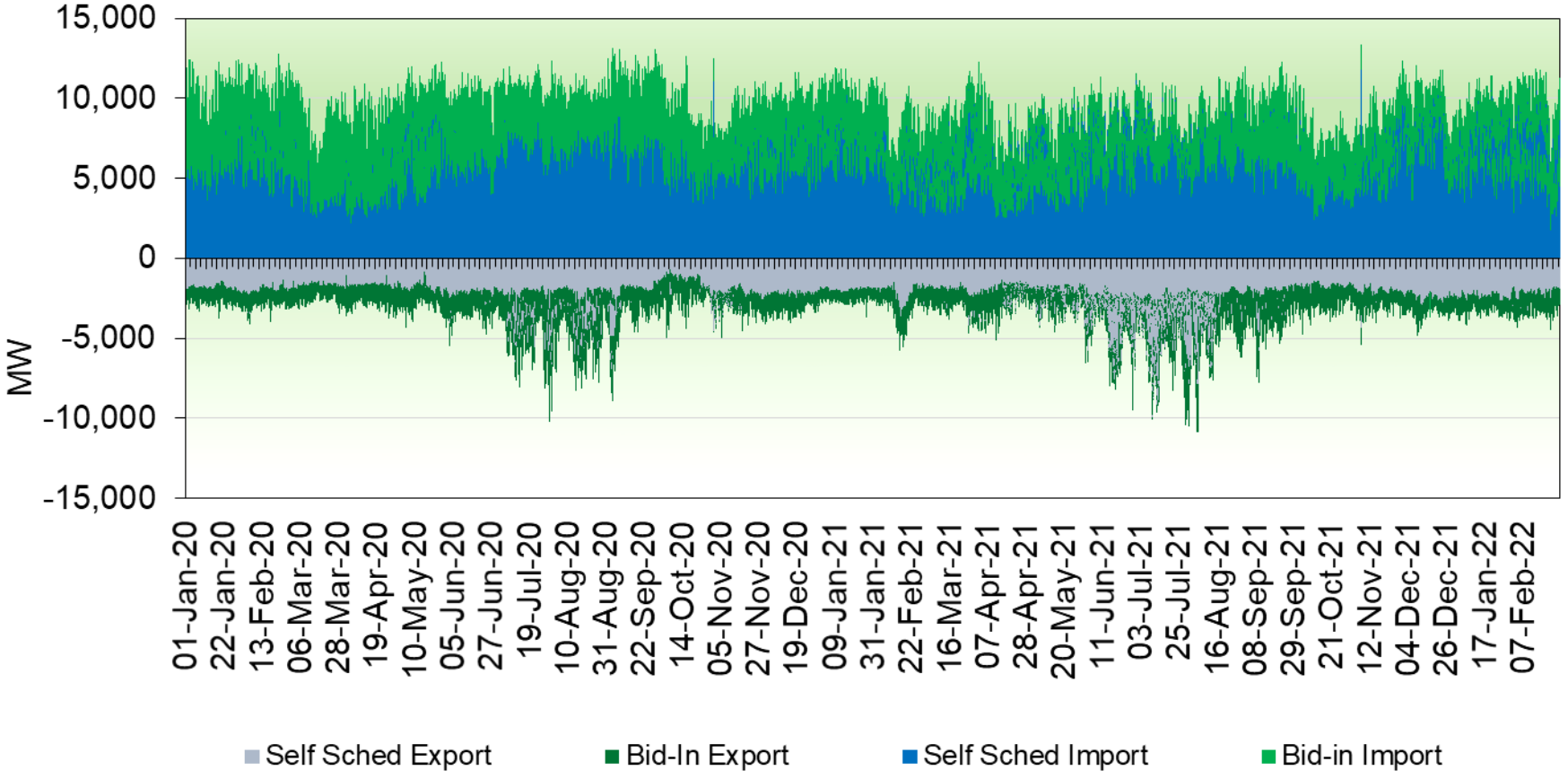


Renewable (VERS) schedules including net virtual supply aligns with VER forecast in January and February

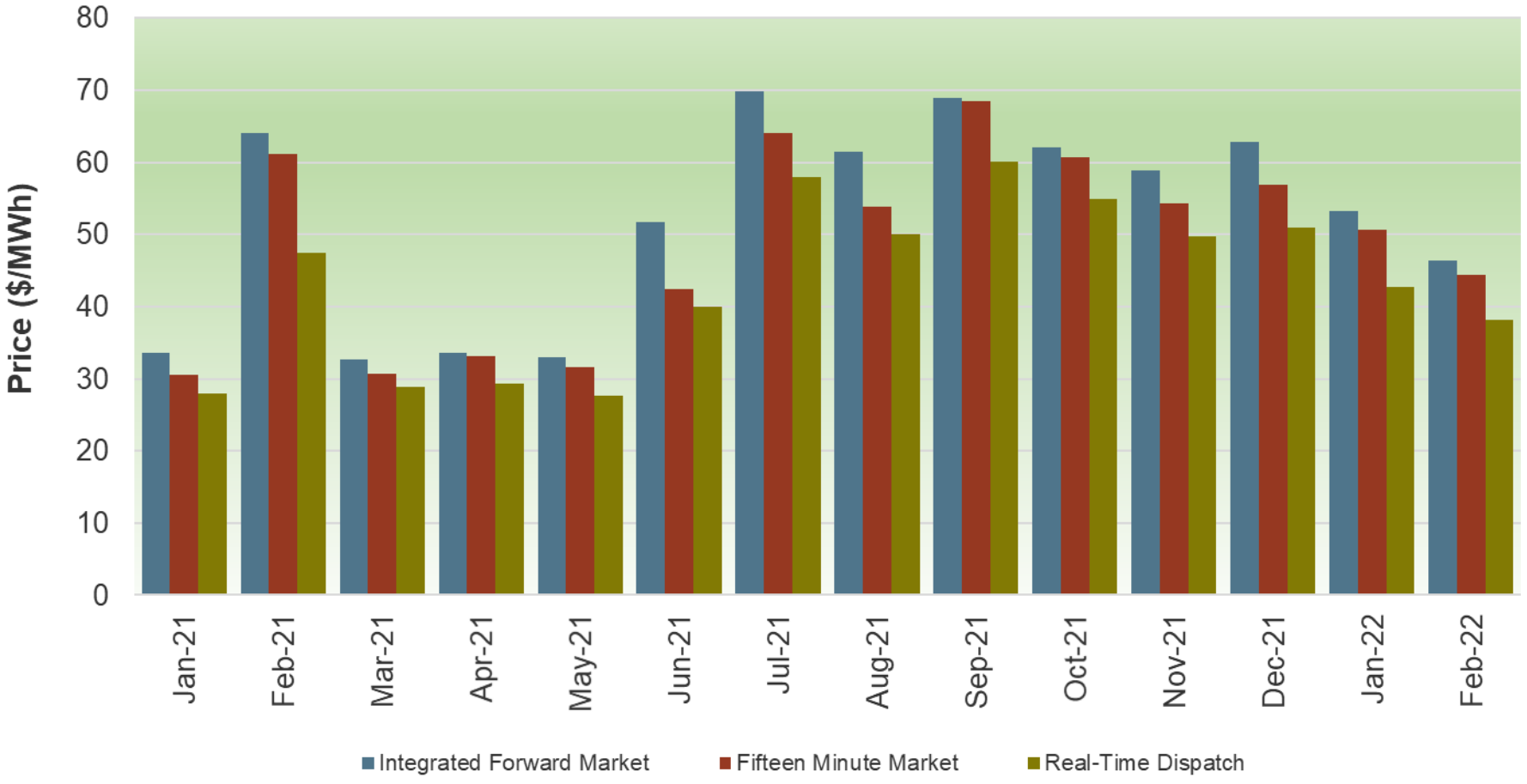


http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=EFF75C2E-F28E-4087-B88B-8DFFAED828F8

Self scheduled exports increased during winter

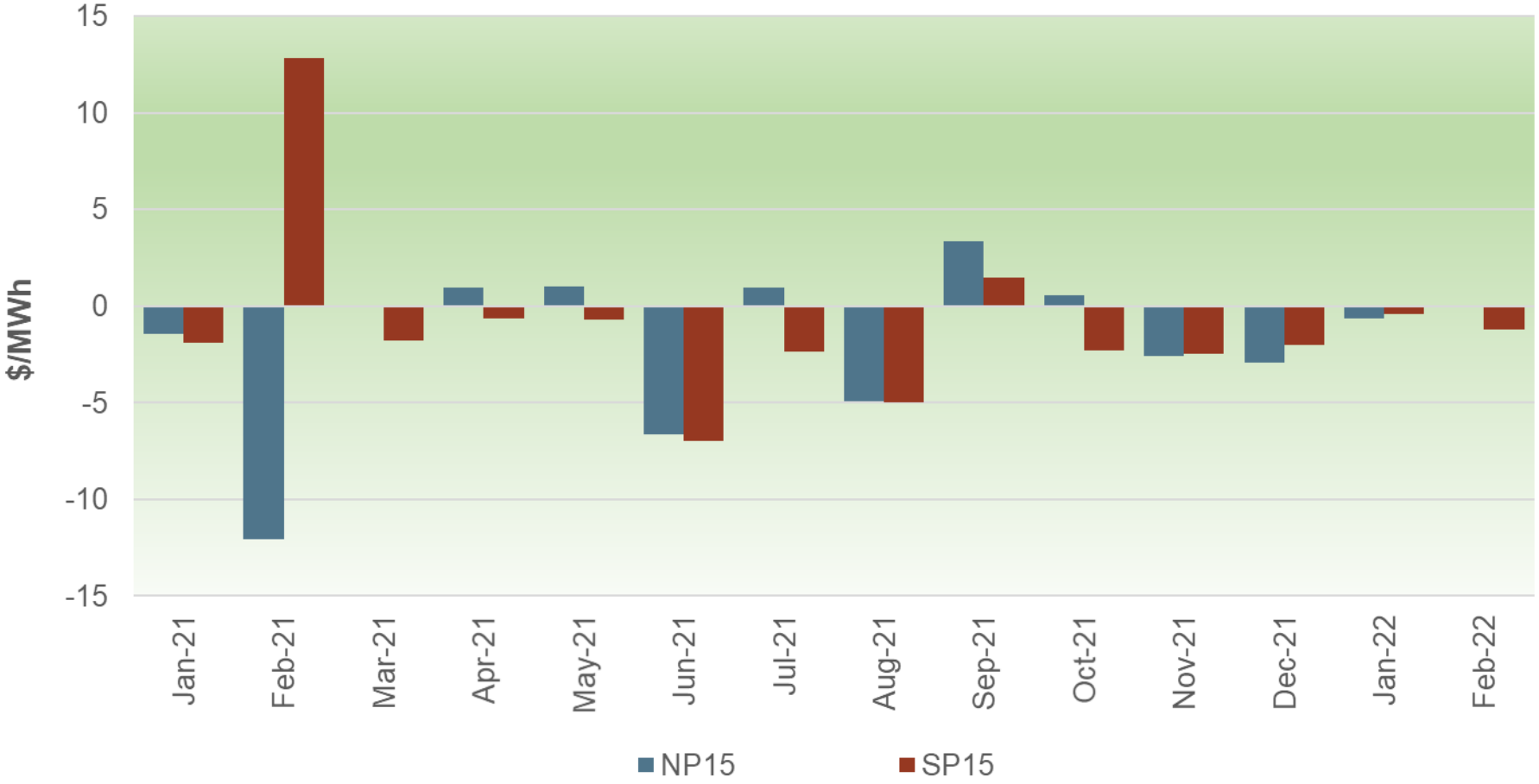


Lower average real-time prices

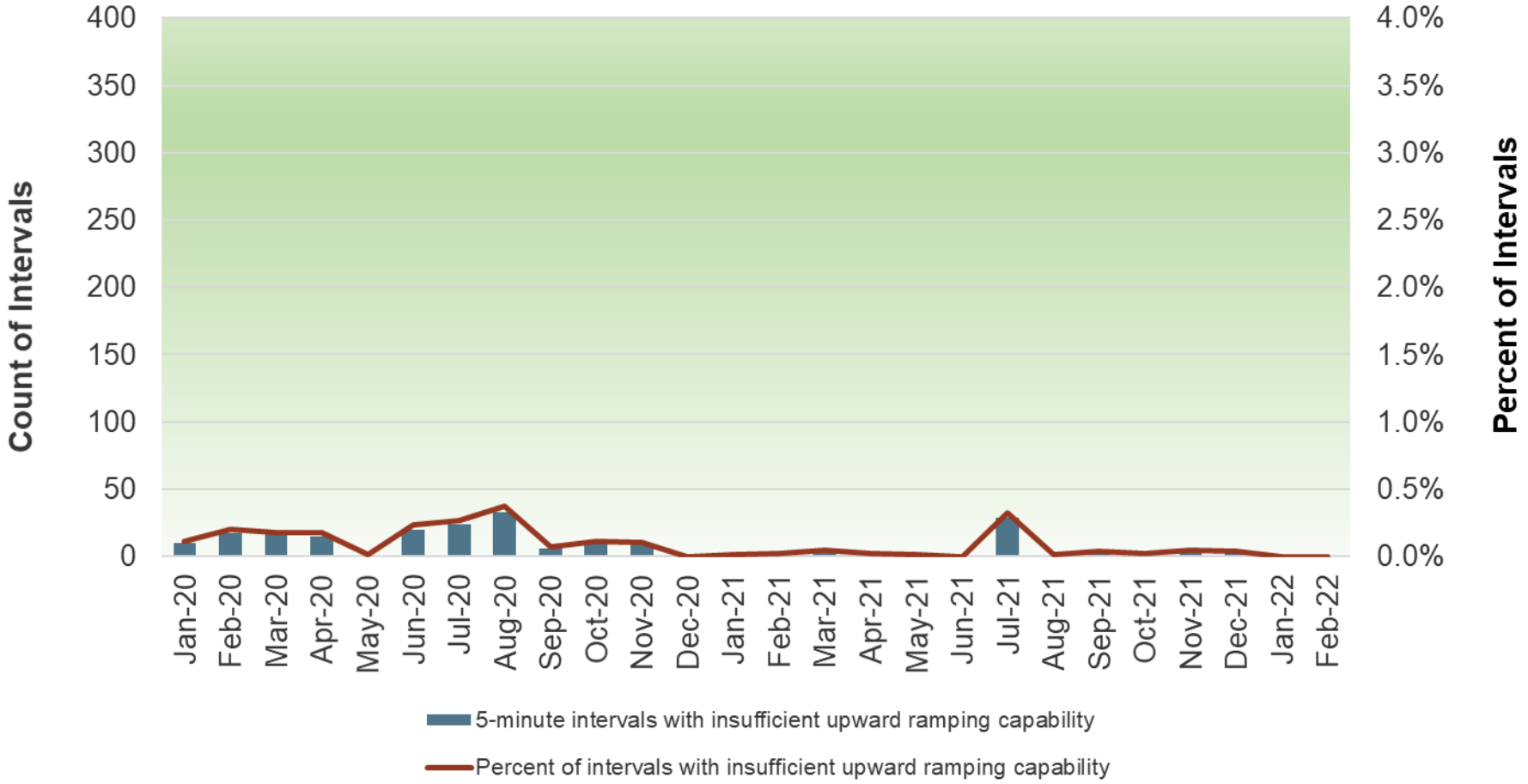


Note: Metric Based on System Marginal Energy Component (SMEC)

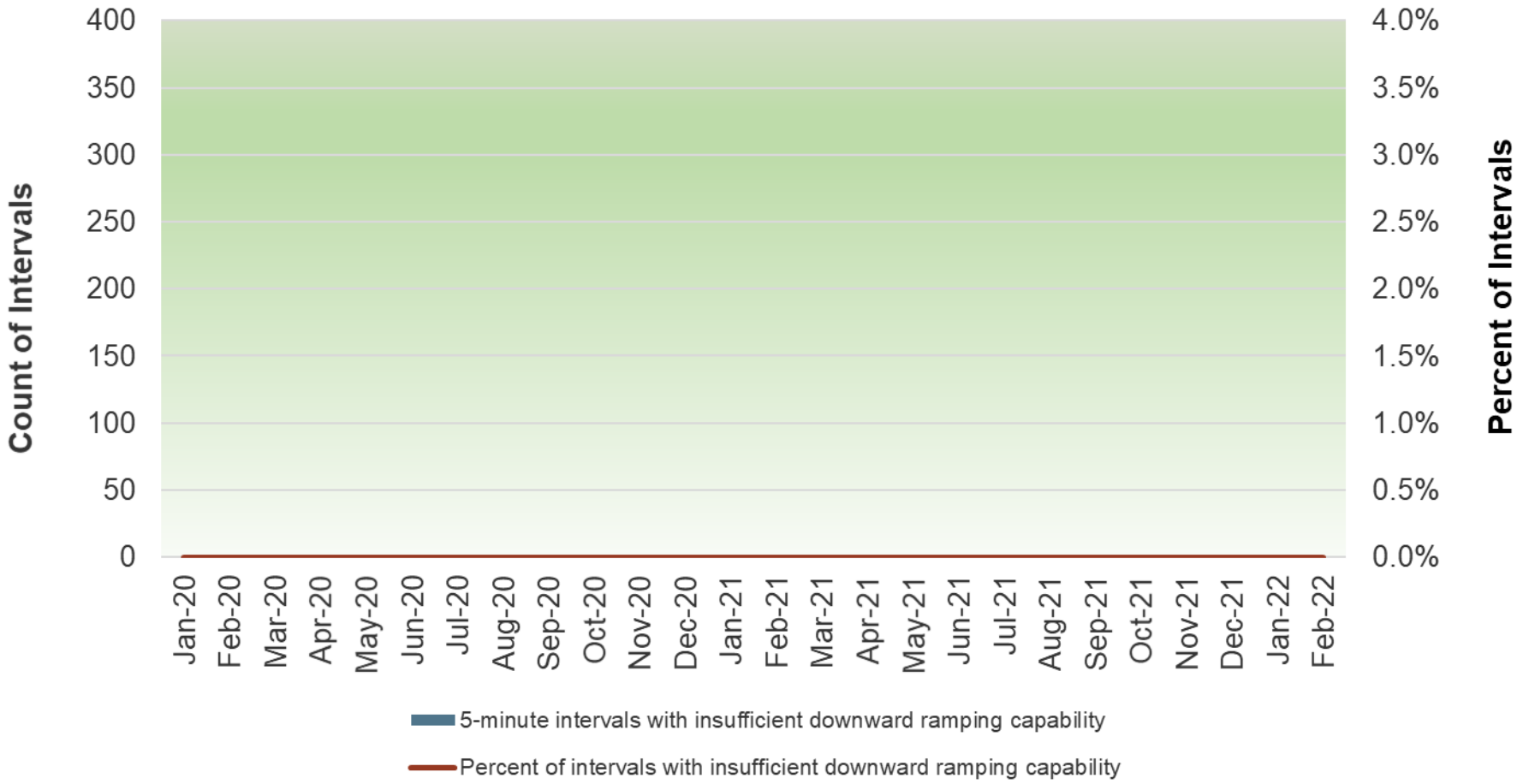
Real-time prices lower than day-ahead prices for both NP15 and SP15 since last November



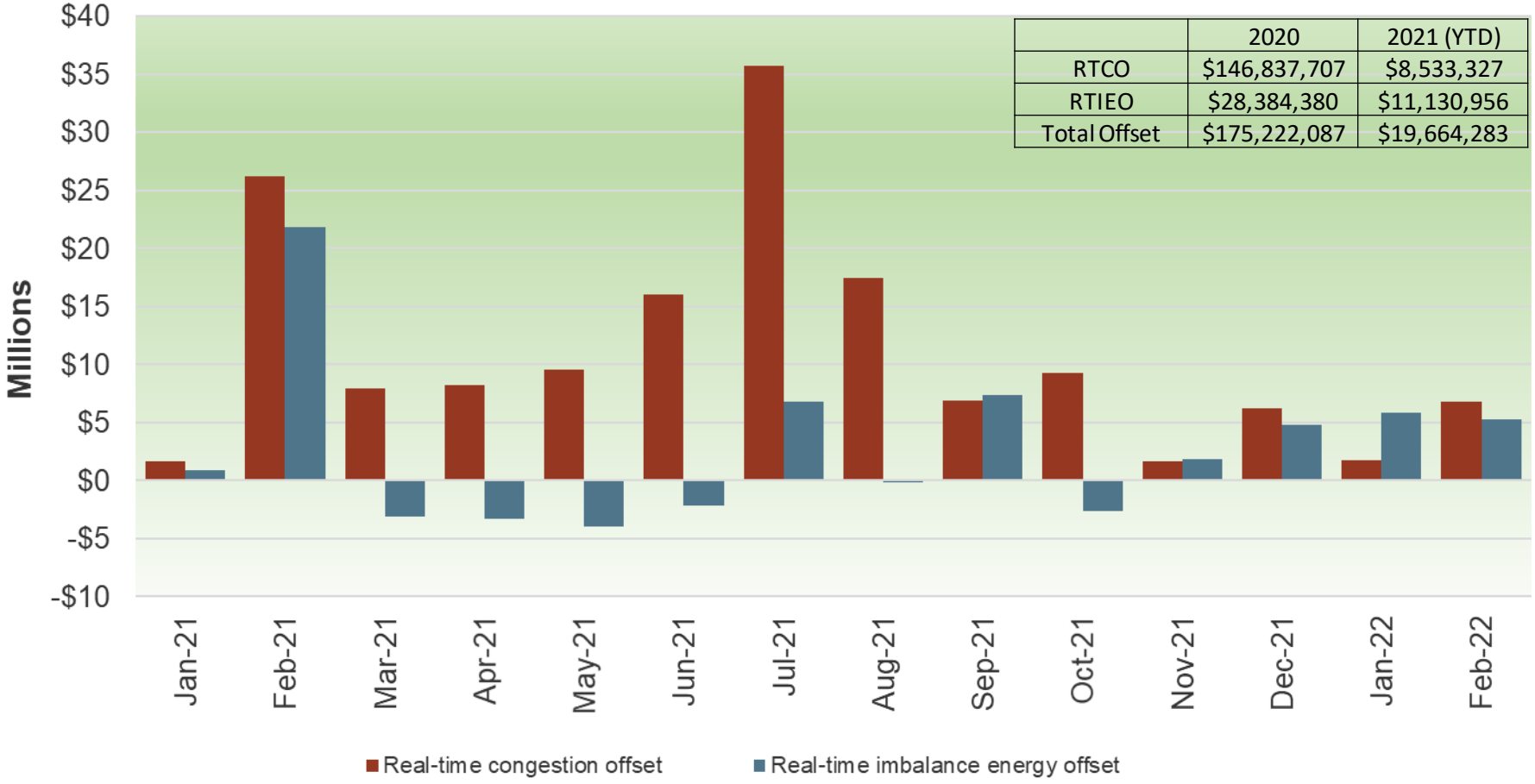
Insufficient upward ramping capacity in ISO real-time fell since July



Insufficient downward ramping capacity in real-time stayed low

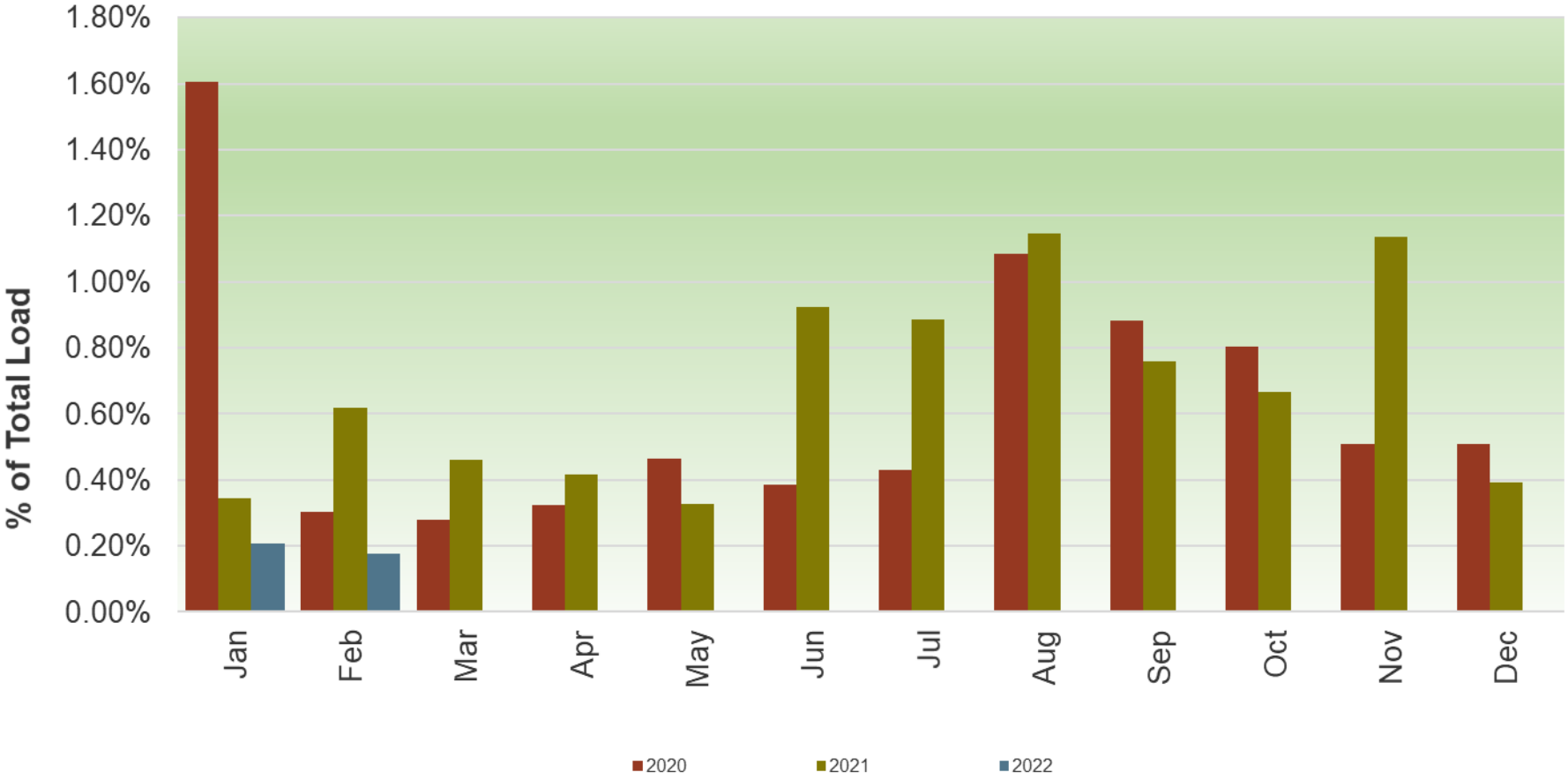


ISO area real-time imbalance energy and congestion offsets remained low since last November

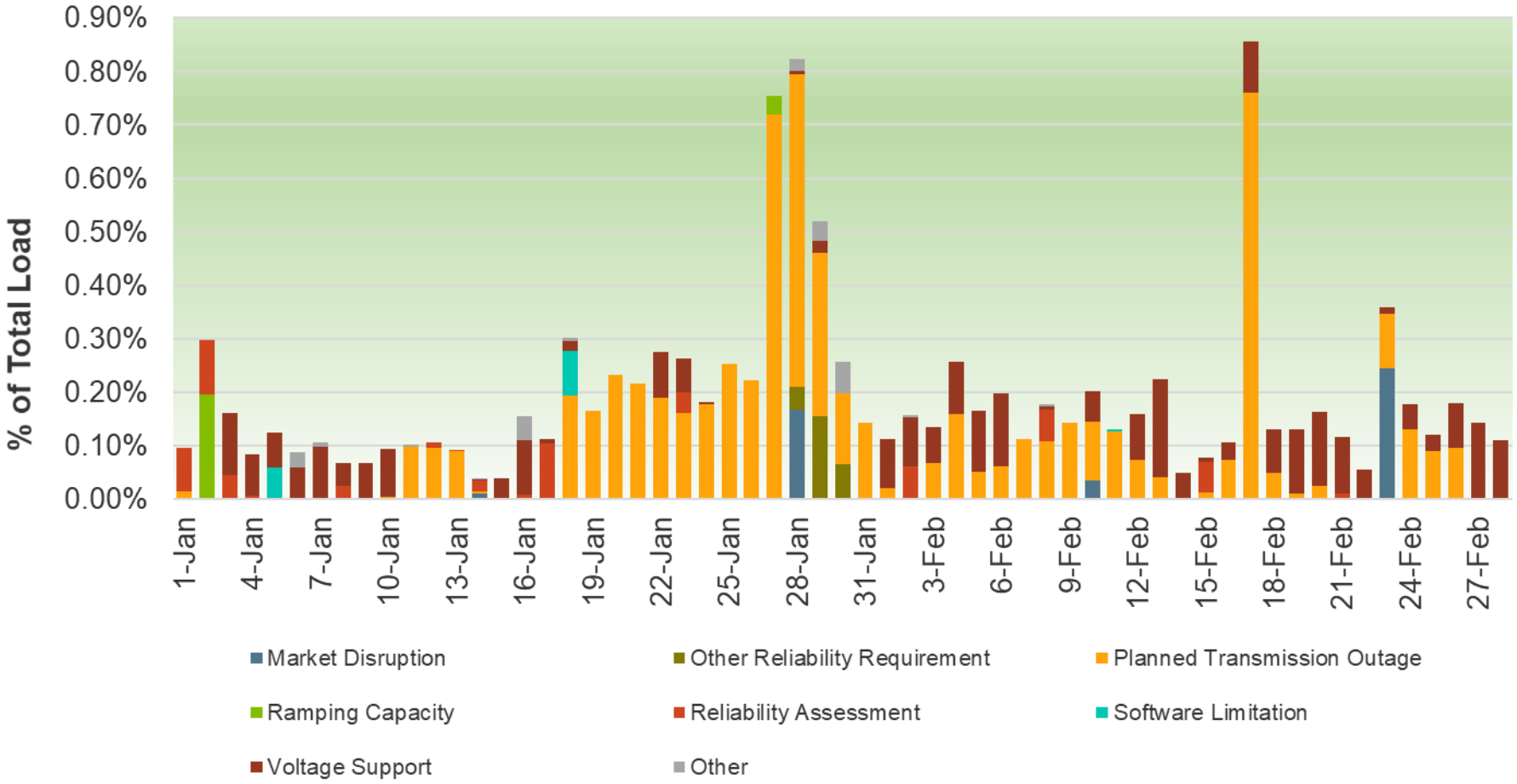


	2020	2021 (YTD)
RTCO	$146,837,707	$8,533,327
RTIEO	$28,384,380	$11,130,956
Total Offset	$175,222,087	$19,664,283

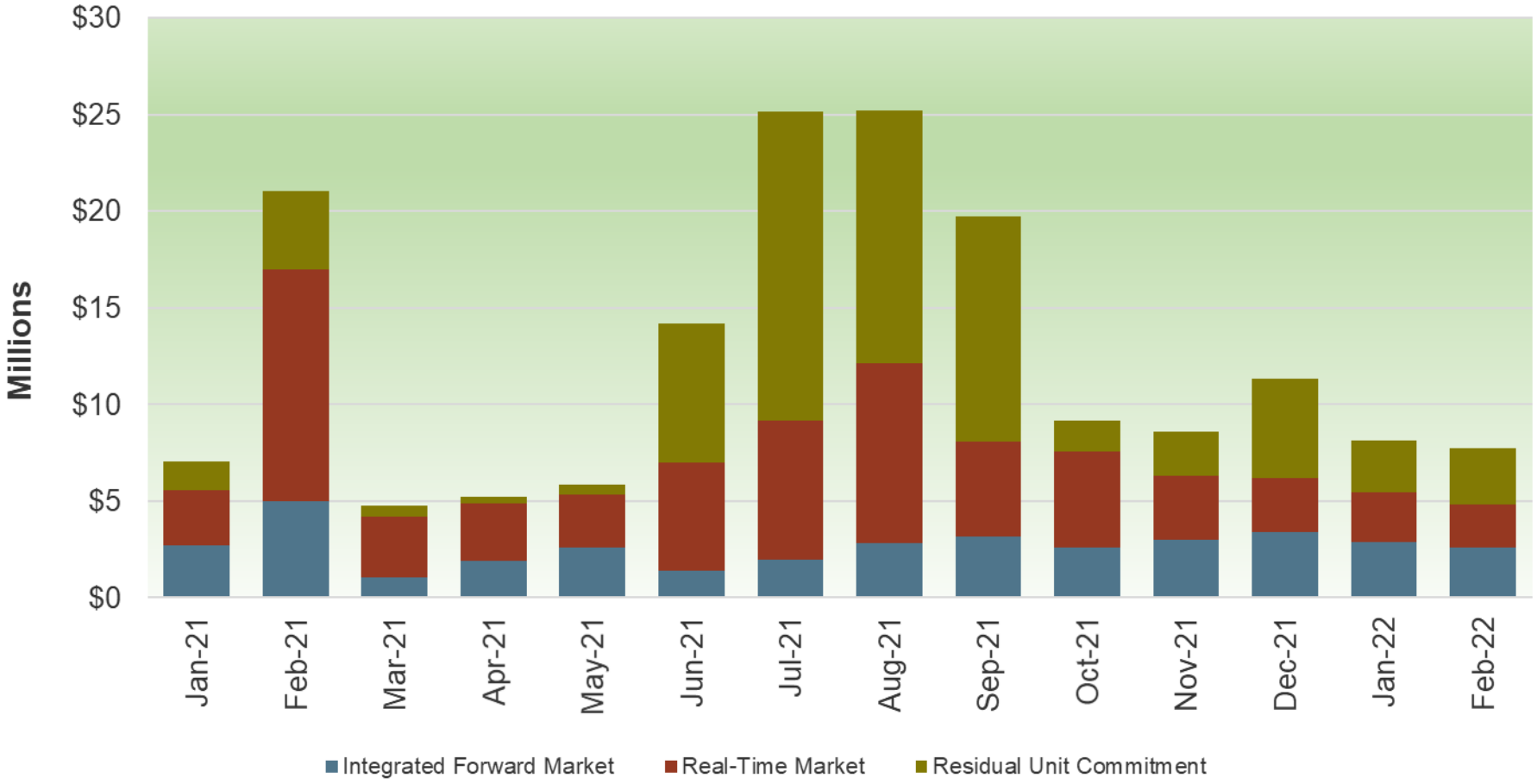
Exceptional dispatch volume in the ISO area are at low levels



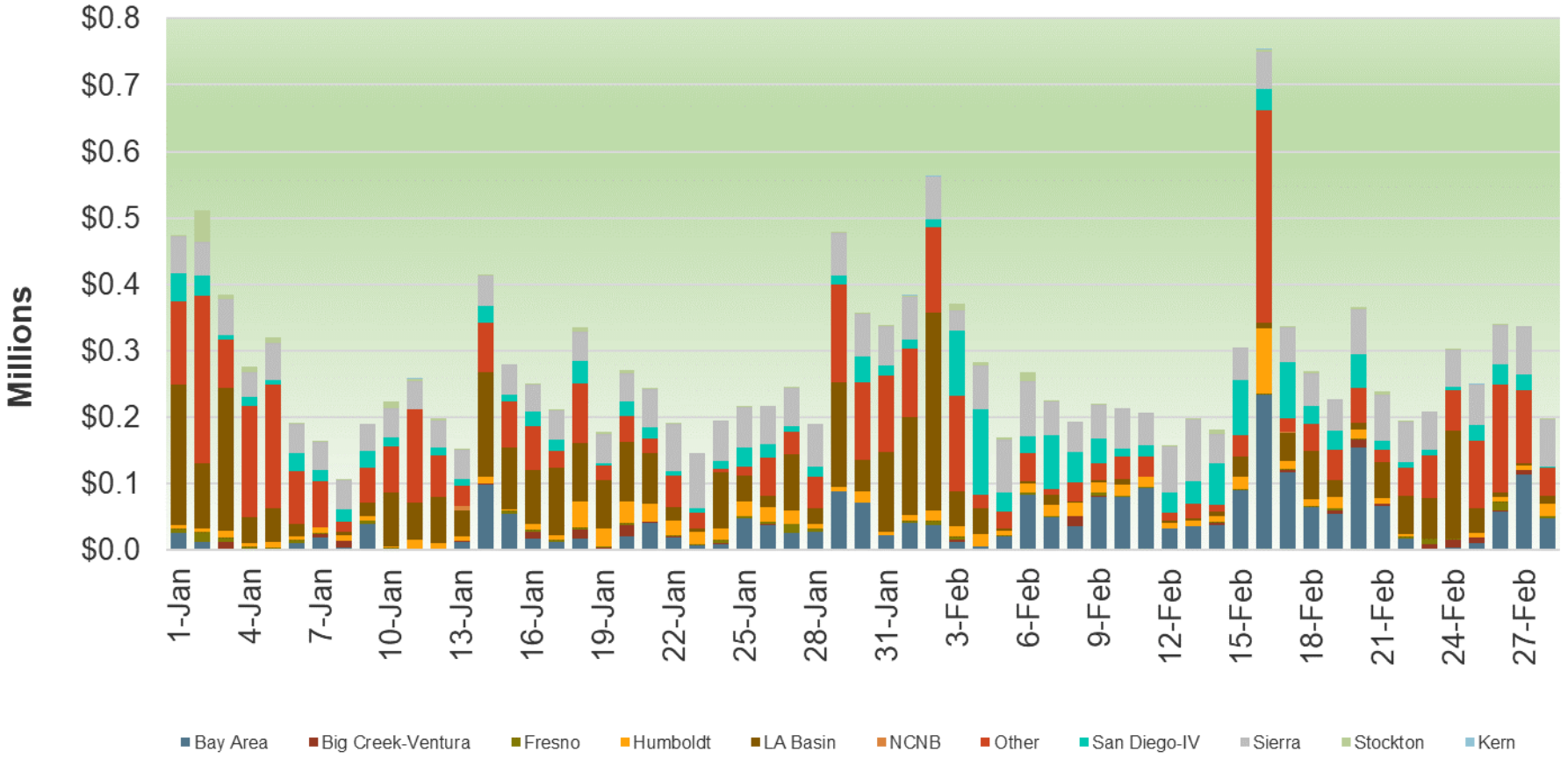
Exceptional dispatches volume driven by a variety of reasons in January and February



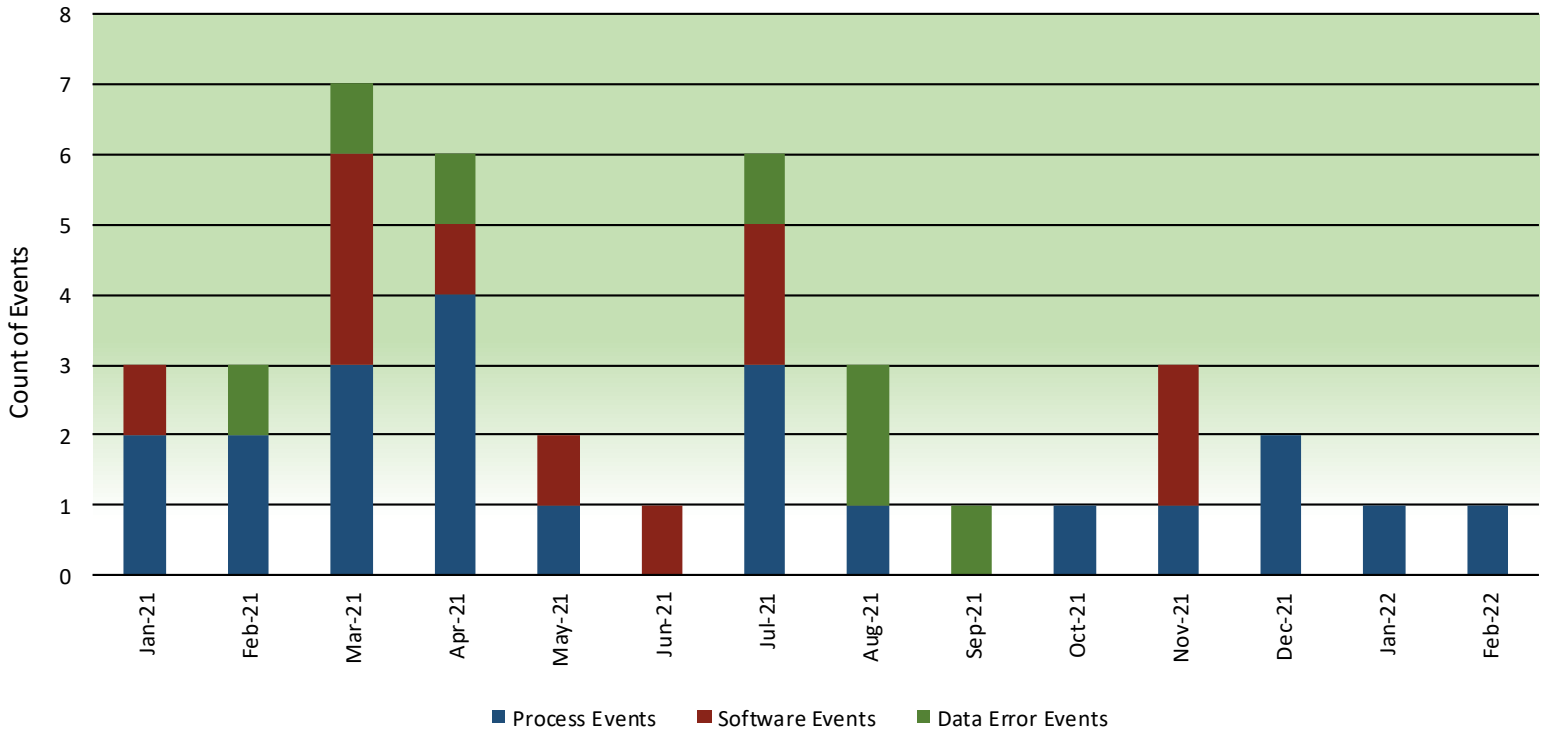
Bid cost recovery trended downward since last August



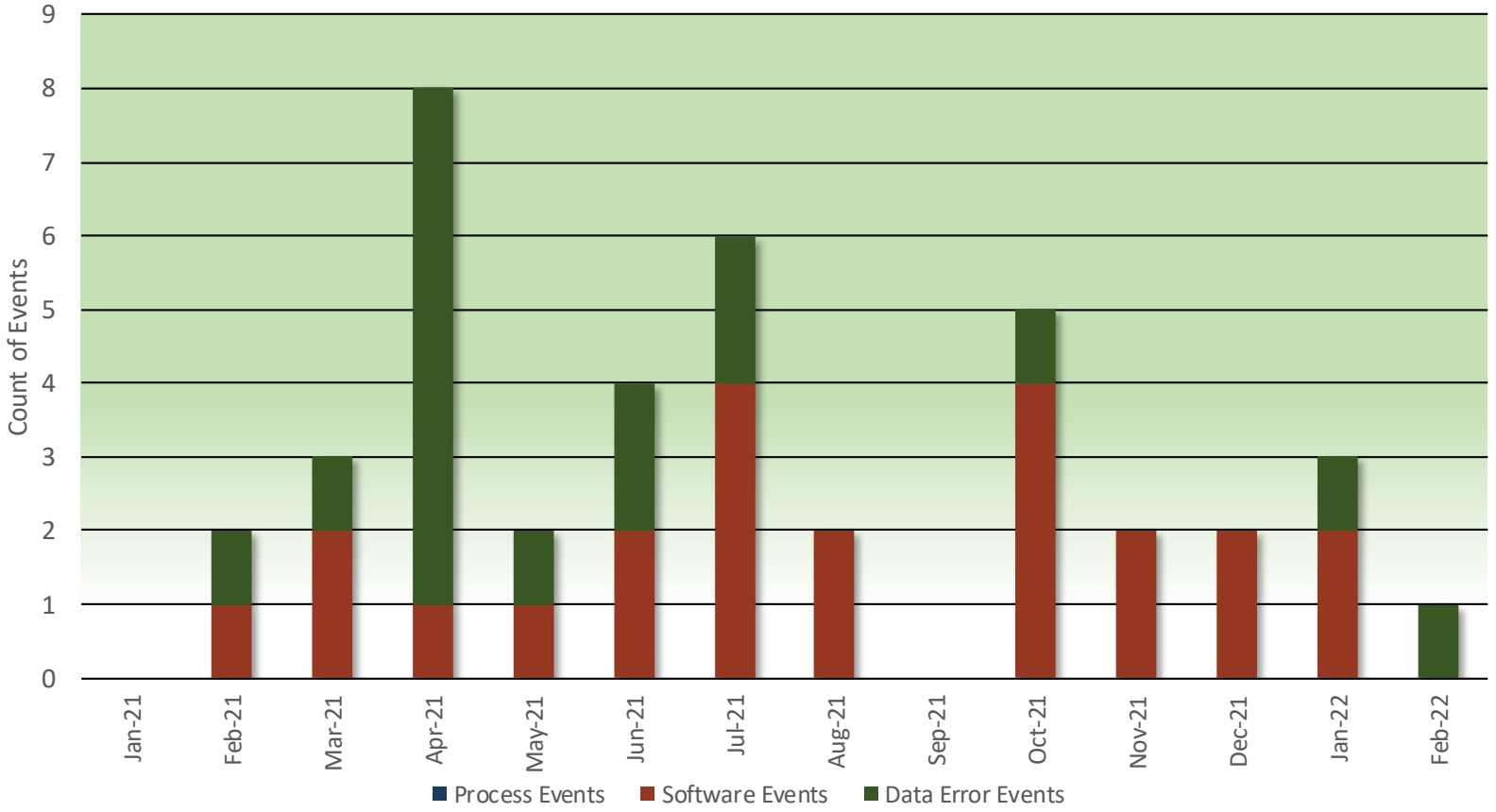
Bid cost recovery (BCR) by Local Capacity Requirement area



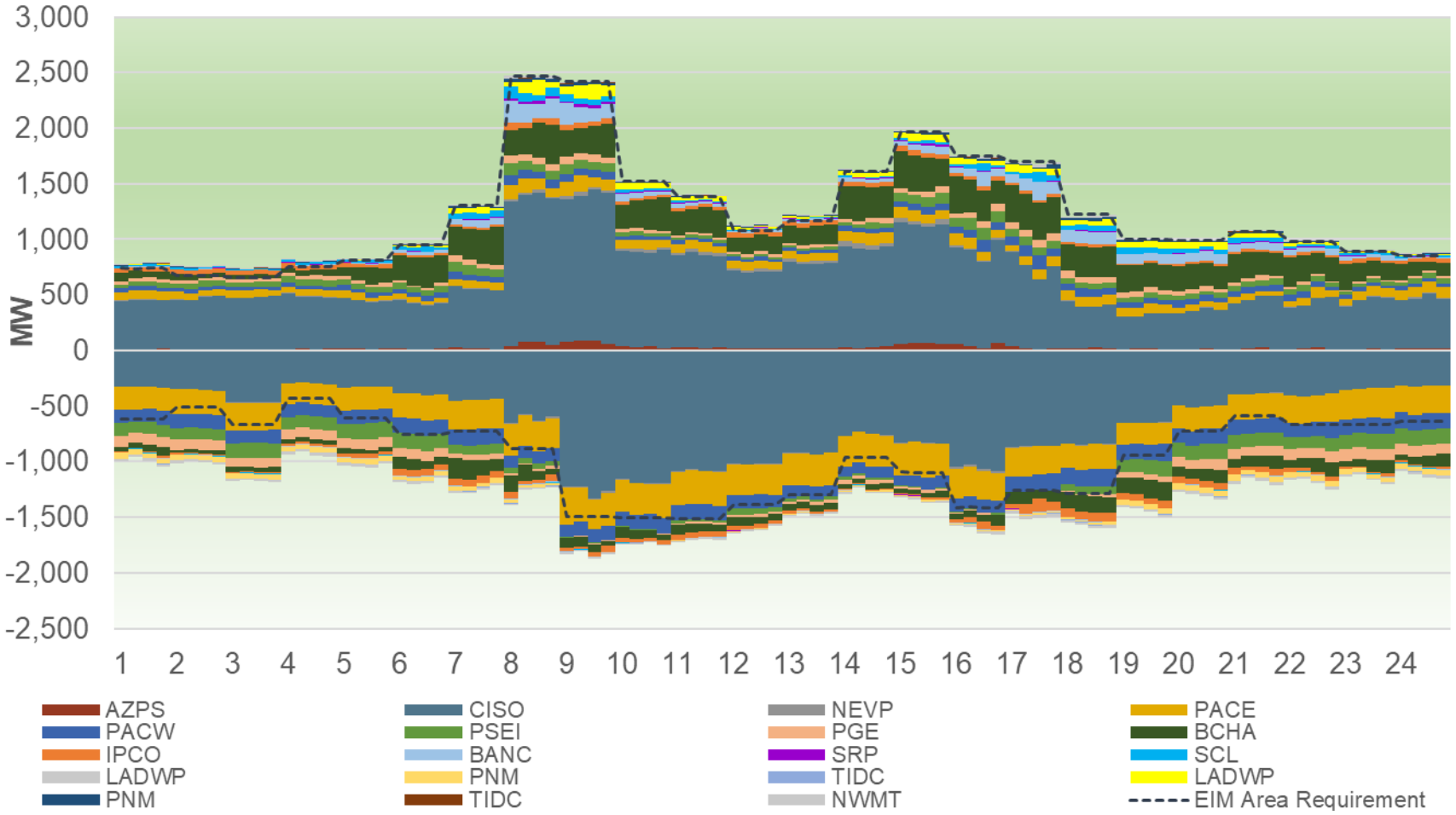
CAISO price correction events are low for January and February



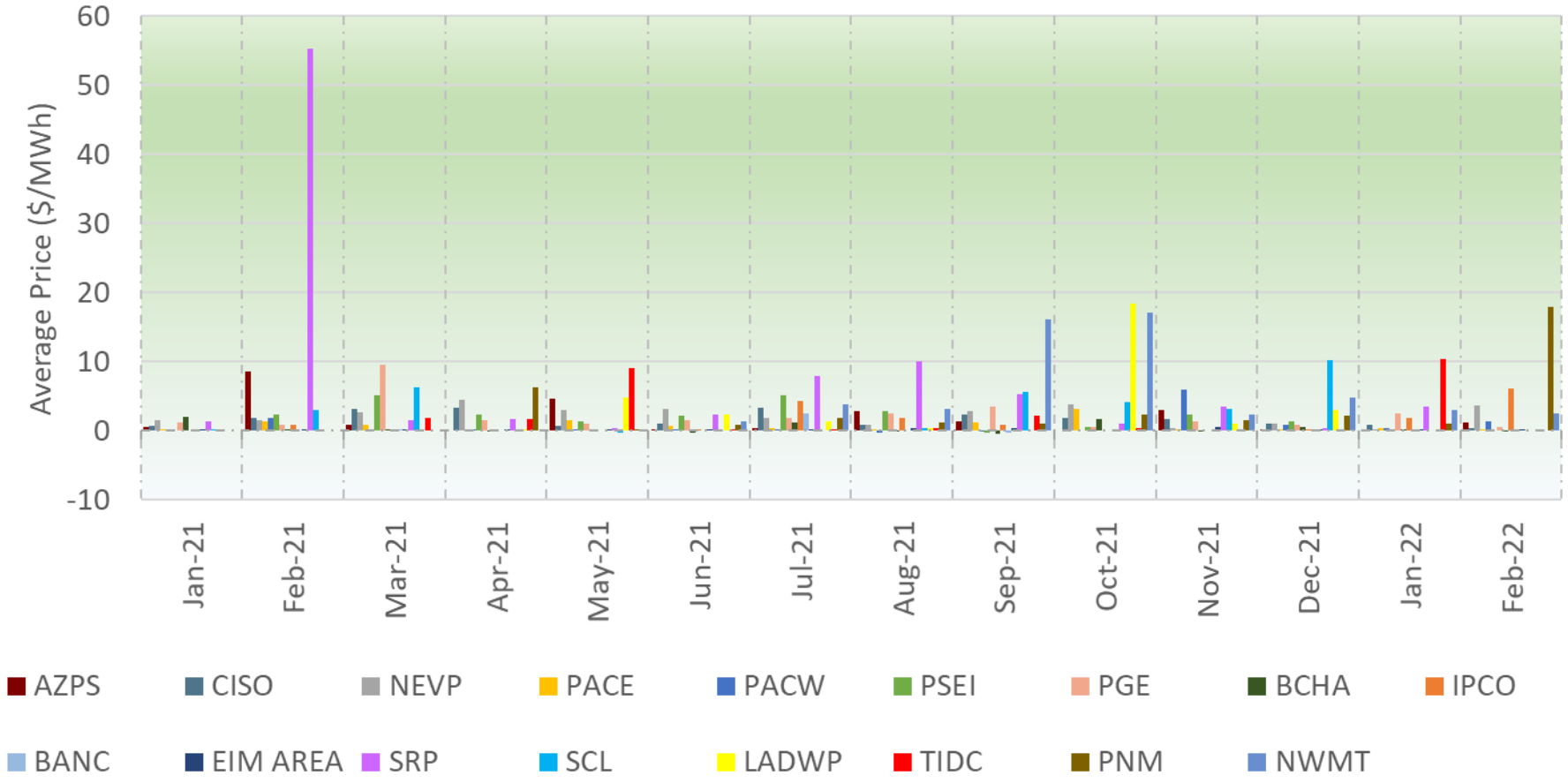
EIM-related price corrections are low for January and February



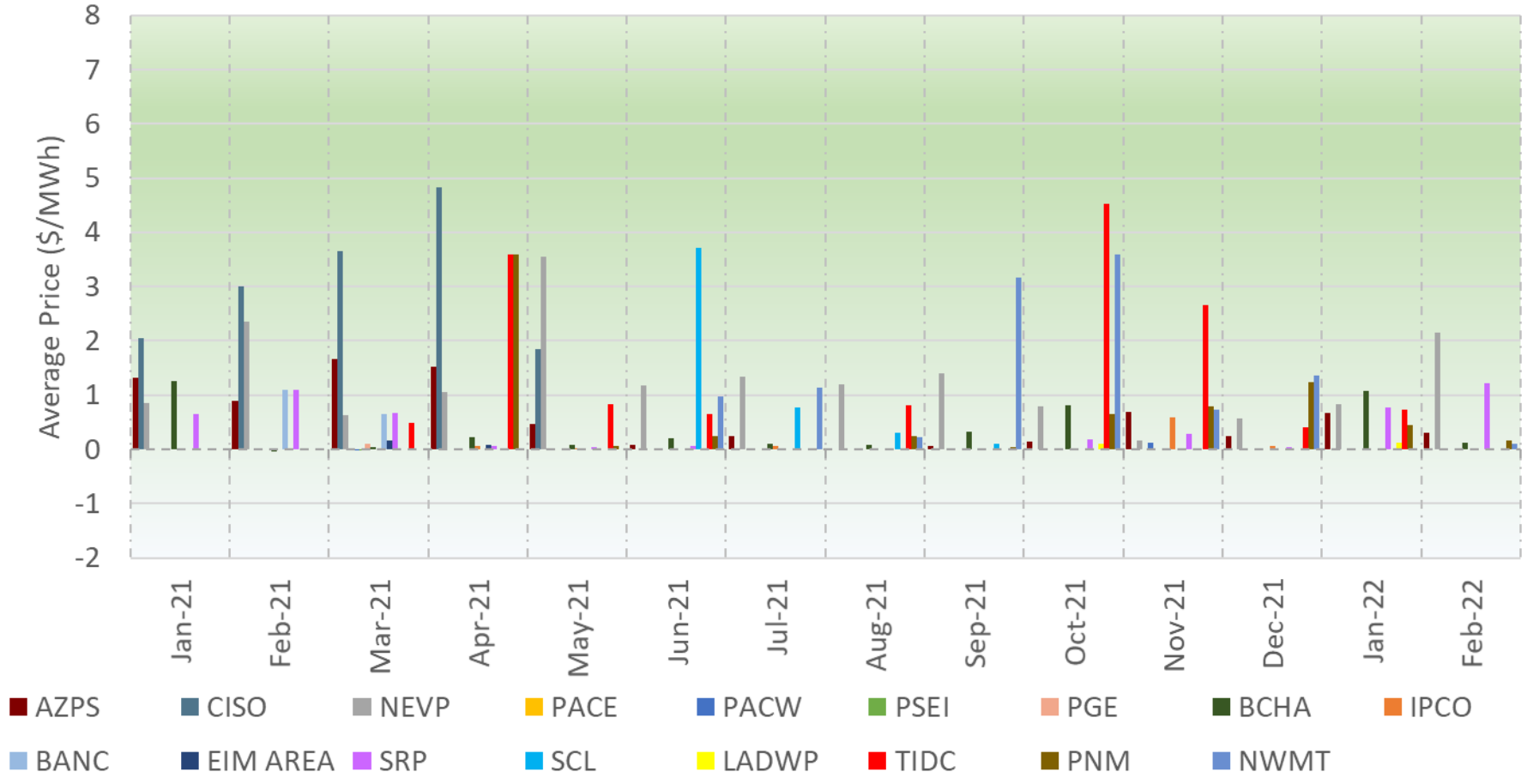
Average flexible ramp product cleared awards for each area with EIM area requirement - Nov 2021 to Feb 2022



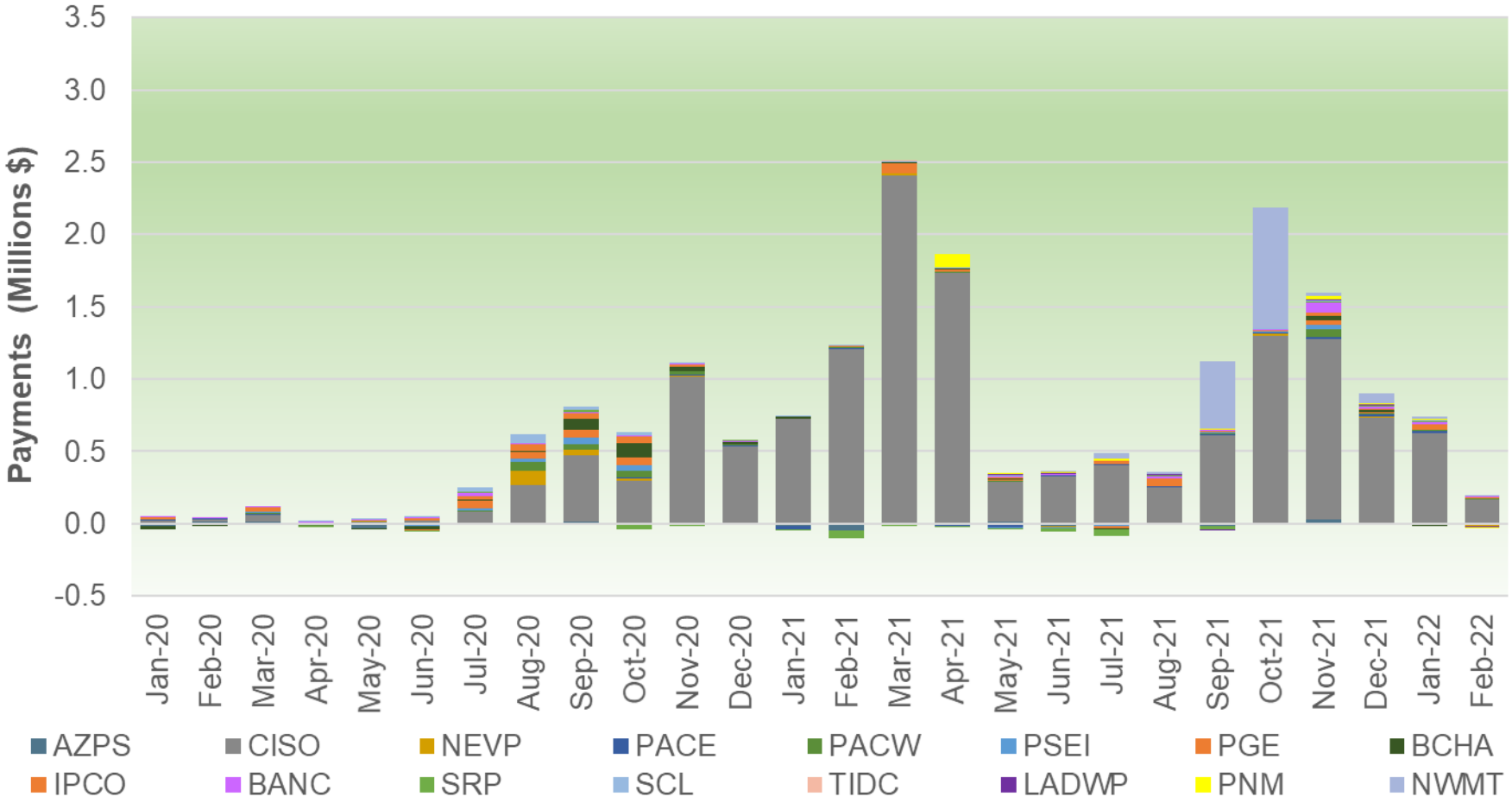
Average flexible ramp up price ($/MWh)



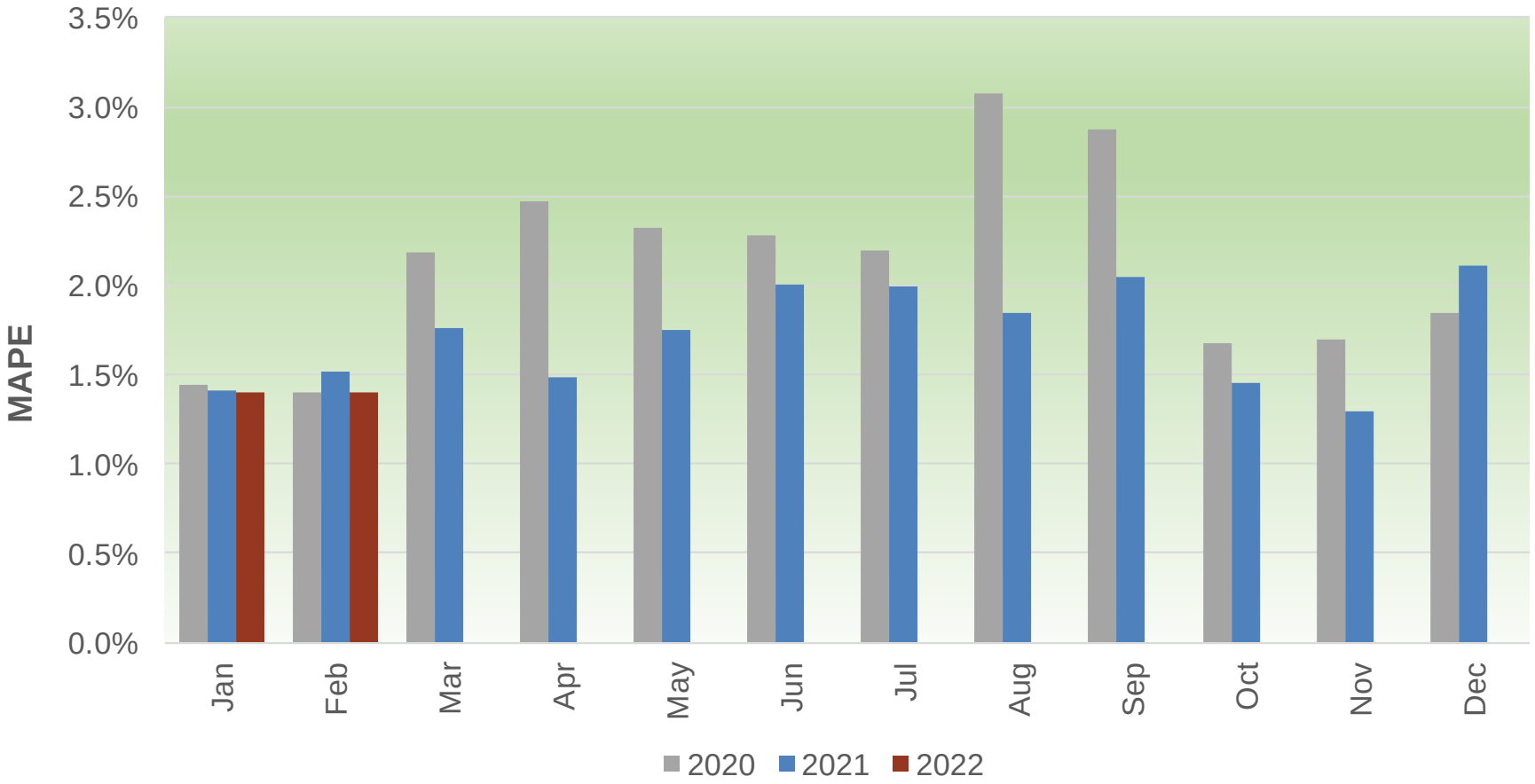
Average flexible ramp down price ($/MWh)



Uncertainty Up Settlement Amount

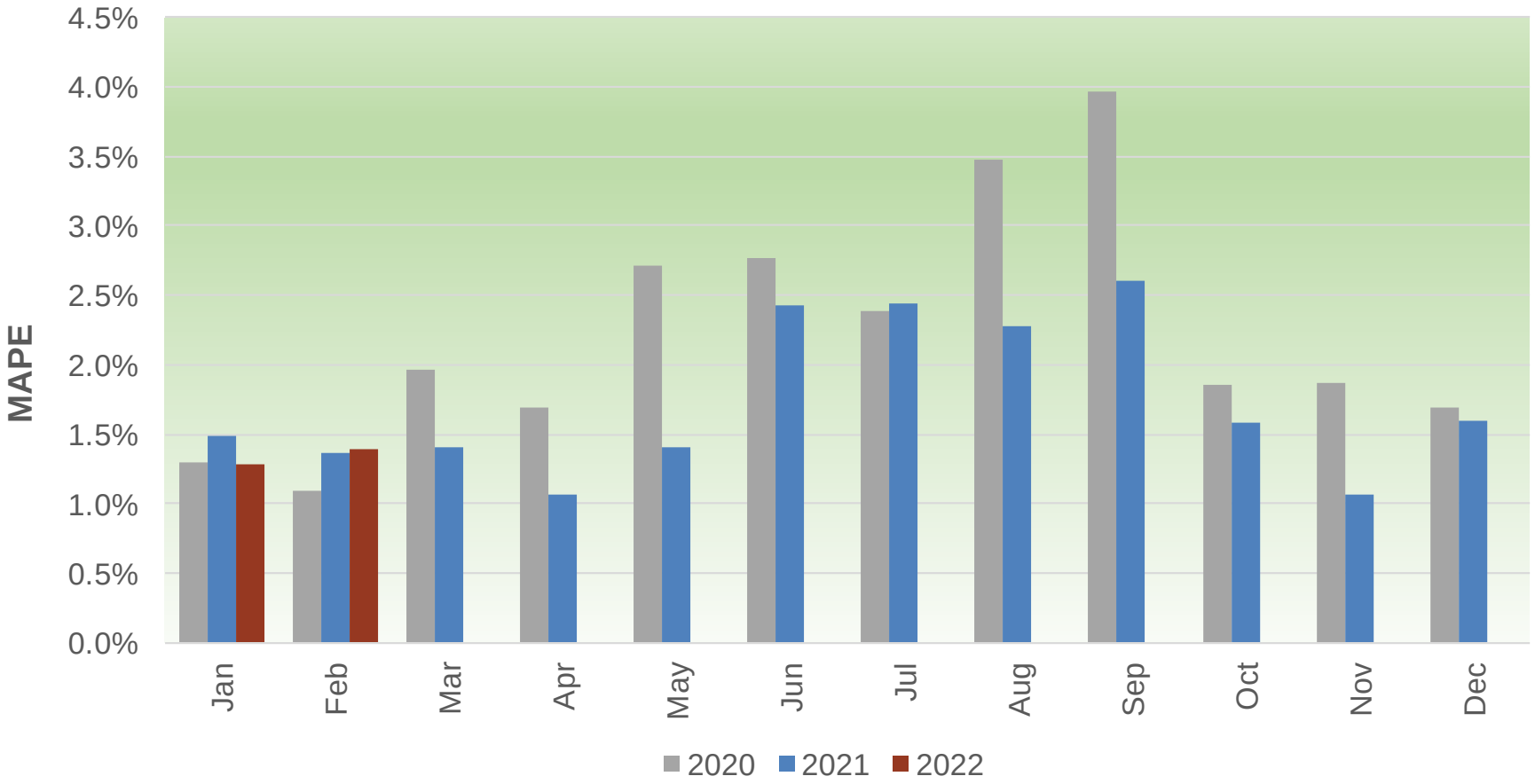


Day-ahead load forecast



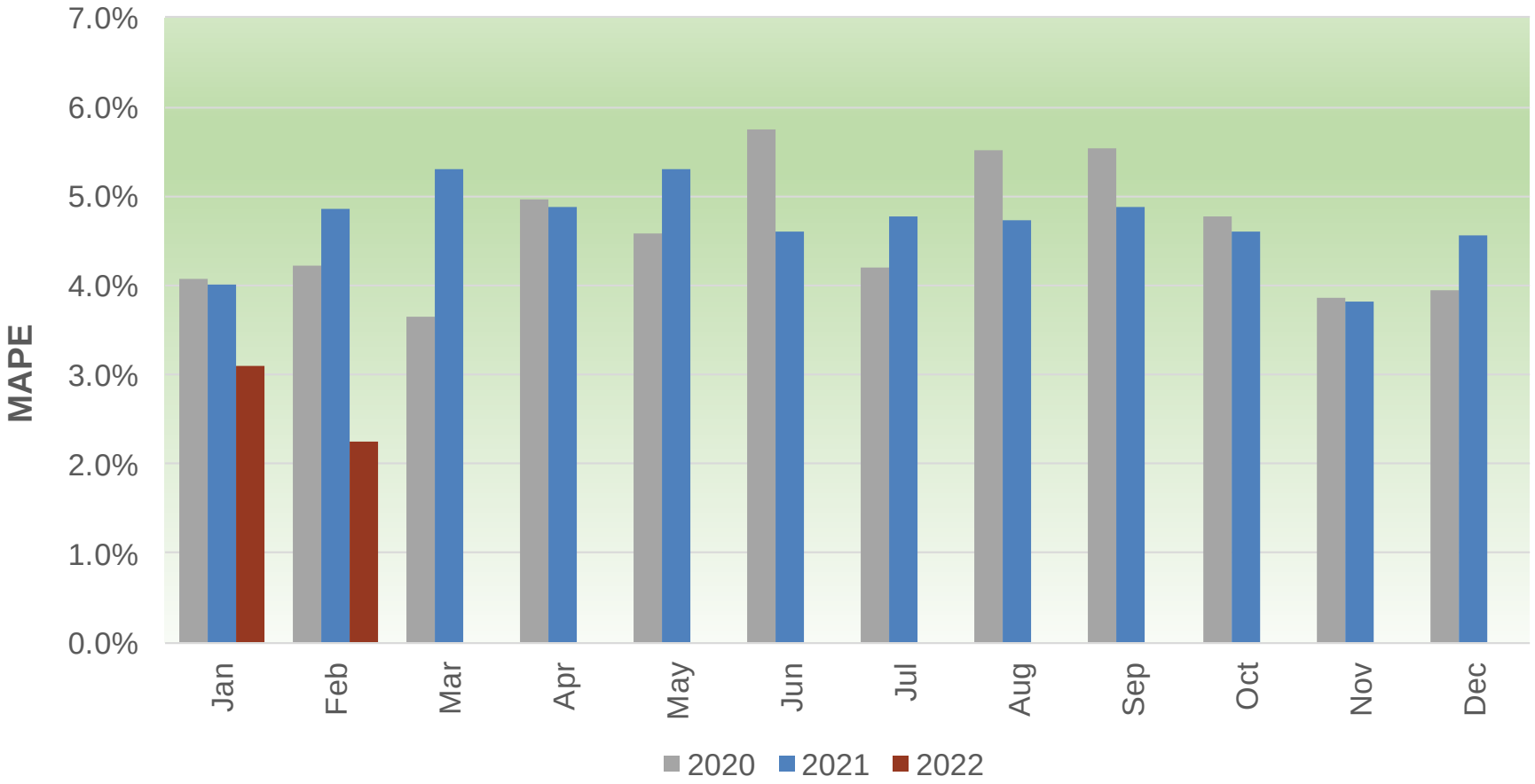
**MAPE = abs(Forecast – Actual)/Actual

Day-ahead peak forecast



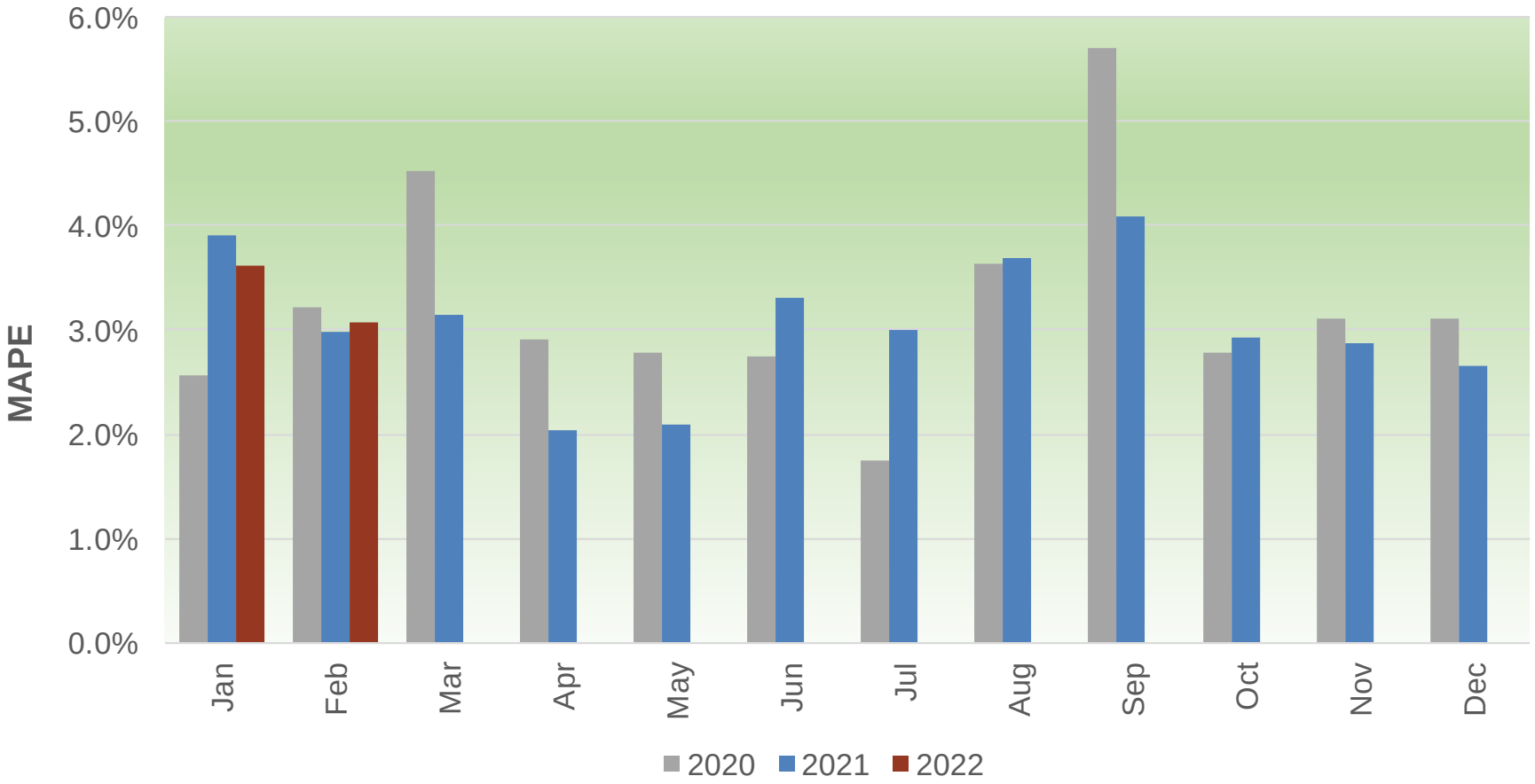
**MAPE = abs(Forecast – Actual)/Actual

Day-ahead wind forecast



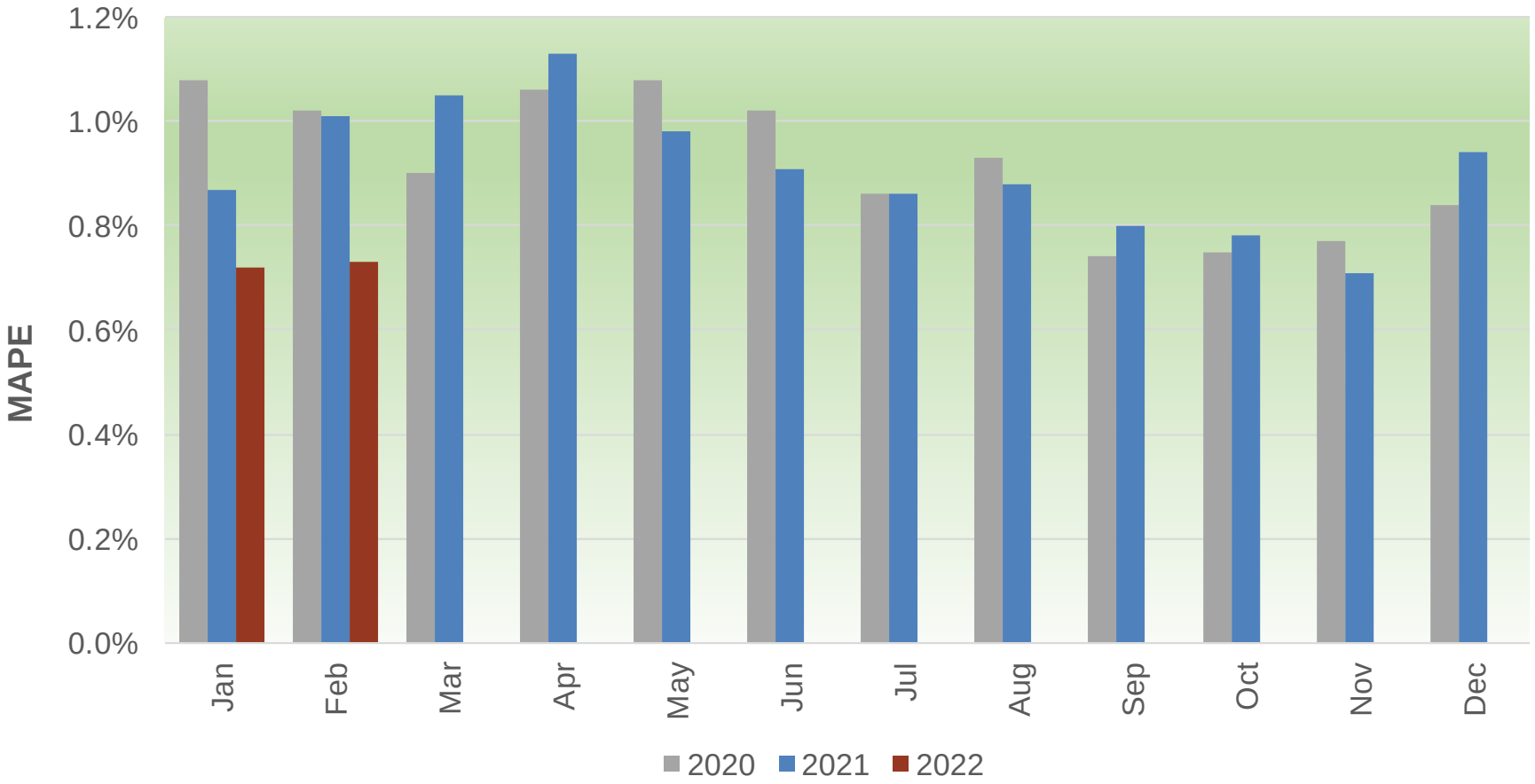
**MAPE = abs(Forecast – Actual)/Capacity

Day-ahead solar forecast



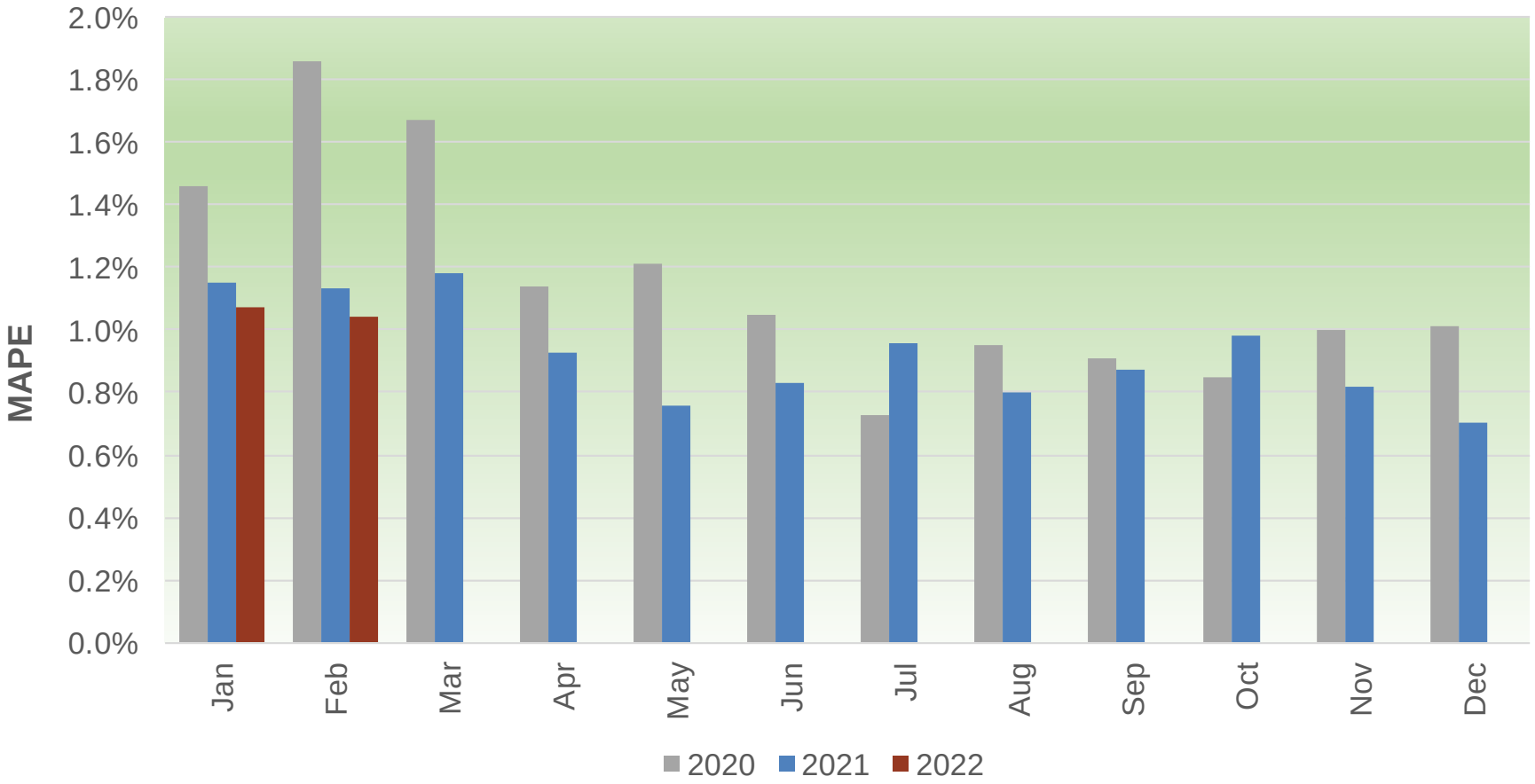
**MAPE = abs(Forecast – Actual)/Capacity

Real-time wind forecast



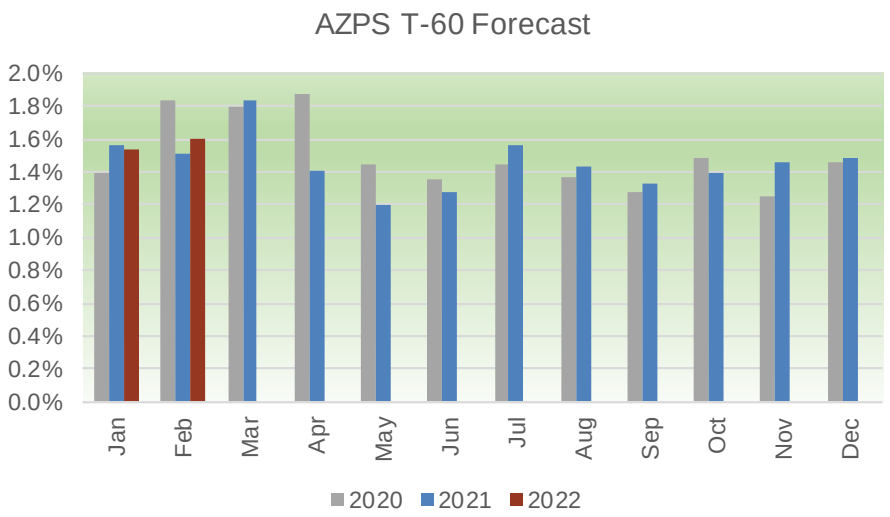
**MAPE = abs(Forecast – Actual)/Capacity

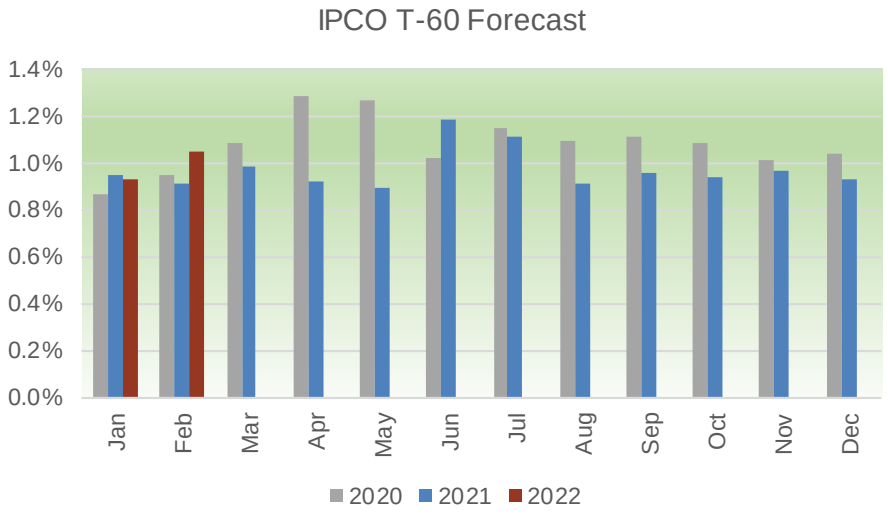
Real-time solar forecast

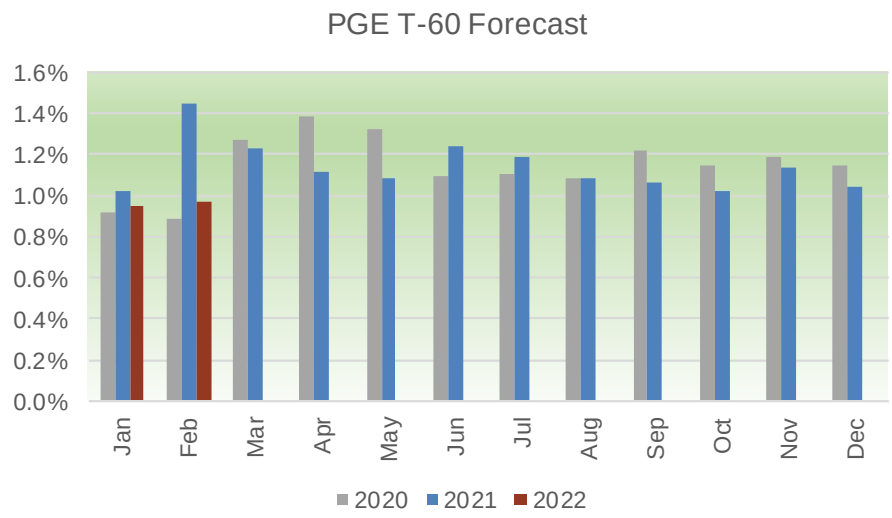


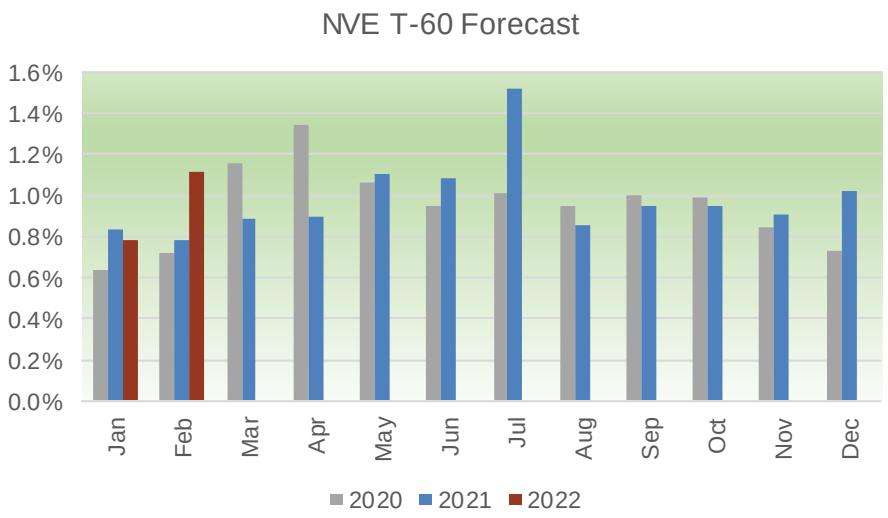
**MAPE = abs(Forecast – Actual)/Capacity

EIM T-60 forecast

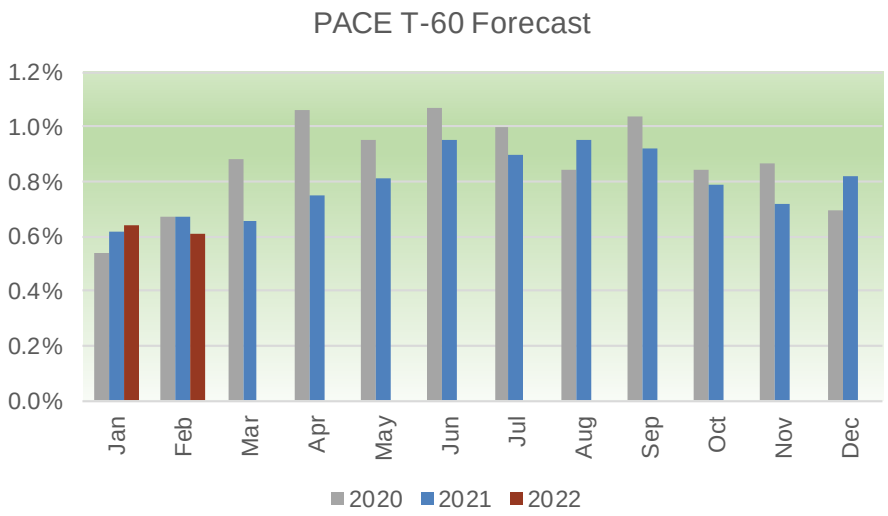


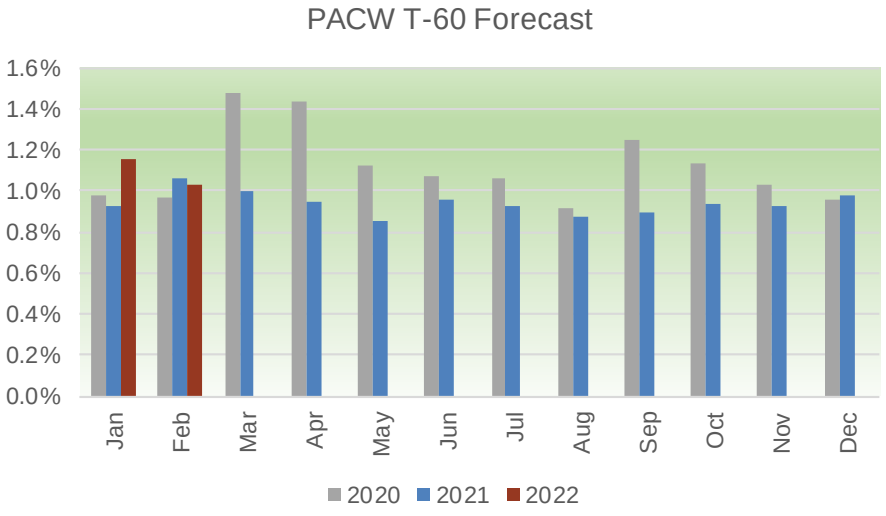


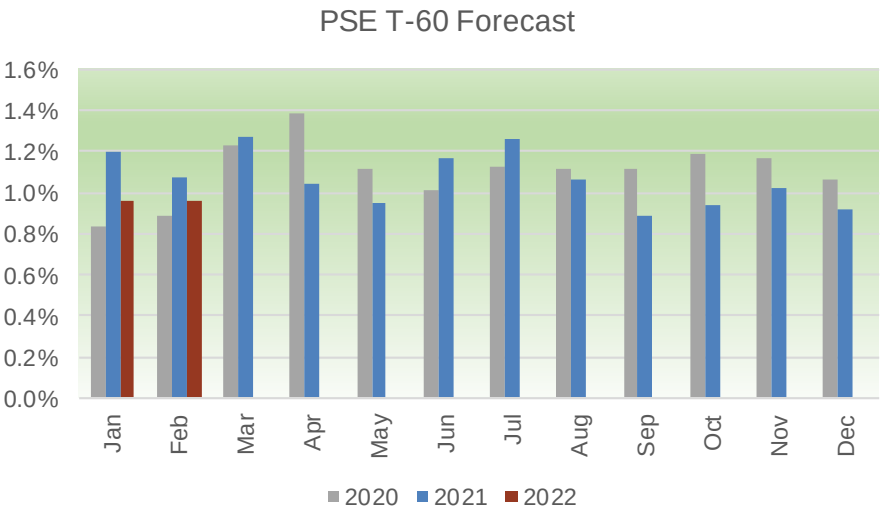


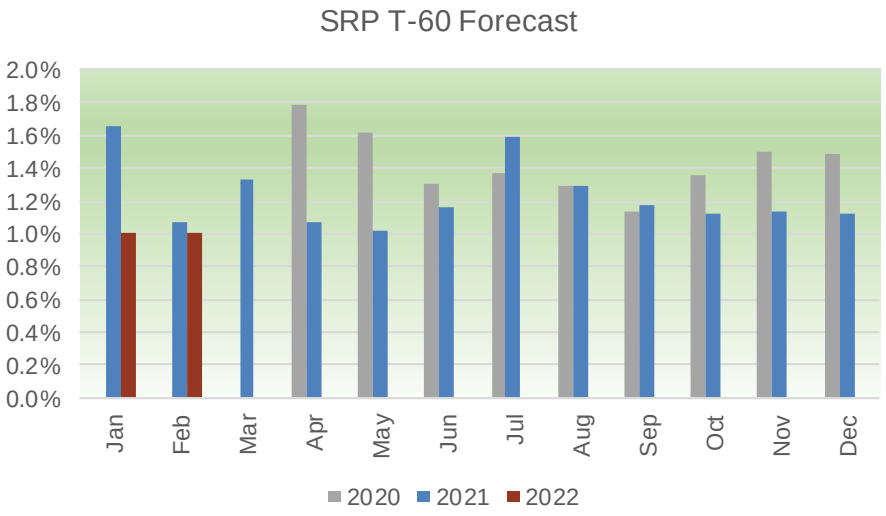


EIM T-60 forecast

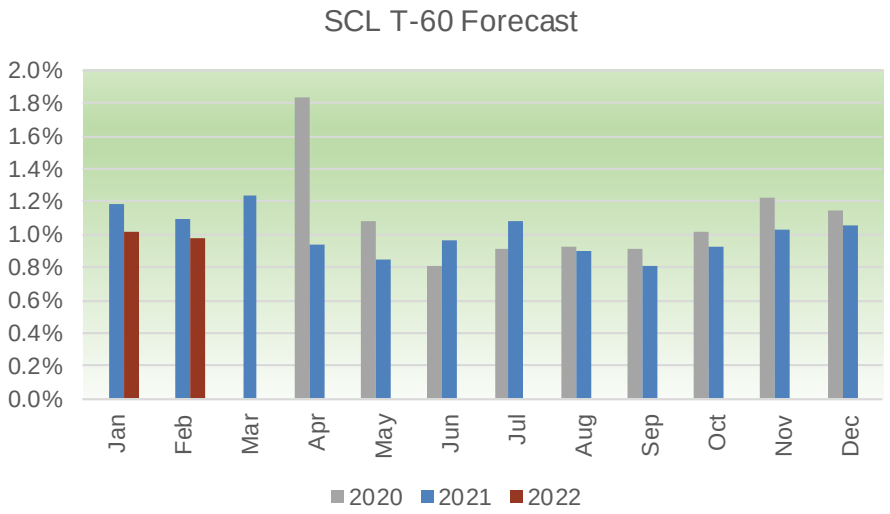


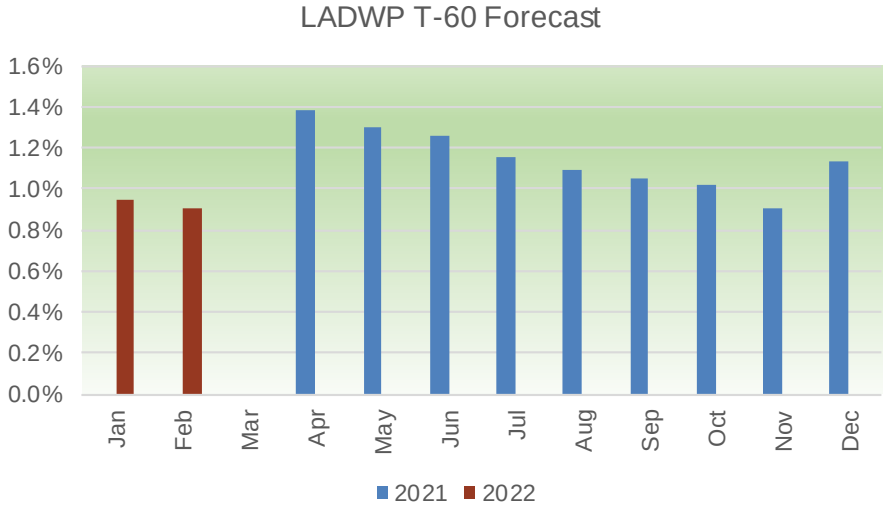


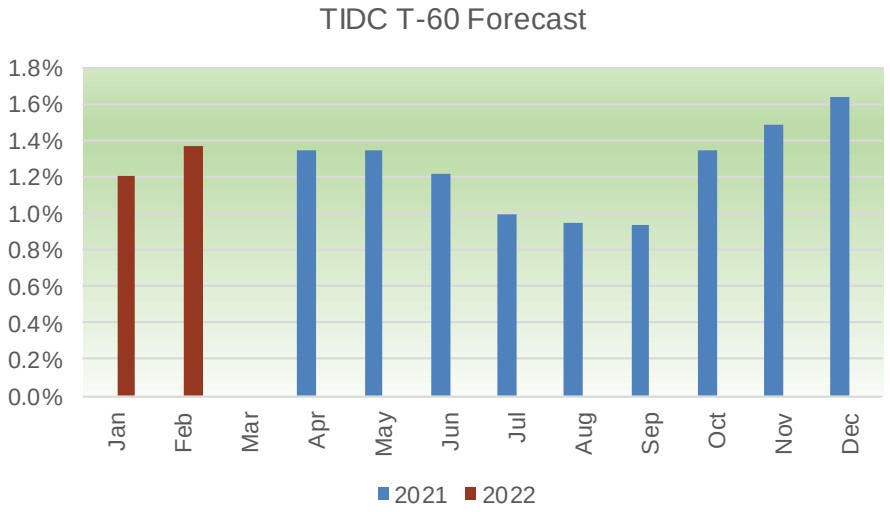


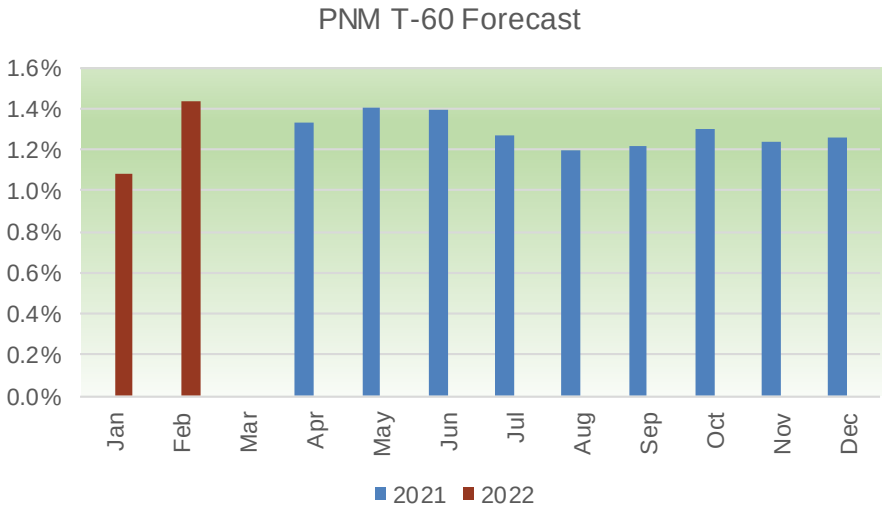


EIM T-60 forecast

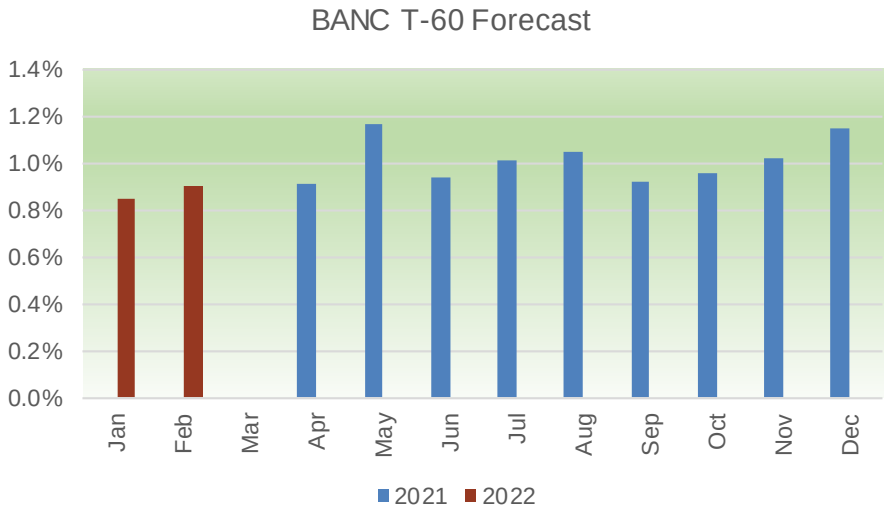


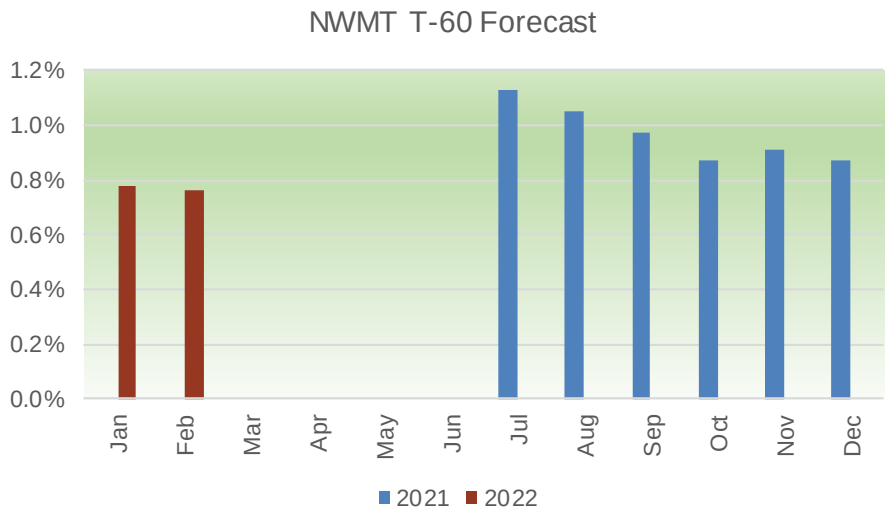






EIM T-60 forecast



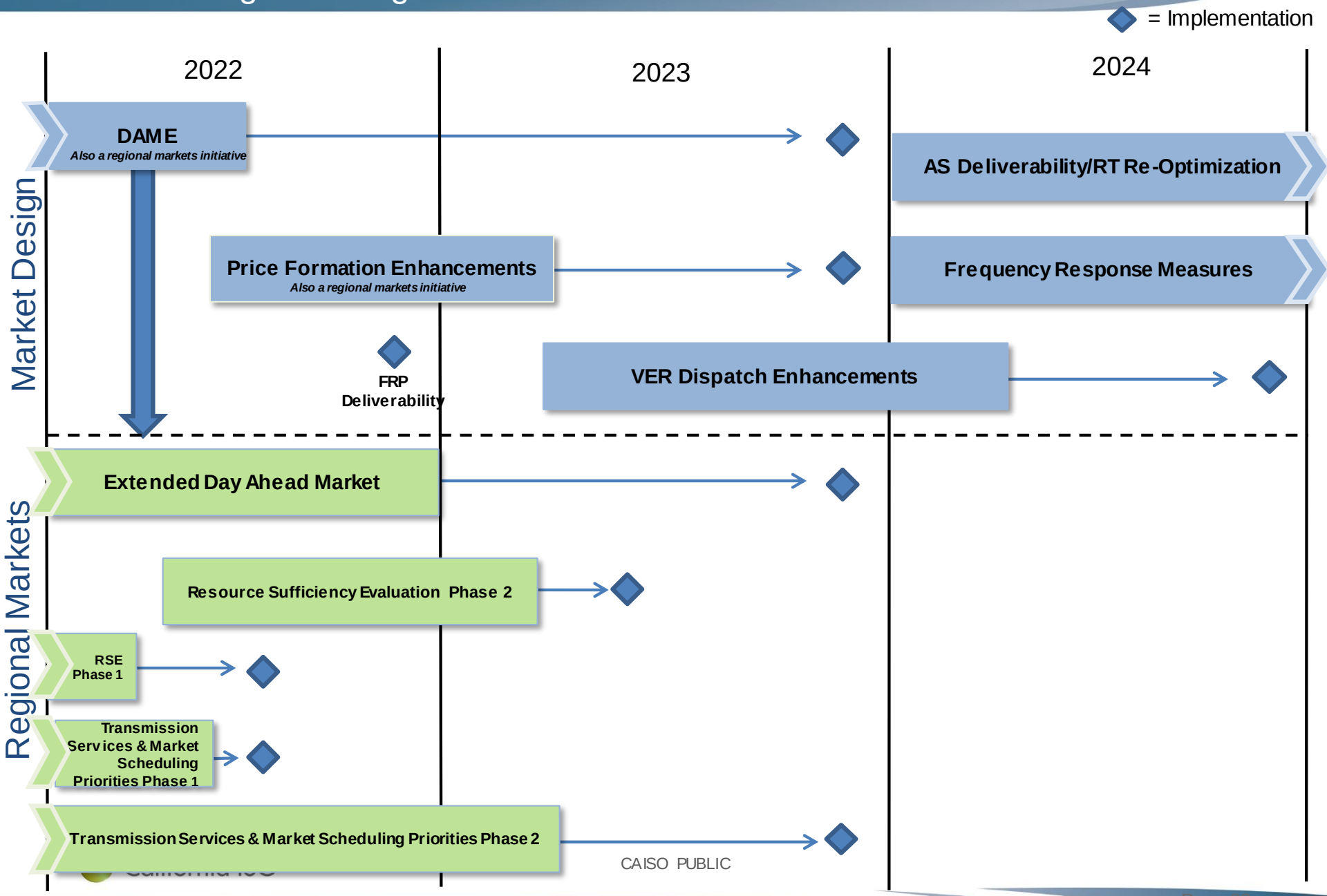


Policy Update

Brad Cooper

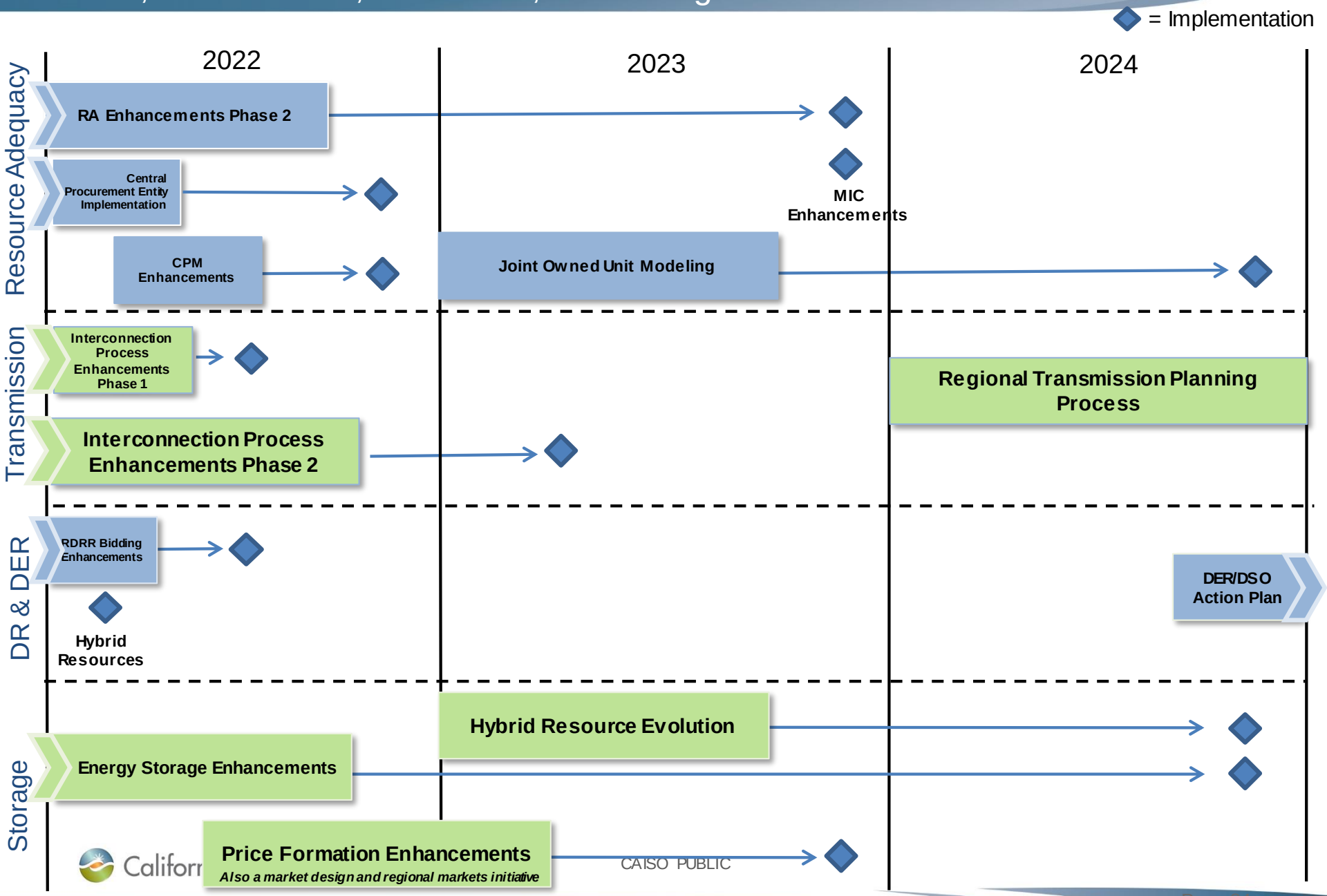
Senior Manager, Policy Integration and Governance

Market Design and Regional Markets



*Timeframes are approximate and subject to change

RA, Transmission, DR & DER, and Storage



*Timeframes are approximate and subject to change

Interconnection Process Enhancements

- Scope: Enhancing the CAISO's generator interconnection and deliverability allocation procedures
  - Enhancements to address queue overload
  - Broader process reform considerations focusing on aligning the procurement processes
- WEIM Governing Body Role: CAISO Board only
- Status:
  - Draft final proposal posted on March 17
  - Phase 1 - May 2022 CAISO Board meeting
  - Phase 2 - Nov 2022 CAISO Board meeting

Reliability Demand Response Resource Bidding Enhancements

- Scope: Enhancements to RDRR bidding:
  - Track 1: Aligning with FERC Order No. 831
  - Track 2:
    - Exploring minimum load costs
    - Potential change to discrete dispatch option cap
- WEIM Governing Body role: joint authority
- Status:
  - Track 1:
    - Approved at March CAISO Board and WEIM Governing Body meeting
  - Track 2:
    - Draft final proposal posted on March 11
    - May 2022 joint CAISO Board and WEIM Governing Body meeting

Resource Sufficiency Evaluation Enhancements – Phase 2

- Scope:
  - Consequences for failing resource evaluation
  - Demand response monitoring
  - Further enhancements to account for storage resources
  - Intertie uncertainty calculation
  - Whether to add load conformance to RSE
  - Interaction with CAISO intertie exports
- WEIM Governing Body role: joint authority
- Status:
  - Stakeholder call on Feb 16 to present plan for analysis
    - Workshops on analyses through June
  - Workshop on using WEIM for emergency assistance on March 23
  - Straw proposal posted in June

Energy Storage Enhancements Initiative

- Scope: Market enhancements to efficiently dispatch storage resources in alignment with operational needs.
  - Improvements to the existing storage model
    - New model for state of charge
  - Storage exceptional dispatch provisions to ensure reliable system operations
  - Storage market power mitigation
  - Enhancements to the co-located resource model
- WEIM Governing Body role: Joint authority
- Status:
  - Revised straw proposal posted on March 10
  - August 2022 joint CAISO Board and WEIM Governing Body meeting

Day-Ahead Market Enhancements

- Scope:
  - Co-optimizing supply based on both cleared demand and imbalance reserve product needs
  - Residual unit commitment process improvements
- WEIM Governing Body Role: Advisory
- Status:
  - Stakeholder workshop on March 2
  - Revised straw proposal to be posted April 6
  - Mid-late 2022 joint CAISO Board and WEIM Governing Body meeting

Resource Adequacy Enhancements – Phase 2

- Scope:
  - Day-ahead market enhancements alignment
    - Bid price and must offer obligations changes
    - Flexible resource adequacy
  - Enhance must offer obligations for storage and conditionally available resources
    - Bid insertion modifications
- WEIM Governing Body role – limited items potentially advisory
- Status:
  - Revised straw proposal to be posted in May 2022
  - Q3 2022 CAISO Board meeting

Transmission Services and Market Scheduling Priorities – Phase 2

- Scope:
  - Process for wheeling transactions through the CAISO BAA to obtain high-priority scheduling rights
- WEIM Governing Body role: advisory
- Status:
  - FERC approved extension of current framework on March 18
  - Phase 2 straw proposal planned for May
  - Late 2022 joint CAISO Board and WEIM Governing Body and meeting

Extended Day-Ahead Market

- Scope: Extending day-ahead market to EIM entities. Scope includes:
  - Supply commitment and resource sufficiency
  - Transmission commitment and congestion rent allocation
  - Greenhouse gas accounting and costs
- EIM Governing Body Role:
  - Management has not yet proposed a decisional designation
- Status:
  - Completed working group process
  - Straw proposal to be posted on April 27
  - Targeting completion by end of 2022

Release Plan Update

Trang Vo
Senior Project Manager,
Strategic Initiative Management

Transparency Enhancements

Area/System	Summary	Initiative	Timeline
CAISO website	Publication of Aggregate Price Taker Wheel Registration Data	Transmission Service & Market Scheduling Priorities Phase 1	Completed - data posted in CAISO website
CAISO website	Publication of Aggregate RA showing Import Data	Transmission Service & Market Scheduling Priorities Phase 1	Completed - data posted in CAISO website
OASIS	Publication of RUC/HASP/RTPD/RTD adjustments (load forecast adjustments/load bias)	Transmission Service & Market Scheduling Priorities Phase 1	Pre-Summer 2022
OASIS	Publication of curtailment (schedule reduction) data (wheels, exports, load)	Transmission Service & Market Scheduling Priorities Phase 1	Pre-Summer 2022
CMRI	Publish Resource-Specific RSE Capacity Test Data Publish Resource-Specific RSE Flexible Ramping Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
OASIS	Increased Resource Sufficiency Evaluation (RSE) Data on RSE Results and Additional Data Transparency and Reporting – Publish Balancing Authority Area (BAA) RSE Capacity Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
OASIS	Increased RSE Data on RSE Results and Additional Data Transparency and Reporting – Publish BAA RSE Flexible Ramping Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
CAISO website Today's Outlook page and ISO Today mobile app	Redesign of the existing Capacity chart to add available unloaded capacity and call out reserves portion	Summer Readiness	Pre-Summer 2022
CAISO website Today's Outlook page and ISO Today mobile app	Addition of a separate line on the Demand Trend that visually indicates when Demand Response is being dispatched and its subsequent divergence from the load forecast	Summer Readiness	Pre-Summer 2022

WEIM Release Plan Summary: 2022

WEIM Spring 2022 - May

- WEIM 2022 - Bonneville Power Administration
- WEIM 2022 - Tucson Electric Power
- Joint Owned Units Pilot

WEIM 2022 Independent

- WEIM Enhancements – Shared Ramping Constraint
- WEIM Enhancements – ETSR UI

Release Plan Summary: 2022

2022 Independent

- Updates to CAISO AWE Tool Pre-Summer (Alert, Warning, Emergency (AWE) to Energy Emergency Alert (EEA) Transition)
- Transmission Service & Market Scheduling Priorities Ph1 (was Ext Load Forward Sched Rights Process Ph1)
- WEIM Resource Sufficiency Evaluation Enhancements – Phase 1
- Adjustment to Intertie Constraint Penalty Prices (Market Parameter Changes)
- RDRR Bidding Enhancements Phase 1
- Short-Long Start Definitions
- Interconnection Process Enhancements Phase 1 **BOG May**
- Operations System Improvements Enhancements

Fall 2022 (tentative – subject to change pending Policy and planning activities)

- Hybrid Resources Phase 2-B
- FRP Improvements
- FERC 2222 Implementation
- Central Procurement Entity Implementation

WEIM Spring 2022 Release

Spring 2022 – WEIM integrations for Avista, BPA, Tacoma Power, Tucson Electric Power

Project Info	Details/Date
Application Software Changes	System modifications as needed to accommodate any unique Avista, BPA, Tacoma Power, and Tucson Electric Power needs to support their WEIM onboarding.
BPM Changes	WEIM BPM will be updated if needed to reflect changes identified during the onboarding and as required to reflect the unique processes of Avista, BPA, Tacoma Power, and Tucson Electric Power.
Market Simulation	October 2021 thru mid-February 2022
Parallel Operations	December 2021 thru mid-April 2022

Milestone Type	Milestone Name	Dates			
		Avista	Tacoma Power	BPA	Tucson Electric Power
Market Sim	Market Sim Window	✓ Oct 2021 thru Nov 2021		✓ Dec 2021 thru mid-Feb 2022	
Parallel Operations	Parallel Operations	✓ Dec 2021 thru Feb 2022		Feb 2022 thru mid-Apr 2022	
Tariff	File Readiness Certification	✓ 2/1/2022		4/1/2022	
Production	Activation	✓ 3/2/22		5/3/22	

Joint Owned Units Pilot

- The purpose of this project is to implement a pilot for Joint Ownership Units (JOU) in the model. This JOU pilot will be limited to a single implementation with the Public Service Company of New Mexico and the Tucson Electric Company. This implementation will require FERC acceptance of a pilot agreement(s) among the parties that sets forth the parameters of the pilot. Based on the results of this pilot, the CAISO intends to pursue a stakeholder initiative that would establish rules for other market participants to implement JOU functionality.
- The JOU Pilot is an opportunity to learn and provide feedback into a stakeholder process. There will be a follow on stakeholder process to establish policy for JOU.
- FERC filing: http://www.caiso.com/Documents/Oct22-2021-JointOwnedUnitJOUAgrmt-CaliforniaISO-NewMexico-Tucson-ER22-190.pdf
- FERC order: http://www.caiso.com/Documents/Dec21-2021-OrderAccepting-JointOwnedPilot-JOU-Agreement-TucsonElectric-New-Mexico-ER22-190-000.pdf

WEIM Enhancements

Project Information	Details/Date
High Level Business Problem or Need	To collectively address important issues identified by WEIM market participants through Customer Inquiry, Dispute and Information system (CIDI) requests to improve the visibility, functions and features in Energy Imbalance Market (WEIM).
High Level Project Scope	• BAAOP: Specify parameters for Shared ramping capability constraint. • BAAOP: Separate ETSR Base from ETSR detail display
BPM Changes	WEIM, Market Instruments
Tariff Change	Section 29.4
Impacted Systems	RTM/BAAOP, RTM/Integration, CMRI, RTM/BAAOP

System	High Level Changes
Real-Time Market (RTM) /Real-Time Base Schedule (RTBS)	• Offline units with Base schedule • centralized activation/de-activation means of this functionality • System shall consider offline resources that are cycling as available for the balancing, bid range capacity, and flexible ramp sufficiency tests if capable for startup within the next hour. Same for shutdown
Real-Time Market (RTM)	• Shared ramping capability constraint • UI for WEIM entity input parameters for ramp sharing • Use in the optimization for each resource based on BAA ramp share parameters

Real-Time Market (RTM)/Real-Time Unit Commitment (RTUC) [(HASP, STUC, FMM)]	• Cycling resource with base schedule in Market
	• centralized activation/de-activation means of this functionality
	  ○ Real-Time Markets shall have the capability to automatically start-up an offline resource that is cycling if it is economic to run.
	  ○ Similarly, Real-Time Markets shall have the capability to automatically shut down an online resource that is cycling if is not economic to run.
	  ○ Consider WEIM resources with positive base schedules above minimum load and with three-part bids as cycling during the relevant trade hour (i.e. optimize its unit commitment on the basis of its bids), with the following exceptions:
	  ○ Self-schedule exists
	  ○ Ancillary service base schedule exists (except when non-spin for an offline resource capable of startup within 10-minutes)
	  ○ Flexible ramp award exists (except when flex ramp up award for an offline resource capable of startup within 5-minutes)
	  ○ Inter-temporal constraint (startup time, minimum up time, minimum down time, maximum daily starts) prevents cycling
	• Real-time market horizon has limitation, where resource startup time plus minimum up time exceeds 240 minutes
	• Cycling shall include both startup and shutdown unit commitment decisions on basis of three-part bids (economic energy bid, startup, minimum load) and applicable temporal constraints.
	• A positive base schedule from a resource without an energy bid shall still be treated as a self-schedule.

Independent 2022 Release

Independent 2022 Overview

	Board Approval	External BRS	Config Guide	Tech Spec	Tariff	BPMs	Training	Market Sim / Ext Testing Start	Production Activation
Independent 2022									
Updates to CAISO AWE Tool Pre-Summer (AWE to EEA Transition)	*N/A*	02/25/22	*N/A*	*N/A*	*N/A*	Mkt Ops PRR1413 03/24/22	4/20/22	*N/A*	05/01/22
Transmission Service and Market Scheduling Priorities Phase 1	01/20/22	03/02/22	*N/A*	OASIS 03/25 SIBR 04/18	Filed 01/27/22 (ER22-906) Accepted 3/15 (ext of L, E, W)	Mkt Ins Mkt Ops	Yes	5/3/22 – 5/20/22	06/01/22
Resource Sufficiency Evaluation Enhancements Phase 1A	02/09/22	03/07/22	01/25/22	OASIS – 03/25 CMRI – 04/07	Filed 03/11/22 (ER22-1278)	DR, WEIM, Mkt Inst, Mkt Ops, RC, Stlmts & Billing	Yes	May 2022	06/01/22
Adjustment to Intertie Constraint Penalty Prices	02/09/22	*N/A*	*N/A*	*N/A*	Filed 03/10/22 (ER22-1246)	Mkt Ops PRR1411; 02/28/22	*N/A (Communication)*	*N/A*	06/01/22
RDRR Bidding Enh Phase 1	03/16/22	03/07/22	*N/A*	*N/A*	03/23/22 (ER22-1431)	Apr 2022 Mkt Inst Mkt Ops	4/11/22	4/19/22 – 5/6/22	06/01/22
Short-Long Start Definitions	03/16/22	06/21/21	05/27/21	*N/A*	03/24/22 (ER22-1438)	03/24/22 MI-1414 MO-1415 RR-1424 SB-1426	*N/A (Communication)*	N/A	06/01/22
Interconnection Process Improvements 2021 Phase 1	05/11/22	*N/A*	*N/A*	*N/A*	File May/Jun 2022	TBD	*N/A*	*N/A*	Sep 2022

Transparency Enhancements

Area/System	Summary	Initiative	Timeline
CAISO website	Publication of Aggregate Price Taker Wheel Registration Data	Transmission Service & Market Scheduling Priorities Phase 1	Completed - data posted in CAISO website
CAISO website	Publication of Aggregate RA showing Import Data	Transmission Service & Market Scheduling Priorities Phase 1	Completed - data posted in CAISO website
OASIS	Publication of RUC/HASP/RTPD/RTD adjustments (load forecast adjustments/load bias)	Transmission Service & Market Scheduling Priorities Phase 1	Pre-Summer 2022
OASIS	Publication of curtailment (schedule reduction) data (wheels, exports, load)	Transmission Service & Market Scheduling Priorities Phase 1	Pre-Summer 2022
CMRI	Publish Resource-Specific RSE Capacity Test Data Publish Resource-Specific RSE Flexible Ramping Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
OASIS	Increased Resource Sufficiency Evaluation (RSE) Data on RSE Results and Additional Data Transparency and Reporting – Publish Balancing Authority Area (BAA) RSE Capacity Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
OASIS	Increased RSE Data on RSE Results and Additional Data Transparency and Reporting – Publish BAA RSE Flexible Ramping Test Data	WEIM Resource Sufficiency Evaluation Enhancements Phase 1	UI: Pre-Summer 2022 API: 2022
CAISO website Today's Outlook page and ISO Today mobile app	Redesign of the existing Capacity chart to add available unloaded capacity and call out reserves portion	Summer Readiness	Pre-Summer 2022
CAISO website Today's Outlook page and ISO Today mobile app	Addition of a separate line on the Demand Trend that visually indicates when Demand Response is being dispatched and its subsequent divergence from the load forecast	Summer Readiness	Pre-Summer 2022

Pre-Summer 2022 Market Simulation

- Register for Market Simulation via Market Sim CIDI and/or e-mail MarketSim@caiso.com **by Apr 7, 2022**

- **Market Simulation Plan Available on Release Planning page**
- **Market Sim Kick-Off Apr 7, 2022**
- Initiatives
  - RDRR Bidding Enhancements Phase 1
    - Start Apr 13, 2022
  - TSMSP Phase 1
    - Start May 3, 2022
  - RSEE Phase 1
    - Start TBD

Independent 2022 – Updates to CAISO AWE Tool - Overview

Project Information	Details/Date
High Level Business Problem or Need	To ensure operators have the proper message types for Summer 2022 this initiative focuses on Updates to AWE Tool by transitioning from specific AWE declarations (Alert, Warning, Stage 1, 2, 3) to EEA declarations (EEA Watch, EEA 1, EEA 2, EEA 3).
High Level Project Scope	Transition to EEA declarations (EEA Watch, EEA 1, EEA 2, EEA 3). **External BRS Posting:** An updated External BRS is expected to be posted late February.
BPM Changes	Market Operations
Tariff Changes	Proposed sections 4.11.5.1 and 34.7 (section 13) – Tariff Clarifications Filing
Impacted Systems	CAISO AWE Tool

Independent 2022 – Updates to CAISO AWE Tool

Milestone Type	Milestone Name	Dates	Status
External BRS	Post External BRS	Feb 25, 2022	✓
Tariff	File Tariff	N/A	
BPMs	Publish Final Business Practice Manuals – Mkt Ops PRR 1413	Mar 24, 2022	✓
External Training	Deliver External Training	Apr 20, 2022	
Market Sim	Market Sim Window	N/A	
Production Activation	Updates to CAISO AWE Tool	May 01, 2022	

Independent 2022 – Transmission Service and Market Scheduling Priorities – Phase 1

Project Information	Details
High Level Business Problem or Need	-To development of a long-term, holistic, and durable, framework for establishing scheduling priorities in the CAISO market. Phase 1 of the initiative will be evaluating near-term enhancements that the CAISO can implement by summer 2022
High Level Project Scope	Transparency enhancements – Publication of Aggregate PT Wheel Registration Data and Aggregate RA showing Import Data Completed -data posted in CAISO website – Publication of RUC/RTPD/RTD adjustments - OASIS – Publication of curtailment (schedule reduction) data (wheels, exports, load) - OASIS Market Scheduling Priorities enhancements – Extension of wheeling through scheduling priorities for Summer 2022 to June 1, 2024 (status quo). – Provide visibility of non-RA capacity for supporting resource, and notification to PT exports and supporting resource when sum of PT export schedules exceed non-RA capacity. -SIBR
BPM Changes	- Market Instruments - Market Operations
Tariff Change	Extension to June 1, 2024 Sections:30.5.1, 31.4, 31.5.5,31.4.1, 34.12.1, 34.12.2, 34.12.3

Impacted systems	Details
SIBR	Allow SC of supporting resource to view the available capacity in SIBR Notify the SC of export when sum of the export exceed supporting resource non-RA capacity from SIBR
Integrated Forward Market, Real Time Market (IFM, RTM)	Publish RUC adjustment Publish RTPD, RTD load forecast adjustment Publish Schedule reduction once the instruction is issued in RUC Publish Schedule reduction once the instruction is issued in HASP that incorporate the post-HASP pro-rate process or operator adjustment
OASIS	Publish RUC adjustments on OASIS Publish RTPD, RTD binding interval and advisory intervals load forecast adjustments on OASIS Publish aggregated schedule reduction after instruction issued in RUC on OASIS Publish aggregated schedule reduction after instruction issued (HASP),

Independent 2022 – Transmission Service and Market Scheduling Priorities – Phase 1

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	Jan 20, 2022	✓
External BRS	Post External BRS	Mar 2, 2022	✓
Config Guides	Post Draft Config Guides	N/A	
Tech Spec	Create ISO Interface Spec (Tech spec) OASIS - Draft SIBR	 Mar 25, 2022 Apr 18, 2022	 ✓
Tariff	File Tariff - ER22-906 FERC Accepted Extension of Loads, Exports, Wheeling thru Jun 1, 2024)	Jan 27, 2022 Mar 15, 2022	✓ ✓
BPMs	Post Draft BPM changes – Mkt Inst, Mkt Ops	Yes	
External Training	Deliver External Training	Yes	
Market Sim	Market Sim Window	May 3, 2022 – May 20, 2022	
Production Activation	Production	Jun 01, 2022	

Independent 2022 –WEIM Resource Sufficiency Evaluation Enhancements – Phase 1

Project Information	Details
High Level Business Problem or Need	Implement enhancements to the WEIM Resource Sufficiency Evaluation (RSE) to ensure the RSE is administered accurately and applied equitably.
High Level Project Scope	Address the following WEIM RSE Enhancements: – Consideration of Intertemporal Constraints in the Capacity Test – Flexible Ramping Test Modifications – Power Balance Constraint – Consider a Resource's Transition through Forbidden Operating Region in the Flexible Ramping Sufficiency Test. – RSE Modifications – Storage Resources Treatment – Balancing Test Modifications – Demand Response Inclusion with RSE – Reliability of CAISO Interchange Schedules – Emergency Actions that Constitute Resource Insufficiency – Increased RSE Data on RSE Results and Additional Data Transparency and Reporting – Increased WEIM Entities Situational Awareness Regarding Test Performance – Net-Load Uncertainty Calculation Removal in Capacity Test – Intertie Uncertainty Calculation Removal in Capacity Test
BPM Changes	- Energy Imbalance Market (WEIM) - Market Instruments - Market Operations - Settlements and Billing
Tariff Change	29.34

Independent 2022 – WEIM Resource Sufficiency Evaluation Enhancements – Phase 1 (cont'd)

Impacted systems	Details
Master File (MF)	Implement the following RSE enhancements: – Demand Response Inclusion with RSE
Real-Time Base Scheduler (RTBS)	Implement the following RSE enhancements: – Consideration of Intertemporal Constraints in the Capacity Test – Flexible Ramping Test Modifications – Power Balance Constraint – Consider a Resource's Transition through Forbidden Operating Region in the Flexible Ramping Sufficiency Test. – RSE Modifications – Storage Resources Treatment – Demand Response Inclusion with RSE – Reliability of CAISO Interchange Schedules – Increased WEIM Entities Situational Awareness Regarding Test Performance – Net-Load Uncertainty Calculation Removal – Intertie Uncertainty Calculation Removal
Balancing Authority Area Operations Portal (BAAOP)	Implement the following RSE enhancements: – Demand Response Inclusion with RSE – Emergency Actions that Constitute Resource Insufficiency – Increased WEIM Entities Situational Awareness Regarding Test Performance
Real Time Market (RTM)	Implement the following RSE enhancements: – Demand Response Inclusion with RSE – Emergency Actions that Constitute Resource Insufficiency
Settlements	Implement the following RSE enhancements: – Balancing Test Modifications – Demand Response Inclusion with RSE – Reliability of CAISO Interchange Schedules
CAISO Website, Today's Outlook	Implement the following RSE enhancements: – Increased RSE Data on RSE Results and Additional Data Transparency and Reporting

Independent 2022 – WEIM Resource Sufficiency Evaluation Enhancements – Phase 1 (cont'd)

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	Feb 9, 2022	✓
External BRS	Post External BRS	Mar 7, 2022	✓
Config Guides	Post Draft Config Guides	Jan 25, 2022	✓
Tech Spec	Create ISO Interface Spec (Tech spec) OASIS - Draft CMRI BAAOP	Mar 25, 2022 Apr 7, 2022	✓
Tariff	File Tariff - ER22-1278	Mar 11, 2022	✓
BPMs	Post Draft BPM changes – DR, WEIM, Mkt Inst, Mkt Ops, RC, Stlmts & Billing	Yes	
External Training	Deliver External Training	Yes	
Market Sim	Market Sim Window	May 2022	
Production Activation	Production	Jun 1, 2022	

Independent 2022 – Adjustment to Intertie Constraint Penalty Prices

Project Information	Details
High Level Business Problem or Need	Change specific penalty price parameters to ensure the market is able to resolve intertie over-scheduling situations, consistent with observed conditions on the grid.
High Level Project Scope	– Increase the HASP ITC penalty price from $1,500/MWh to $2,900/MWh for $1,000 bid cap and $5,800 for $2,000 bid cap. – Adjust additional HASP penalty prices for priority among penalty prices – Increase the RUC ITC penalty price from $1,250/MWh to $3,200/MWh for $1,000 and $2,000 bid caps.
BPM Changes	- Market Operations
Tariff Change	– 27.4.3.2.1 – 27.4.3.3.1

Impacted systems	Details
Day-Ahead Market (DAM)	– Increase the RUC ITC penalty price from $1,250/MWh to $3,200/MWh for $1,000 and $2,000 bid caps.
Real-Time Market (RTM)	– Increase the HASP ITC penalty price from $1,500/MWh to $2,900/MWh for $1,000 bid cap and $5,800 for $2,000 bid cap. – Adjust additional HASP penalty prices for priority among penalty prices for: ▪ Exceptional Dispatch for Tie Generators ▪ WEIM Base Scheduled Exports ▪ Tagged Quantity for Exports ▪ WEIM Base Scheduled Imports ▪ Tagged Quantity for imports ▪ WEIM Transfer Constraint

Independent 2022 – Adjustment to Intertie Constraint Penalty Prices (cont'd)

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	Feb 9, 2022	✓
External BRS	Post External BRS	N/A	
Config Guides	Post Draft Config Guides	N/A	
Tech Spec	Create ISO Interface Spec (Tech spec)	N/A	
Tariff	File Tariff - ER22-1246	Mar 11, 2022	✓
BPMs	Post Draft BPM changes – Mkt Ops (PRR 1411)	Feb 28, 2022	✓
External Training	Deliver External Training	N/A – Communication	
Market Sim	Market Sim Window	N/A	
Production Activation	Production	Jun 1, 2022	

Independent 2022 – RDRR Bidding Enhancements – Phase 1

Project Information	Details
High Level Business Problem or Need	Aligning RDRR real-time bidding with FERC Order No. 831 by proposing that RDRRs must bid at least 95% of the hard energy bid cap ($1,900/MWh) when the conditions are satisfied that raise the soft energy bid cap to $2,000/MWh.
High Level Project Scope	Automatically adjust the submitted RDRR bids based on the change in energy bid cap by maintaining the percentage of the bid cap originally submitted by the Scheduling Coordinator. This automatic adjustment will occur after the market close and will only apply if no action is taken by the close of each hour's real-time market by the Scheduling Coordinator.
BPM Changes	- Market Instruments - Market Operations
Tariff Change	Section 30

Impacted systems	Details
SIBR	Implement the following : – New rules to increase the bid floor for all RDRRs under certain conditions. – Post-close rules to adjust bid prices based on the bid cap.

Independent 2022 – RDRR Bidding Enhancements – Phase 1

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	Mar 16, 2022	✓
External BRS	Post External BRS	Mar 7, 2022	✓
Config Guides	Post Draft Config Guides	N/A	
Tech Spec	Create ISO Interface Spec (Tech spec)	N/A	
Tariff	File Tariff	March 23, 2022	
BPMs	Post Draft BPM changes – Mkt Inst, Mkt Ops	Apr 2022	
External Training	Deliver External Training	Apr 11, 2022	
Market Sim	Market Sim Window	Apr 19, 2022 – May 6, 2022	
Production Activation	Production	Jun 1, 2022	

Independent 2022 – Short-Long Start Definitions

Project Information	Details
High Level Business Problem or Need	- To align market applications and business processes with revised ISO Tariff definitions of Short and Long Start resources. - To simplify and streamline CAISO definitions regarding startup classifications. - To clarify operational and settlement communication and outcomes for WEIM and ISO market participants.
High Level Project Scope	- Update current ISO Tariff definitions and business practice manuals. - The Medium Start definition will be removed and rolled into the Short Start definition. - Clarify operational and settlement communication and outcomes for WEIM and ISO market participants.
BPM Changes	- Definitions & Acronyms - Market Instruments - Market Operations - Reliability Requirements - Settlements & Billing
Tariff Change	The tariff is being changed to 1) align the market and settlement systems, and 2) align to the existing real-time optimization horizon. Sections: 34.3.1, 34.3.2, 34.6 40.6.2

Impacted systems	Details
Market Quality System (MQS)	Auxiliary Processes (Startup, Minimum Load, and Transition Cost BCR pre-qualification) shall consider a resource to be eligible for real-time commitment if the sum of startup time and minimum up time is 240 minutes or less (was previously startup time 270 minutes or less.)
SIBR	Update bid insertion rules to account for changes to Short Start and Long Start definitions under tariff revisions; account for the DA/RT unit commitment 240 minute cycle time for Short Start units (was previously 270 minutes). As previously implemented, Long Start units will not have bid-insertion performed in real-time markets if not committed in the Day-Ahead Market.
Integrated Forward Market, Real Time Market (IFM, RTM)	• Update IFM and RTM market systems to have the DA binding commitment cycle time (startup time + minimum up time) changed from 270 to 240 minutes. • No software impacts to Operator Displays.
Settlements	Settlement systems shall account for new tariff startup definitions when applying DA/RT Bid Cost Recovery, AS Non-Spin/Spin No Pay, and RAAIM Pre-Calc calculations.

Independent 2022 – Short-Long Start Definitions

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	Mar 16, 2022	✓
External BRS	Post External BRS	Jun 21, 2021	✓
Config Guides	Post Draft Config Guides	May 27, 2021	✓
Tech Spec	Create ISO Interface Spec (Tech spec)	N/A	
Tariff	File Tariff	Mar 24, 2022	✓
BPMs	Post Draft BPM changes	Mar 25, 2022	✓
External Training	Deliver External Training	N/A (Communication)	
Production Activation	Short-Long Start Definitions	Jun 1, 2022	

Independent 2022 – Interconnection Process Enhancements (IPE) 2021 – Phase 1

Project Information	Details
High Level Business Problem or Need	The proposal is focused on four main areas including how to manage the "currently overheated" interconnection queue and encourage resource developer discipline to submit only viable projects; removing barriers for timely development of needed resources; better alignment of resource procurement by LSEs with the ISO process and state policy direction; and addressing residual issues that have emerged since the process was last reviewed in 2018. Those residual issues include how to allocate costs for generator driven network upgrades, and reimbursement for reliability network upgrades for generators outside the ISO system.
High Level Project Scope	The project will focus on the following: •Continuous improvement of the generator interconnection process •Provide greater visibility and transparency to the stakeholders •Eliminate manual workarounds •Provide single source of data
System Changes	N/A

Independent 2022 – Interconnection Process Enhancements (IPE) 2021 – Phase 1 (cont'd)

Milestone Type	Milestone Name	Dates	Status
Board Approval	Board of Governors	May 11, 2022	
External BRS	Post External BRS	N/A	
Config Guides	Post Draft Config Guides	N/A	
Tech Spec	Create ISO Interface Spec (Tech spec)	N/A	
Tariff	File Tariff	May/Jun 2022	
BPMs	Post Draft BPM changes	TBD	
External Training	Deliver External Training	N/A	
Market Sim	Market Sim Window	N/A	
Production Activation	Production	Sep 2022	

Operations Systems Improvements 2021/2022 Enhancements

Project Information	Description
High Level Business Problem or Need	• The goal of this project is to deliver timely systems improvements that support efficient day-to-day work and operations. The project aims to improve market robustness, performance, and the technology foundation for system grid reliability by updating functionality and interfaces to reduce workarounds, automating manual processes and addressing functionality enhancements. A list of specific high priority improvements will be the scope for the project. A number of these improvements may have an impact on the way in which customers interact with CAISO systems.
Affected Systems	• A preliminary list of enhancements is included on the next slide. PLEASE NOTE: This list may change as the project progresses and priority are factored. The goal is to provide advanced notification of changes whenever possible
Schedule	• External BRS 2022 External BRS ECD 4/18 • MAP Stage Availability TBD* • Customer Training TBD* • PROD TBD* * The plans for testing and deployment will vary between improvement items as these may be released individually or in groups. More information on specific improvements will be made available as planning and schedules are solidified.

Operations Systems Improvements Projects

List of Proposed Improvements*

***PLEASE NOTE: This list may change as the project progresses and priorities are factored. The goal is to provide advanced notification of changes whenever possible**

2021

System	Summary Description	Next Step
Market	Ability to block/unblock ETSRs for a specified Time interval	PROD w/ WEIM 2021
ADS	Add advance filter, additional color scheme, change grid color	PROD – May 2022

2022

System	Summary Description	Next Step
MRI - Settlements	Automate PTO submission of TAC Rates	2022
Market	Modify Unit Details UI	2022
~~CIRA~~	~~Publish bilateral trades from CIRA to OASIS~~	~~2022~~
~~CIRA~~	~~EFC data to OASIS Phase 3~~	~~2022~~

Potential 2022 Enhancements may include updates to the following systems:

- OMS
- RTM
- ADS
- CIDI
- Market
- ~~CIRA~~
- MRI-S

2022 Fall Release

Fall 2022 Release Overview

	BRS	Config Guide	Tech Spec	Draft Tariff*	BPMs	External Training	Market Sim	Production Activation
Fall 2022 Release	**04/01/22**	**05/31/22**	**05/20/22**	**06/21/22**	**07/15/22**	**07/18/22 – 07/22/22**	**07/25/22 – 09/02/22**	**10/1/22**
Hybrid Resources Phase 2-B	8/3/21 1/12/22	01/25/22	09/10/21	09/17/21	02/14/22	By 7/22/22	07/25/22 – 09/02/22	10/01/22
FRP Improvements - Deliverability	V1.0: 01/28/21 Reqmts Enh V1.0: 3/11/22	05/31/22	5/06/22 - OASIS	08/31/20	05/27/22	07/21/22	07/25/22 – 09/02/22	10/01/22
FERC Order 2222	3/29/22	*N/A*	MF				07/25/22 – 09/02/22	10/01/22
Central Procurement Entity Implementation	3/10/22	05/31/22					07/25/22 – 09/02/22	10/01/22

Fall 2022 – Hybrid Resources Phases 2-B - Overview

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 project participation (hybrid and co-located resources) in the ISO markets.
High Level Project Scope	**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. The Phase 2 project has been split into two separate implementations, phases 2-A and 2-B, to support strategic delivery timing. Phase 2-B information is available under the Spring 2022 release section. **Phase 2-A** was implemented on December 15, 2021. This phase focuses on implementing Ancillary Services (AS) and High Sustainable Limit (HSL) functionality with a focus on the EMS and IFM/RTM systems. **Phase 2-B** is scheduled to implement Fall 2022. This project phase focuses on implementing the Hybrid Dynamic Limit functionality, Multiple ACC, along with all remaining project scope to include changes to systems RIMS, Master File, EMS, SIBR, IFM/RTM, OASIS, ALFS, Settlements, MRI-S Metering, CMRI, MPP, Today's Outlook, ISO Today Mobile Application, Monthly Renewables Performance Report, Wind and Solar Real-Time Dispatch Curtailment Report', and the Over Supply Page. **External BRS Posting:** An updated External BRS v1.2 has been posted. V1.3 expected by 3/13.
BPM Changes	Direct Telemetry, Market Instruments, Market Operations, Metering, Settlements and Billing
Tariff Changes	Proposed sections 4.18, 34.1.6.3, 30.5.6.1 Sections 27.13, 8.4.1.1(g), 8.4.3, Appendix K, Parts A, B and C, 8.2.3, 8.4.5, 34.7, 11.6.6, 4.8.2, 40.9.2 (b) (D)
Impacted Systems	ALFS, CMRI, Reporting, IFM/RTM, Master File, OASIS, RIMS, Settlements, MRI-S Metering, SIBR, MPP, Today's Outlook, ISO Today Mobile Application, Monthly Renewables Performance Report, Wind and Solar Real-Time Dispatch Curtailment Report, Over Supply Page.

Fall 2022 – Hybrid Resources Phase 2-B (Cont'd)

System	High Level Changes
Automated Load Forecast System (ALFS)	• Identification of variable energy resources (VER) • New forecast type for hybrid resources • Forecast for hybrid resources that elect for ISO forecast
CAISO Market Results Interface (CMRI)	• Updates to include resource specific forecast data for hybrid resources (VER components).
Reporting	• Update report(s) for resource tagging changes: Solar Total tag, Wind Total Tag, Battery Total Tag (Renewable watch, Curtailment Report, ISO Today), and new Hybrid Total Tag
Integrated Forward Market (IFM)/Real-Time Market (RTM)	• When any resource behind an ACC constraint has an AS award, all resources behind that ACC constraint must follow their DOT and receive the must follow flag • Create a new user interface to display the hybrid summary (dynamic limits) • Modify 'Must Follow DOT' flag for AS cleared or AS dispatched award ○ Must Follow DOT Flag must turn to 'Y' for Ancillary Service Cleared by resource ID • Software that takes the submitted limit and haircuts the energy bid used in each interval of the market time horizon • Limit the economic dispatch of a hybrid resource in the real-time market based on dynamic limits submitted to SIBR • For resources and hybrids, add new user interfaces • Dynamic Limit functionality: • Display a hybrid resources upper limit and lower limit
OMS	• System shall consume the new "HYBD" fuel type value and display the value for hybrid resource outages

Fall 2022 – Hybrid Resources Phase 2-B (Cont'd)

System	High Level Changes
Master File (MF)	• Enhance MF to identify Hybrid resources • Create a new categorization in MF to identify hybrid resources to handle dynamic limits • Add the ability to store the state-or-charge minimum and maximum limit • Identification of variable energy resources (VER) • Enhance MF to map hybrid resource to individual VER component(s) • **Note:** Renewable registration for VER components is currently mapped to Resource ID; will need further automation to map to individual VER component • New unit type to identify a hybrid resource under the existing NGR model • New identification of individual renewable components that make up a hybrid resource • Ability to elect for ISO forecast or SC submitted forecast to be at the renewable component level • Make the new categorization of hybrid resources along with associated attributes available for downstream applications • Add a MF rule to make sure the 'MOO Qualified Flag' is set to "N" for hybrid resources • Modifications to support the need for a few MF resource attributes (for example, fuel type, technology type, QF Flag, VER NGR flag, etc.) that need to be associated to the VER components that make up the hybrid resources • Map PI Tags (VER actual and meteorological tags) to each Resource ID or VER component. **Note:** System to be determined per Architecture Definition
Open Access Same Time Information (OASIS)	• Updates to create a new category for hybrid resources to be included in the forecast data reports.
Settlements	• Consume new VER Component ID for forecasting fee • Updates to forecast fee calculation based on meter data submitted for the VER components that elect ISO forecast
Metering (MRI-S)	• Ability to receive meter data at the VER Component ID level for hybrid resources • Updates for Western Renewable Energy Generation Information System (WREGIS) reporting of meter data on the Hybrid components
Scheduling Infrastructure and Business Rules (SIBR)	• Treat all hybrid resources as non REM NGRs • Flagging must be configured to ensure bid insertion does not occur • SIBR rules and new rule flow needs to be created to receive and validate the dynamic operating limits • Allows market participant to submit their dynamic limit • Allow submission of upper and lower economic limits for each 5-minute interval in a three hour window for hybrid resources • Validation of upper and lower economic limits • Validate the dynamic operating limits

Fall 2022 – Hybrid Resources Phase 2-B

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Nov 18, 2020	✓
External BRS	Post External BRS (Includes Phase 2-A and 2-B)	Aug 3, 2021	✓
	Post External BRS revisions - Elaboration on BRQs and clarifications	Jan 12, 2022	✓
Config Guides	Post Draft Config Guides	Jan 25, 2022	✓
Tech Spec	Create ISO Interface Spec (Tech spec)	Sep 10, 2021	✓
Tariff	File Tariff	Sep 17, 2021	✓
Market Sim Scenarios	Post proposed scenarios (Unstructured)	Feb 8, 2022	✓
BPMs	Publish Final Business Practice Manuals for mkt sim	Feb 14, 2022	✓
External Training	Deliver External Training	By Jul 22, 2022	
Market Sim	Market Sim Window	Jul 25, 2022 – Sep 02, 2022	
Production Activation	Hybrid Resources Phase 2-B	Oct 1, 2022	

Fall 2022 – Flexible Ramping Product Improvements Deliverability

Project Information	Details/Date
High Level Project Scope	The scope of the project FRP Deliverability is: 1. Procurement of FRP for BAA's that fails the flex test is separate for each BAA. 2. Procurement of FRP for BAA's that pass the flex test for the entire group of BAA. 3. Transmission constraints and transfer limits are enforced in FRP deployment scenarios 4. Distributing the uncertainty requirement in each BAA load and VER locations versus just load 5. Distributing the demand curve surplus variable as a decision variable at load aggregation points (LAP) versus Balancing Authority Areas (BAA) 6. To establish the Locational Marginal Capacity Prices (LMCP) for FRP The scope of the FRP Requirements Enhancements is: 1. To enhance the current approach by adopting a quantile regression method to adjust the current flexible ramping product up and down requirement. 2. Calculation of the demand curve.
BPM Changes	Market Instruments, Market Operations
Tariff Change	Yes
Impacted Systems	RTM, Settlements, CMRI/OASIS

System	High Level Changes
Real Time Markets (RTM)	• RTM to be impacted based on the change in the FRP procurement systems. • Input data needed for forecasted advisory in the binding interval for RTPD for approx. 40 work days or weekends. • New demand curve calculation is needed.
Settlements	• Prices are nodal therefore mechanics for cost allocation pricing to be changed • Nodal FRP prices
CAISO Market Results Interface (CMRI)/ Open Access Same time Information (OASIS)	• Publish Resource Nodal prices for the FRP awards (CMRI) • Publish requirements for FRP per BAA and BAA group (OASIS) • Publish surplus by LAP (OASIS) • Publish the nodal FRP prices (OASIS)

Fall 2022 – Flexible Ramping Product Improvements Deliverability

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	Sept 30, 2020	✓
External BRS	Flexible Ramp Product: Deliverability	Jan 28, 2021	✓
	Flexible Ramp Product: Requirements Enhancements	Mar 11, 2022	✓
Tariff	File Tariff	Apr 21, 2022	
BPMs	Publish Draft BPM updates	May 27, 2022	
Config Guides	Post Draft Config Guides	May 31, 2022	
Tech Spec	Publish Technical Specification - OASIS	May 06, 2022	
External Training	Deliver External Training	Jul 21, 2022	
Market Sim	Market Sim Window	Jul 25, 2022 – Sep 02, 2022	
Production Activation	FRP Deliverability	Oct 01, 2022	

2023 CRR System Upgrade

2023 – Congestion Revenue Rights (CRR) Upgrade

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

2023 – Congestion Revenue Rights (CRR) Upgrade

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

2023 – Congestion Revenue Rights (CRR) Upgrade

Milestone Type	Milestone Name	Dates	Status
Board Approval	Obtain Board of Governors Approval	N/A	
External BRS	Publish External BRS	N/A	
Config Guides	Post Draft Config Guides	N/A	
Tech Spec	Publish Technical Specification	Draft 11/5/21	✓
Tariff	File Tariff	N/A	
BPMs	Publish Draft BPM updates	TBD	
External Training	Deliver External Training	Oct 13, 2022 – Oct 25, 2022	
Market Sim	Market Sim Window	Jan 26 , 2023 – Mar 8, 2023	
Production Activation	CRR Upgrade	Mar 20, 2023	
Phase 2 Production Activation	Phase 2 Go-Live	July 31, 2023	

2023 CRR System Upgrade - Overview

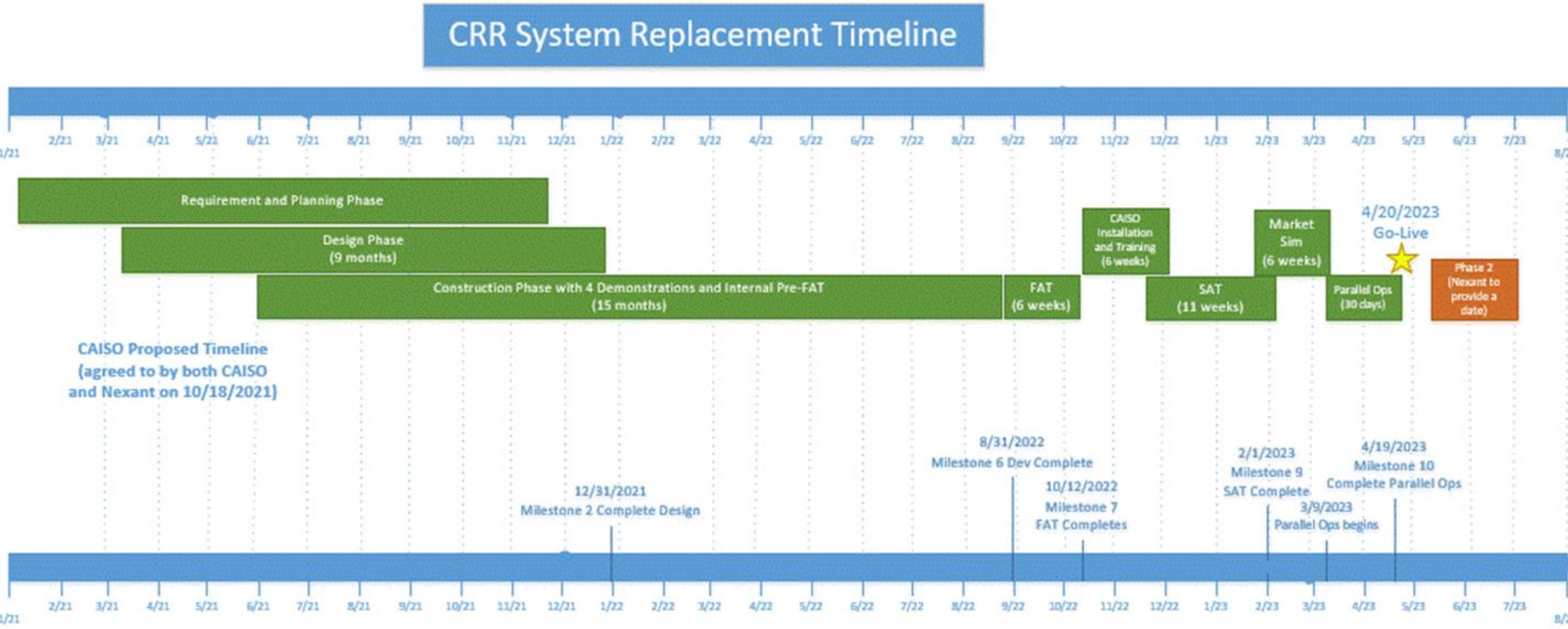
The Congestion Revenue Rights (CRR) system was implemented by CAISO in 2008 as part of the Market Redesign and Technology Upgrade (MRTU) implementation. The current CRR system is at its end of life, does not have the flexibility to accommodate future policy changes and requires the ISO to calculate data and run processes manually outside the current system to produce a successful CRR Auction.

The CAISO has decided to replace the existing CRR system with a new system that adopts 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.

2023 CRR System Upgrade – Get Connected

- The two technical meetings we would like CRR technical users to attend are:
  - **Bi-weekly Technical User Group (TUG)** meetings at 10 AM on Tuesdays, alternating with RUG.
    - Meetings are 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
  - **B2B Improvements – Webinar Series**
    - This meeting is by invitation only
    - Technical representations only as the meeting covers technical details with respect to the new integration pattern
    - Team met on 11/3/2020 and next webinar is tentatively planned for 2/3/2022
    - Interested folks should send email to inambiar@caiso.com
    - All CRR new API specifications will be presented and discussed in this meeting

2023 CRR System Upgrade – Milestone Schedule



2024 Settlement Upgrade

2024 - Settlement Upgrade - Overview

The current settlement system, implemented in 2008 as part of the Market Redesign and Technology Upgrade (MRTU) implementation, is nearing its end of life. The CAISO is upgrading existing settlement applications to approved architectural and information security standards.

Benefits for our customers include:

- Improved business efficiency
- Better gathering and analysis for data and front-end improvements for customers interacting with CAISO Settlement Systems
- Increased transparency for some calculations
- Accommodating data processing increases resulting from new market products and an increase in market participants
- Ability to perform complex settlement calculations

2024 - Settlement Upgrade – Get Connected

- Vendors and Market Participants plan to attend:
  - **Settlement User Group (SUG)** 10 AM on Wednesdays, alternating with RUG. (Next meeting 3/2)
    - Schedule updates, request for enhancements, Configuration change details, examples, calendar format differences etc.
- Settlement technical users plan to attend:
  - **Bi-weekly Technical User Group (TUG)** 10 AM on Tuesdays, alternating with RUG. (Next meeting 3/1)
    - B2B Improvements and New API specifications will be presented and discussed in this meeting
    - meeting details and presentation materials are available on the CAISO Developer site at www.developer.caiso.com , requires an account setup for access

Note: Meetings are available on the CAISO calendar on www.caiso.com

2024 - Settlement Upgrade – Targeted Goals

- The ISO will work closely with our market participants to ensure seamless transition from e-terra 2.5 to 3.0 configuration output file.
- The ISO will provide a forum for participants to ask more technical questions.
- The ISO will provide an environment with production-like data allowing customers to validate changes.
- The system will provide settlement outputs in various file formats, allowing all customers to access and use the data in day-to-day operations. The ISO will strive to make formulas and inputs transparent to enable market participants to monitor and/or validate settlement results.
- The ISO will provide market participants with an extended market simulation
- The ISO will give timely support to the market participants and their vendors during the testing phase.

2024 - Settlement Upgrade – Targeted Goals Cont.

- From a vendor perspective:
  - ISO will provide third party vendors with support during the transition period.
  - ISO will provide an extended market simulation and/or parallel statements and invoices during the transition period so vendors can resolve defects on their systems.
  - ISO will provide open communications to resolve settlement differences through a customer forum.

2024 - Settlement Upgrade – We would like to hear from you

- Decomposition of the settlement files
- Migrating to OpenAPI specifications
- Upgrading to a new output config file format
- Any other enhancement requests?

- Next steps
  - Use the CIDI process to submit comments and enhancement requests. Your submittal will be reviewed and added to a master list that will be presented at the Settlement User Group (SUG)
    - The CIDI ticket will be closed once added to the SUG master list.

Stay Informed

Ways to participate in releases

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

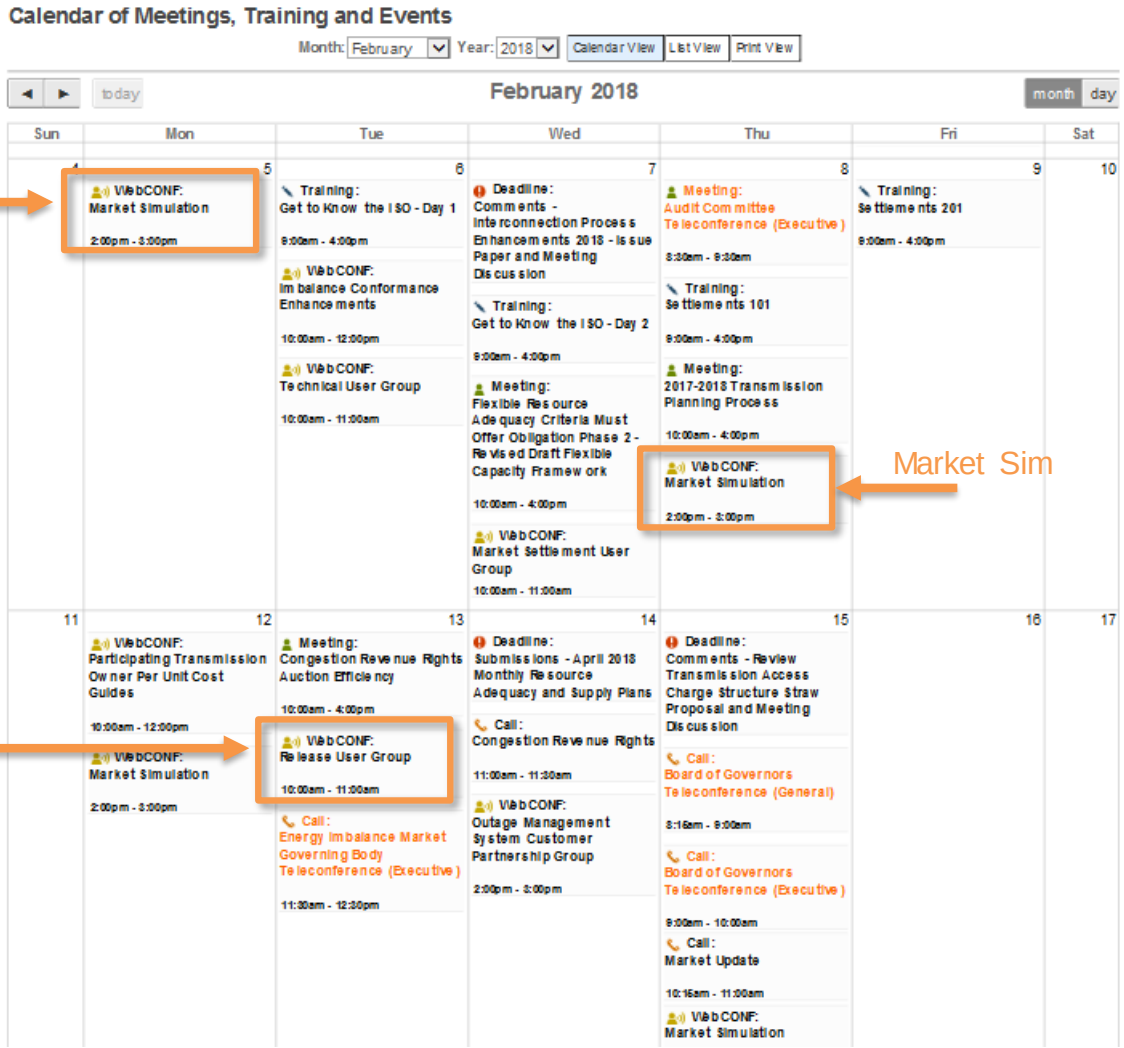
- Attend meetings
  - Release Users Group (RUG) bi-weekly meetings
    - Initiative status updates
    - System change updates on independent releases
  - Market Simulation calls
    - Visit the ISO calendar at www.caiso.com for meeting dates and times and add events to your calendar
    - Typically 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



Upcoming meetings

The next MPPF is scheduled for June 16, 2022.

MPPF related materials are available on the ISO website here.

Agenda topic suggestions:

- Submit through CIDI
  - Select the *Market Performance and Planning Forum* category

- Send email to isostakeholderaffairs@caiso.com.

California ISO

2022

Market Performance and Planning Forum Meetings

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

March

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

June

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

September

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

December

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

Meeting Agenda to Post

Follow us on Twitter @CaliforniaISO and @ISONotices for our latest updates

- The ISO is pleased to be hosting the Stakeholder Symposium in-person at the Safe Credit Union Convention Center in downtown Sacramento on Nov. 9 – 10, 2022
- Registration will be open in May
  - Public notice will be issued once the site is available
- Additional information is available on the Stakeholder Symposium page on ISO's website at: http://www.caiso.com/informed/Pages/MeetingsEvents/StakeholderSymposium/Default.aspx
- Please direct questions to symposiumreg@caiso.com

Next MPPF Meeting: June 16, 2022