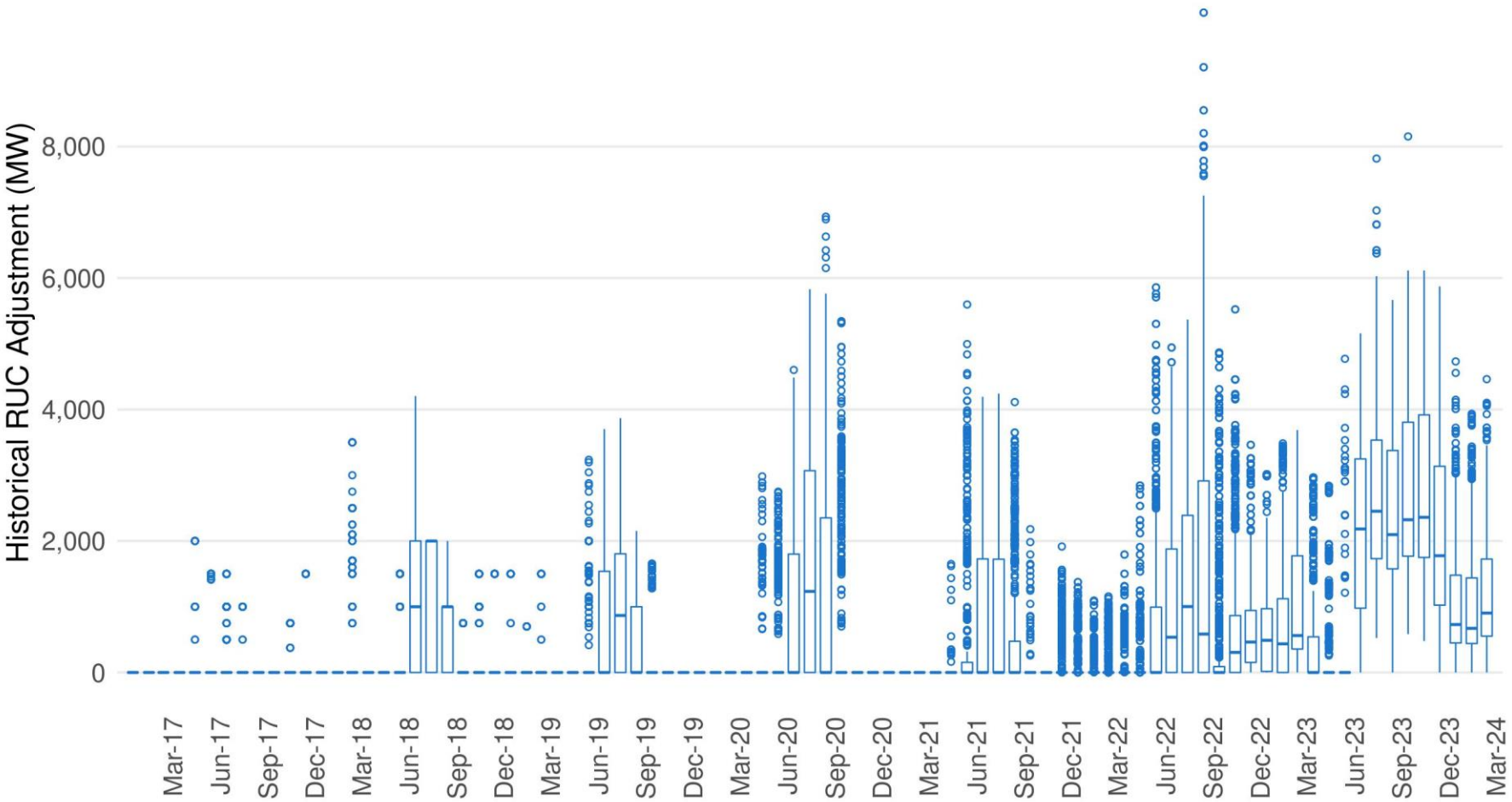
RUC adjustments and their market implications

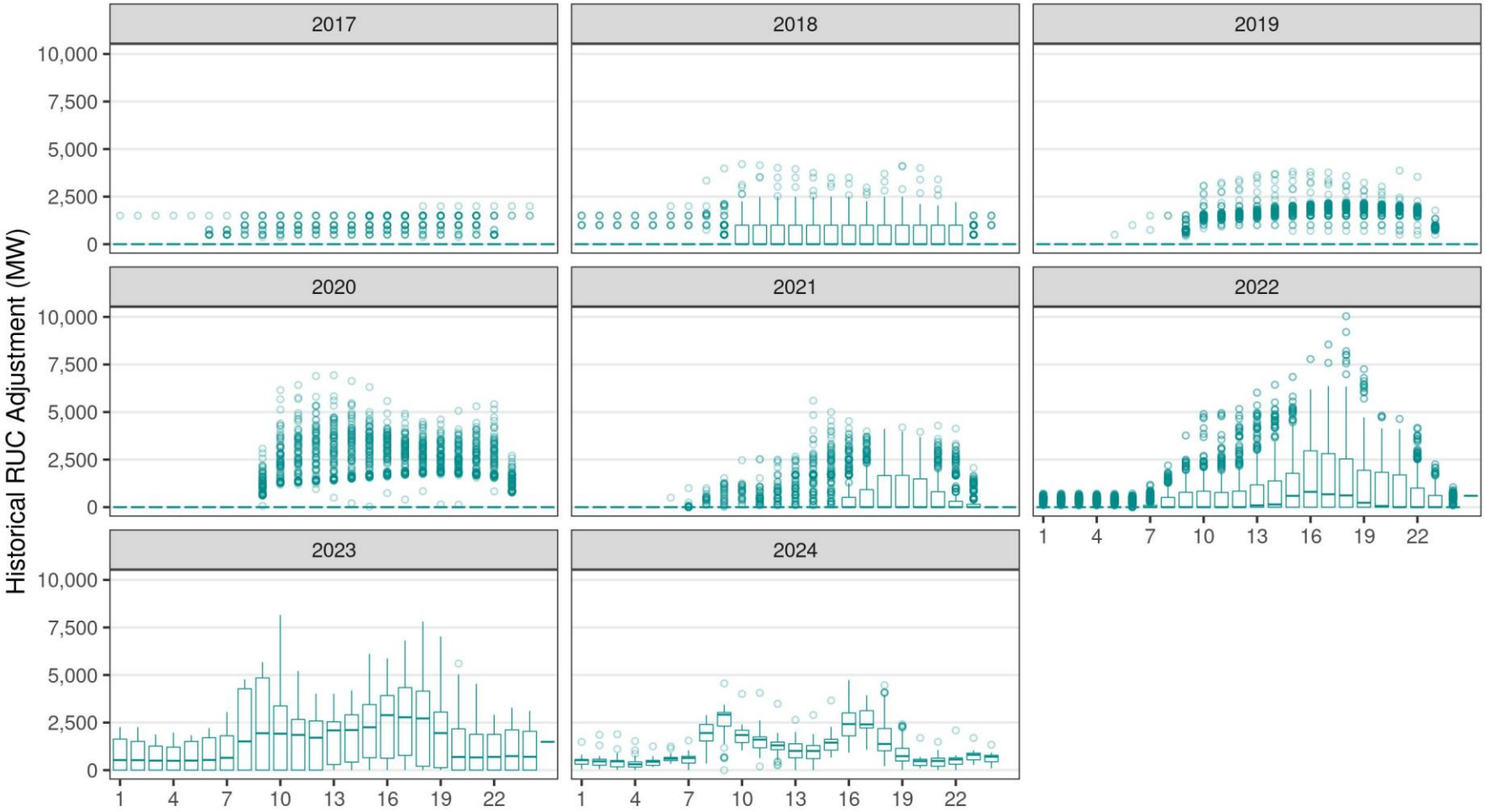
Guillermo Bautista Alderete
Abhishek Hundiwale
Market Performance and Advanced Analytics

Market Surveillance Committee Meeting
General Session
April 11, 2024

The magnitude and frequency of RUC adjustments have evolved over the years



Peak hours were the main target of RUC adjustments since summer 2020

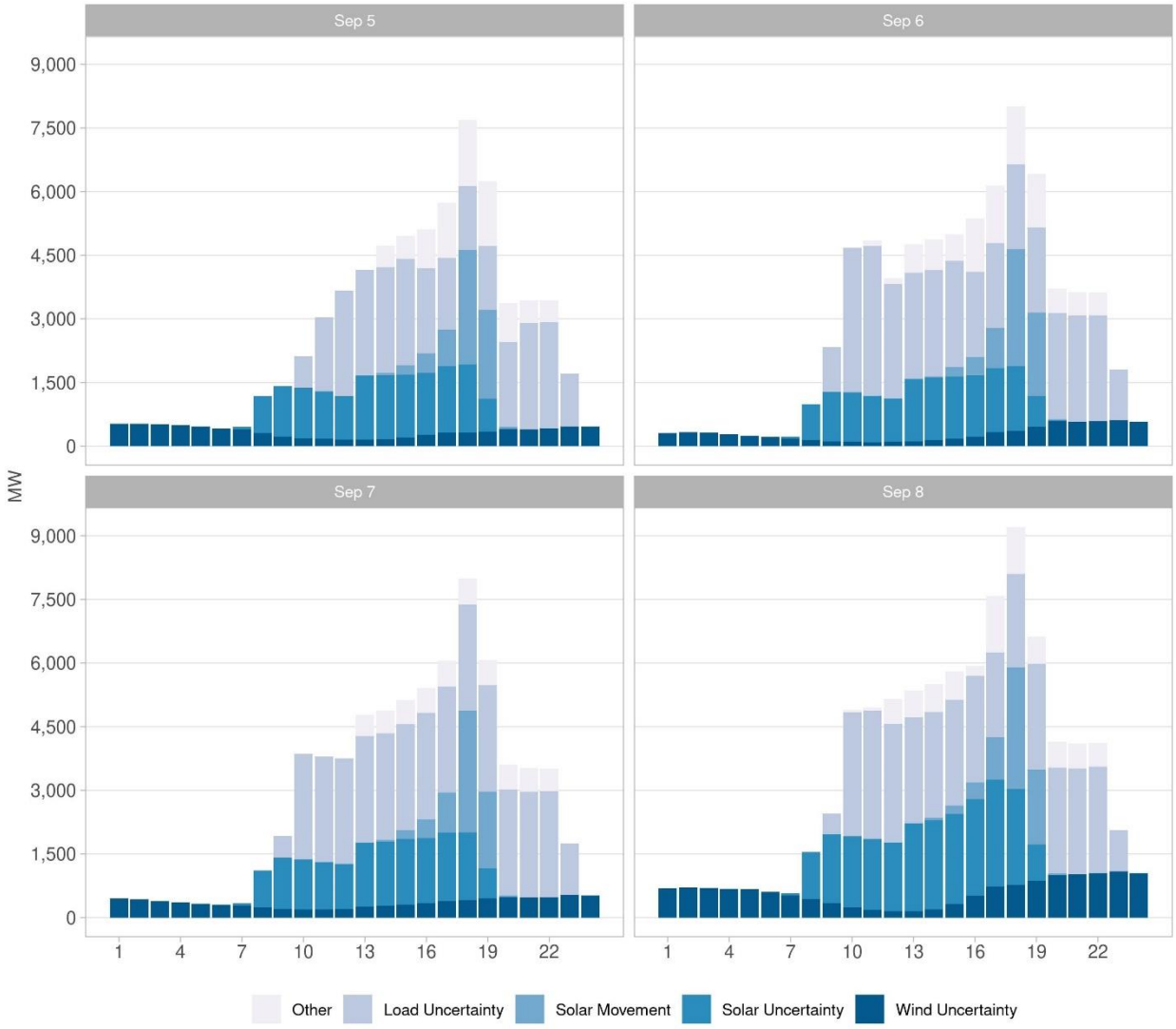


From the Summer 2022 performance, ISO committed to further assess the need and use of load conformance across markets

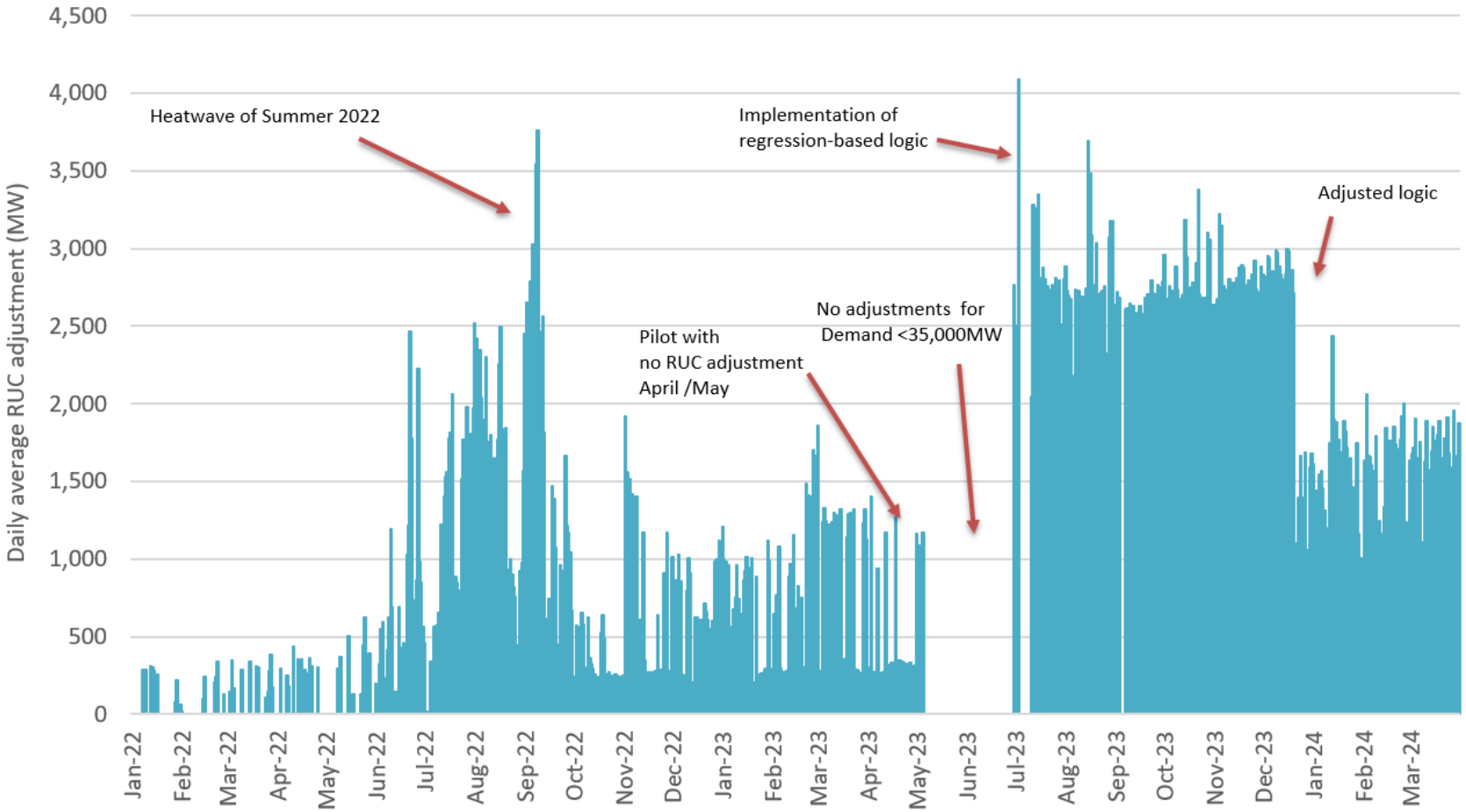
In September 2022, RUC conformance reached 10,000MW

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

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

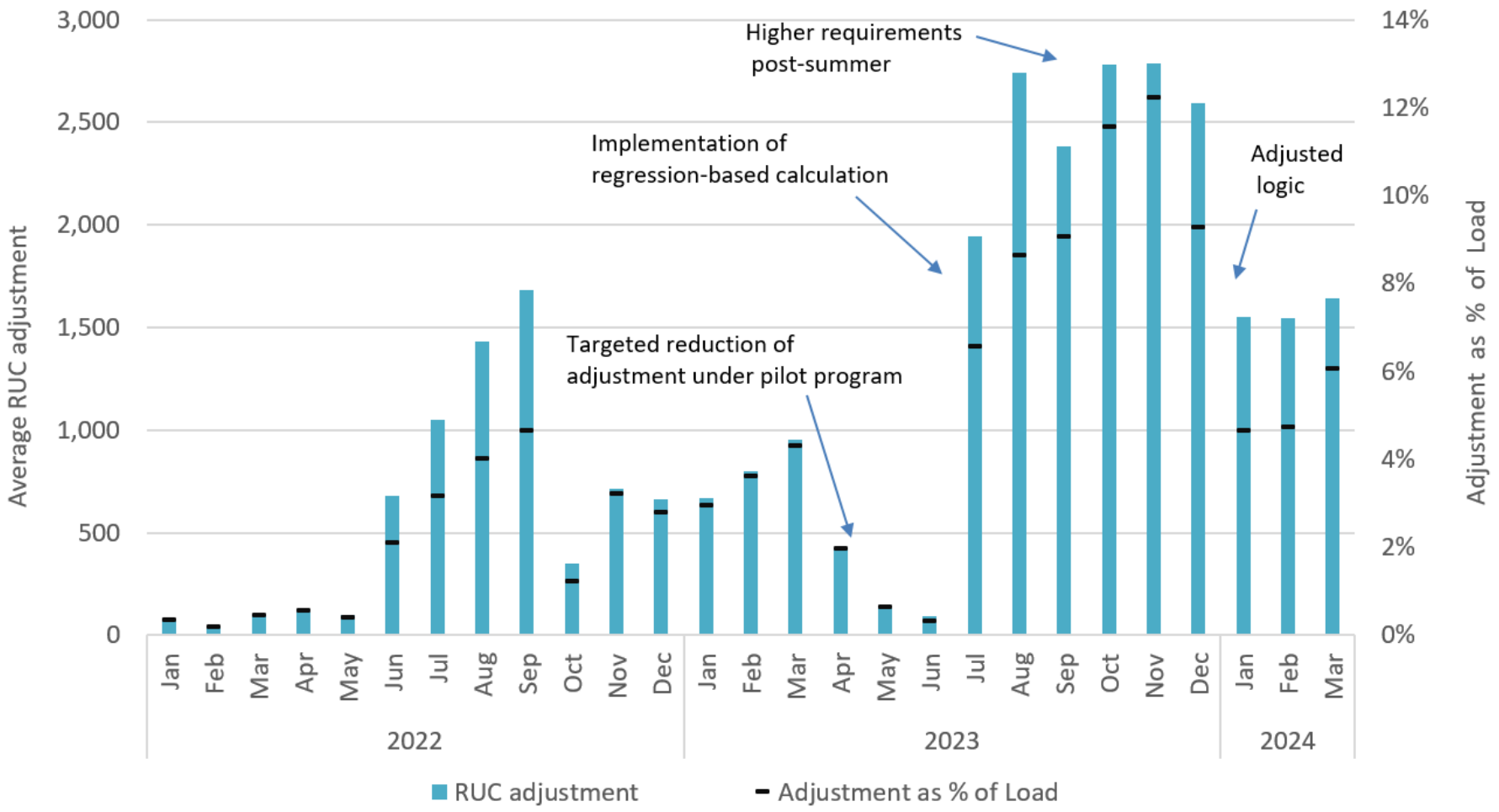


ISO has been assessing and running a pilot program on the utilization and the implications of load conformance across markets

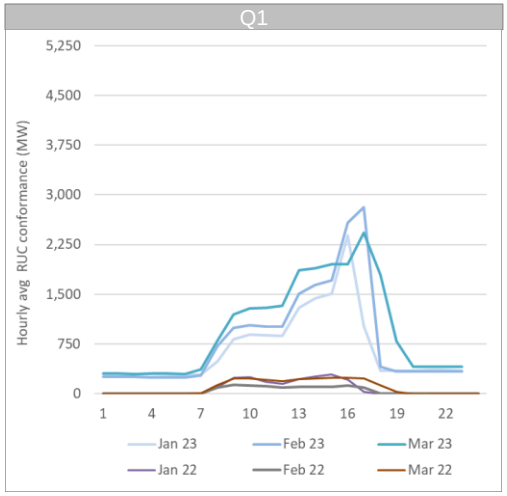


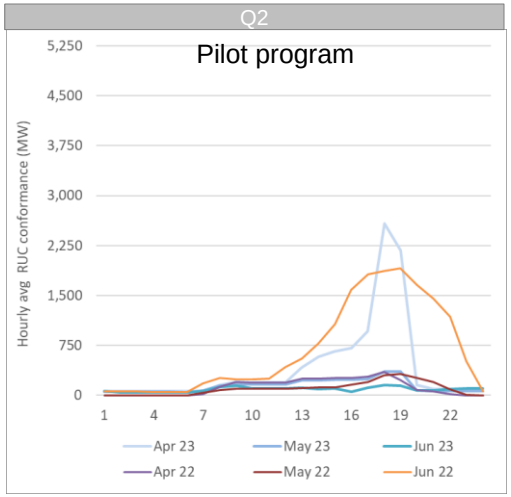
Results of pilot case study provided preliminary insights of the merits of RUC adjustments

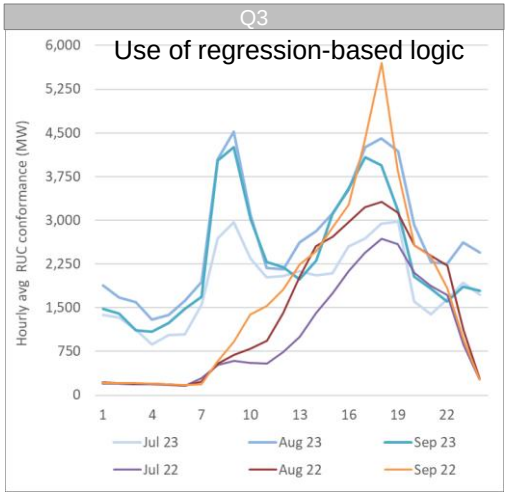
The percentage of RUC adjustment relative to the load increased steeply, up to 37%, after the use of regression-based logic

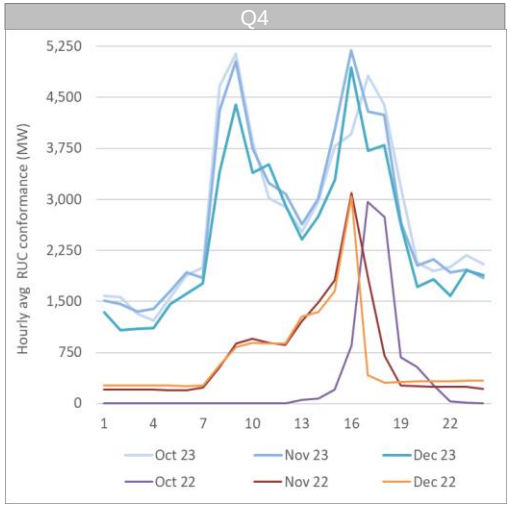


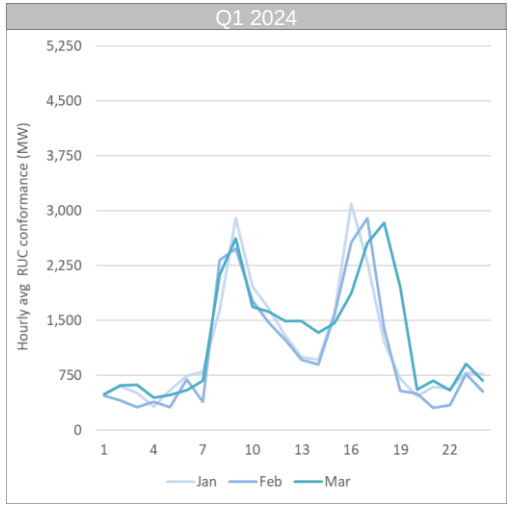
Hourly profile of RUC adjustments shows a reduction with the run of the pilot program but an increase with the use of new methodology









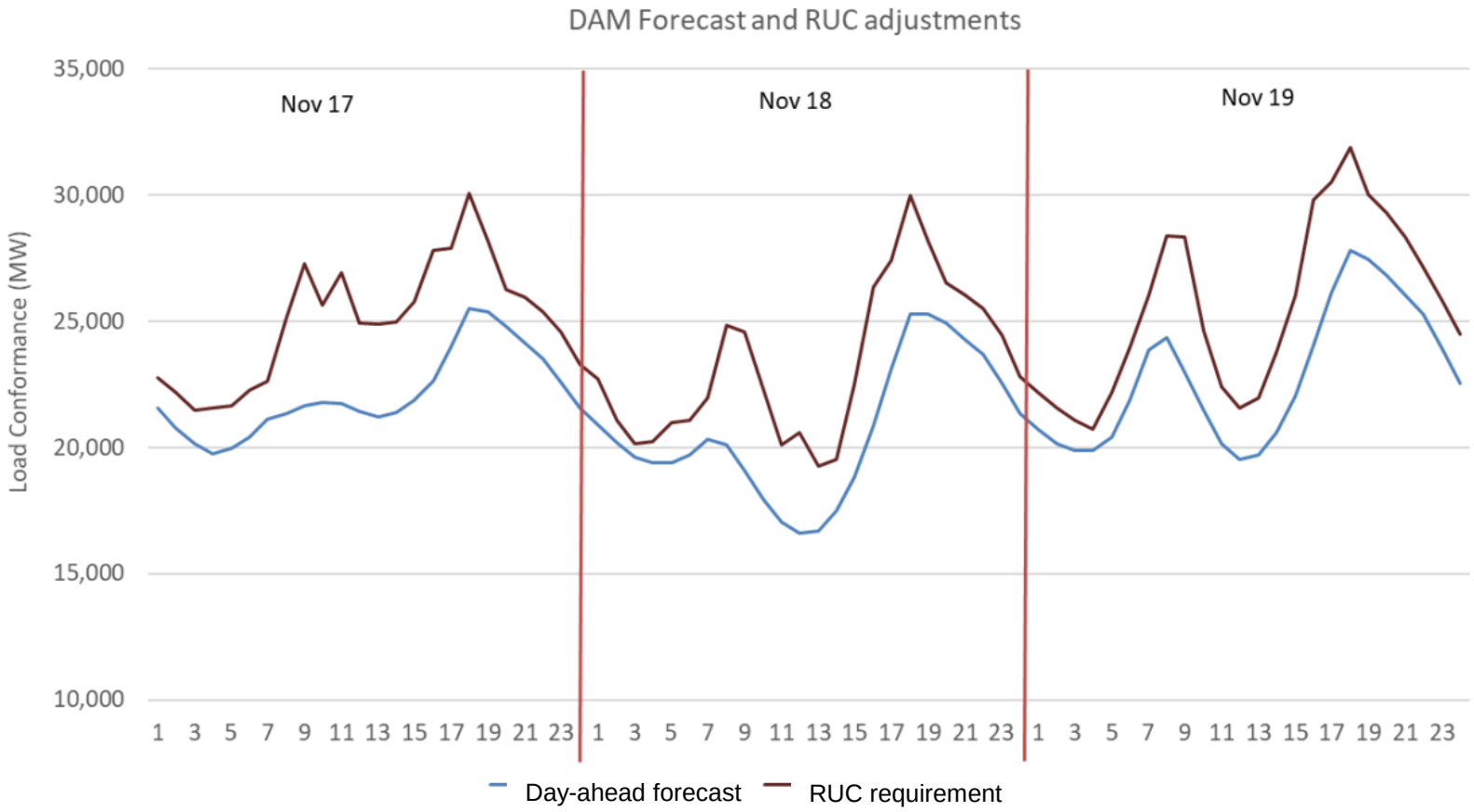


Profiles for July-September are different once the guiding methodology switched to use regression-based logic

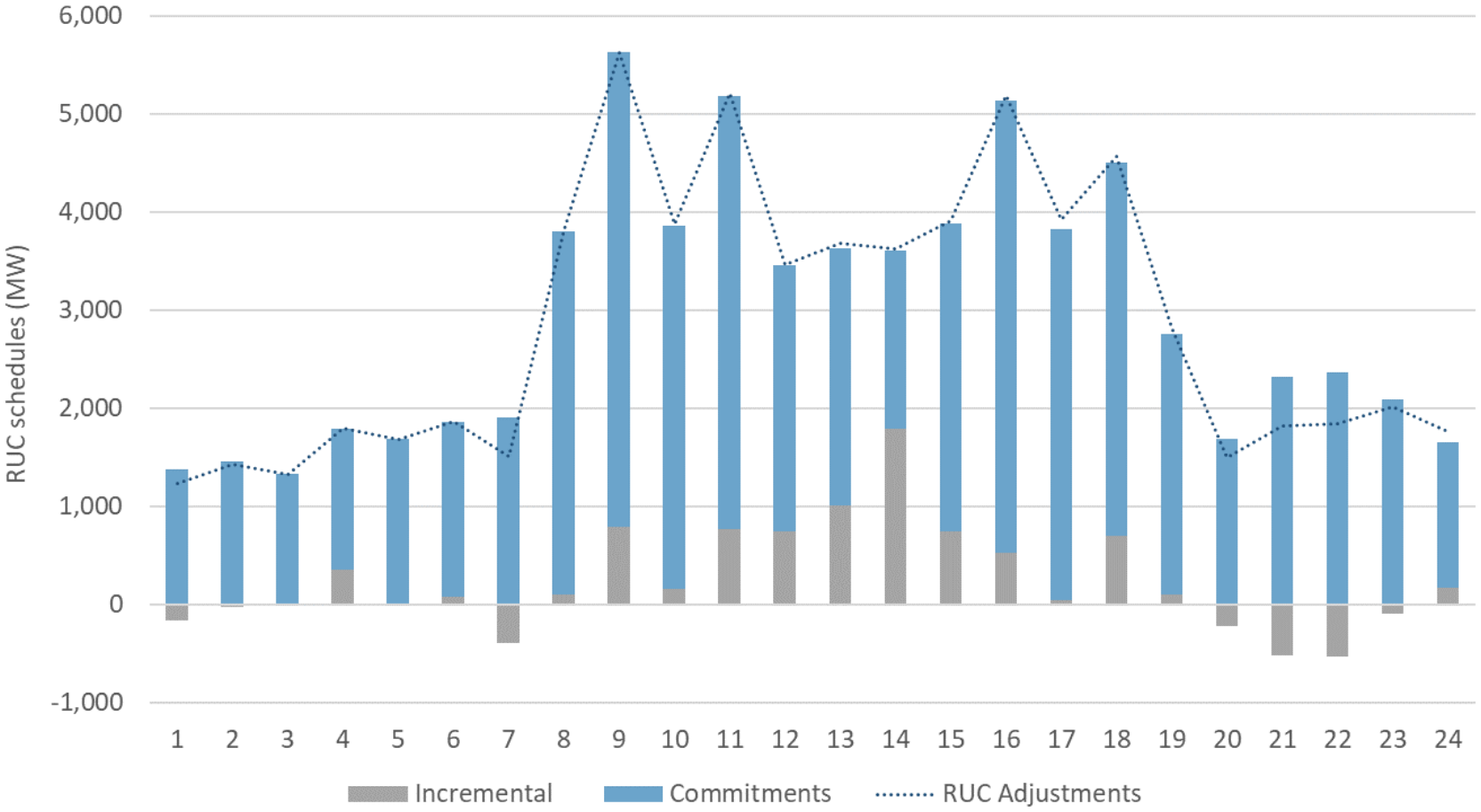
What were the market implications of changing to the new methodology?

- Logic based on similar methodology to what will be used to estimate imbalance reserves
- Average adjustments were higher in Q4 post-summer months
- Nonzero values applicable to all hours of the day including midday hours
- Given the significant high values observed post summer, ISO adjusted the logic
  - Values were higher due to being based on net load differences from Day Ahead to RTD; they were adjusted to be from Day Ahead to FMM in December 2024 to align with DAME definition
  - Percentile adjusted down from 97.5th to a condition-based logic
  - It still relies on the same regression-based logic

The significant RUC adjustments in non-summer months drove additional supply dispatch for morning and midday hours

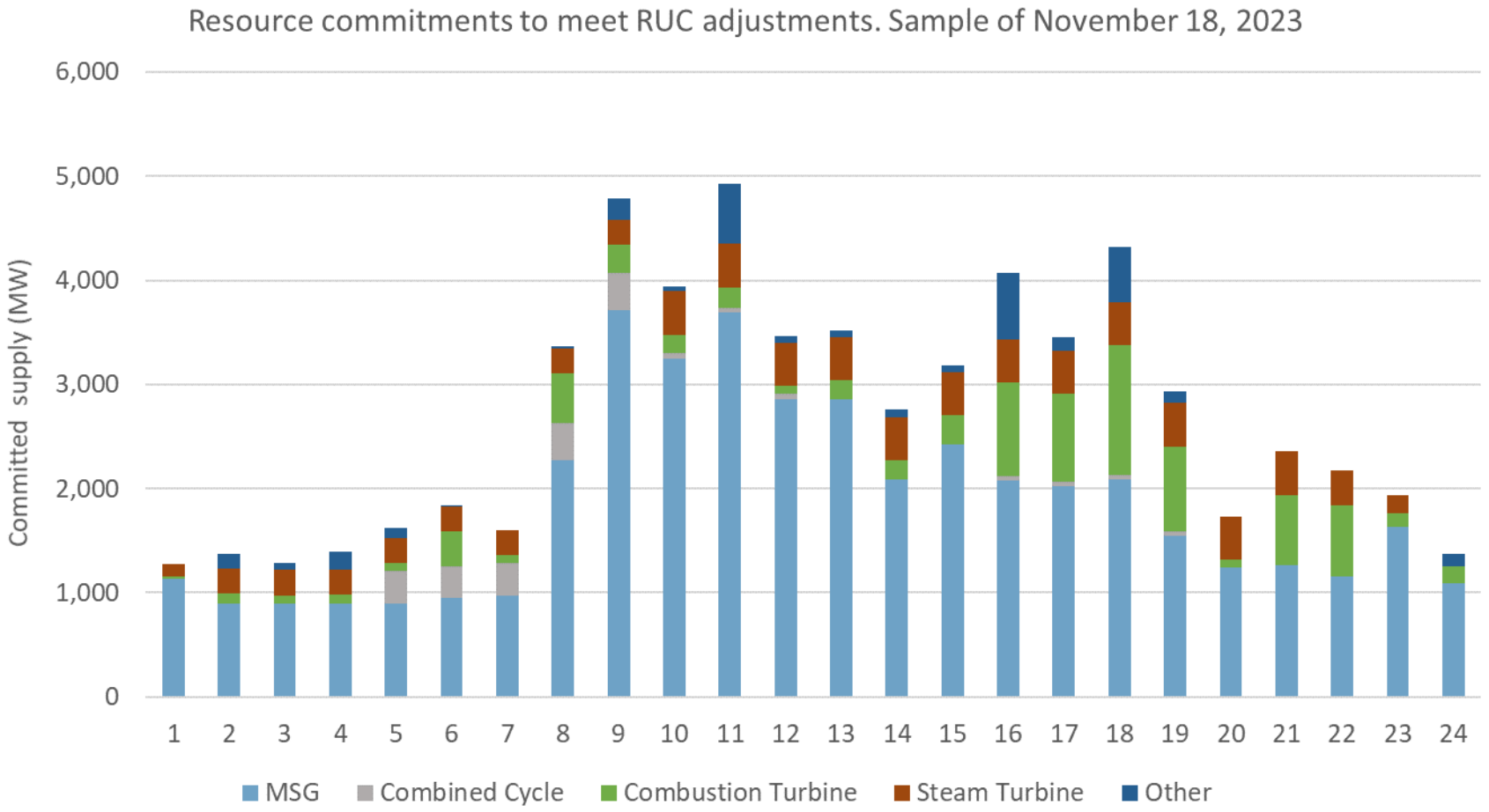


Sample illustration. November 18. RUC adjustments were mainly met with unit commitments

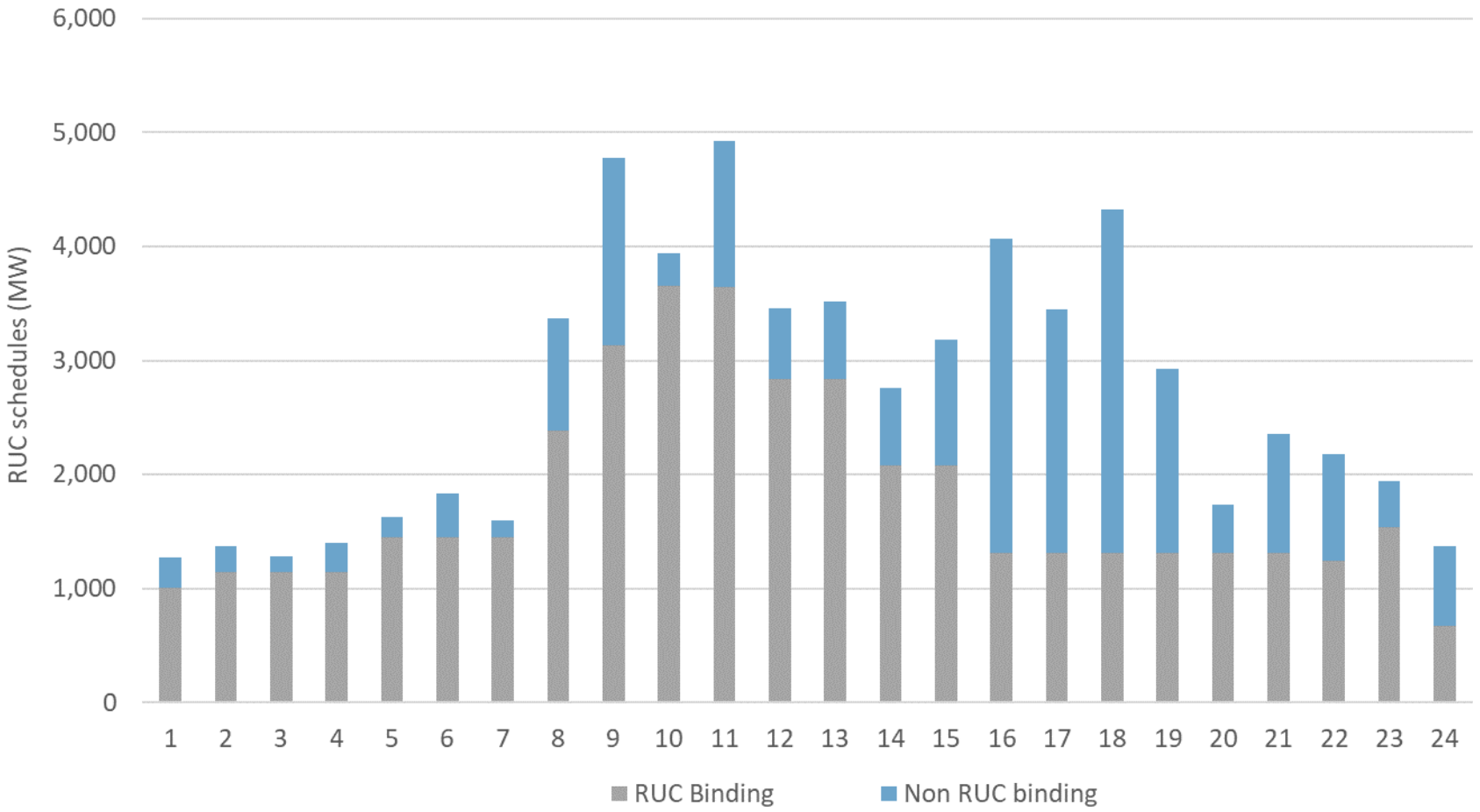


This metric reflects only the additional schedules to meet the RUC adjustments
Additional schedules to meet the gap from IFM schedules to load forecast/virtuals
already consumed the incremental capacity available from IFM commitments and non-long start units

The significant RUC adjustments in early hours can drive commitment of less flexible units, which in some cases had to remain online for subsequent hours



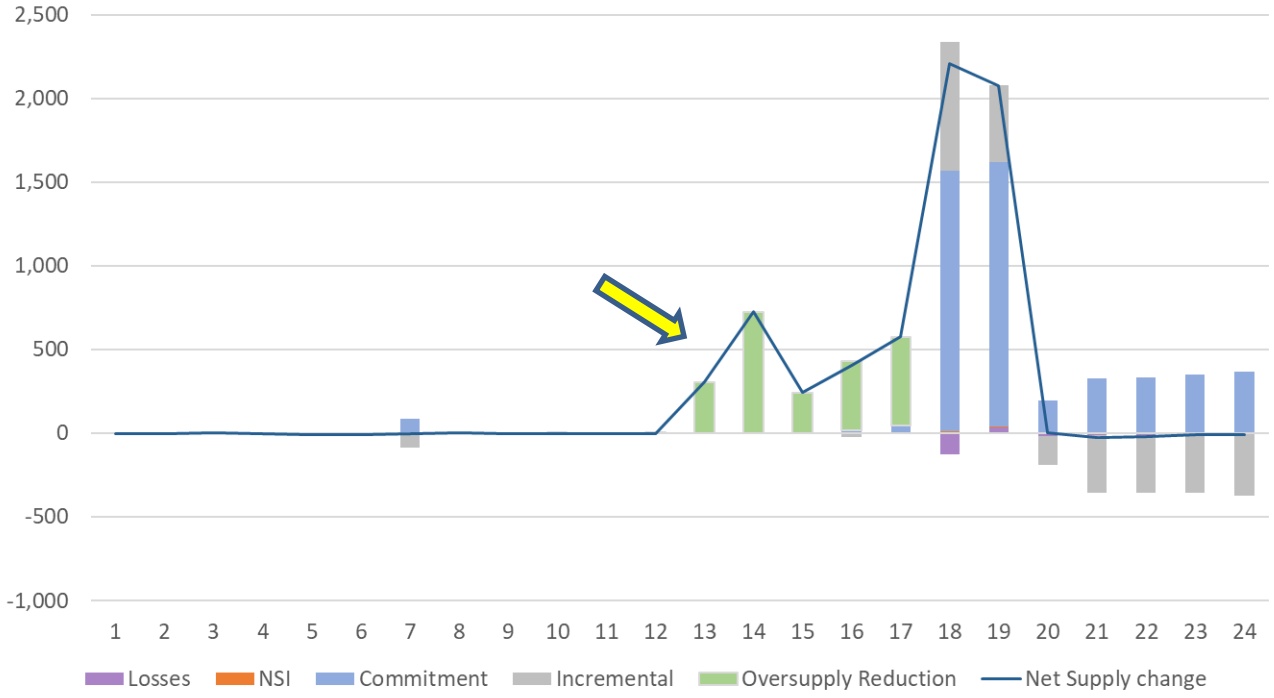
A significant volume of commitments in RUC were binding to real time



The RUC adjustment will increase supply dispatch but not necessarily result in additional commitments

HE13-HE17 observed oversupply, the RUC adjustment masked it by simply reducing the level of oversupply

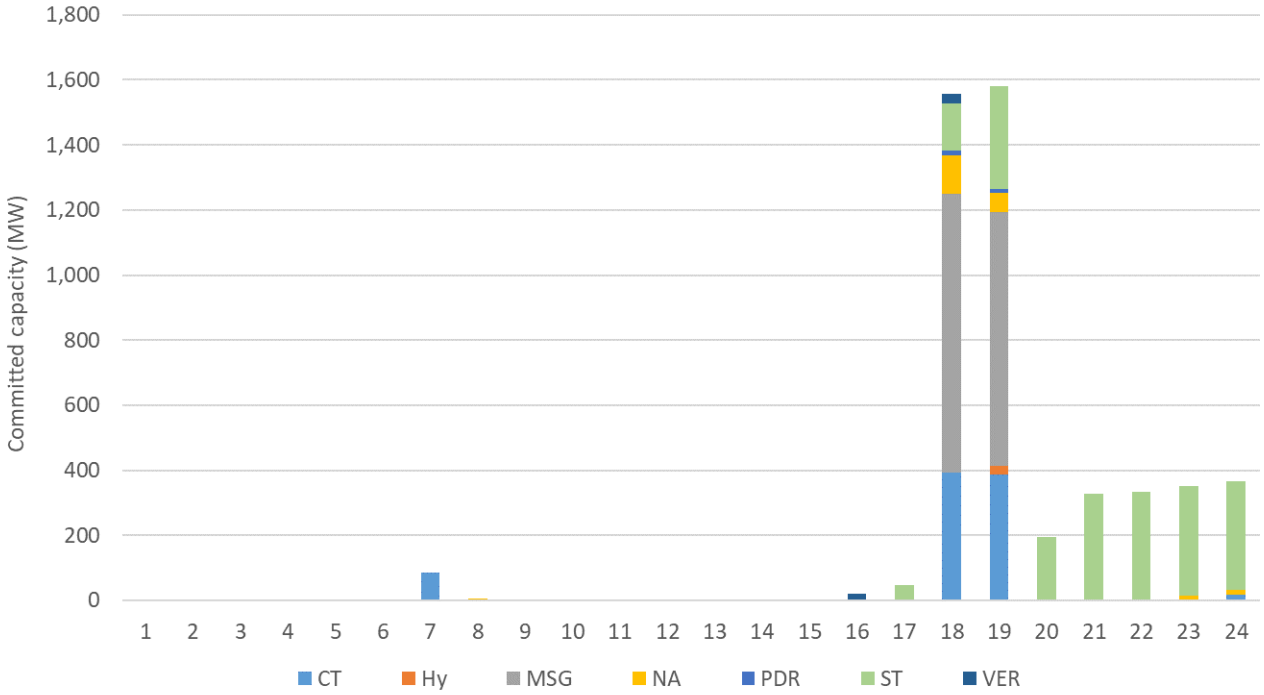
The RUC adjustment may not result in any additional supply nor relieve oversupply



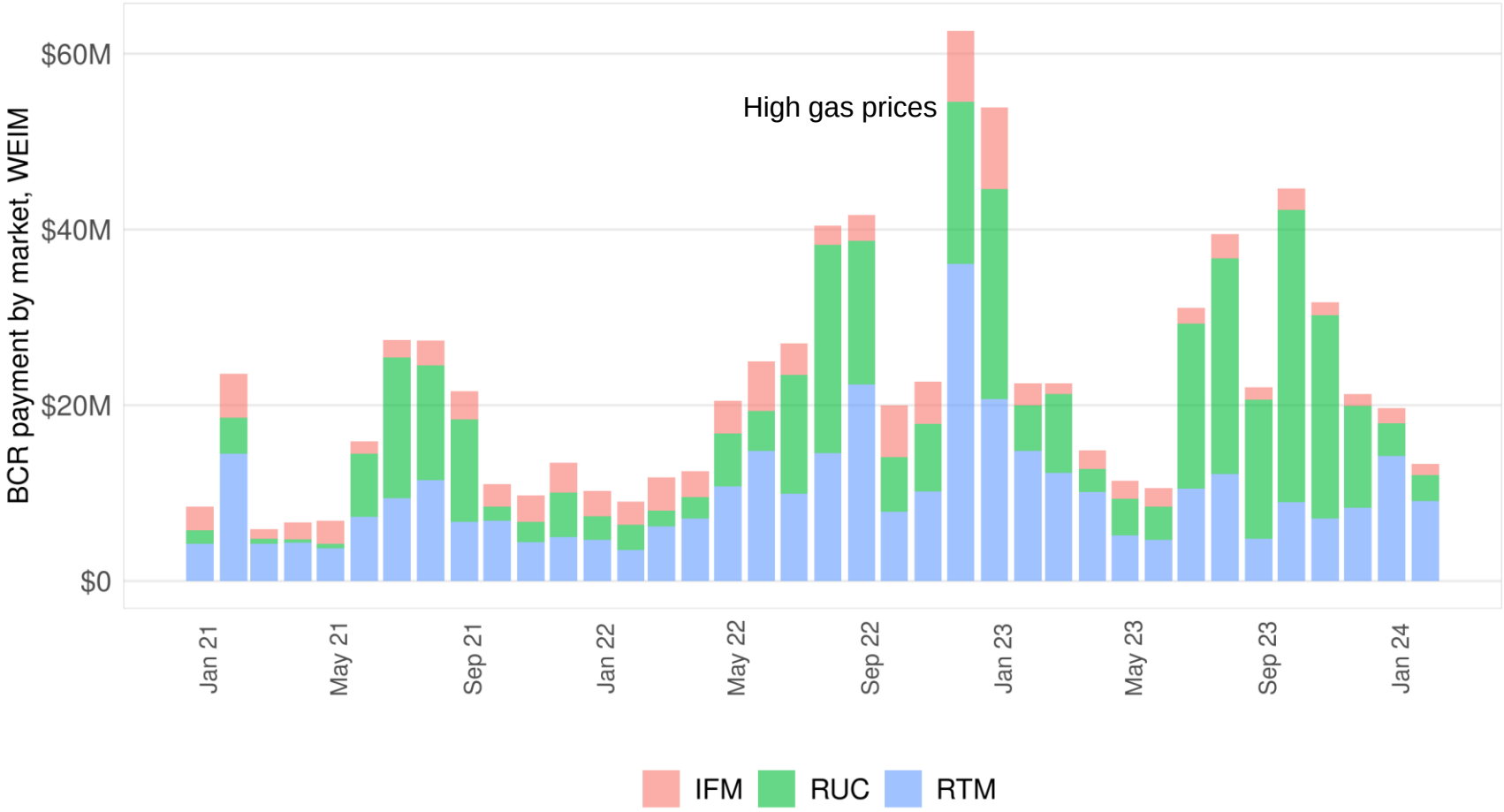
The additional committed supply can be met from a different type of resource

Committed capacity may be from CTs, which are fast start peakers

Supply from CTs is not supply gained in the day-ahead as it eventually will be committed by the real-time market if needed

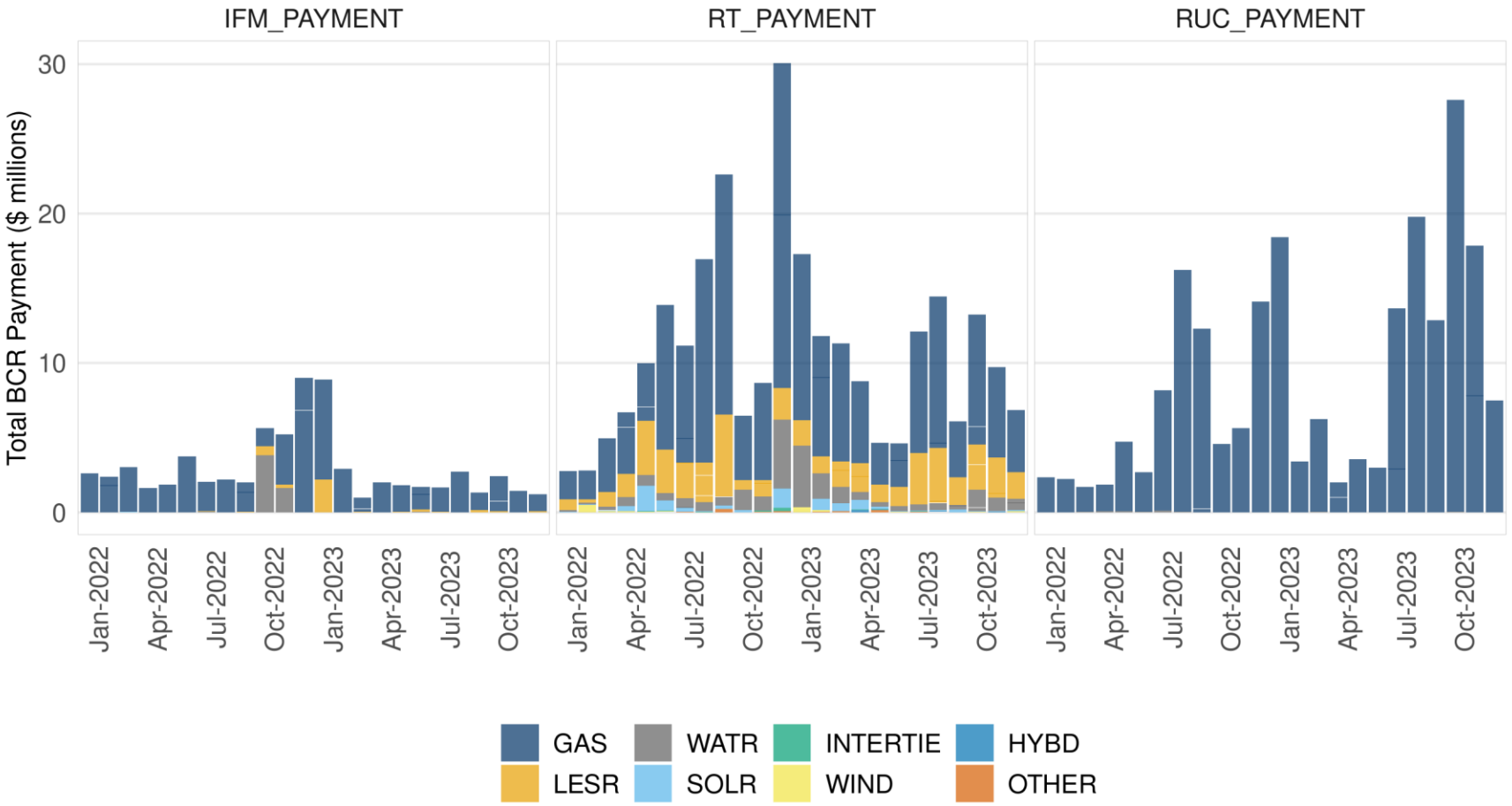


Bid cost recovery associated with RUC increased significantly when higher RUC adjustments were in place since July



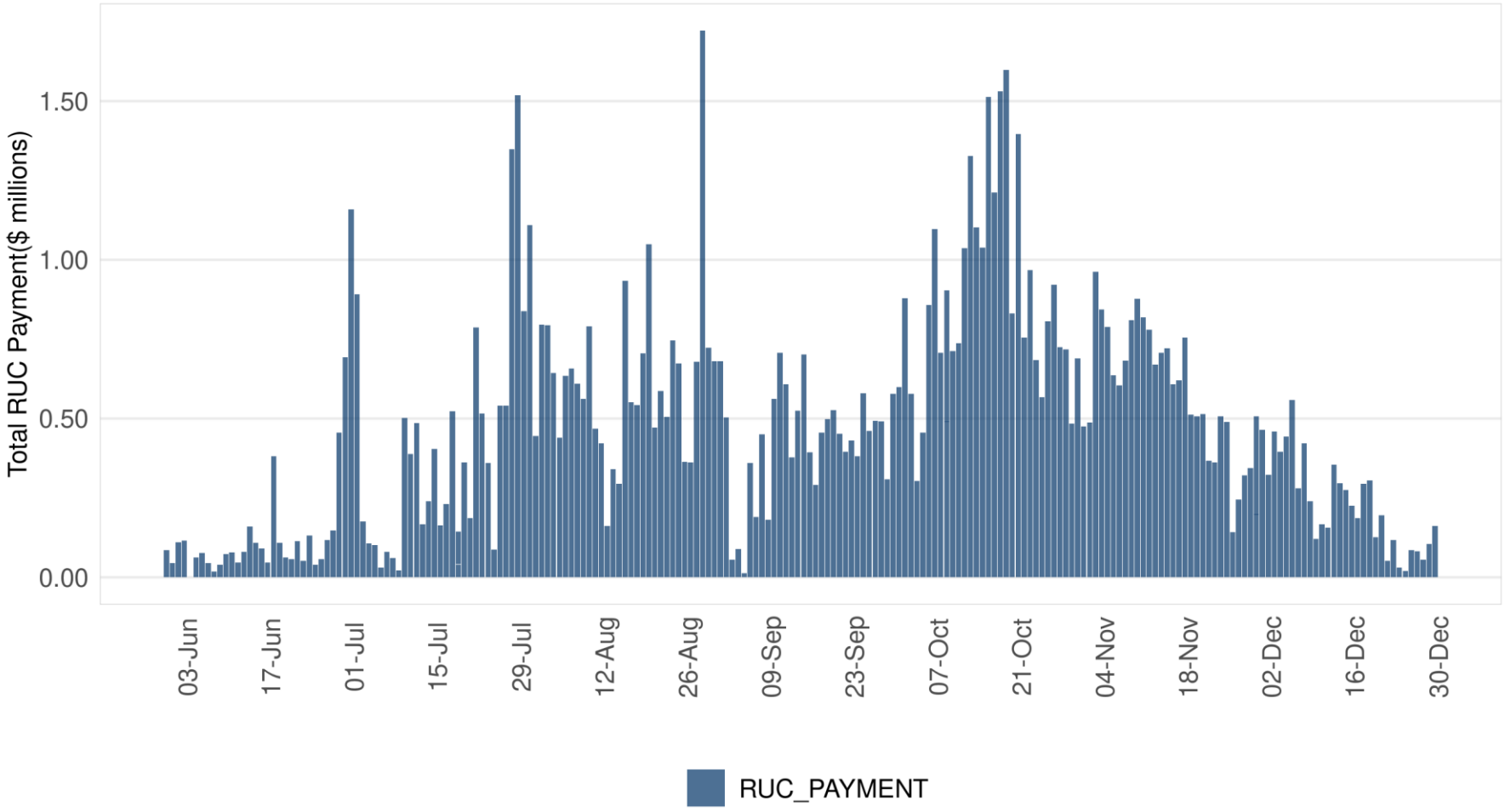
This metric is based on the BCR allocation to the different markets

The RUC bid cost recovery was fully accrued on gas resources



This metric is an approximation of BCR accrued on resources by market

The daily profile of RUC BCR shows a persistent trend



What are the implications of using programmatic RUC adjustments based on net load uncertainty?

- The RUC process is to ensure there is sufficient capacity online to meet load forecast
- RUC adjustments included to cover for net load uncertainty
- RUC does not necessarily guarantee ramp capability into real-time
- RUC adjustments will not result in units dispatched in real-time at certain level, it only ensures there can be sufficient capacity committed
- Unit ramp capability still to be determined by real-time market
- RUC adjustments for midday hours can exacerbate oversupply, requiring more renewable curtailments
- RUC adjustments in the last quarter of 2023 resulted in over $30 million of bid cost recovery payments
- What is the risk being covered in non-summer months with 24-hour adjustments, and is the cost-benefit appropriate?

RUC Uncertainty Requirement

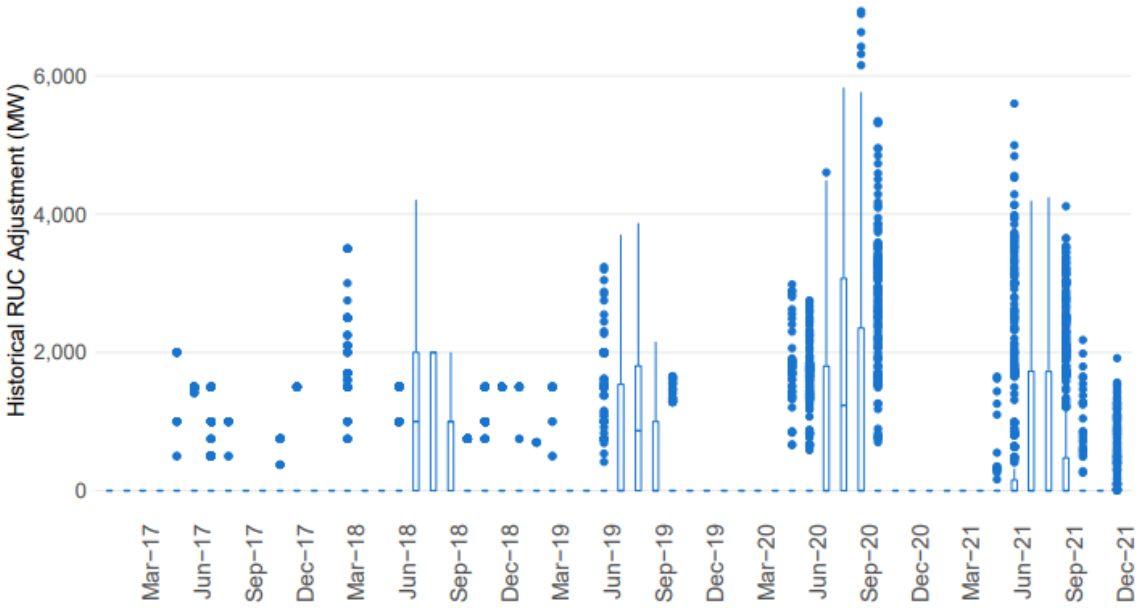
Lysha Matsunobu, Power Systems Forecaster Specialist
Tobiah Steckel, Forecast Modeler
Amber Motley, Director Short Term Forecasting

Market Surveillance Committee Meeting
General Session
April 11, 2024

Outline

- Forecasting analysis
  - Background
  - Performance review and summary
  - Takeaways

Motivation



Above: Figure 8 from DAME Analysis Report (Jan 2022)

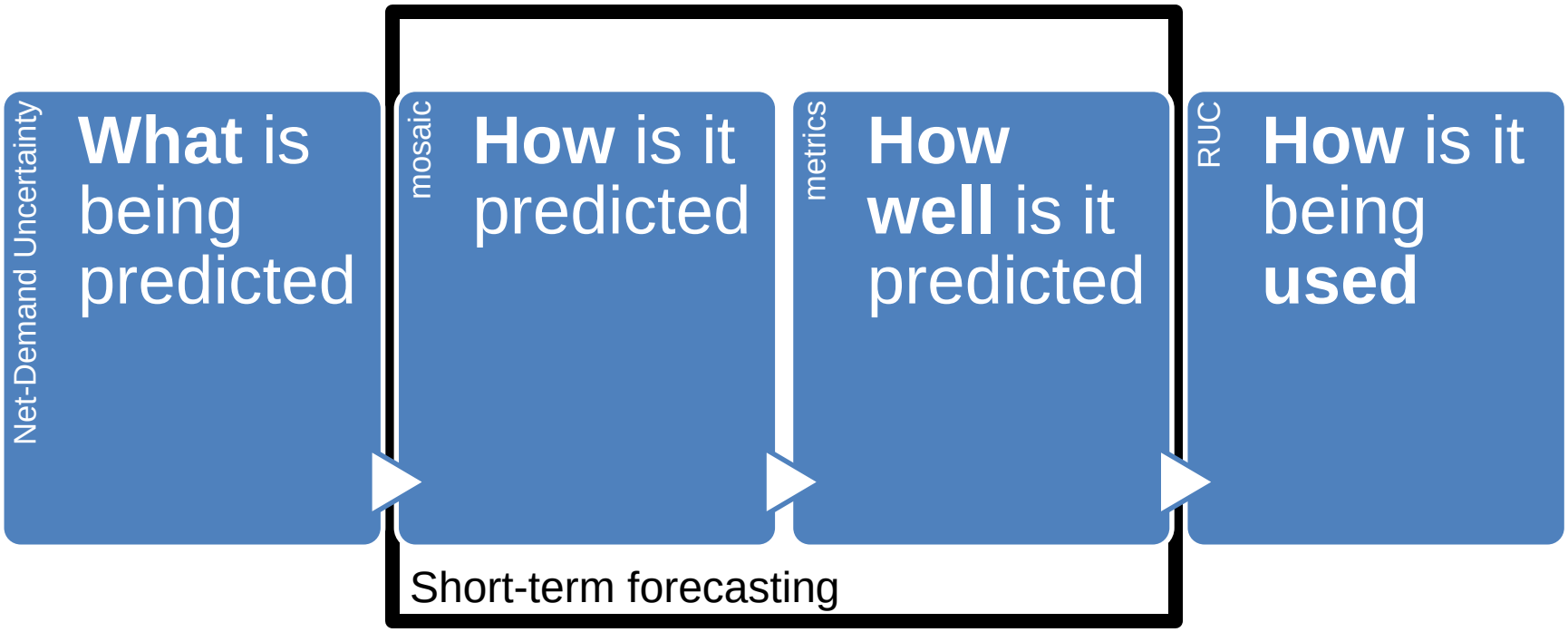
RUC adjustments have been shown to increase in magnitude and frequency.

Net load uncertainty continues to grow with increasing renewables.

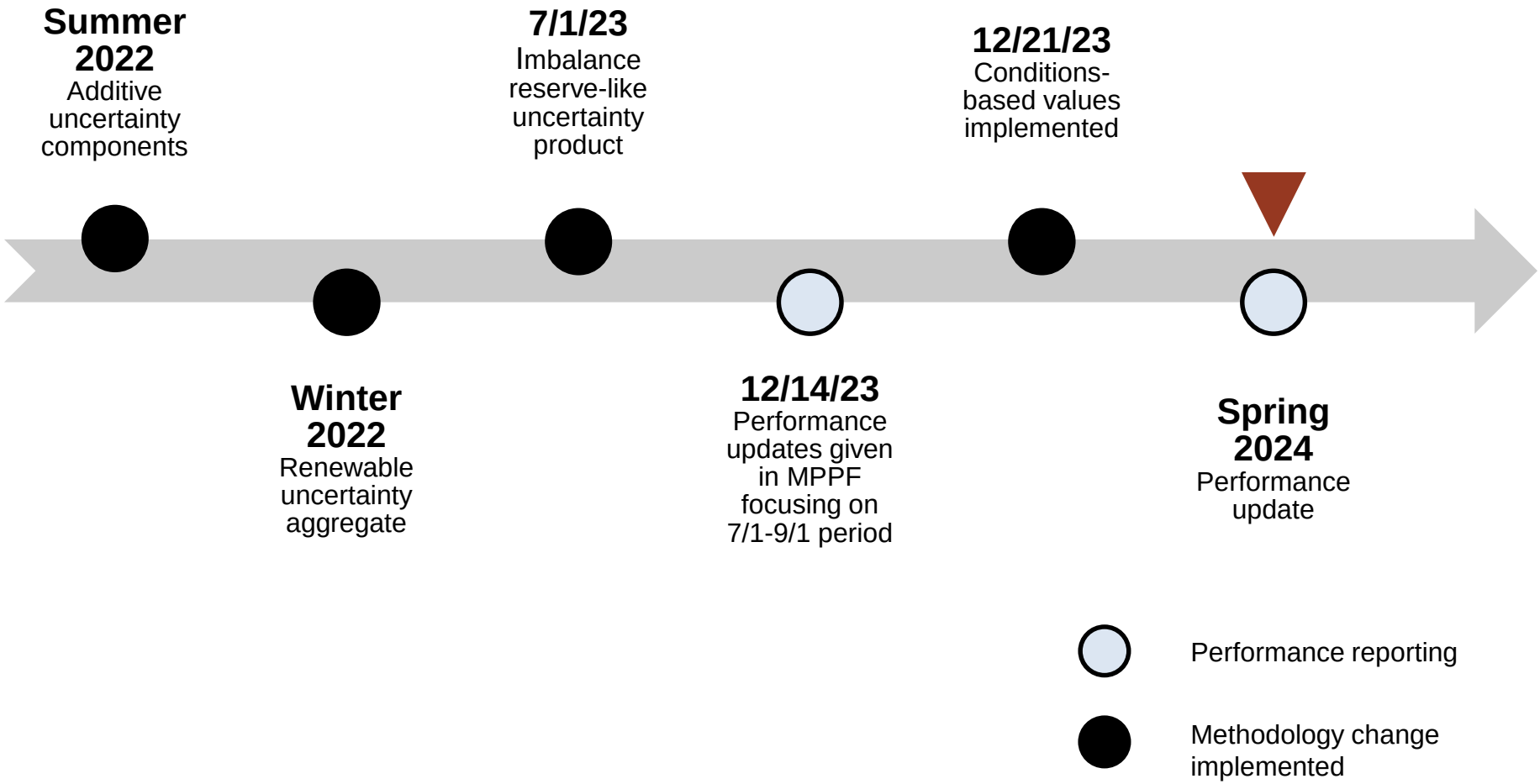
ISO continues to enhance the guiding logic for RUC adjustments through techniques similar to the proposed Imbalance Reserves to assist with growing net load uncertainty and RUC adjustments.

DAME, and the imbalance reserve product, is not going live until 2026.

This review and analysis is a *subset* of a larger process



Timeline


Summer 2022
Additive uncertainty components
Winter 2022
Renewable uncertainty aggregate
7/1/23
Imbalance reserve-like uncertainty product
12/14/23
Performance updates given in MPPF focusing on 7/1-9/1 period
12/21/23
Conditions-based values implemented
Spring 2024
Performance update
Performance reporting
Methodology change implemented

Current RUC methodology

Conditions-based values implemented 12/21/23

- ISO operator may adjust RUC Net Short as necessary.
- Conditions-based values allowed for lower percentiles on non-alert days, driving lower requirements.

Uncertainty is defined as the hourly max difference between the hourly net load DA forecast and 15-min net load FMM forecast

$$\text{uncertainty} = \max(NL_{\text{FMM}} - NL_{\text{DA}})$$

Conditions for RUC adjustment considerations as listed in A.3.2.3. in Operating Procedure 1210 (v19.4)

- Demand Response.
- Load Forecast errors – Risk Predictor.
- Fire dangers – Cal Fire and PTO updates.
- Weather changes – updated weather forecasts and PTO updates.
- Reliability Coordinator next-day analysis – from the RC.
- Potential loss of resources – test energy, update from PTOs, subsequent Outages.
- Stranded Capacity – potential for transmission Outages or overloads.
- Address reliability concerns or need for additional capacity "insurance" to cover the following non-summer operational risks:
    - Tighter Resource Adequacy (RA) supply margins as identified by the Assistance Energy Transfer (AET) Yellow System Conditions Alert email, including days where the CAISO opts-in to AET.
    - Weather forecasts where additional Regulation is procured to cover cloudy and other weather-related volatility.
    - West-wide grid impacts where the WEIM footprint is experiencing weather as designated by a Peak Outlook alert as extreme conditions within the 95-98th percentile of normal ranges.

Condition	Method	Percentile
Operational RA	Mosaic DA-FMM (max)	97.5%
Uncertain Forecast	Mosaic DA-FMM (max)	75%
West-Wide Grid Impacts	Mosaic DA-FMM (max)	97.5%

Definitions

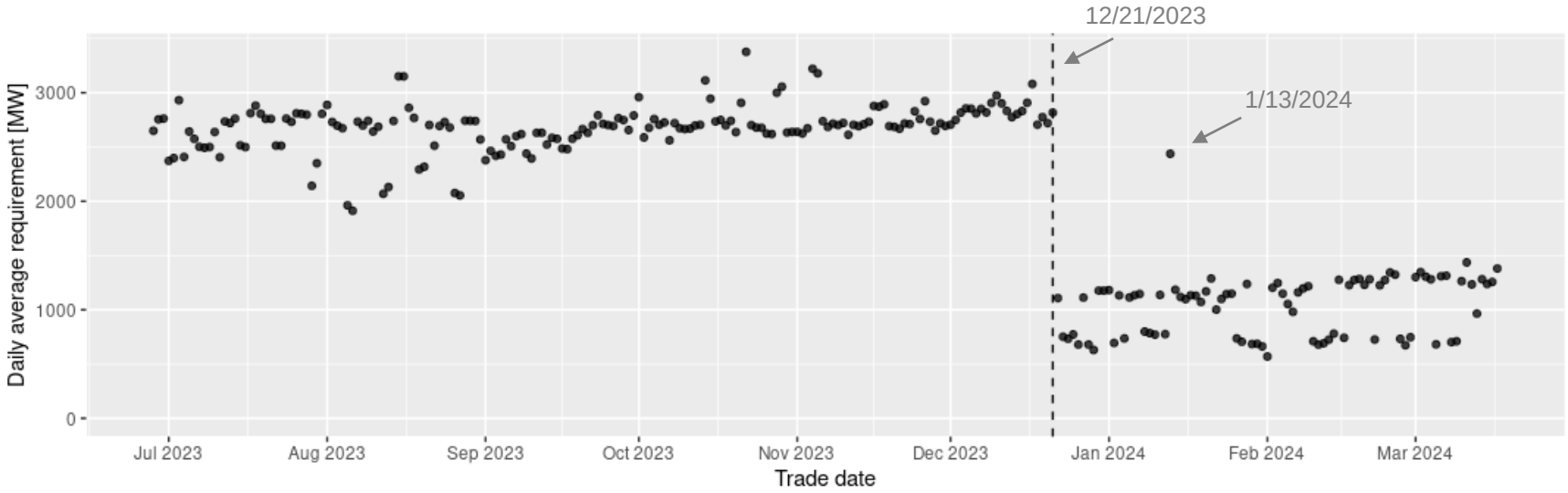
- Uncertainty: $x_h = \max(NL_{\mathrm{FMM}} - NL_{\mathrm{DA}})$
- Performance metrics
  - Coverage: $\frac{1}{N}\sum_h^N (r_h \geq x_h)$
    - Average of binary coverage over hourly intervals
    - Ought to be considered in tandem with daily RUC Net Short adjustments and targets
  - Requirement: $\frac{1}{N}\sum_h^N r_h$
    - Average of requirement values over hourly intervals

Glossary	
DA	day-ahead
FMM	fifteen-minute market
h	hourly interval index
N	number of intervals
NL	net load forecast
r	requirement [MW]
x	interval uncertainty [MW]

Summary metrics

	Coverage [-]	Requirement [MW]
Normal (50th)	0.52	723
Uncertain forecast (75th)	0.68	1231
Operational RA or West-wide grid impacts (97.5th)	1.00	2438

Metrics given for sample period 12/21/2023 to 3/13/2024

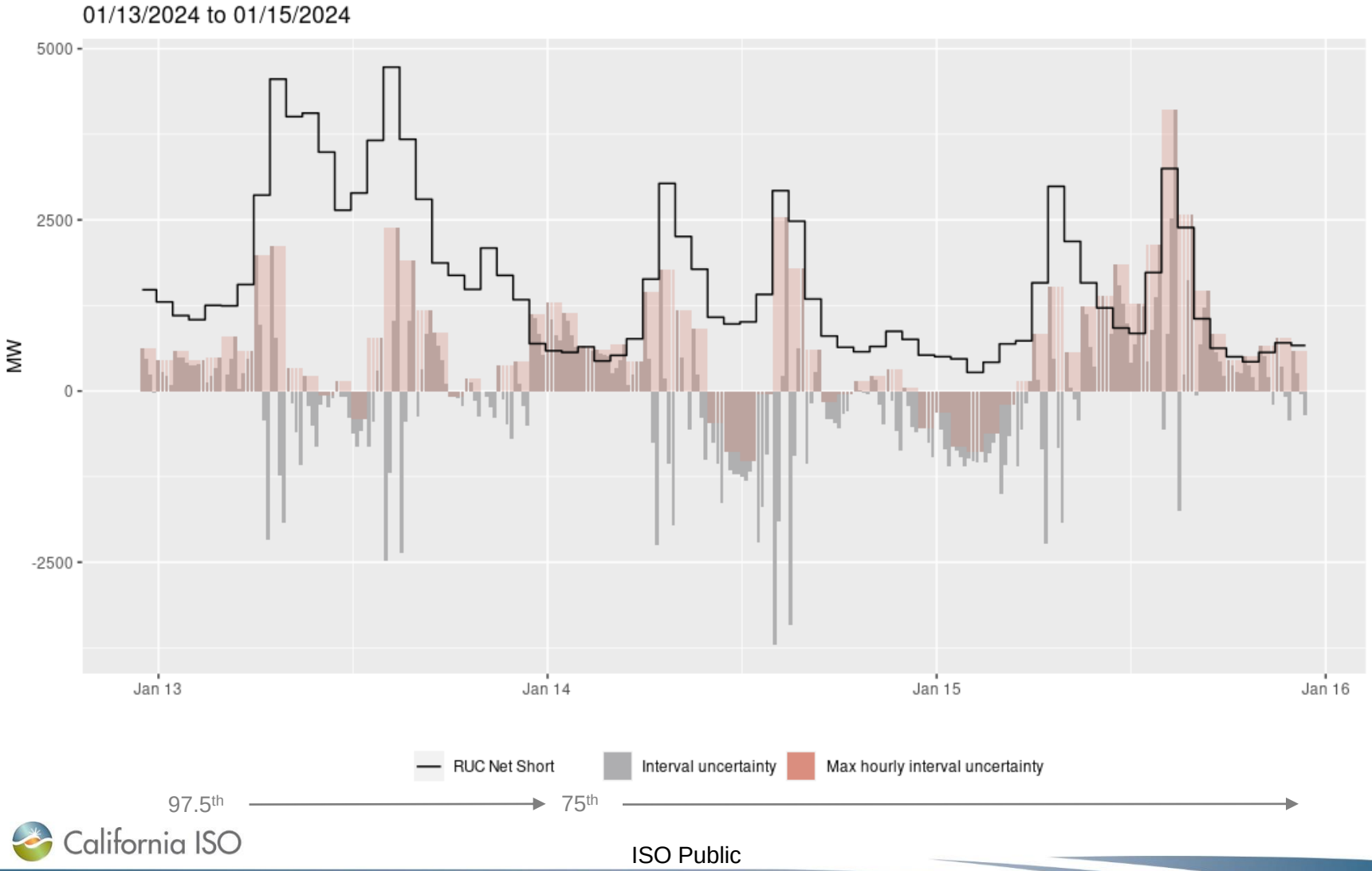


Takeaways

- ISO continues to assess the best methodology for the need and the use of load conformance in RUC to protect against net load uncertainty in varying conditions.
- Operator-adjusted conditions-based targets allowed lower percentiles on non-alert days.

APPENDIX

January cold event days. RUC percentiles on 1/14 forward were adjusted following excessive coverage on 1/13. RUC performed as expected during this event.



For a sample of recent days under normal conditions, requirement magnitudes are comparable to max hourly uncertainty, though coverage falls below target during this period.

