



Adapting probabilistic forecasts based on conditions

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Special thank you to Tobiah Steckel, Hong Zhou,
Rebecca Webb, and Amber Motley

June 2024

ESIG Forecasting and Markets Workshop – Salt Lake City, UT

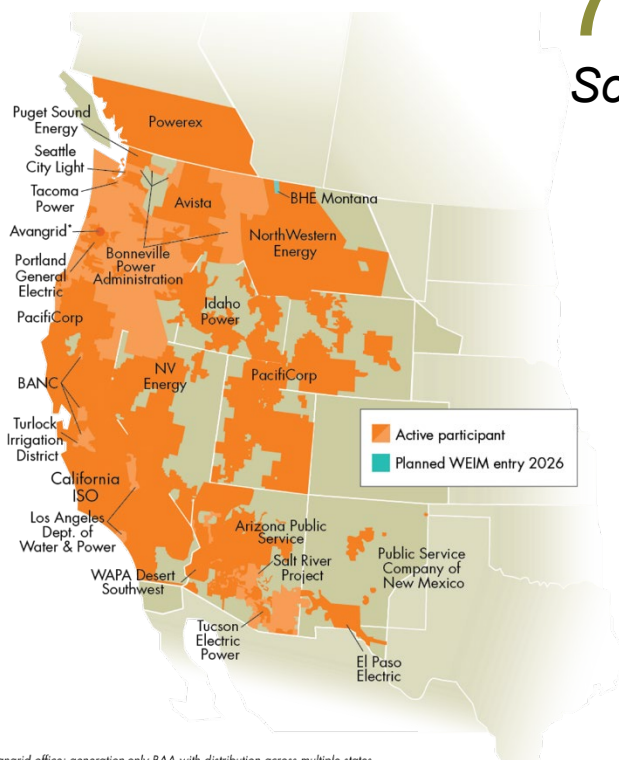
Probabilistic forecasts help us **manage uncertainty**. Adapting for **conditions** helps us balance cost with risk.

California ISO

One of **9** ISO/RTOs in North America

52,061 MW record peak demand
(Sept. 6, 2022)

76,184 MW power plant capacity
Source: ISO's Masterfile, August 2023



*Avangrid office; generation-only BAA with distribution across multiple states.
Map boundaries are approximate and for illustrative purposes only.

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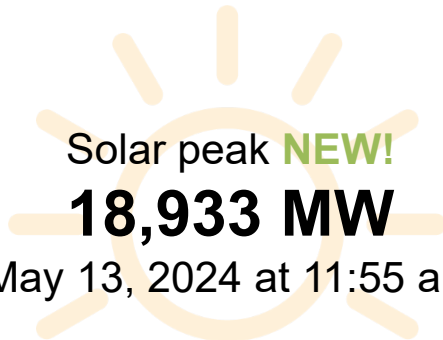
Western Energy Imbalance Market (WEIM)

22 participating entities

925,568 metric tons of CO₂ avoided

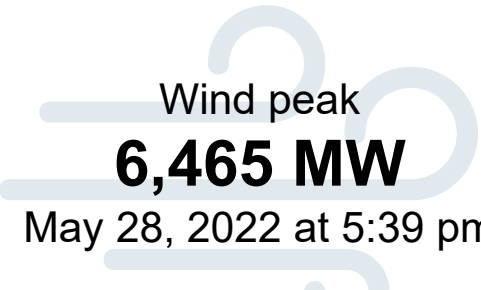
CAISO Renewables

Historical statistics and record (as of May 30, 2024)



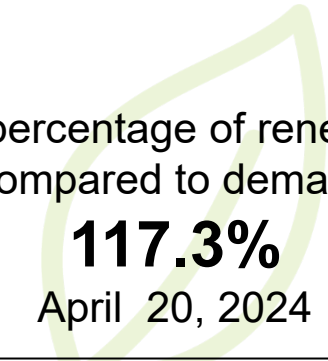
Solar peak **NEW!**
18,933 MW
May 13, 2024 at 11:55 am

Previous record:
18,770 MW, May 9, 2024



Wind peak
6,465 MW
May 28, 2022 at 5:39 pm

Previous record:
6,265 MW, March 4, 2022



Peak percentage of renewables
compared to demand
117.3%
April 20, 2024

Previous record:
107%, June 2023

Number of Renewable Resources: **529**

MW Forecasted Large Scale Renewables: **27,872 MWs**

MW Capacity Behind-the-Meter Solar: **16,200 MWs**

Values are approximate as of May 2024

Renewables
increase net load
uncertainty and
drive the need for
probabilistic
forecasts.

Uncertainty driven by renewables and electrification



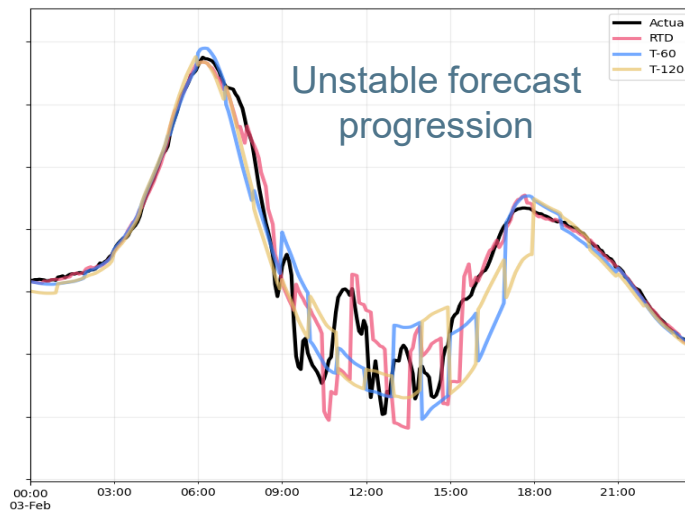
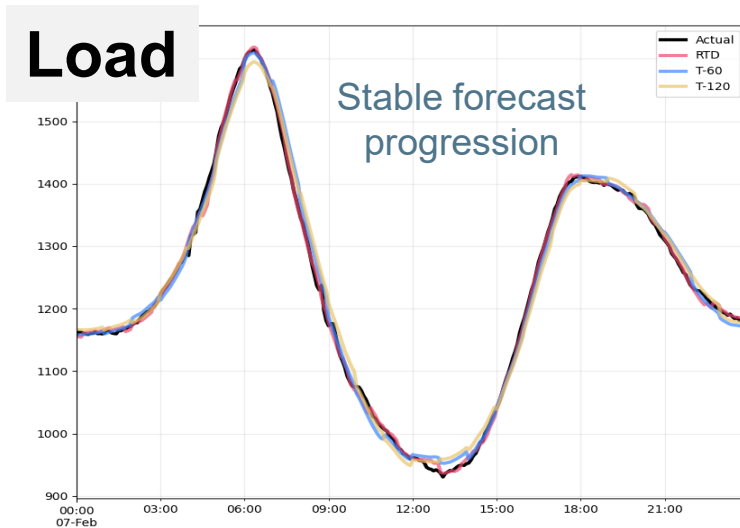
Solar

Topaz Solar Farm, San Luis Obispo County, California



Wind

Tehachapi Pass



Net-Load Uncertainty Requirements

These requirement products employ target percentiles to help cover forecast uncertainty.

Day-ahead

Requirement

Time frame

Method

Imbalance Reserve (IBR)

DA to FMM

Quantile Regression (Mosaic)

Flexible Ramp Product (FRP)

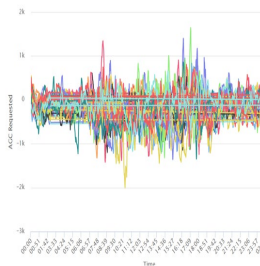
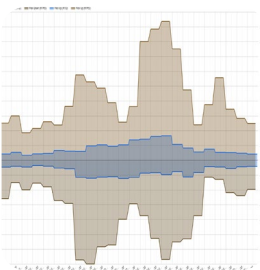
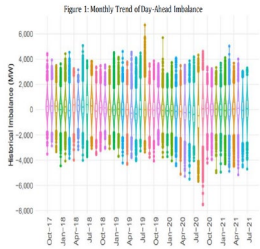
FMM to RTD

Quantile Regression (Mosaic)

Regulation

RTD to actual

Combination



Real-time

Focusing on RUC

Requirement

Time frame

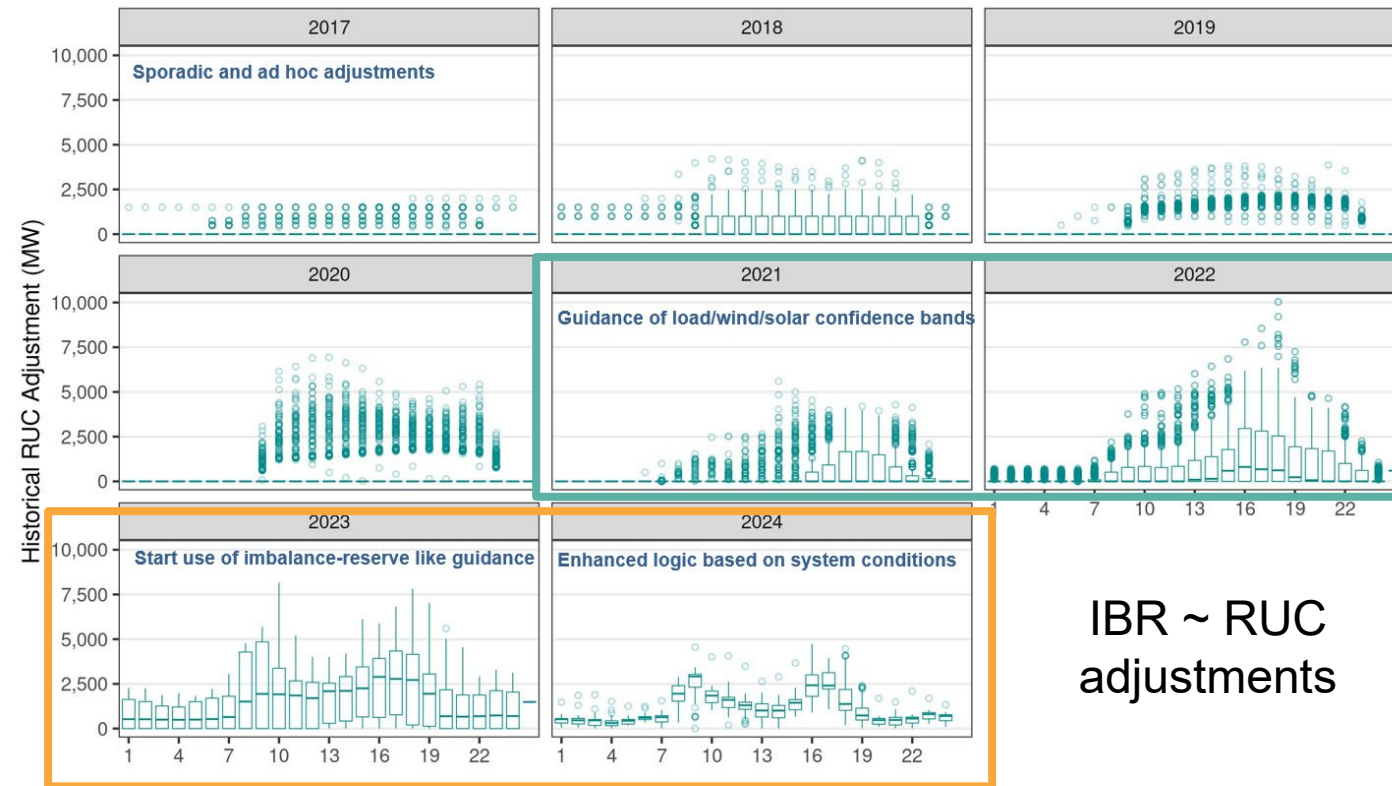
Method

**Imbalance
Reserve (IBR)**

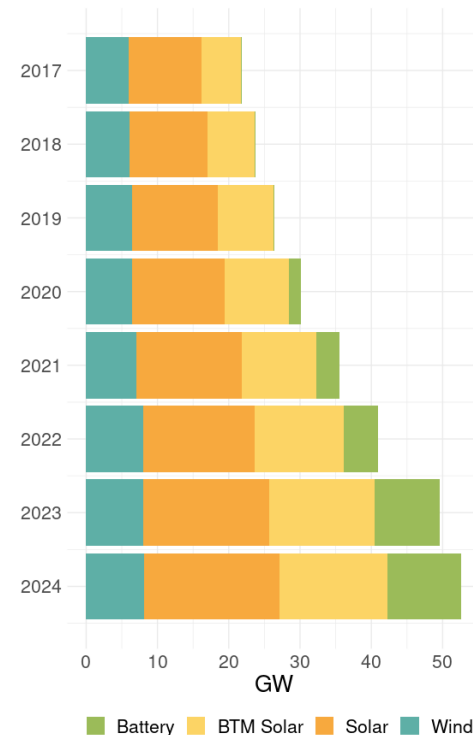
DA to FMM

Quantile
Regression

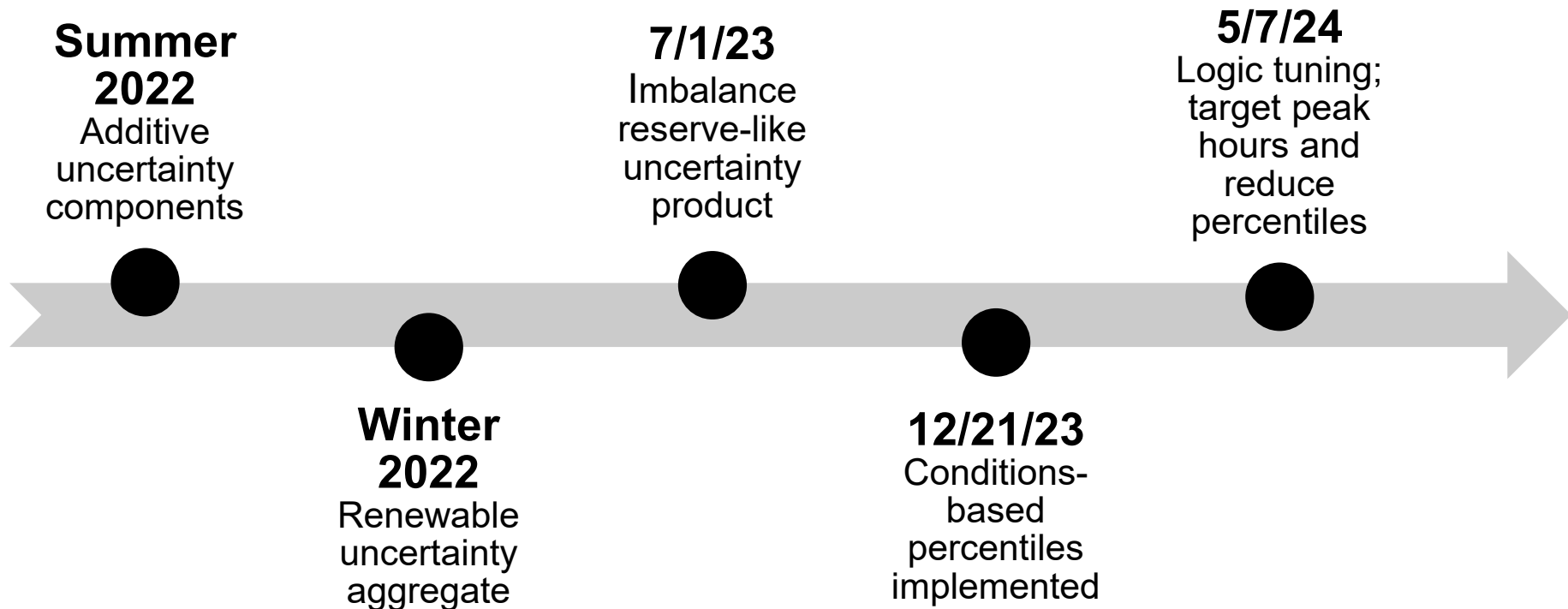
Frequency and magnitude of RUC adjustments have grown over time, along with evolution of the resource mix.



IBR ~ RUC
adjustments

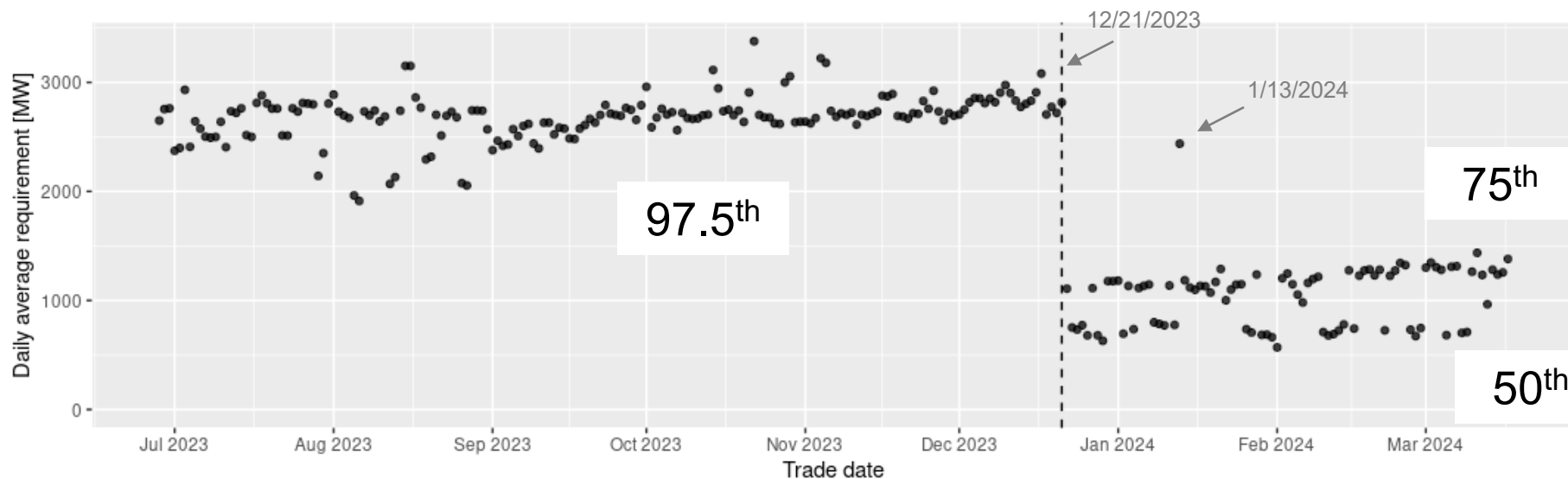


Guidance for RUC adjustments have increasingly incorporated conditional signals in conjunction with probabilistic forecasts



Recent tuning has reduced target percentiles and focuses on adjustments in morning and evening peak hours.

Conditions are used to inform target percentiles



List of conditions are outlined in Operating Procedure 1210.

Examples of conditions:

- Weather
- West-wide grid impacts
- Operational RA supply

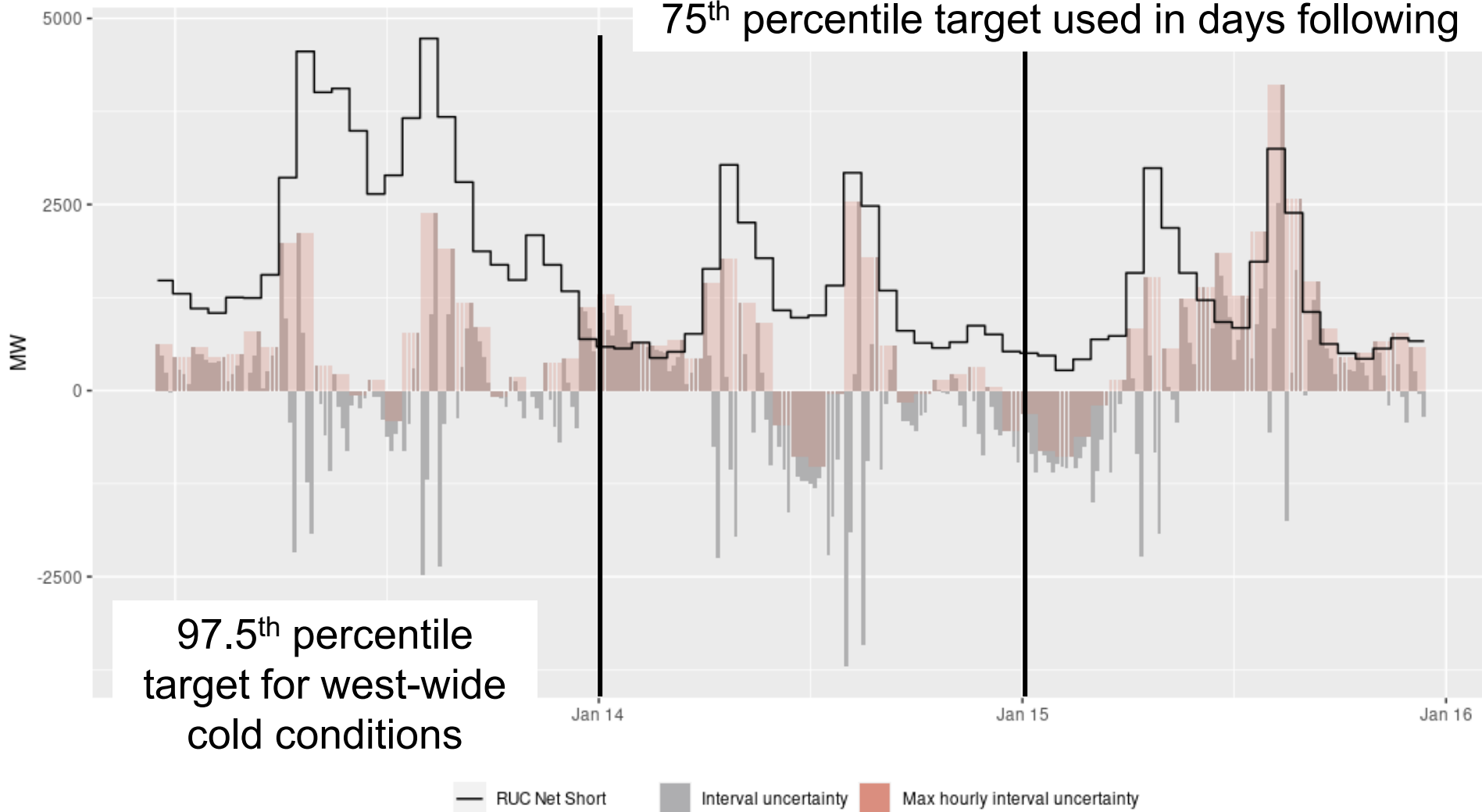


Image from NYTimes

Example case

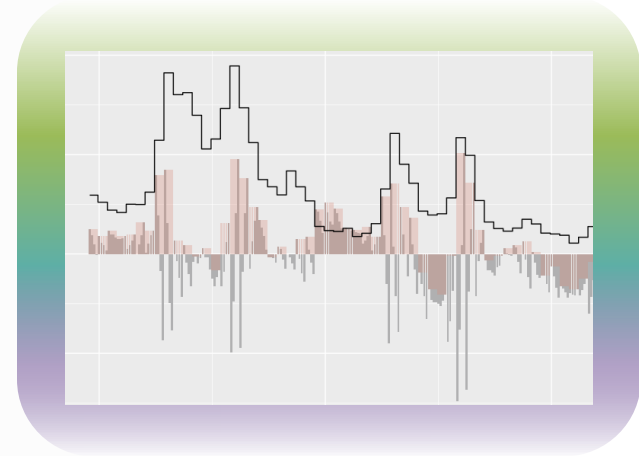
$$\text{uncertainty} = \max(NL_{\text{FMM}} - NL_{\text{DA}})$$

75th percentile target used in days following



Summary

Probabilistic forecasts help us **manage uncertainty**. Adapting for **conditions** helps us balance cost with risk.



Next Steps

Enhancements to mosaic methodology

- Day-type change – Completed
- Revise historical sample data utilized – Expected late 2024 for FRP, under review for IBR

Ongoing exploration, development, and review of data quality tracking, conditional triggers, and historical sample sets to improve probabilistic forecasts of uncertainty.