



California ISO

Forecasting Forum - Q3 2026

Short Term Forecasting

23 July 2026

Housekeeping



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The meeting is structured to stimulate dialogue and engage different perspectives.



Please engage in a respectful and professional manner. Introduce yourself and your organization when speaking. Follow the facilitator's guidance for speaking or asking questions.



Please keep comments brief and avoid repeating points already made to ensure everyone has an opportunity to participate in a robust discussion.



You can access Closed Captioning and the Transparency Viewer using the controls located at the bottom of the Webex screen.

Instructions for Raising Your Hand to Ask a Question



Please remember to state your name and affiliation before making your comment.



If you are connected to audio through your computer or used the 'call me' option, select the raise hand icon located on the bottom of your screen. Start speaking a couple of seconds after you're unmuted.



If you are connected on the phone line only and not the Webex dial *3 to be added to the queue.



You may also send questions via chat to all panelists.

If you need technical assistance during the meeting, please send a chat to the event producer, Intellor Events.

Meeting Agenda

Time	Topic	Target Audience	Presenter
1:00 – 1:05 PM	Welcome		Christina Guimera
1:05 – 1:20 PM	Overview of Forecasting Forum	WEIM/EDAM	Lysha Matsunobu
1:20 – 1:25 PM	Operational Requirements Data Quality	WEIM/EDAM	Lysha Matsunobu
1:25 – 1:40 PM	Summer Outlook Update	WEIM/EDAM	Jessica Stewart
1:40 – 2:25 PM	Forecasting Large Load	WEIM/EDAM	Amber Motley
2:25 – 2:40 PM	Break		
2:40 – 2:55 PM	Demand Response	WEIM/EDAM	John Rudolph
2:55 – 3:20 PM	Performance Metrics	WEIM/EDAM	Lysha Matsunobu
3:20 – 3:25 PM	EDAM Demand Forecast Performance	EDAM	David Tolentino
3:25 – 3:30 PM	EDAM OASIS Reports	EDAM	Rebecca Webb
3:30 – 3:35 PM	EDAM Imbalance Reserve Performance	EDAM	Jesse Saechao
3:35 – 3:45 PM	Next Steps		Christina Guimera

OVERVIEW OF FORECASTING FORUM

Overview of new Forecasting Forum

What: Launch a new quarterly stakeholder series on Short Term Forecasting topics, methodologies, performance, and upcoming enhancements.

Why: Provide a centralized forum for sharing Short Term Forecasting updates, discussing technical topics, communicating key developments, and engaging with stakeholders in a consistent and transparent manner.

Who: The primary audience is stakeholders across WEIM, EDAM, and CAISO BA. The forum will be open to the public.

When: Quarterly meetings, aligned with the Market Performance Planning Forum schedule, where practical.

A more detailed reference document will be made available on Forecasting Forum page

Additional notes to highlight on Forecasting Forum

- Short Term Forecasting (STF) Areas

- Weather
- Load and Renewable (VER) Forecasts
- Uncertainty Requirements
- VER Registration
- Alerting

- Relationship to MPPF

- Similar format to Market Performance and Planning Forum (MPPF)
- STF performance metrics will move from MPPF to Forecasting Forum

- Stakeholder Participation Expectations

- Questions and feedback are encouraged
- Stakeholders are encouraged to submit topic suggestions for future meetings

- Indicators of Success

- Stakeholder engagement
- Awareness of forecasting efforts
- Reduced need for ad hoc stakeholder outreach



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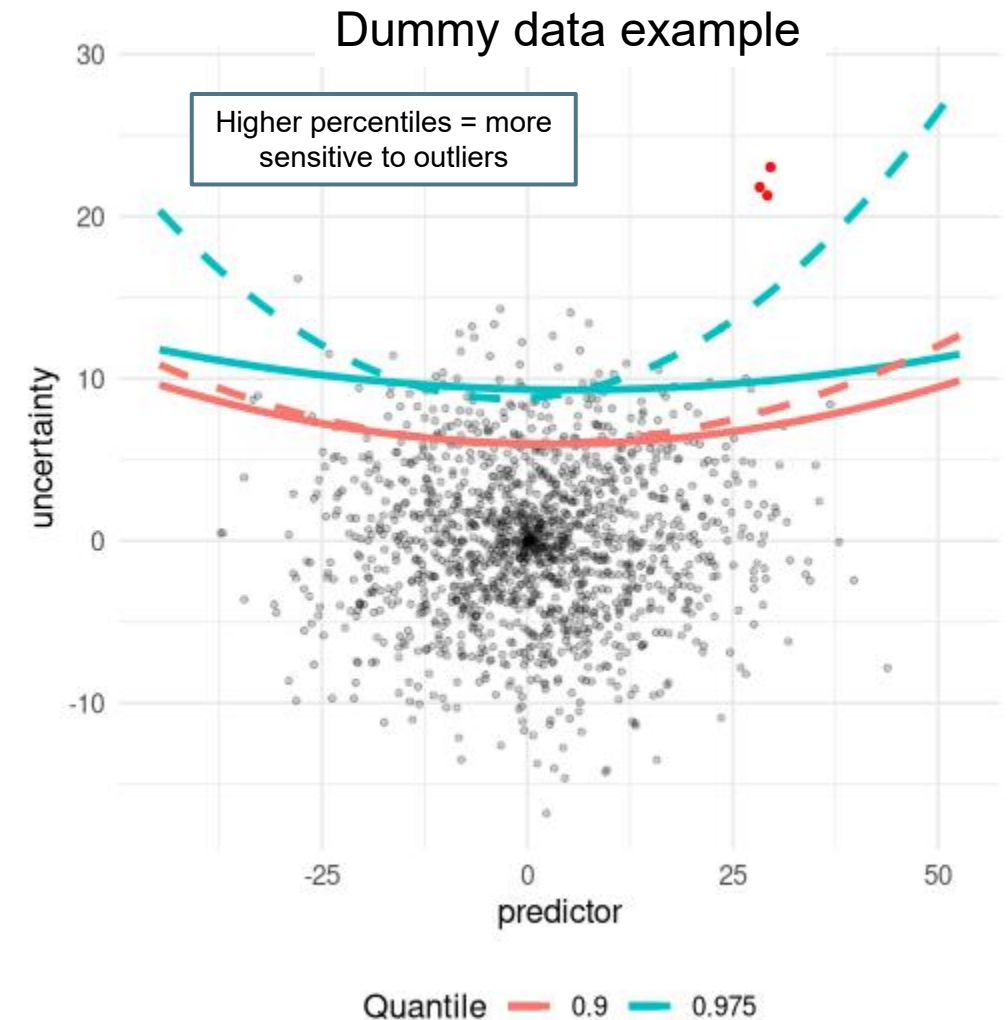
caiso.com/meetings-events/topics/forecasting-forum

Forecasting Forum session held on 25 Mar 2026

OPERATIONAL REQUIREMENTS DATA QUALITY

Recording available for presentation on data quality procedure for operational requirements

- Short Term Forecasting presented on data quality procedure and management for operational requirements.
- Key points:
 - Described data quality challenges particular to operational requirements (imbalance reserve and flexible ramp product)
 - Outlined approach to identifying and classifying anomalous data, before implementing discard ranges
- Recording and materials posted to [Meetings | Forecasting Forum | California ISO](#)

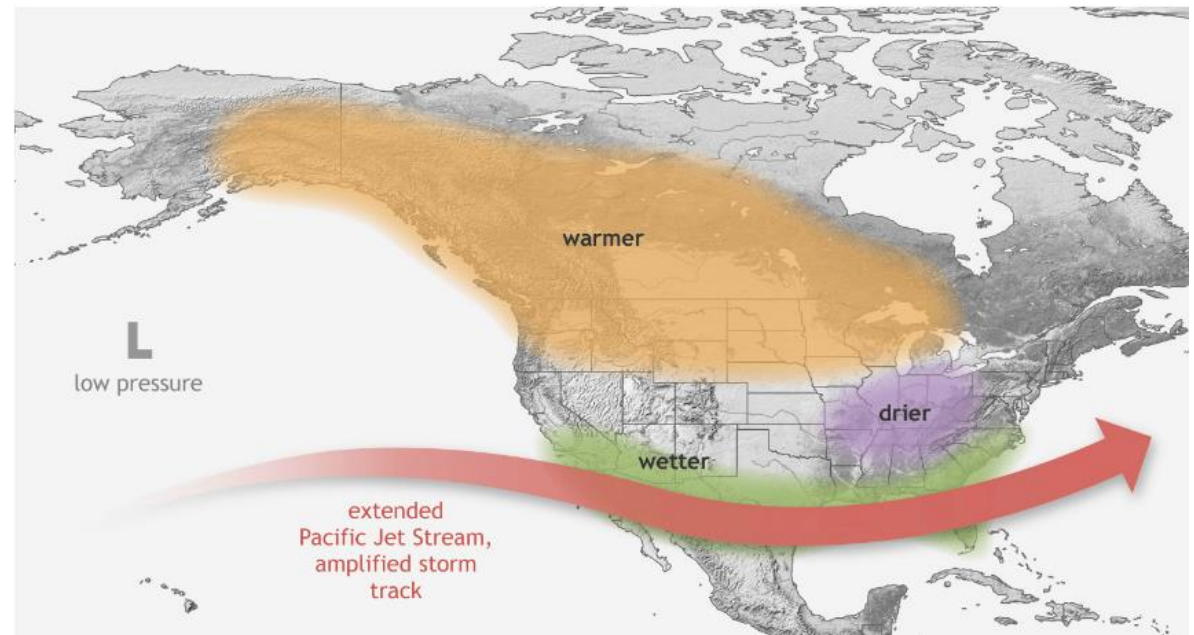
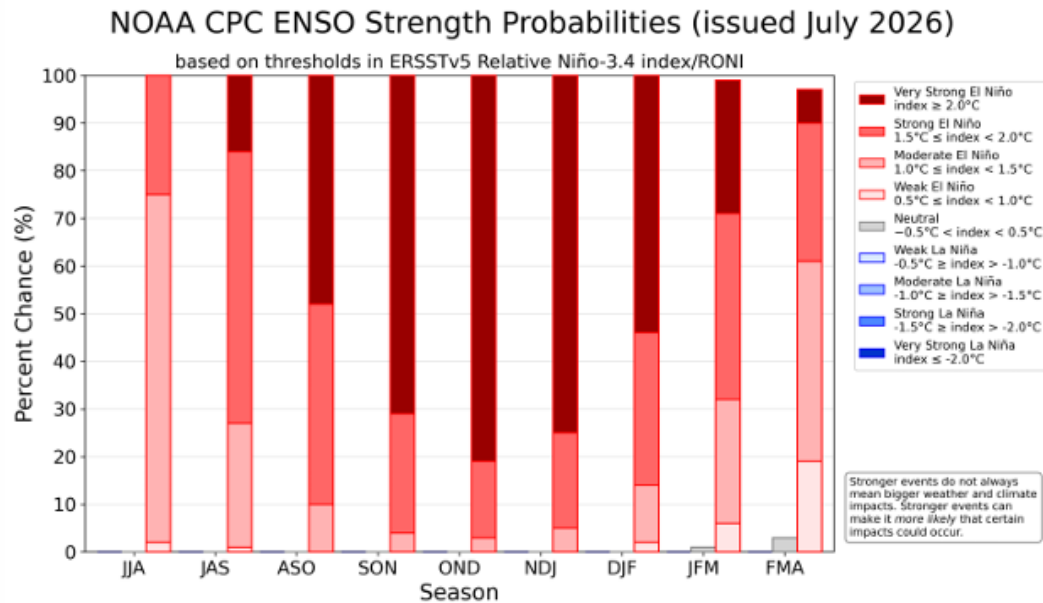


Dashed lines use samples that include outliers

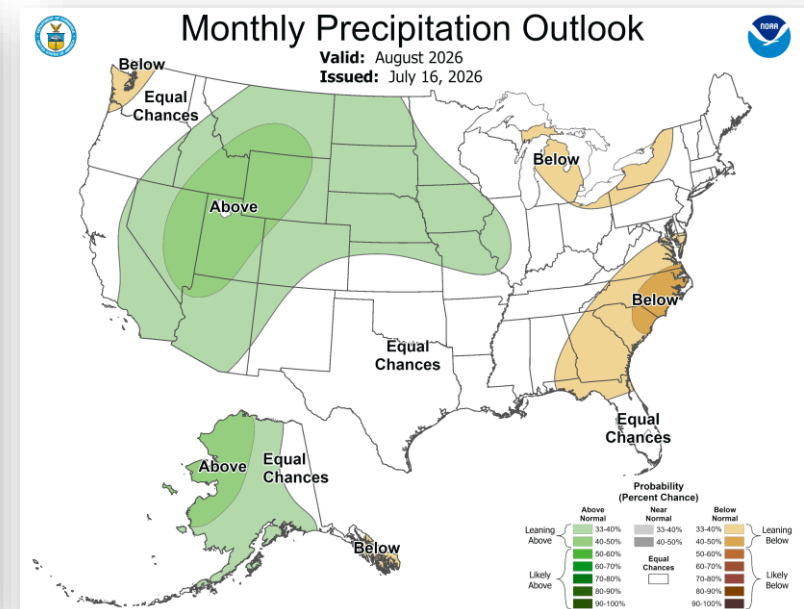
SUMMER OUTLOOK UPDATE

ENSO forecast from the Climate Prediction Center (CPC) shows strengthening El Nino through the rest of the year

- El Nino conditions: Equatorial Pacific sea surface temperatures (SSTs) are above normal
- > 80% chance to be in very strong El Nino beginning in the fall and lasting into winter
- Typical El Nino impacts of the northern hemisphere winter are shown below



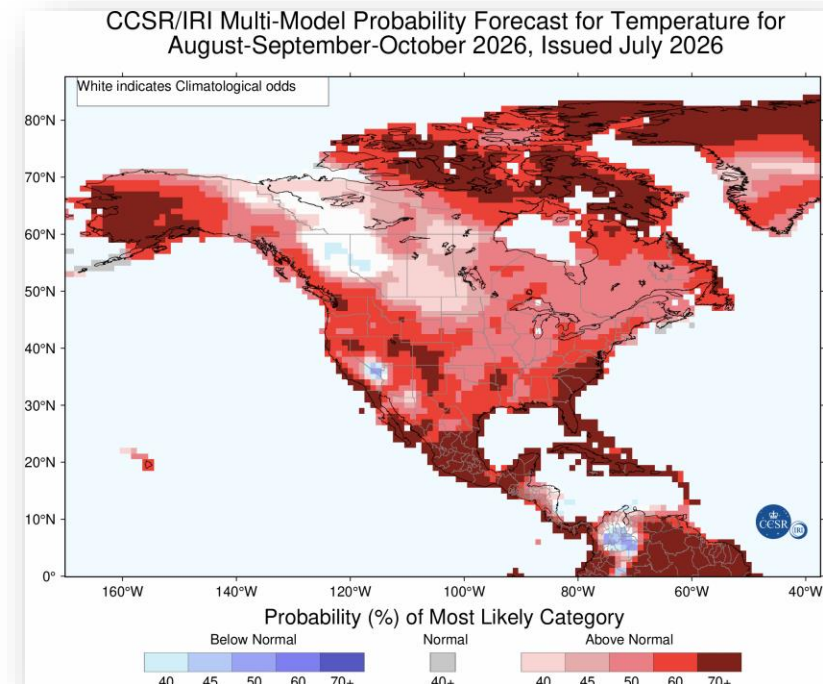
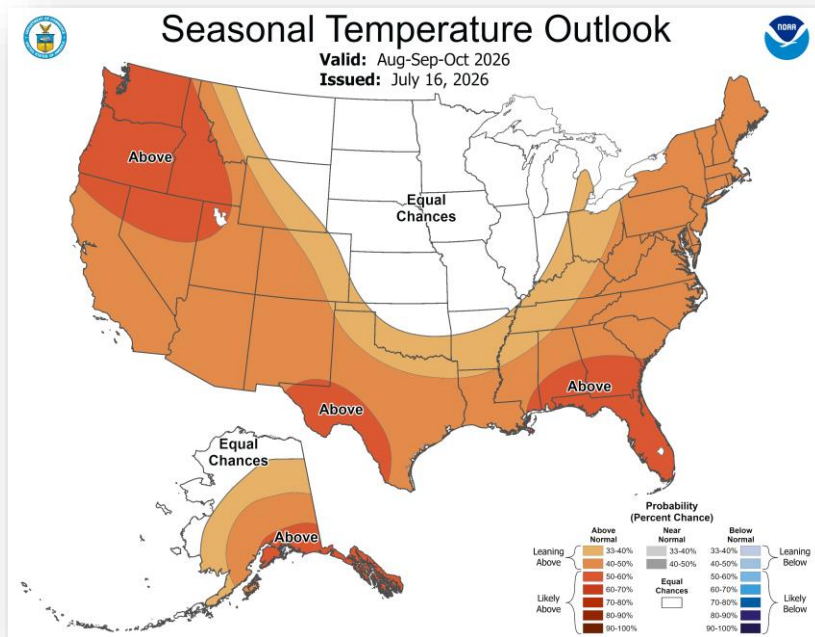
- High risk for above normal temperatures to end July across the west
- Potential for above normal temperatures lowers going into August
- Above normal monsoonal precipitation across Desert SW and SoCal continues



Temperature Outlook

August – October 2026

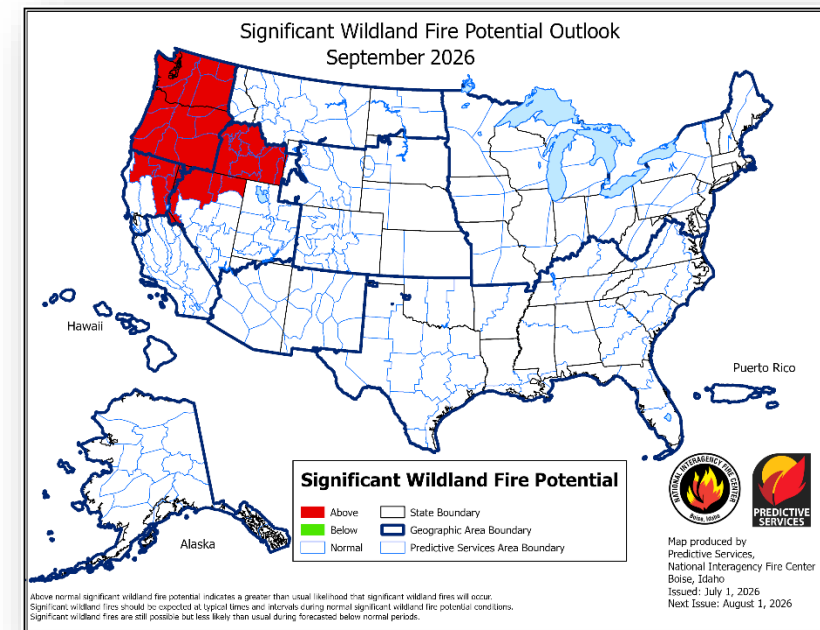
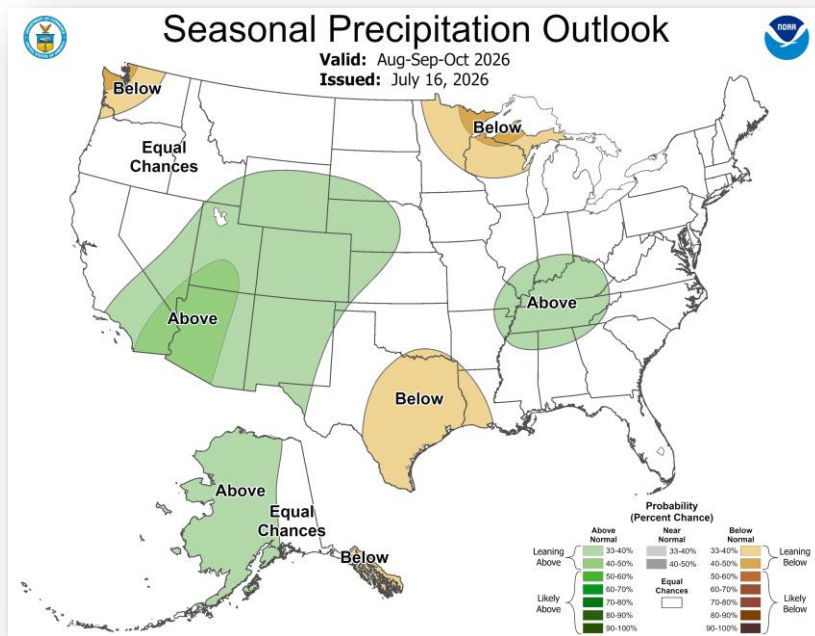
- Above normal temperatures likely to continue west-wide for summer and into fall with highest risk in the Pacific NW and northern California
- Well above normal coastal sea-surface temperatures are a critical driver increasing the likelihood of warmer temperatures for the coast
- Monsoonal cloud cover could assist in keeping Desert SW temperatures from getting too extreme



Precipitation and Fire Outlook

August – October 2026

- Above normal monsoonal rainfall across the Desert Southwest is expected to continue, with potential for SoCal to see above normal precipitation as well
- Near-to-above normal fire risk developing across northern California and Pacific NW heading into fall
- Potential for a more active Pacific hurricane season which could limit fire risk in SoCal and Desert Southwest



LARGE LOAD DEMAND FORECASTING

System Transformation and Emerging Load Challenges

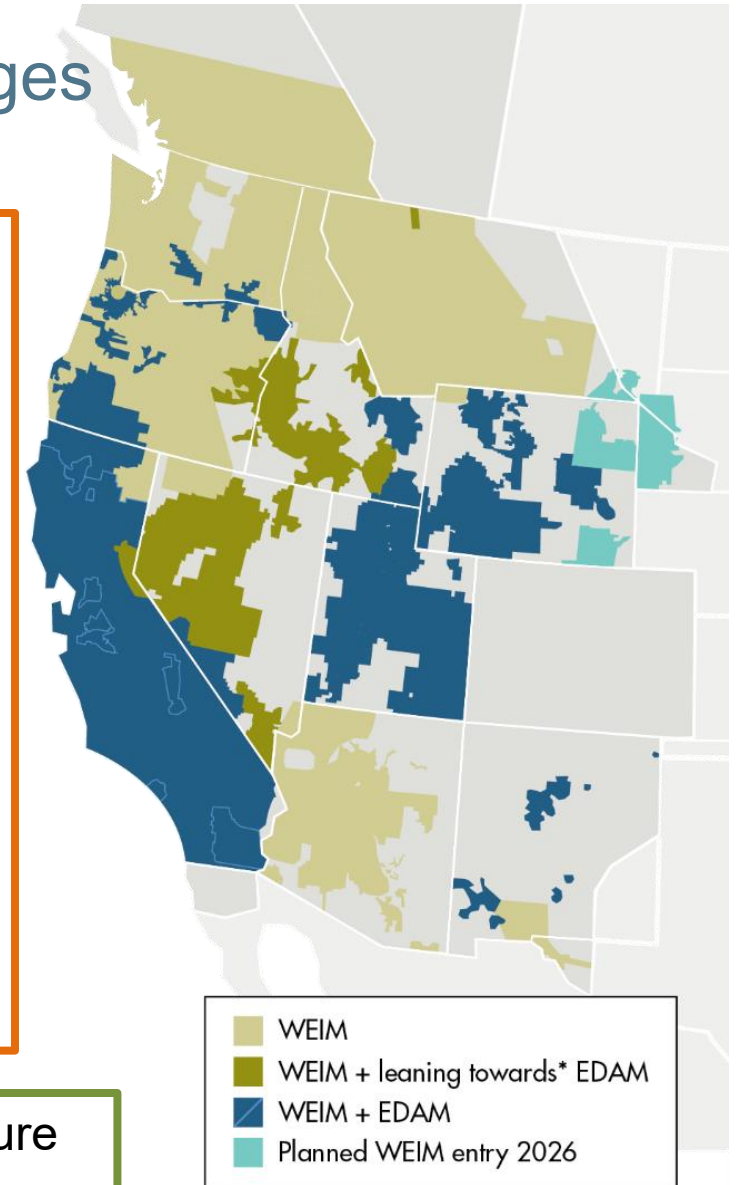
System Trends

- Growing electricity demand, increasing extreme weather, and rapid expansion of DERs and emerging large loads are reshaping system operations, driving new coordination challenges, and increasing the need for visibility across the T&D interface

Emerging Large Load Forecasting Challenges

- Scale and behavior introduce forecasting uncertainty
- Often treated as conforming demand, despite non-conforming characteristics
- Leads to data and visibility gaps (e.g. telemetry)
- No requirement for non-conforming participation

Regional markets like EDAM and the WEIM create new opportunities to capture and scale demand flexibility, if it is measurable, visible and coordinated.



**These entities have publicly indicated a leaning towards EDAM as their preferred day-ahead market.*

Purpose

- Socialize how the Demand and Distributed Energy Market Integration (DDEMI) initiative is thinking about large load:
 - **Market Design:** evaluating whether refinements to existing market models are needed or if new market constructs are required to accommodate the evolving characteristics of large loads
 - **Data Definition Enhancements:** developing and implementing data collection requirements for large load participating on either the demand or supply side of ISO-administered markets

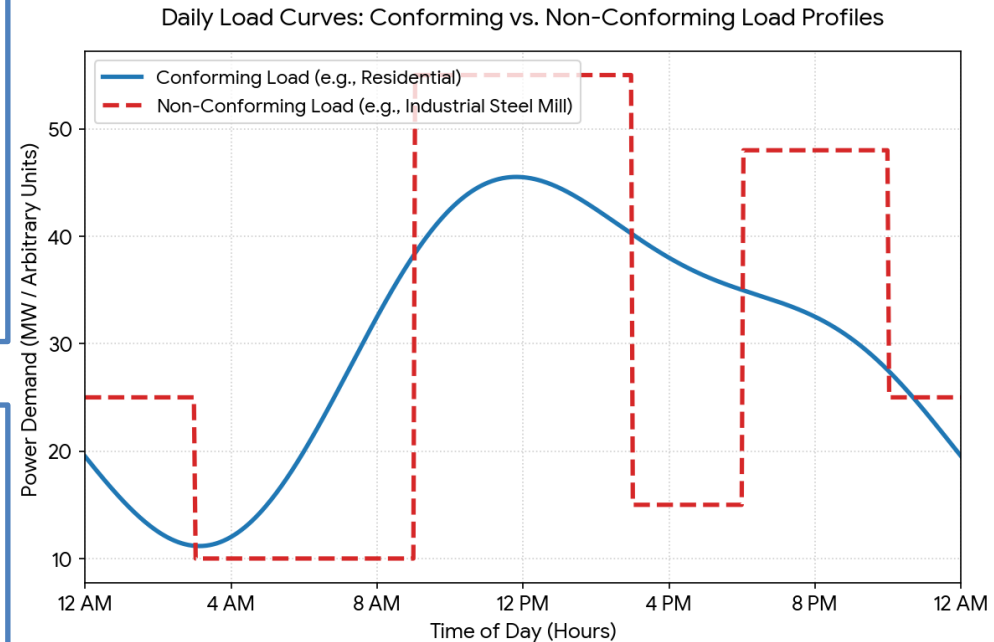
Conforming vs. Non-Conforming Load Definition

Conforming Load

- Predictable patterns driven by:
 - Weather (temperature, seasonality)
 - Calendar effects (hour, day, weekday/weekend)
- Can be reliably forecast using standard CAISO models
- Forms the basis for:
 - Historical load actuals
 - Balancing Authority (BA) load forecasts
 - Core CAISO / EIM / EDAM market operations

Non-Conforming Load

- Does not follow typical weather- or time-based patterns
- Cannot be reliably captured in standard load forecasts
- To avoid distorting forecasts, it is:
 - Excluded from conforming load and historical datasets
 - Modeled separately
- Used in CAISO / EIM / EDAM for:
 - Operational modeling
 - Market participation and settlement



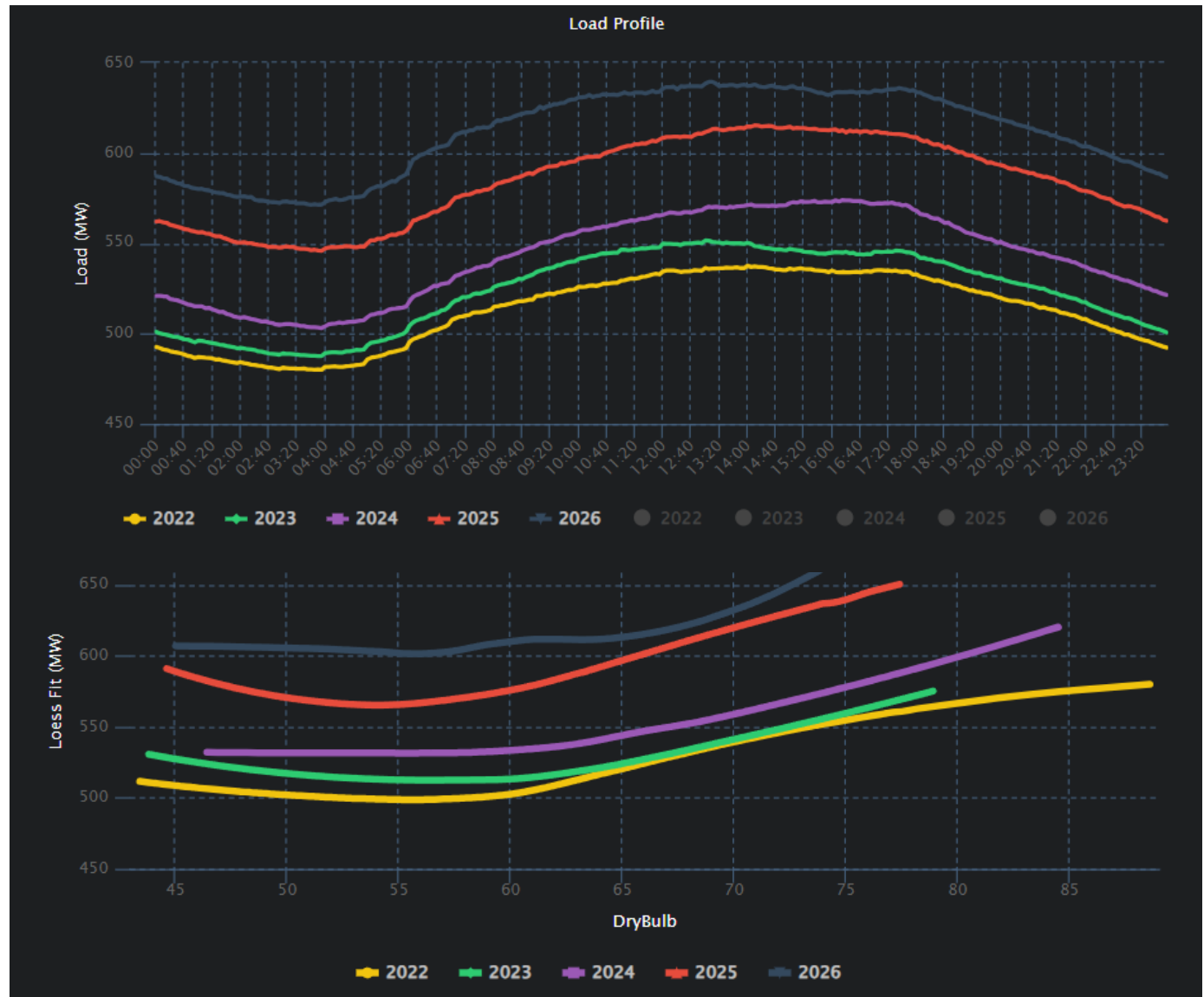
Current Options of Incorporation Large Load into Market Optimization

Data Characteristic Consideration	Conforming Demand	Non-Conforming Demand	PDR	RDRR
Demand or Supply Side	Demand	Demand	Supply	Supply
Telemetry Requirements	Could account for Telemetry and Non-Telemetry	Y	> 10 MW = Y < 10 MW = N	> 10 MW = Y < 10 MW = N
Schedules/ Bid	Y/N	Y/Y	N/Y	N/Y
Availability/ Performance Accounting	No	Uninstructed Deviation	Y/Uninstructed Deviation	N/Uninstructed Deviation
Uncertainty Requirement Coverage	Yes	Only in Regulation Requirement	No	No

DEVELOPING DATA REQUIREMENTS FOR LARGE LOAD

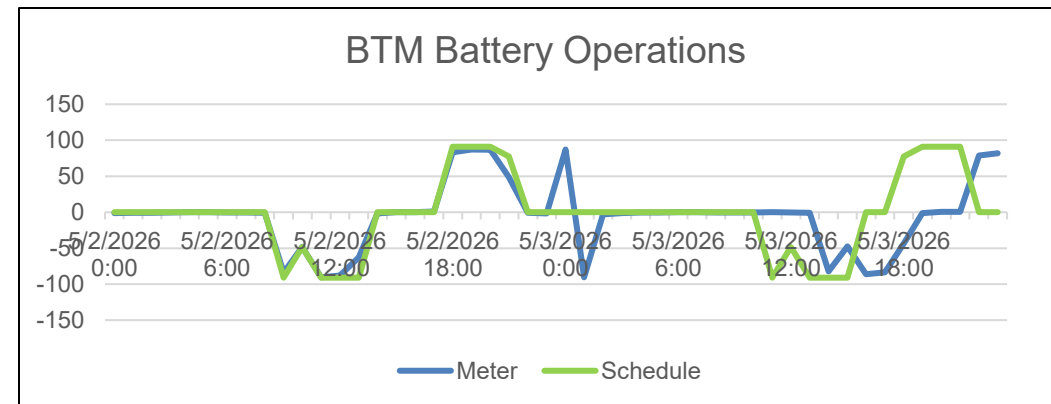
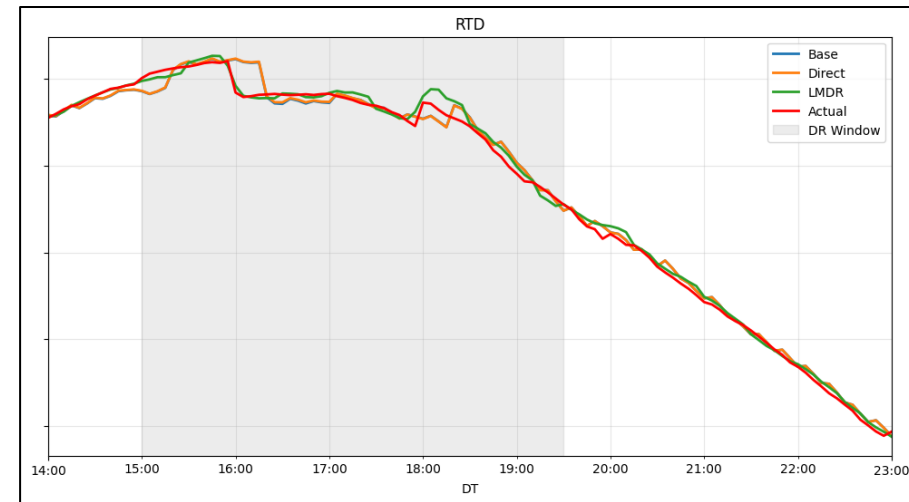
Large Load Driven Demand Growth

- Demand forecasting model training data spans a certain timeframe (e.g. 2022-Present).
- When year-over-year growth trend appears, conforming forecasts may become low-biased because the model is basing the relationship on years with lower load.
- Weather based models particularly exhibit reduction in forecast accuracy.



Background: Incorporating scheduled demand fluctuations

- Current demand forecast model suite can incorporate non-market demand response schedules to preemptively account for scheduled effect of program.
- Similarly, large BTM battery (~100 MW capacity) submit schedules which can be incorporated into demand forecast.
- Schedules and actuals are the data streams needed to handle Non-Conforming Load Movement.
- When large loads are subject to operating limits, schedules can be incorporated to handle movements, preserving forecast quality.



Potential data elements that could support improved visibility and forecasting of large load

1

Load Growth Information:

Transparent visibility into expected load additions over time, including raw capacity development trajectories and energization timelines.

2

Effective Operating Profiles:

Representative demand characteristics for large loads, such as median or typical daily demand profiles, to support baseline forecasting assumptions.

3

Load Movement and Variability:

Operational visibility through submission of schedules and actual metered demand for large loads, enabling improved tracking of intra-day and day-ahead deviations.

4

Operating Limits and Constraints:

Information on operational bounds, including minimum and maximum consumption levels, ramping characteristics, and any flexibility or curtailment capabilities that may influence dispatch and system balancing.

BREAK

DEMAND RESPONSE

New demand response (DR) service status update

- New automated DR service available for MAPStage testing
- New DR service is available in Production but WEIM entities will need to successfully test in MAPStage before submitting to Production
- Still have not received any test submittals from WEIM entities in MAPStage
- Have already received feedback from WEIMs for enhancements:
 - Develop a retrieve service so WEIM entities can better validate their submittals
 - Reporting enhancements to help with WEIM accreditation and settlement processes
- Encourage all WEIM entities to transition to the automated service, but recognize that internal system development may be required so the existing email process will remain available through 2026
- Planning larger set of BPM updates for non-market DR processes in upcoming PRR(s)

Overview new automated DR process for EDAM & WEIM

Step	Current Process	New Automated Process	New Features/Functionality
1	WEIM entity notifies CAISO short-term forecasting (STF) of DR event via email	WEIM entity submits schedule using new API service	New API service which accepts 5-min frequency DR schedules
2	If DR event is $\geq 5\%$ demand forecast then STF must include DR event.	5% threshold removed and DR included into demand forecast by default. STF operational forecasting will continue to closely monitor demand model and forecast on DR event days.	Automated inclusion into demand forecast by default.
3	If DR event is $< 5\%$ of demand forecast then STF performs an accuracy evaluation.		
4	STF sends email back on determination if DR event will be included or not in load forecast.	API service confirms DR schedule submission. WEIM entity will see DR submittal reflected in updated demand forecast.	Automated alerting and storage to CAISO STF and RTMO. Potential for enhanced reporting.
5	WEIM entity can make a BAAOP adjustment for RSE credit if STF is not including.	Do not anticipate BAAOP RSE adjustment being utilized with automation enhancement.	

Existing email process will remain in place through 2026 and until new automated process has received broader adoption

[Energy Imbalance Market BPM](#)

[Demand Response BPM](#)

[EDAM Business Requirements Specification](#)

[Draft EDAM BPM](#)

New demand response (DR) developer portal service tech specs

 California ISO

Developer

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ALFS Advanced Load Forecasting System

Technical specs are in the ALFS MAPStage developer portal. Testing is available for both WEIM/EDAM entities.

RESTful services

 About status

Filter ▾

SERVICE	SPECIFICATION	DOCUMENTATION
EDAM	caiso_alfs_status_api_v1.0.0.yaml	caiso_alfs_status_api_v1.0.0.html
	caiso_alfs_external_entity_load_forecast_v1.0.2.yaml	caiso_alfs_external_entity_load_forecast_v1.0.2.html
FIAW	caiso_alfs_weather_variables_data_by_weather_station_v1.0.0.yaml	caiso_alfs_weather_variables_data_by_weather_station_v1.0.0.html
	caiso_alfs_irradiance_data_by_load_forecast_zone_v1.0.0.yaml	caiso_alfs_irradiance_data_by_load_forecast_zone_v1.0.0.html

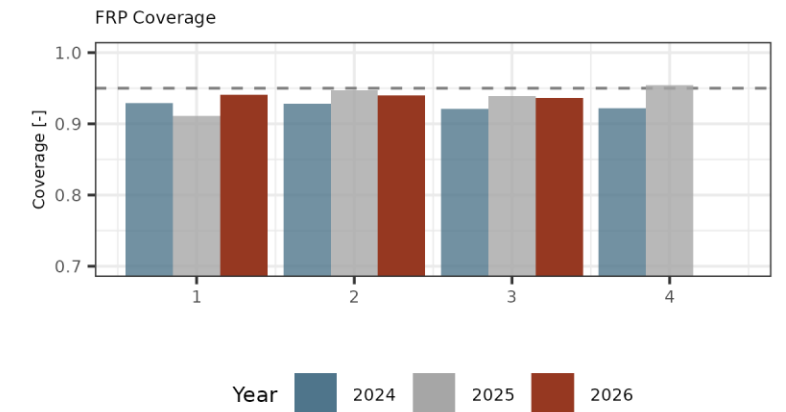
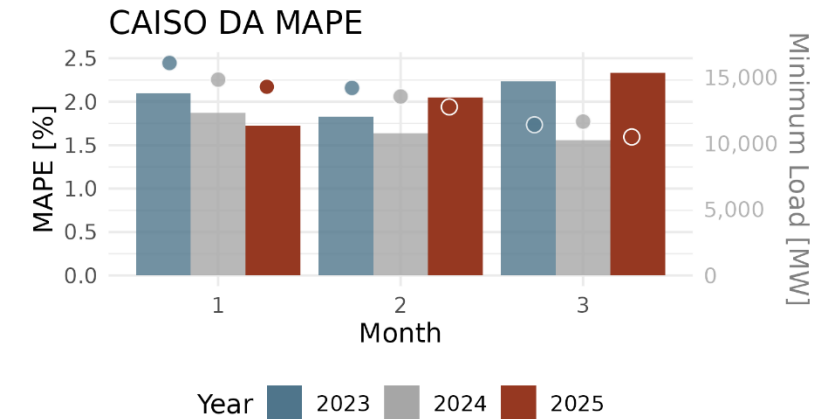
Please submit a CIDI ticket to help coordinate MAPStage testing

METRICS

STF metrics

- STF provides quarterly reporting on load, uncertainty, and renewable forecast performance
 - Historically reported in Market Performance and Planning Forum (MPPF) and WEIM quarterly forecasting forum
 - Now reporting these metrics in Forecasting Forum
- Organization
 - Load and uncertainty metrics are collected and ordered by balancing area (BA)
 - EIM Area and EDAM Area are aggregations we report on for FRP and IR respectively
- Sample
 - Load and renewables report through a latest completed month
 - Uncertainty will include metrics for incomplete quarters
 - Where possible, we provide a three-year window to compare metrics with historical performance
- Additional details on specific calculations provided at start of Appendix

Preview of graphical performance metrics



Data current to 2026-07-07. Quarter number on x-axis.

Takeaways from STF metrics

Highlights:

- IPCO and SRP saw especially strong T-60 demand forecast performance compared to previous Junes
- Most BAs saw directional coverage closer to target in 2026 Q2 than in 2025 Q2

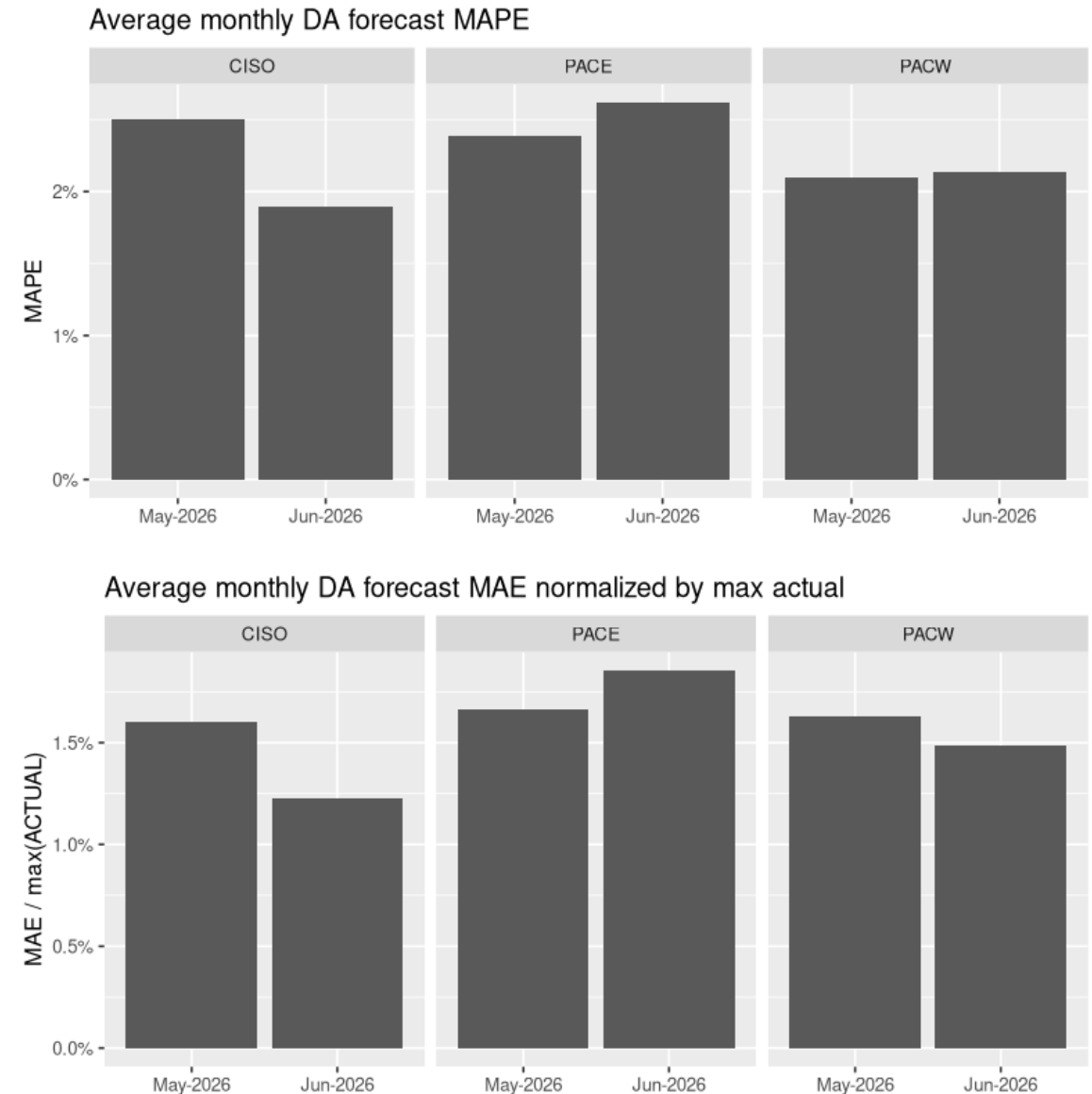
Areas STF is actively reviewing:

- NWMT had elevated demand forecast error metrics in June
- CAISO and PACW are have trended toward over-coverage in the first months of IR
- PACE upward FRP coverage is low

EDAM PRODUCTS

Demand Forecast Performance

- Day-ahead (DA) demand forecasts are generally performing well since May 1
 - Overall average DA MAPE near 2.3%, which is in the seasonal ranges for EDAM BAs
- As EDAM entities join, they are added to the daily operational review of DA forecasts
- STF operational team has updated and continues to refine our daily review process for EDAM entities



OASIS reports

	Information	OASIS Report	Time Posted
Available to EDAM & WEIM	Final Load Forecast: Hourly granularity for DA through 7DA <i>**new addition of 3DA through 6DA</i> <i>**DA forecasts for non-EDAM entities are advisory</i>	<i>System Demand:</i> CAISO Demand Forecast	9am
	Final Load Forecast: Peak MW for DA through 7DA	<i>System Demand:</i> CAISO Peak Demand Forecast	9am; latest information only (previous updates overwritten)
EDAM Entities Only	DA Load Forecast updates for RSE	<i>System Demand:</i> Sufficiency Evaluation Demand Forecast	Every 30 min between 5:30am and 9am
	DA Renewable Forecast	<i>Energy: EDAM</i> EDAM Wind and Solar Forecast	9am
	Imbalance Reserve Requirements	<i>Energy: Imbalance Reserve</i> Imbalance Reserve Results	After each RSE run

Imbalance Reserve (IR) Product

CAISO

May had high coverage with downward requirements at 94%, and upward requirements performed as expected.

In June, both requirements are over covering.

PACE

Upward and downward requirements are performing as expected

PACW

May had high coverage with downward requirements, and performed as expected with upward.

In June, both requirements are over covering.

CAISO

PACE

PACW

May

Coverage Target = 90%

IR Coverage		IR Coverage		IR Coverage	
Type	Value	Type	Value	Type	Value
IR Covered Up %	0.9	IR Covered Up %	0.88	IR Covered Up %	0.88
IR Avg Up Requirement	1551	IR Avg Up Requirement	632	IR Avg Up Requirement	130
IR Covered Down %	0.94	IR Covered Down %	0.91	IR Covered Down %	0.94
IR Avg Down Requirement	-1895	IR Avg Down Requirement	-632	IR Avg Down Requirement	-151
IR Avg Up Exceedance (MW)	412	IR Avg Up Exceedance (MW)	155	IR Avg Up Exceedance (MW)	35
IR Avg Down Exceedance (MW)	-334	IR Avg Down Exceedance (MW)	-199	IR Avg Down Exceedance (MW)	-48

June

IR Coverage		IR Coverage		IR Coverage	
Type	Value	Type	Value	Type	Value
IR Covered Up %	0.94	IR Covered Up %	0.87	IR Covered Up %	0.95
IR Avg Up Requirement	1607	IR Avg Up Requirement	589	IR Avg Up Requirement	138
IR Covered Down %	0.97	IR Covered Down %	0.9	IR Covered Down %	0.91
IR Avg Down Requirement	-1835	IR Avg Down Requirement	-710	IR Avg Down Requirement	-145
IR Avg Up Exceedance (MW)	285	IR Avg Up Exceedance (MW)	205	IR Avg Up Exceedance (MW)	32
IR Avg Down Exceedance (MW)	-286	IR Avg Down Exceedance (MW)	-182	IR Avg Down Exceedance (MW)	-36

Next Steps

- Meeting materials are available on the [Forecasting Forum](#) webpage.
 - The meeting recording will be posted there soon.
- If you have any additional questions feel free to email us at ISOStakeholderAffairs@caiso.com.

This Week at the ISO – 7/20/26

Stakeholder Meetings - *For an overarching view of where each initiative is in the development process, view the [Policy Initiatives Timeline](#).*

All public stakeholder meetings are also listed on the [CAISO Calendar](#)

- Tuesday, July 21 – Interconnection Customer User Group
 - 1:00pm – 2:00pm PT ([registration link](#))
- Wednesday, July 22 – Resource adequacy modeling and program design
 - 9:00am – 12:00pm PT ([link](#), in person register [here](#))
- Wednesday, July 22 – Storage design and modeling
 - 1:00pm – 4:00pm PT ([link](#), in person register [here](#))
- Wednesday, July 22 – Settlement User Group
 - 10:00am – 11:00am PT ([link](#))
- Thursday, July 23 – Market Update
 - 10:00am – 10:30am PT ([link](#))
- Thursday, July 23 – Forecasting Forum 2026
 - 1:00pm – 4:00pm PT ([link](#))

Comment Submission Deadlines

- Thursday, July 23 - Demand and Distributed Energy Market Integration.
- Thursday, July 23 - 2026 Variable Operations and Maintenance (VOM) Cost Review

This Week at the ISO continued

DAME/EDAM Resources

FAQ & Training:

- [EDAM FAQ Guide](#) - Designed to address general EDAM related questions
- [EDAM Training Resources](#) - A comprehensive set of EDAM training materials is available, offered in both instructor-led and computer-based training (CBT) formats. These resources include courses covering:
 - Bids and Base Schedule
 - EDAM Bidding Basic Concepts
 - Scheduling Infrastructure Business Rules (SIBR)
 - EDAM Scheduling Coordinator responsibilities
 - Intertie Scheduling
- [EDAM Business Requirements Specifications](#) - Describes EDAM's business processes and the associated business requirements.
- [DAME Business Requirements Specifications](#) - Describes DAME's business processes and the associated business requirements.
- [EDAM Scheduling Coordinator Decision Matrix](#)

Settlements:

- [Settlements BPM Walkthrough](#)

BPMs:

- [Extended Day-Ahead Market BPM](#)
- [Market Instruments BPM](#)
- [Reliability Requirements BPM](#)
- [Market Operations BPM](#)
- [BPM Change Management Process \(PRRs\)](#)

EDAM Stakeholder Initiative:

- Meeting materials and recordings can be accessed through the stakeholder initiative page [here](#).

This Week at the ISO continued

Market Simulations

Please refer to our [Release Schedule](#) for the most recent updates of initiatives scheduled for MAP- and Production- stage market sims

- None Scheduled this week

Presentations and recordings of the Parallel Operations Meeting are posted [here](#).

To participate in the DAME and EDAM Implementation pre-Market Simulation meeting series, please follow these steps:

Submit a CIDI Request:

- Log in to the CAISO Customer Inquiry, Dispute, and Information (CIDI) system.
- Create a new request with the 'Functional Environment' set to "Market Simulation."
- In the request, specify your intent to participate in the DAME & EDAM Market Simulation.
- Include the following information:
 - Market Simulation initiative(s) you will participate in.
 - Any specific resources or systems you plan to test.
 - Contact names and email addresses for coordination.

Email Option:

- If you do not have access to CIDI, you may send an email to marketsim@caiso.com with the subject line "DAME & EDAM Market Simulation Registration."

Business Practice Manual (BPM) Updates

- The status of all PRRs and updated BPMs in the [BPM Library](#) are published on the [BPM Change Management Website](#).
- *Please note: The California ISO has updated how participants access call-in information for Business Practice Manual (BPM) Change Management meetings. Going forward, registration is required to receive Webex and audio participation details. Previously, meeting links were posted directly on the event calendar. This change allows us to collect participant contact information to support future outreach, communication, and process improvement efforts.*

Energy Matters blog provides timely insights into ISO grid and market operations as well as other industry-related news and a new energy podcast from CAISO



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News Release | Western Energy Markets

Anita Decker reappointed to Western Energy Markets Governing Body

06/17/2026



GUESTS:
DR. BEN HOBBS AND SCOTT HARVEY

S1 E3 - PART 1

Podcast | Markets

Episode 3: Wisdom and wonkiness of the Market Surveillance Committee

06/16/2026



Story | Operations, Inside the California ISO

Powering the West's future with demand flexibility

By Anja Gilbert

06/11/2026

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Announcing the launch of a new publication series:



Western Energy Markets Observations

This new periodical offers concise and accessible insights into notable developments across the western power markets. [Read the first issue](#) for highlights on market performance during the first weeks of Extended Day-Ahead Market (EDAM) operations.

The document will be posted on the [EDAM Overview page of WesternEnergyMarkets.com](#) website.

REGISTRATION IS OPEN

2026 STAKEHOLDER SYMPOSIUM

Welcome reception - Oct. 5

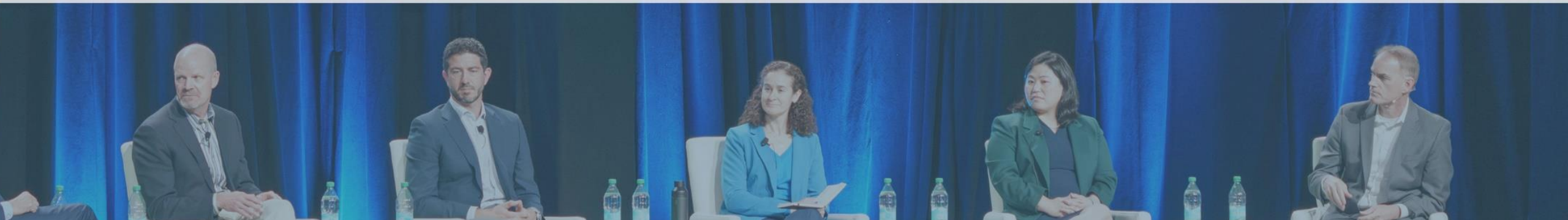
at Kimpton Sawyer Hotel, Sacramento, CA

Symposium program - Oct. 6

SAFE Credit Union Convention Center
Sacramento, CA

Visit: <https://www.caiso.com/meetings-events/events/stakeholder-symposium>

SPONSORSHIP OPPORTUNITIES AVAILABLE

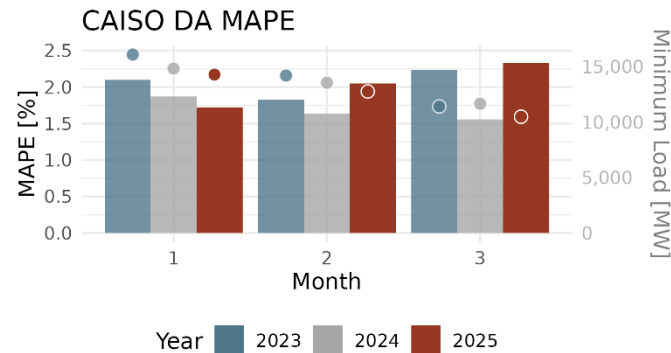


APPENDIX – METRICS REFERENCE

Interpreting load forecast accuracy plots

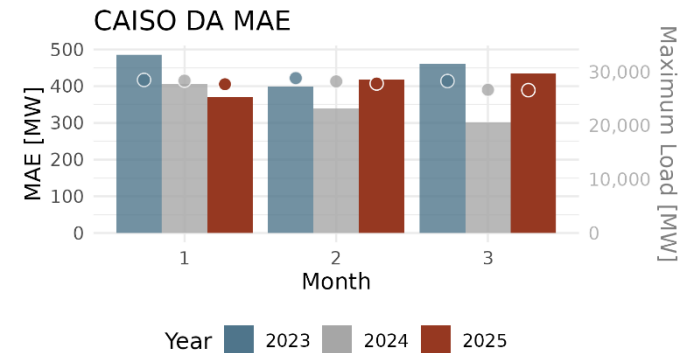
Mean absolute percent error (MAPE)

$$\text{MAPE} = \frac{1}{N} \sum_{i=1}^N \left(\frac{|\text{Forecast} - \text{Actual}|}{\text{Actual}} \right)_i$$



Mean absolute error (MAE)

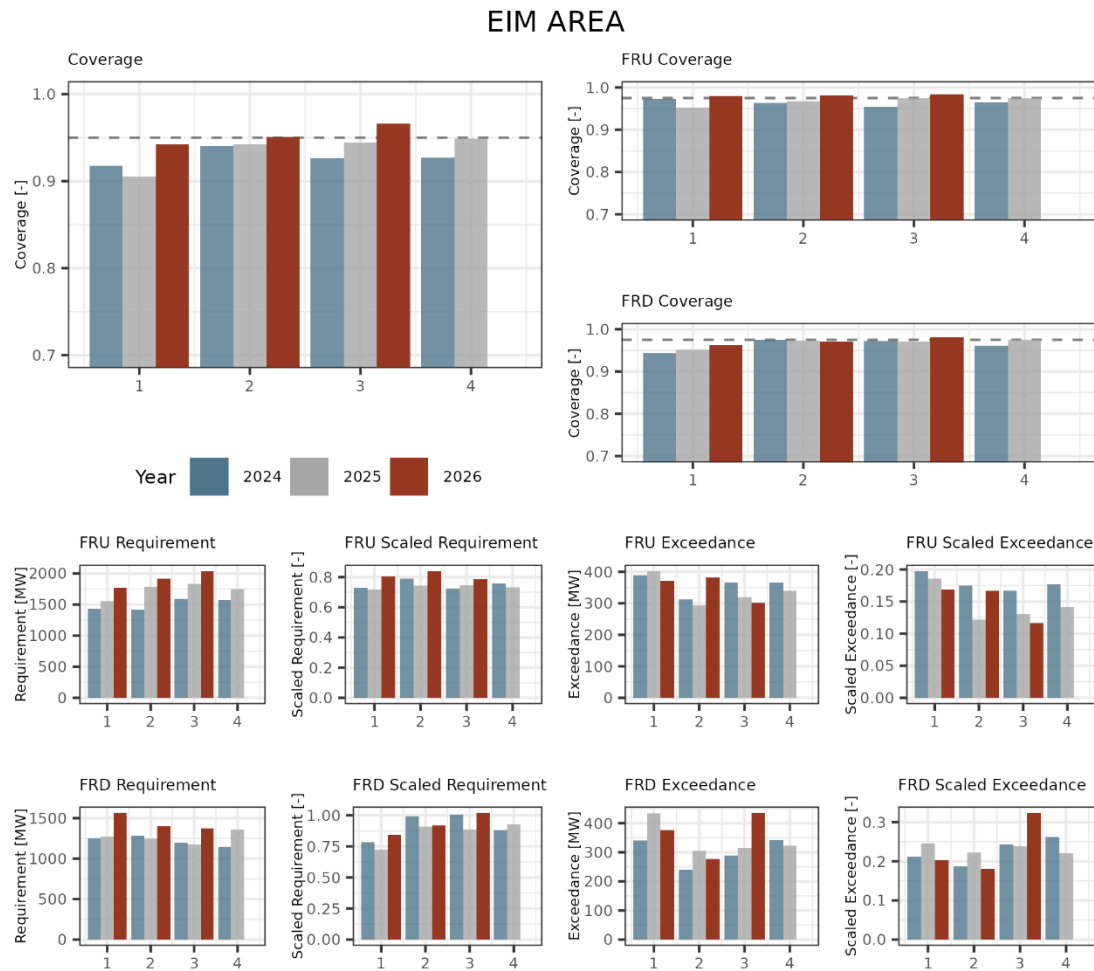
$$\text{MAE} = \frac{1}{N} \sum_{i=1}^N (|\text{Forecast} - \text{Actual}|)_i$$



- MAPE is shown with *minimum* load per month on a secondary y-axis.
- **Expected:** Low midday loads will lead to higher MAPE. More BTM solar and DERs will decrease midday load.
- **Desired:** MAPE decreases over time.

- MAE is shown with *maximum* load per month on a secondary y-axis.
- **Expected:** Higher loads will lead to higher MAE. Peak loads may grow over time.
- **Desired:** MAE decreases over time.

Interpreting uncertainty plots



Data current to 2026-07-06. Quarter number on x-axis.

Uncertainty plots show quarterly coverage, directional coverage, directional requirement and exceedance, and scaled directional requirement and exceedance.

FRP statistics reflect RTPD where uncertainty is the RTD binding forecast minus RTPD advisory forecast. IR statistics reflect uncertainty defined as the RTPD binding forecast minus DA advisory forecast.

Goal:

- Obtain coverage near target
- Keep requirement magnitudes comparable to observed net demand uncertainty
- Decrease average exceedance

Quarters are defined by calendar month. Quarter 1 is Jan – Mar, Quarter 2 is Apr – Jun, etc. Note, we provide reporting on incomplete quarters, whose metrics will update with the next reporting cycle.

Caption notes the latest trade date included in the current quarter evaluation as MPPF slides are prepared prior to the end of the quarter.

Uncertainty metrics

Applicable for flex ramp product (FRP) and imbalance reserve (IR).

Both products have an upward and downward requirement representing a high and low percentile probabilistic forecast that estimates net demand uncertainty.

Coverage captures the percentage of time when uncertainty falls within the requirement range.

$$\text{overall coverage} = \frac{1}{N} \sum_{i=1}^N (\text{RD} \leq x \leq \text{RU})_i$$

$$\text{RU coverage} = \frac{1}{N} \sum_{i=1}^N (x \leq \text{RU})_i$$

$$\text{RD coverage} = \frac{1}{N} \sum_{i=1}^N (x \geq \text{RD})_i$$

Requirement captures average directional requirement MW value.

$$\text{RU requirement} = \frac{1}{N} \sum_{i=1}^N (\text{RU})_i$$

$$\text{RD requirement} = \frac{1}{N} \sum_{i=1}^N (\text{RD})_i$$

Exceedance captures average MW value that observed uncertainty exceeds the directional requirement.

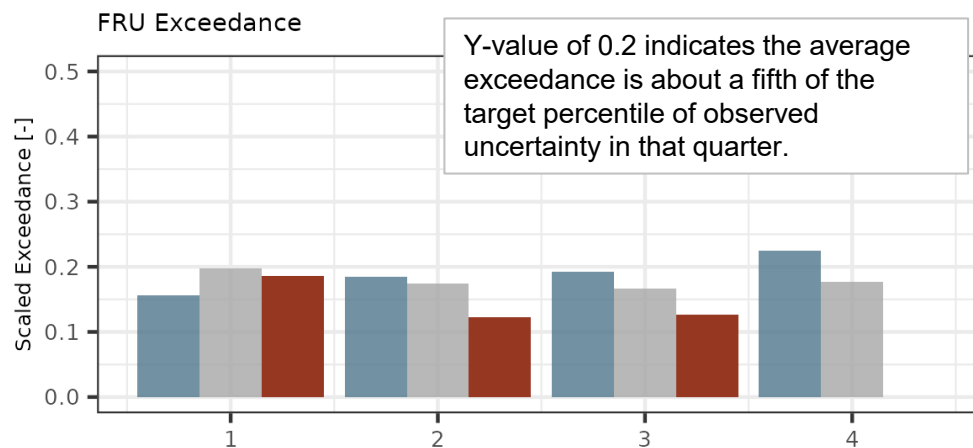
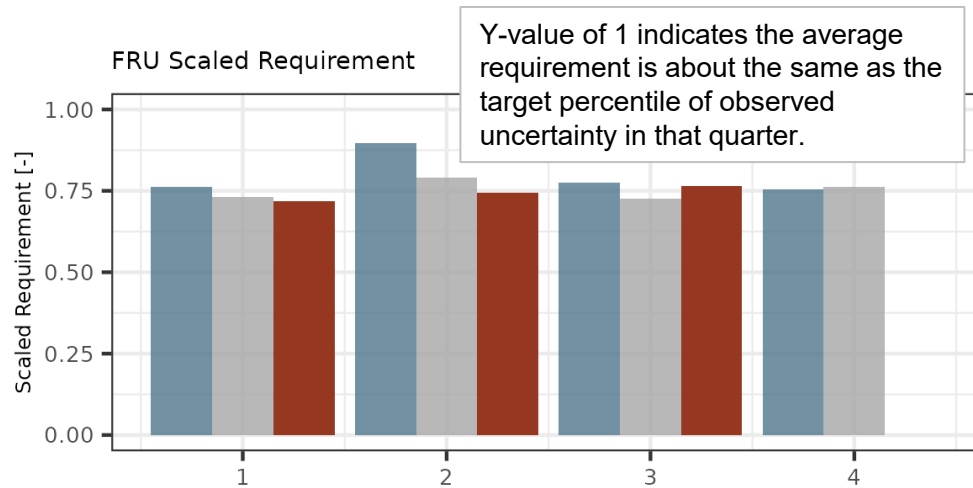
$$\text{RU exceedance} = \frac{1}{M} \sum_{j=1}^M (x - \text{RU})_j, \text{ for interval } j \text{ where } x_j > \text{RU}$$

$$\text{RD exceedance} = \frac{1}{M} \sum_{j=1}^M (x - \text{RD})_j, \text{ for interval } j \text{ where } x_j < \text{RD}$$

Symbol	Name
RU	Upward requirement; requirement at the high percentile (FRU or IRU)
RD	Downward requirement; requirement at the low percentile (FRD or IRD)
x	Realized uncertainty
N	Total number of intervals under evaluation
M	Number of intervals under evaluation where realized uncertainty was not covered

Interpreting uncertainty metrics: scaled requirement and exceedance

Scaling requirement and exceedance adds another dimension for evaluation, where these MW metrics are reviewed in the context of uncertainty patterns.



Scaled requirement

- Presented as positive factor
- **Requirement / realized uncertainty**
 - Upward requirement / 97.5th uncertainty for FRU
 - Downward requirement / 2.5th uncertainty for FRD
 - Upward requirement / 90th uncertainty for IRU
 - Downward requirement / 10th uncertainty for IRD
- Scaled requirements may generally be near ~1 as requirements should be comparable to target uncertainty

Scaled exceedance

- Presented as positive factor
- **Exceedance / realized uncertainty**
 - Upward exceedance / 97.5th uncertainty for FRU
 - Downward exceedance / 2.5th uncertainty for FRD
 - Upward exceedance / 90th uncertainty for IRU
 - Downward exceedance / 10th uncertainty for IRD
- Exceedance sample size will vary per quarter. If a historical value is missing post-onboarding, it indicates a quarter in which there was no exceedance

Interpreting scaled requirements

Ideally: Overall coverage is on target and scaled requirement < 1

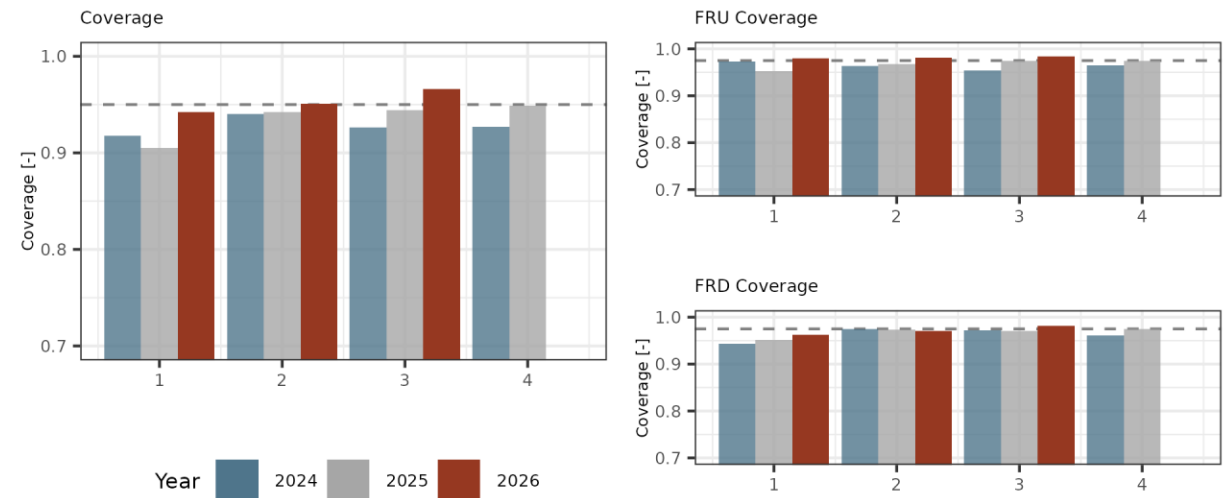
For probabilistic forecasting, there's a trade off between accuracy and efficiency, i.e. coverage and requirements. We aim to maximize efficiency (minimize requirements) without compromising coverage. A scaled requirement of ~1 is generally meeting performance expectations. In addition, comparing the requirement to scaled requirement trends help indicate performance as outlined below.

Requirement trend year-on-year per quarter	Scaled requirement trend year-on-year per quarter	Scenario description	Interpretation, assuming coverage is about the same
Decreasing	Decreasing	Requirements are decreasing faster than observed uncertainty (uncertainty is staying about the same or increasing)	Great
	Staying the same	Requirements are decreasing at about the same rate as observed uncertainty	Performance is meeting expectations. Overall, this is a good trend since uncertainty is decreasing.
	Increasing	Requirements are decreasing on average, but observed uncertainty is decreasing at a faster rate	Good from an operations standpoint since requirements are decreasing. Neutral to negative on mosaic performance as the model may be lagging the uncertainty trend; requirements tend to be larger than needed.
Staying the same	Decreasing	Requirements are staying the same despite observed uncertainty increasing	Maintenance – mosaic is looking more efficient
	Staying the same	Requirements and observed uncertainty are staying consistent for the season	Maintenance – fair
	Increasing	Requirements are staying the same, but observed uncertainty is decreasing	Maintenance – mosaic has been less efficient
Increasing	Decreasing	Requirements are increasing at a slower rate than observed uncertainty	Good from model performance standpoint as mosaic is looking efficient. May be challenging operationally since requirements are increasing.
	Staying the same	Requirements are increasing at about the same rate as observed uncertainty	Performance is meeting expectations. Entity may want further review to identify why uncertainty is increasing. Review coverage metrics, scaled requirements relative to 1, renewable capacity growth, and load and renewable forecast accuracy.
	Increasing	Requirements are increasing faster than observed uncertainty (uncertainty is staying about the same or decreasing)	Bad. This is challenging operationally since requirements are increasing and mosaic has been less efficient.

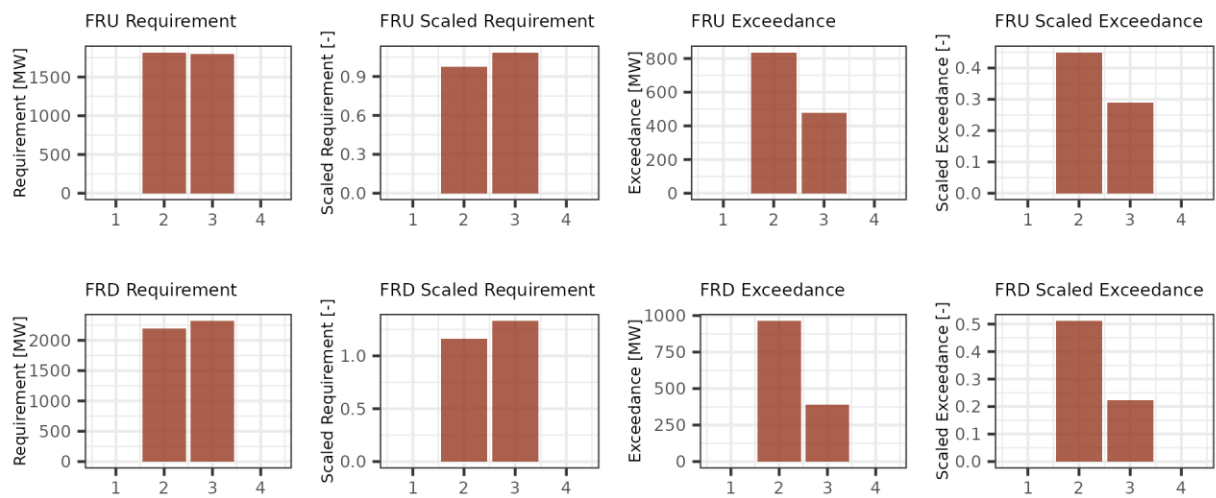
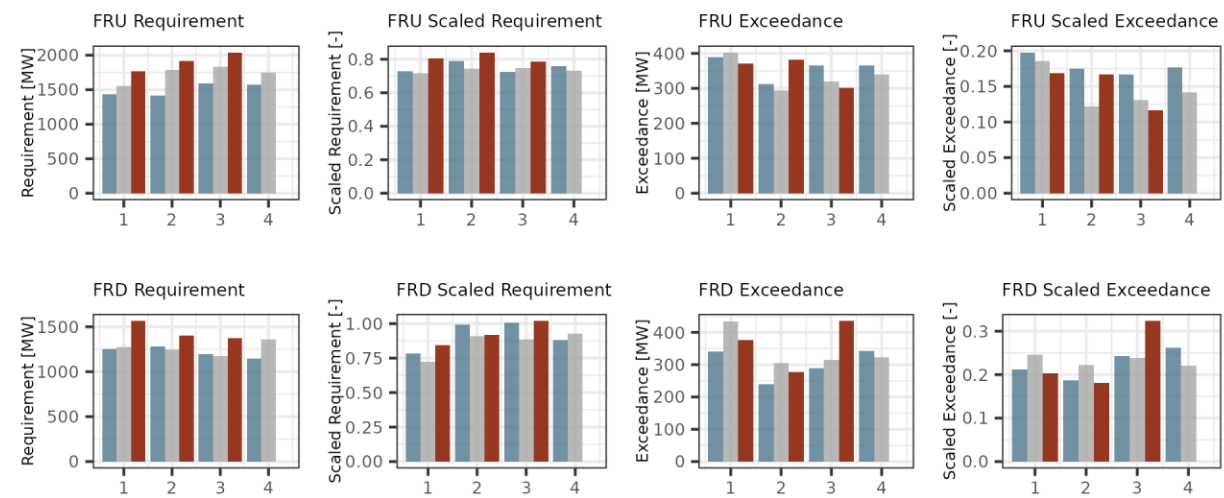
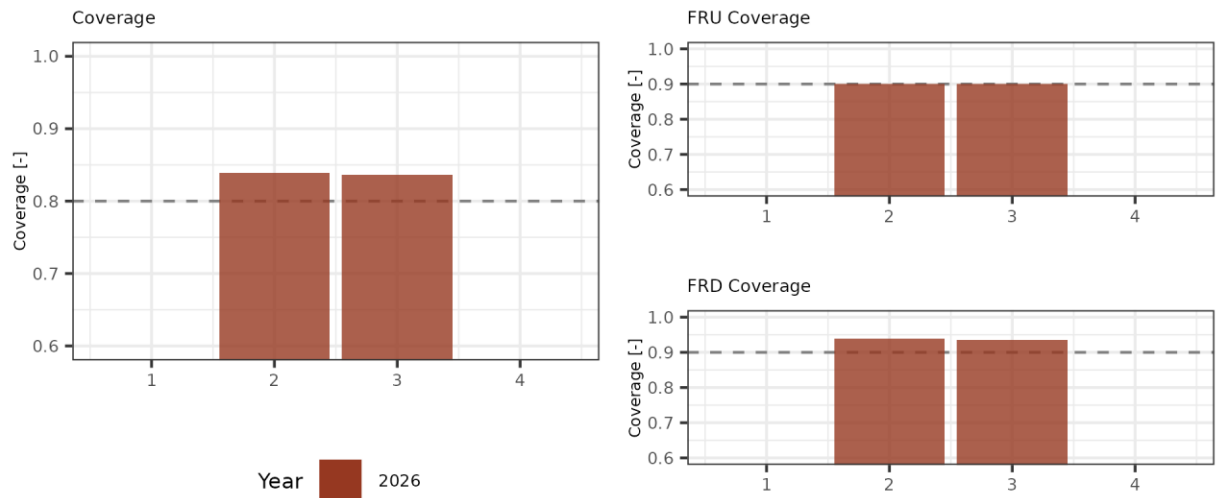
APPENDIX – LOAD AND UNCERTAINTY

FRP and IR metrics for aggregated areas

EIM AREA



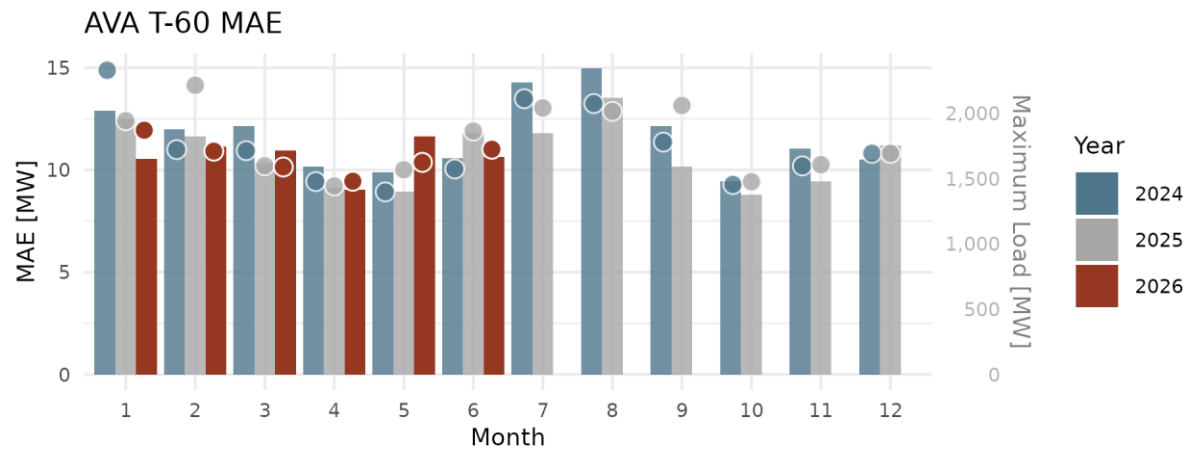
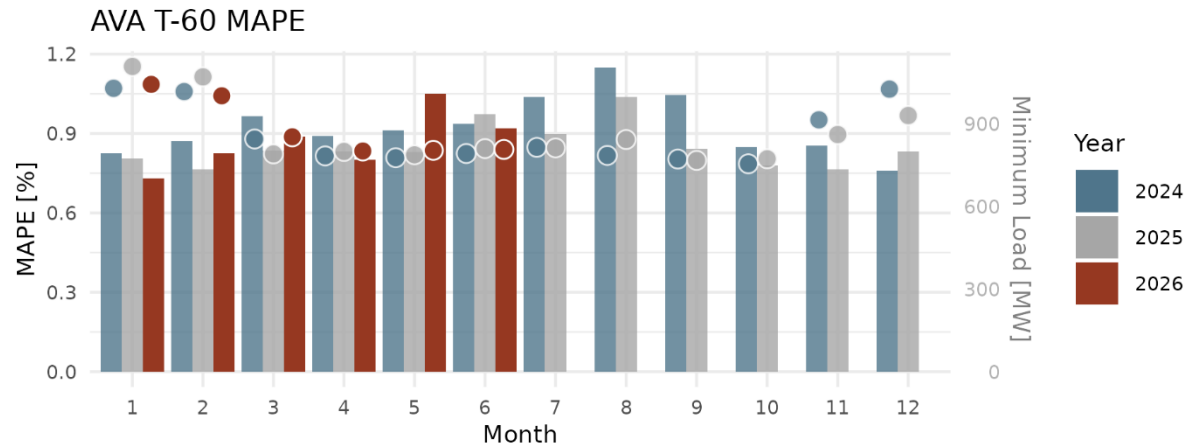
EDAM AREA



Data current to 2026-07-06. Quarter number on x-axis.

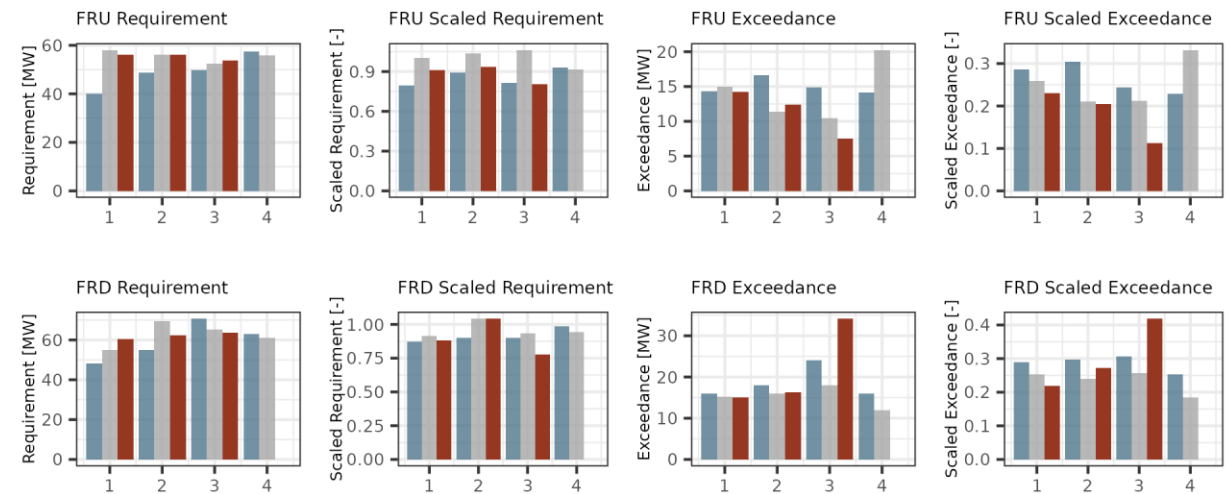
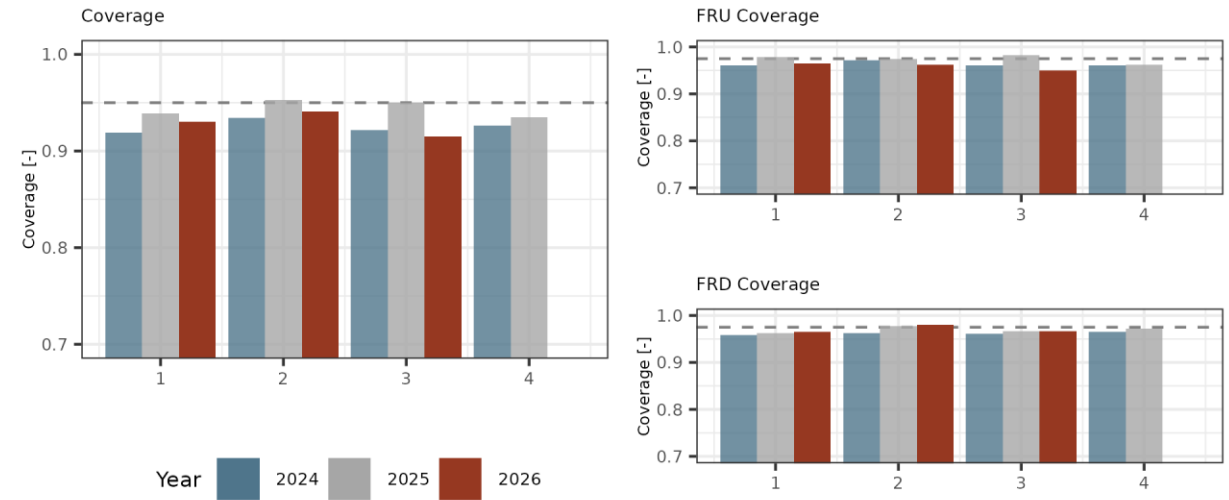
Data current to 2026-07-07. Quarter number on x-axis.

AVA



Bars use primary y-axis at left. Points use secondary y-axis at right.

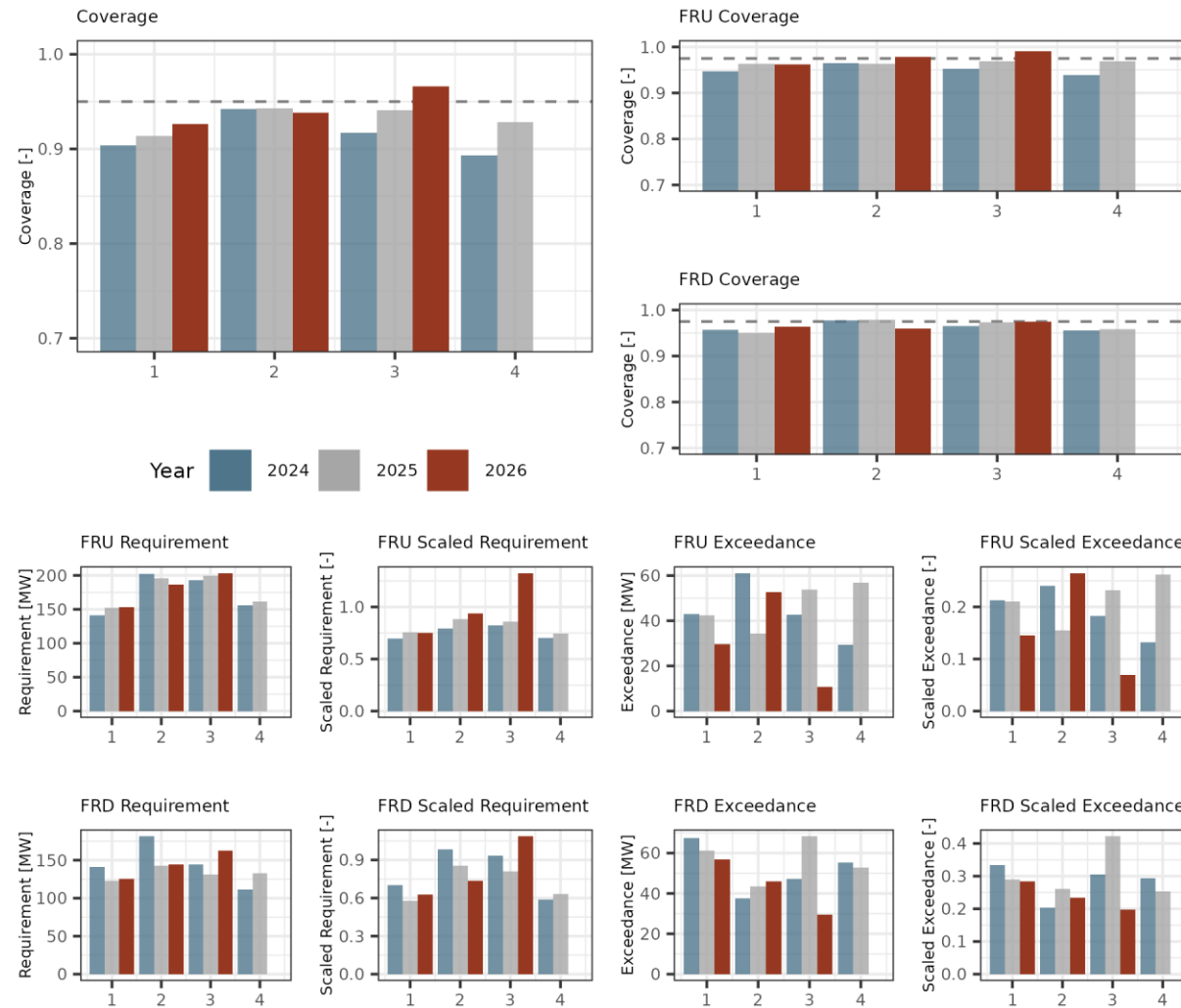
AVA



Data current to 2026-07-06. Quarter number on x-axis.

AVRN

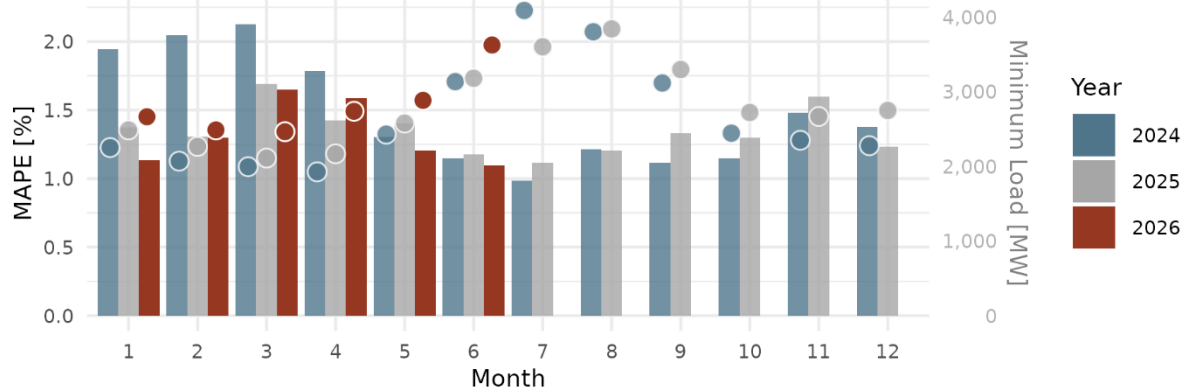
AVRN



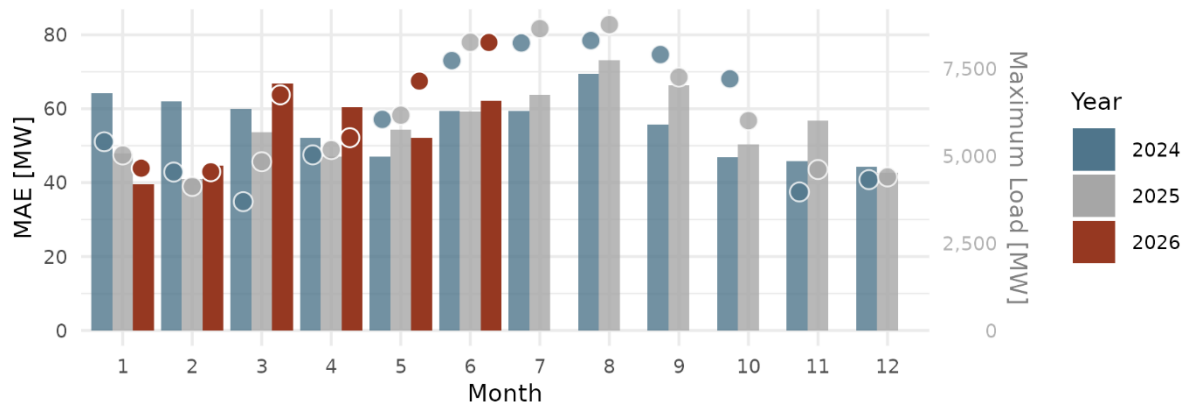
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APS

APS T-60 MAPE

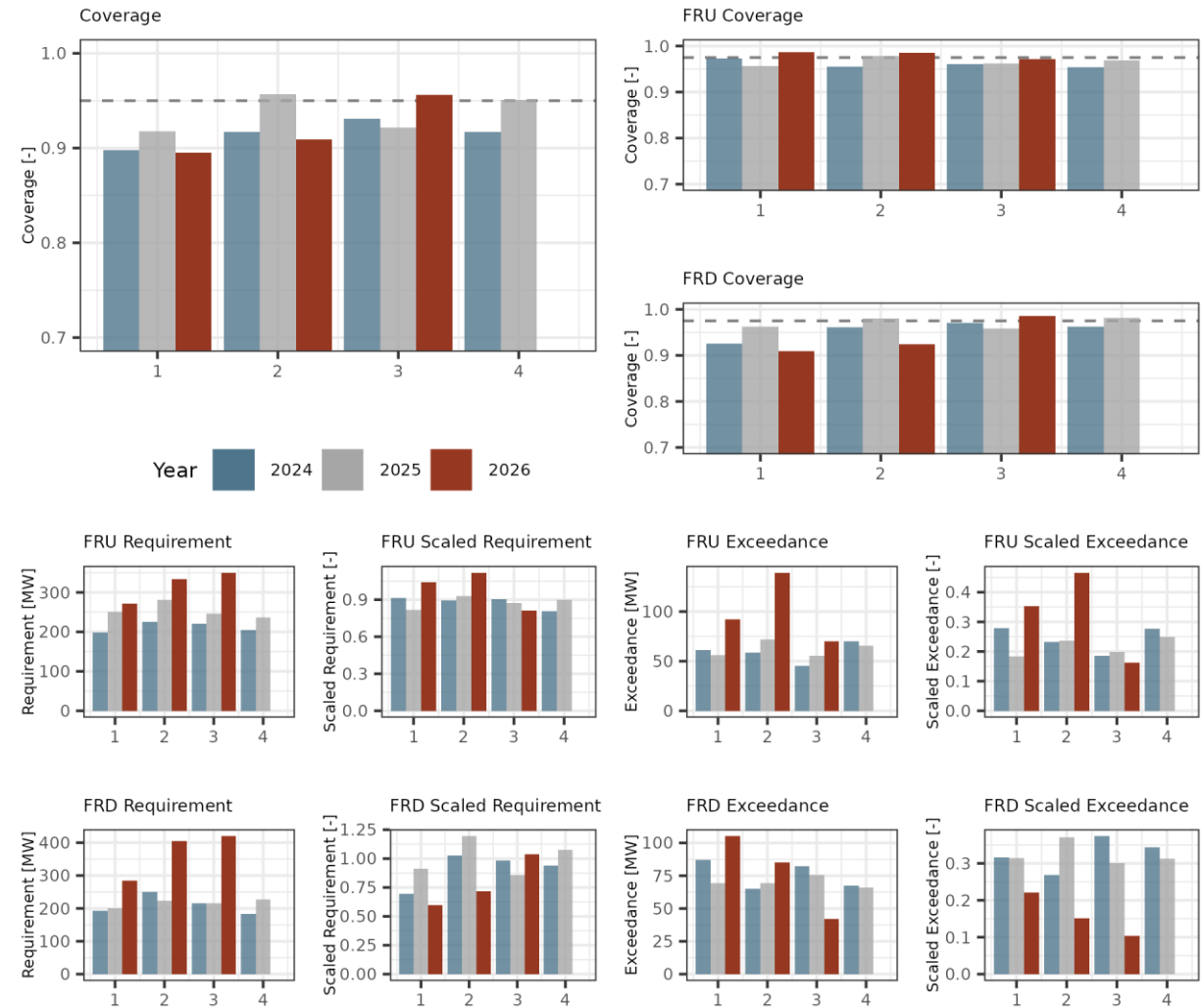


APS T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

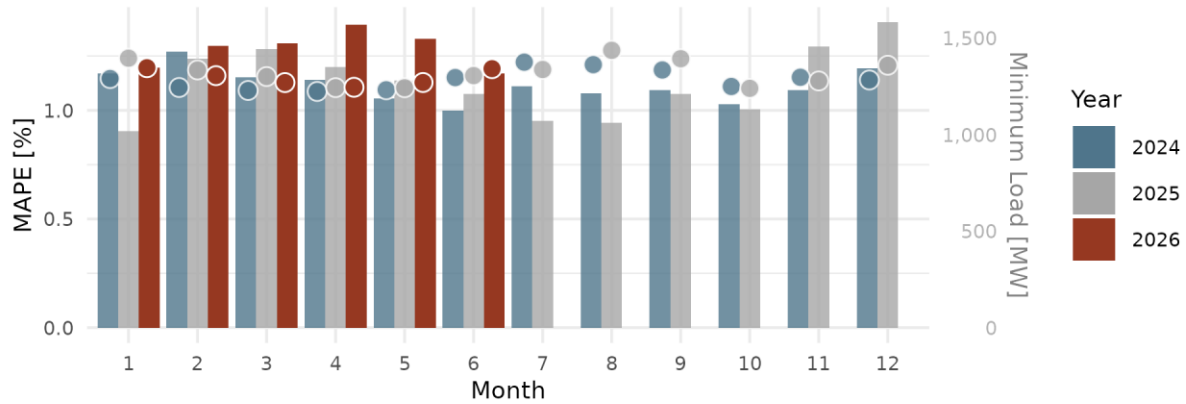
APS



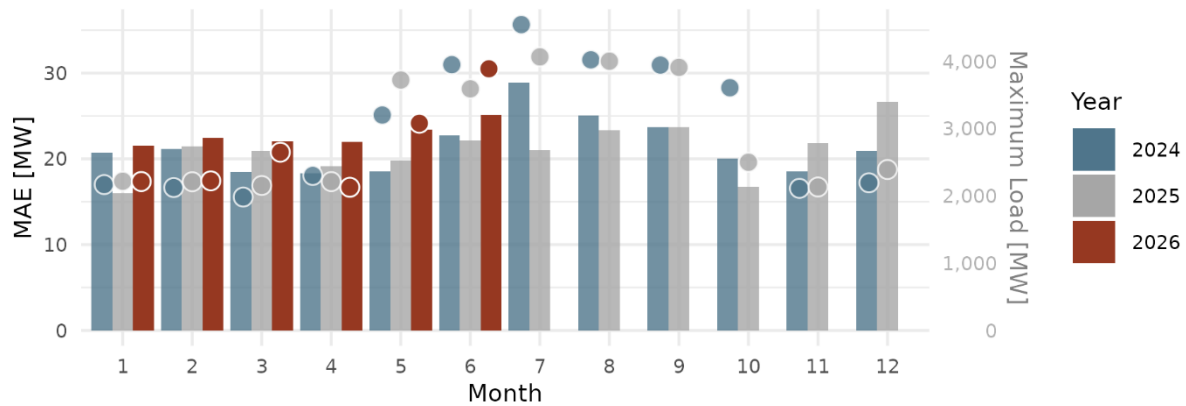
Data current to 2026-07-05. Quarter number on x-axis.

BANC

BANC T-60 MAPE

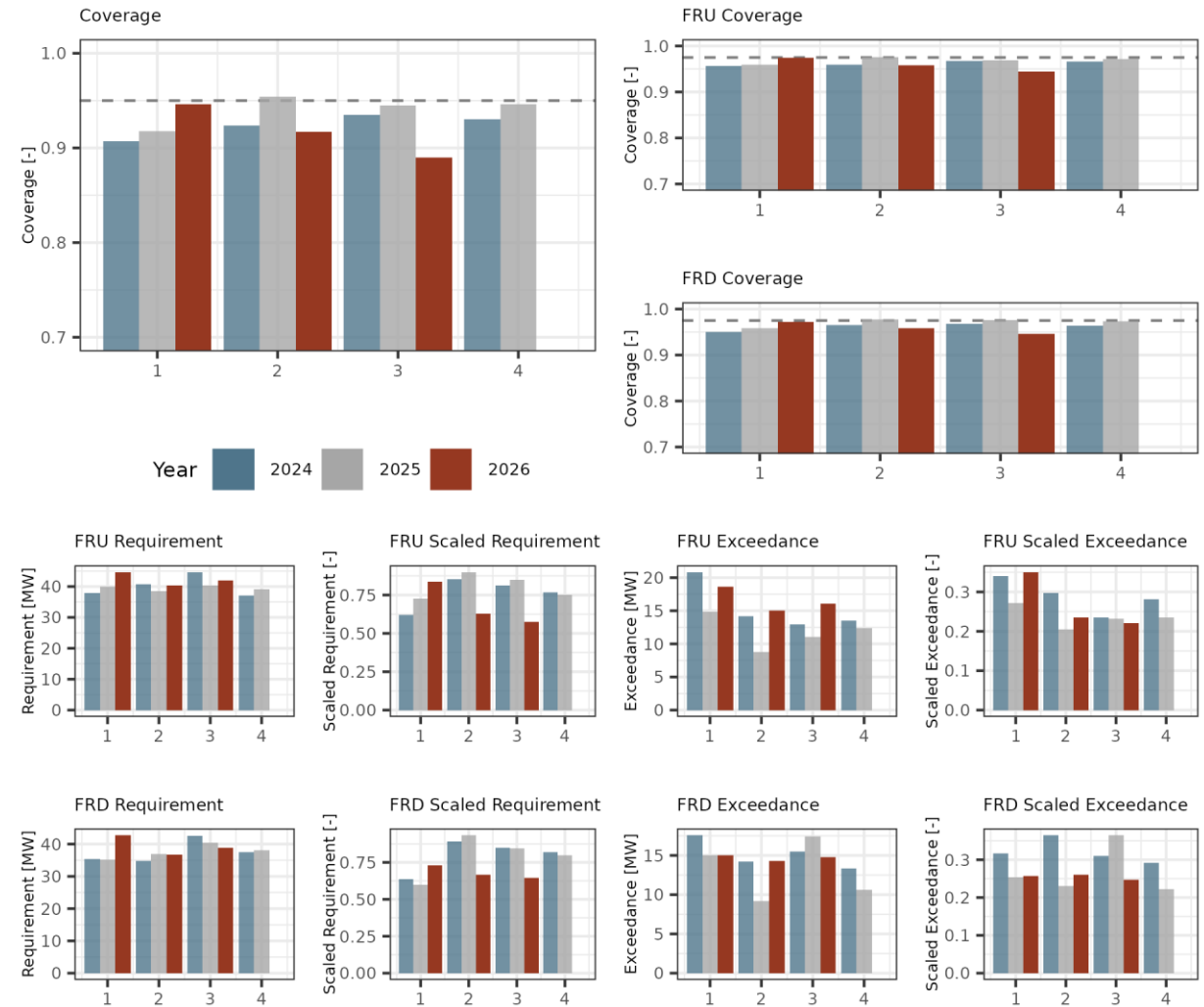


BANC T-60 MAE



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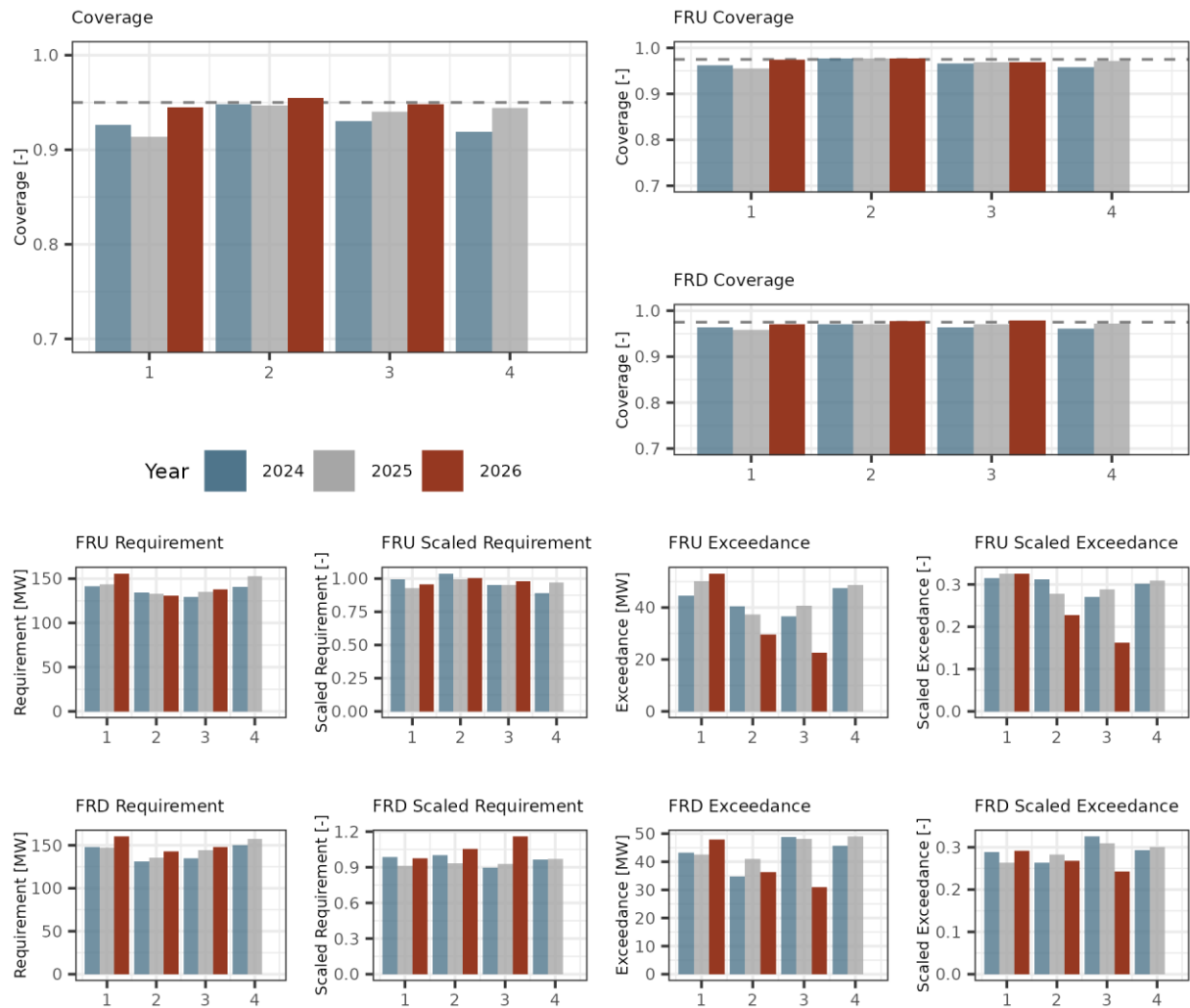
BANC



Data current to 2026-07-06. Quarter number on x-axis.

BCHA

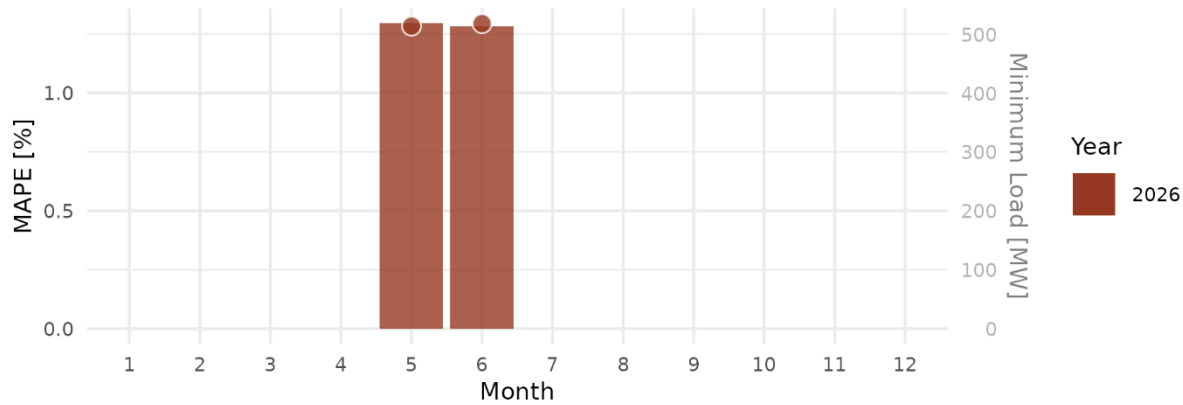
BCHA



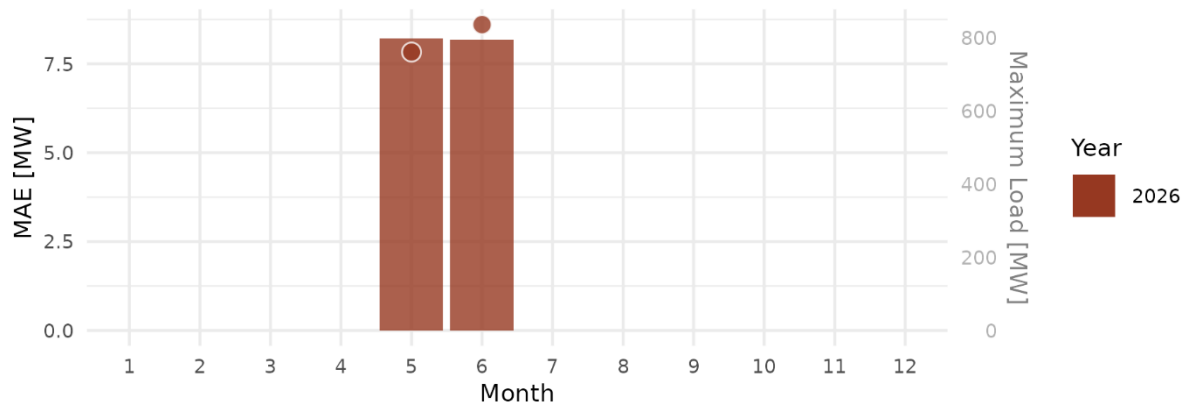
Data current to 2026-07-06. Quarter number on x-axis.

BHBA

BHBA T-60 MAPE



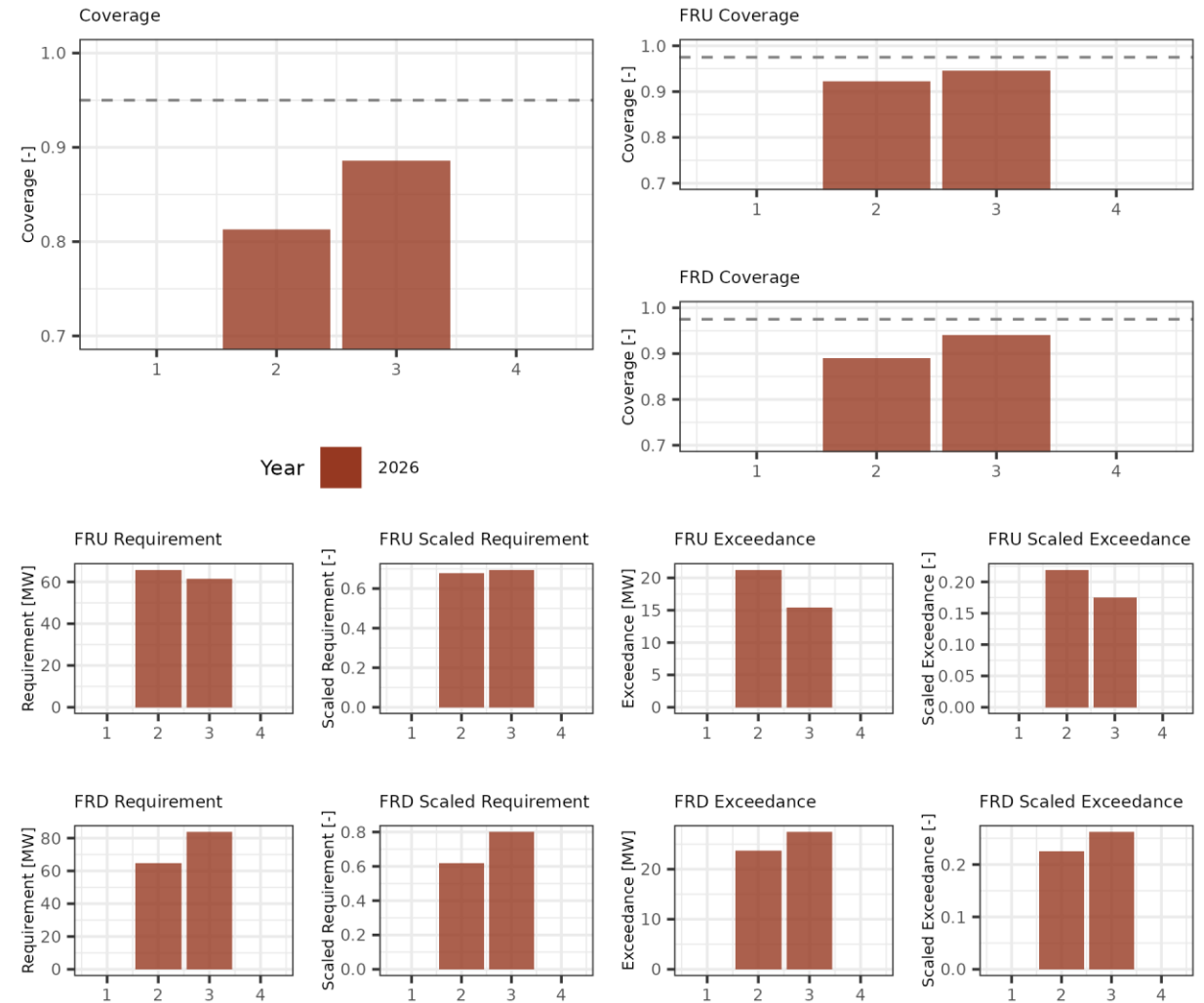
BHBA T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

Note, BHBA went live on May 6. For simplicity, demand forecast metrics start May 1.

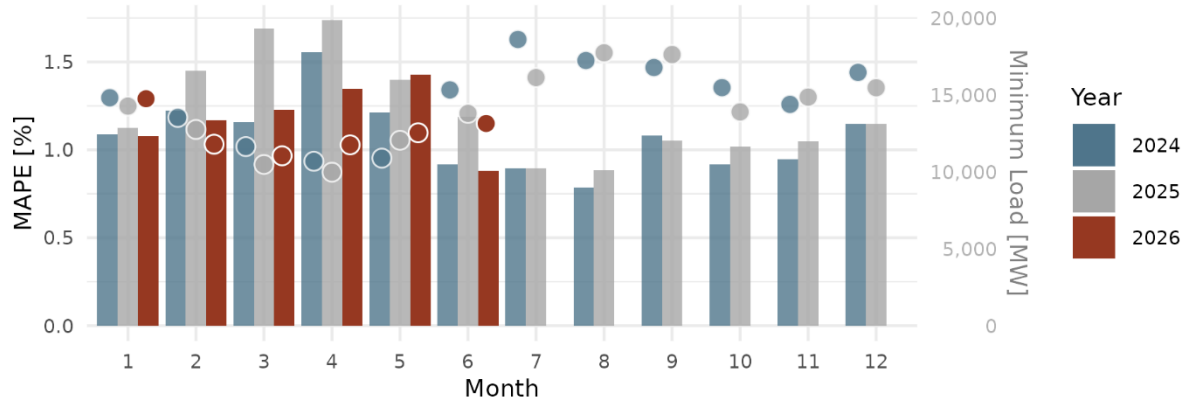
BHBA



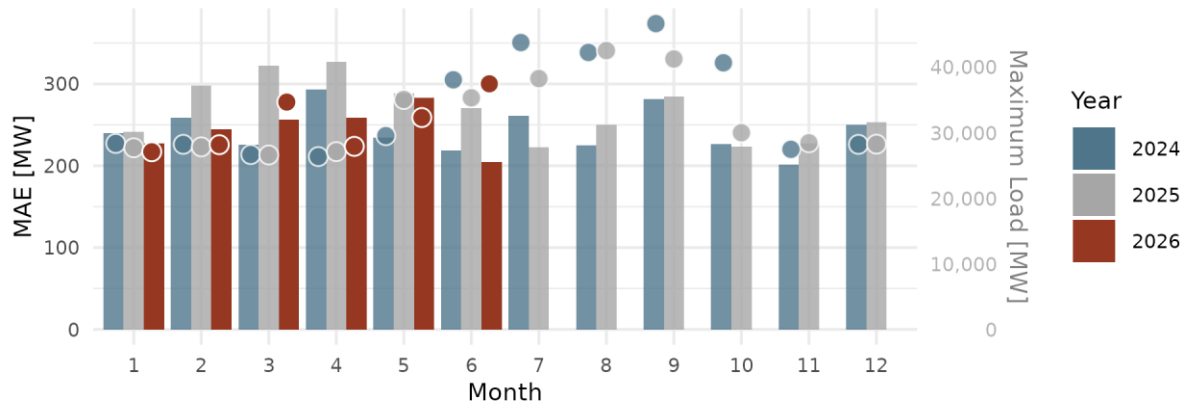
Data current to 2026-07-09. Quarter number on x-axis.

CAISO

CAISO HASP MAPE

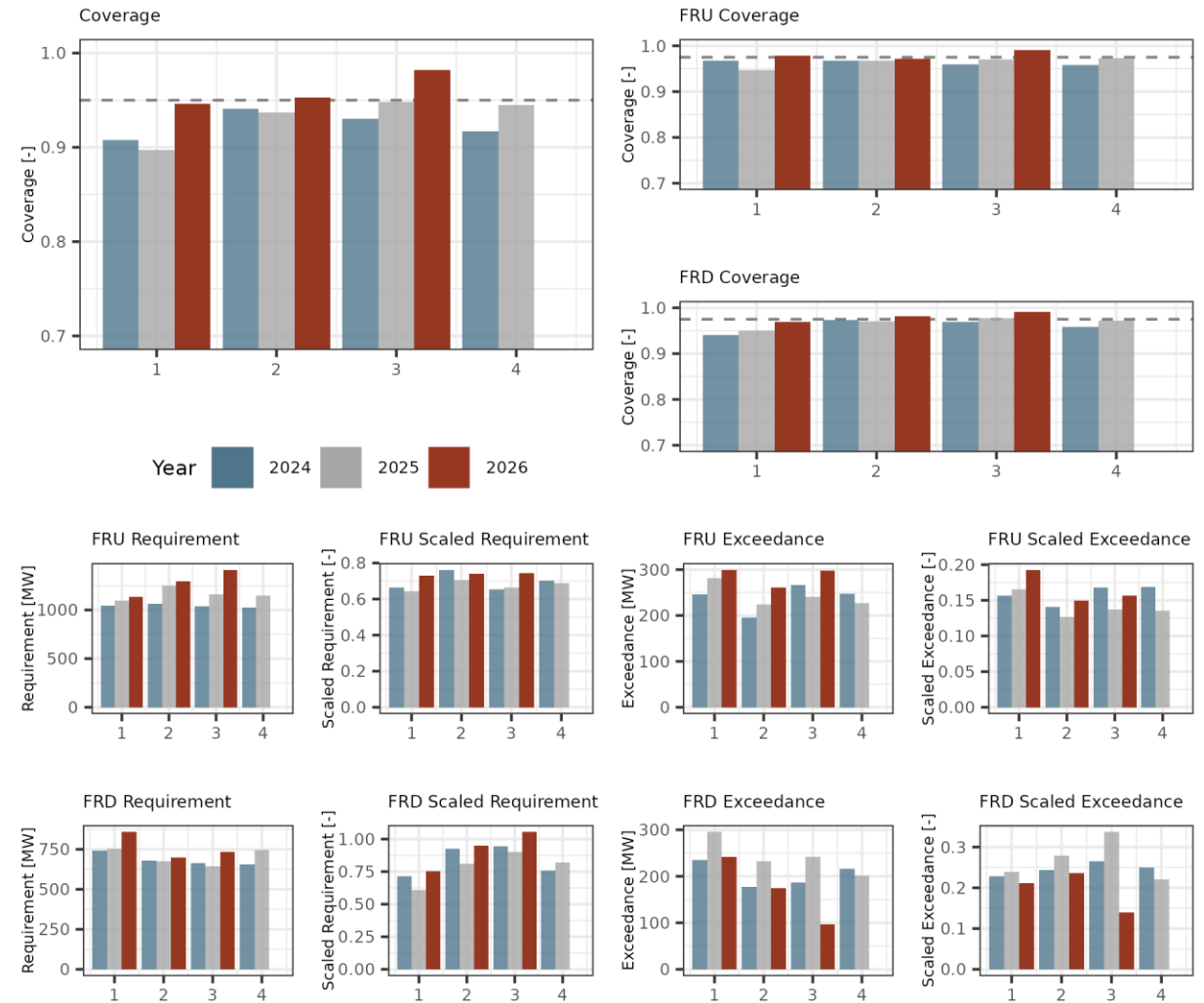


CAISO HASP MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

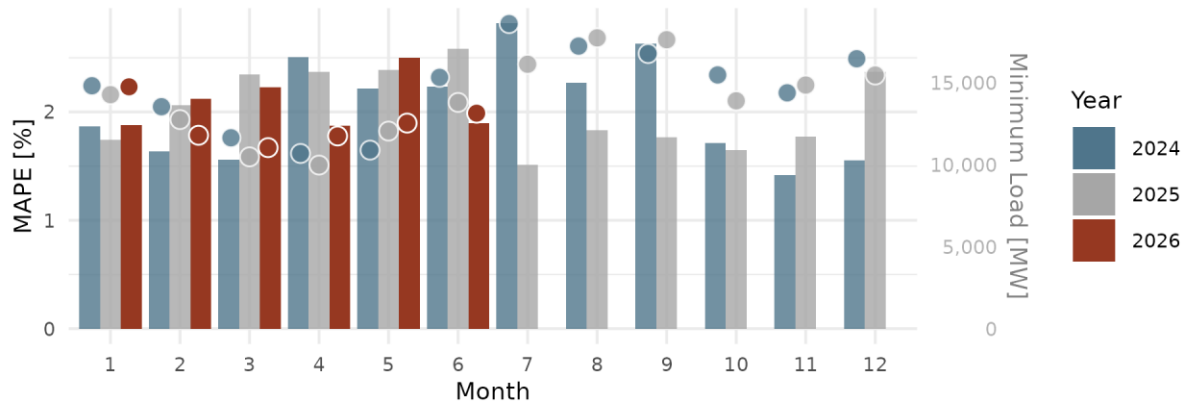
CAISO



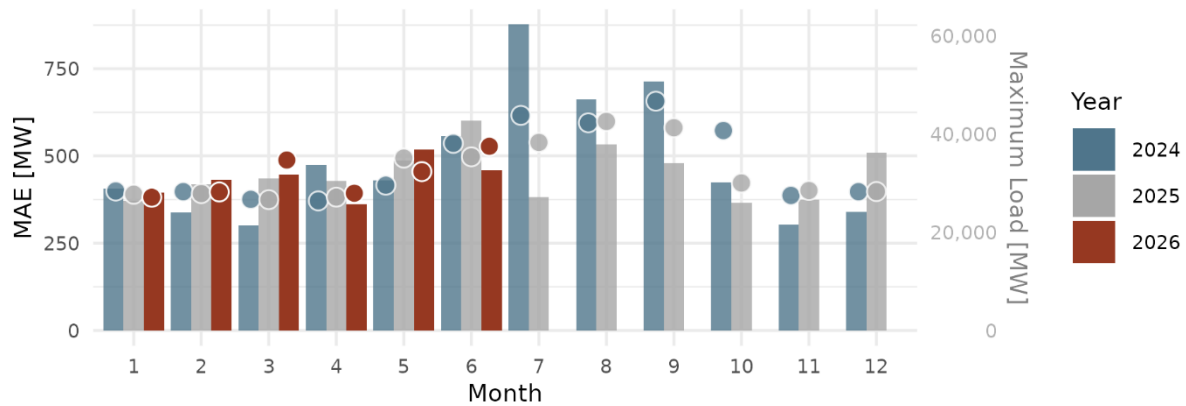
Data current to 2026-07-06. Quarter number on x-axis.

CAISO

CAISO DA MAPE

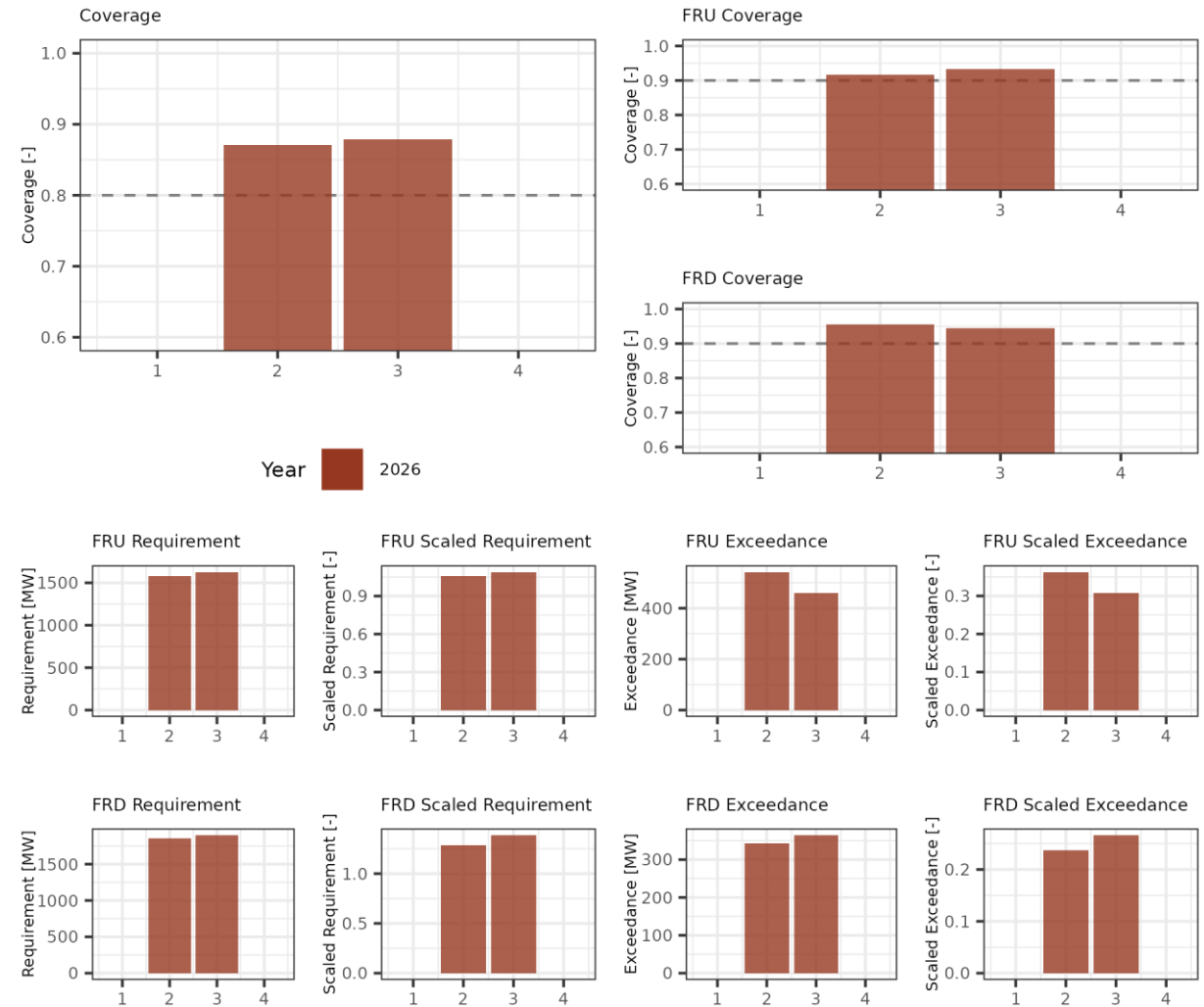


CAISO DA MAE



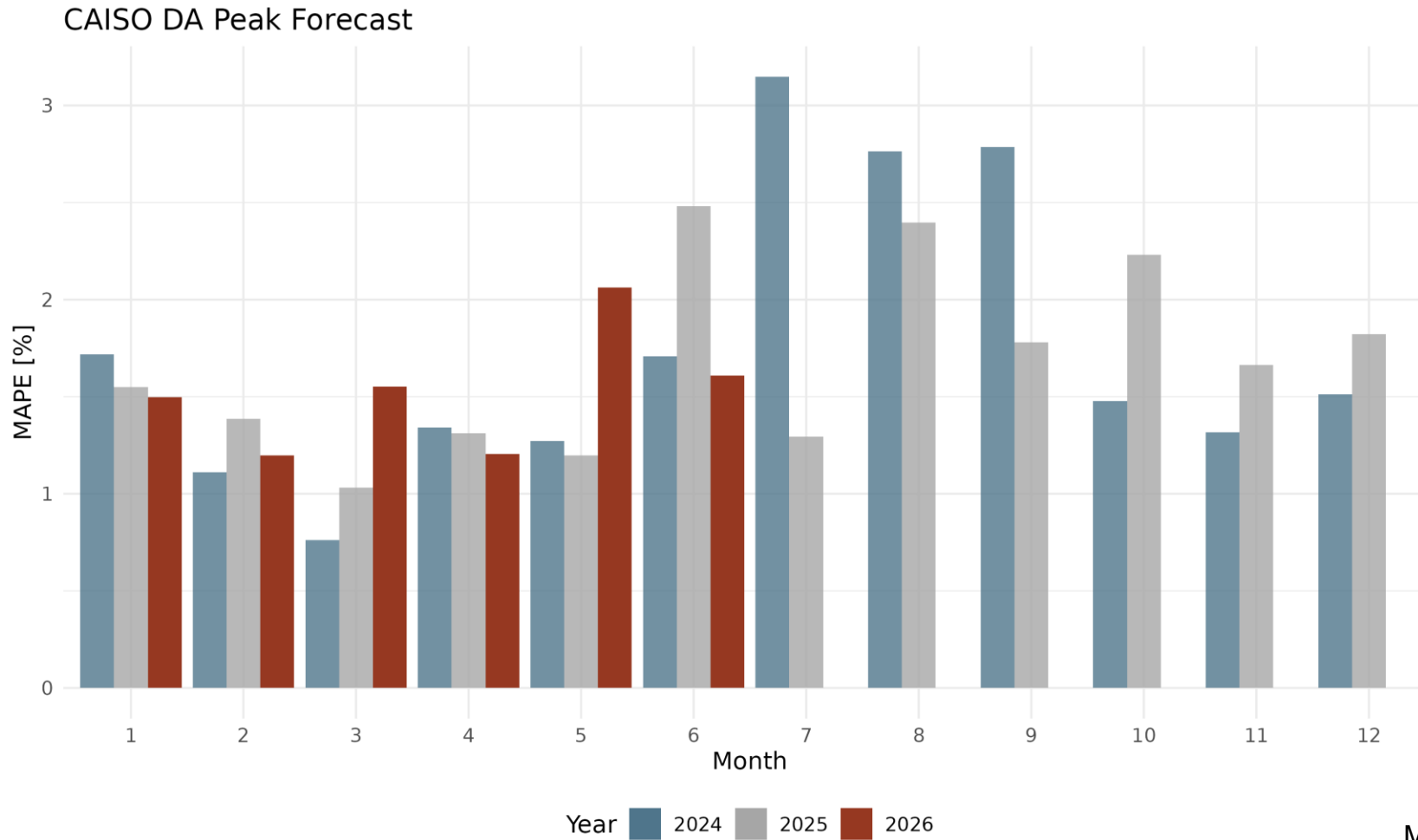
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CAISO



Data current to 2026-07-07. Quarter number on x-axis.

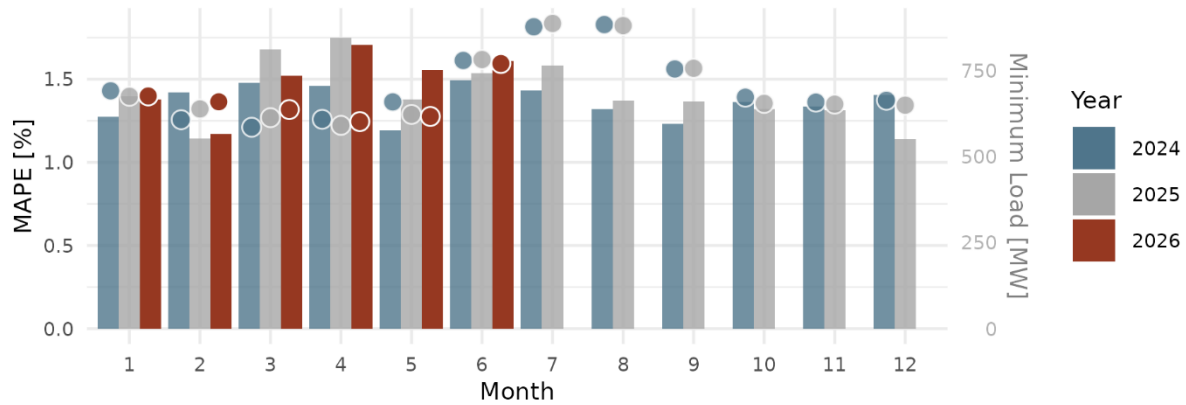
CAISO DA peak



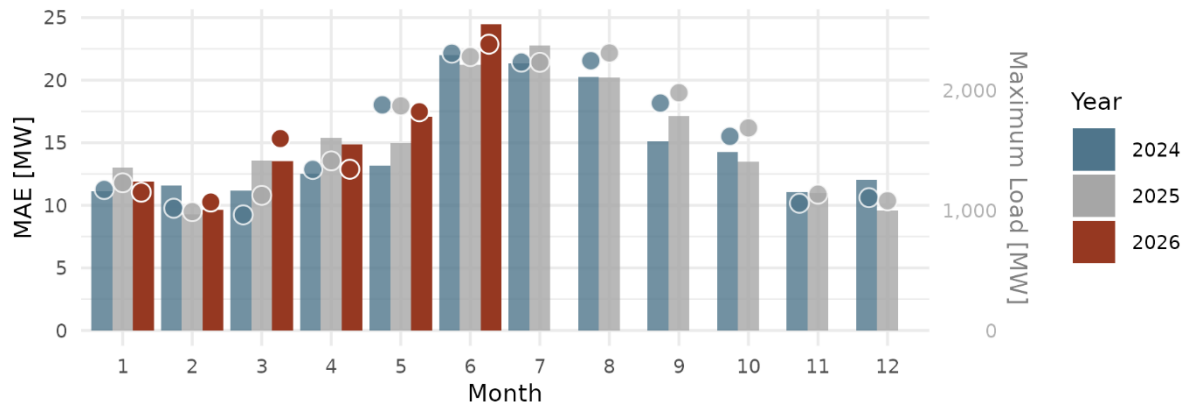
Monthly average DA forecast
MAPE in peak load hour

EPE

EPE T-60 MAPE

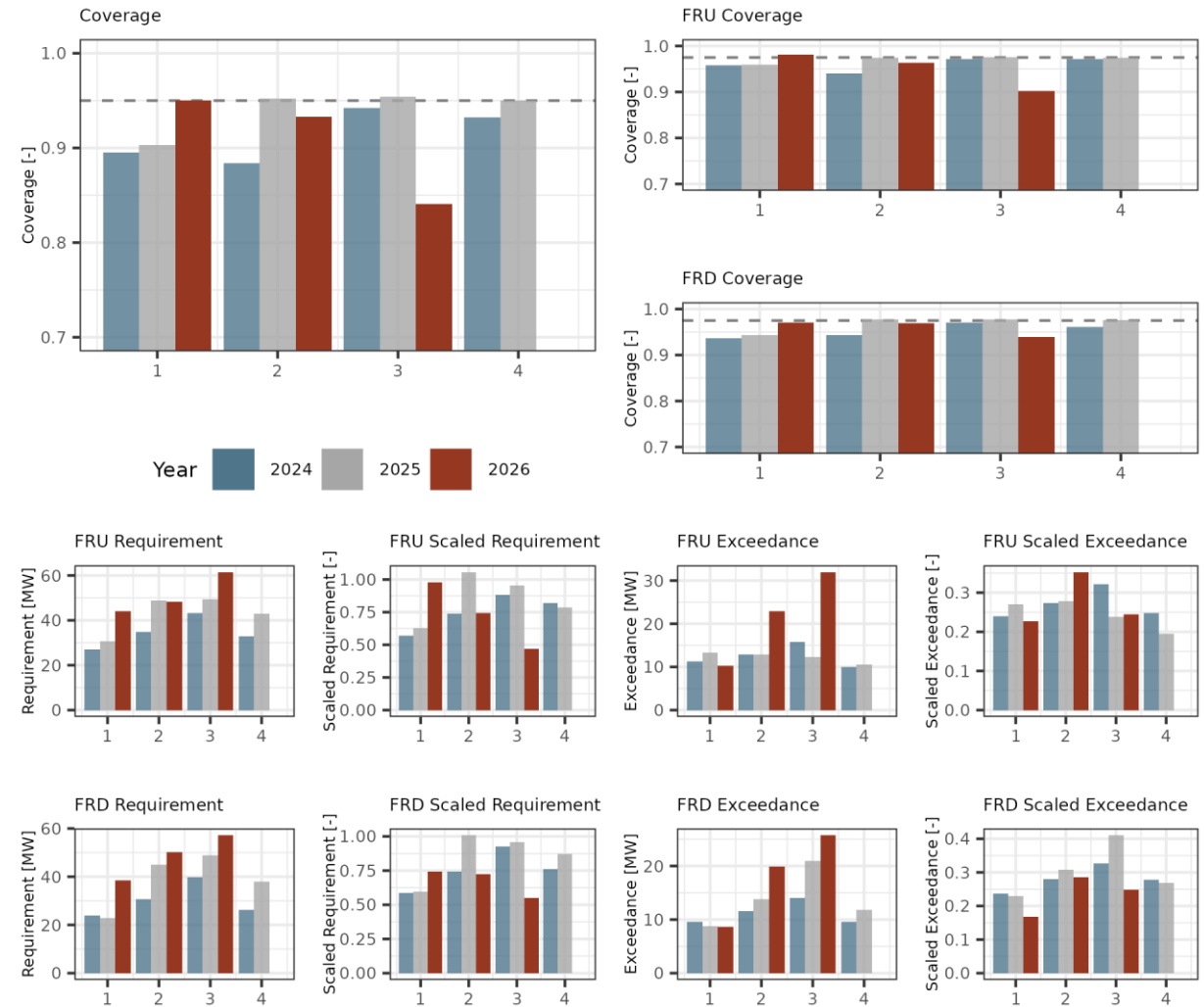


EPE T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

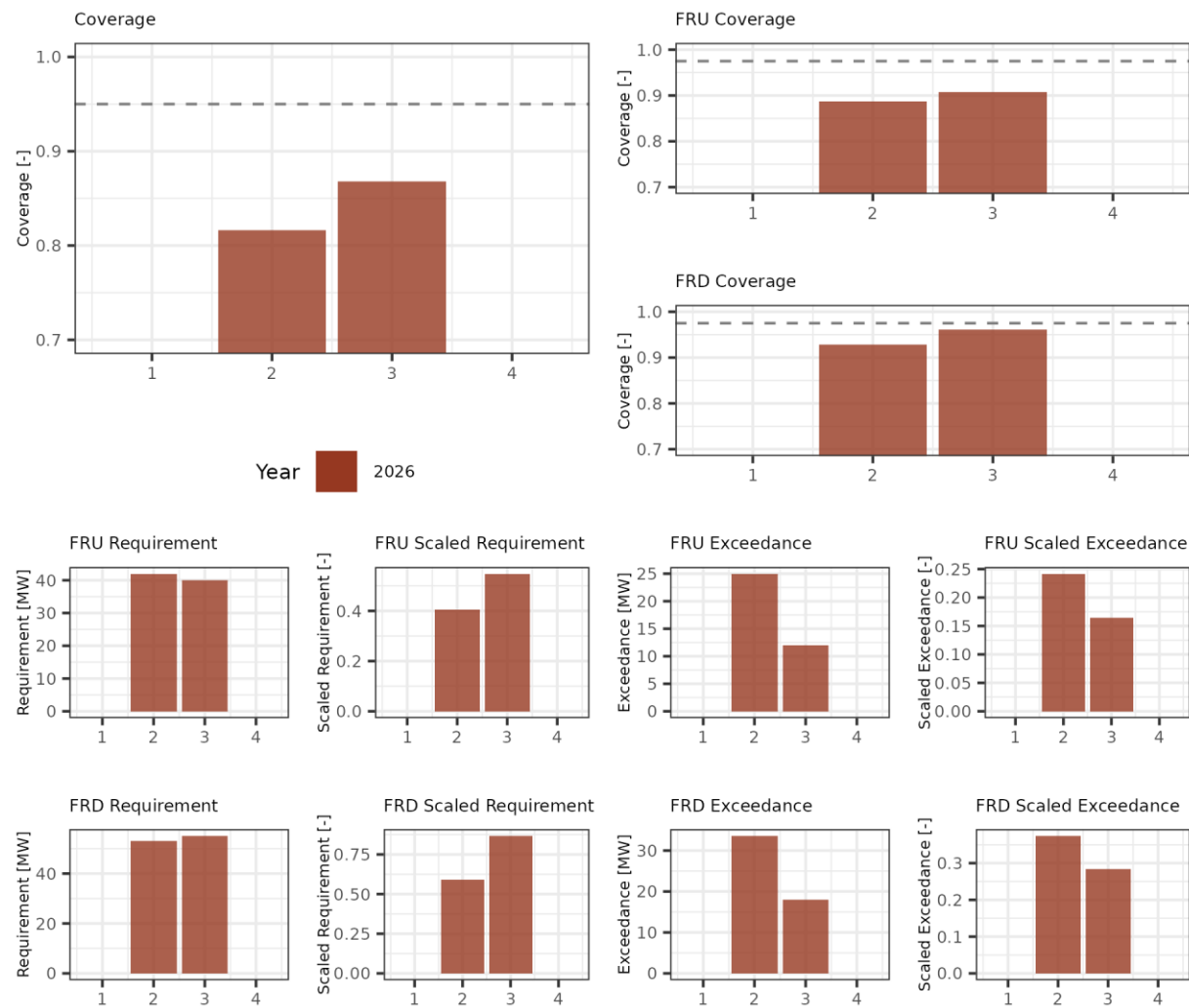
EPE



Data current to 2026-07-06. Quarter number on x-axis.

GWA

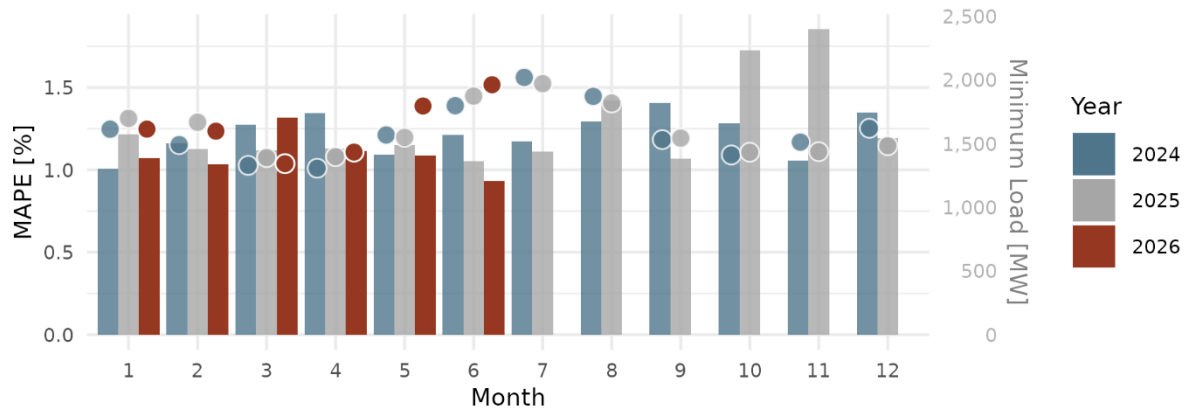
GWA



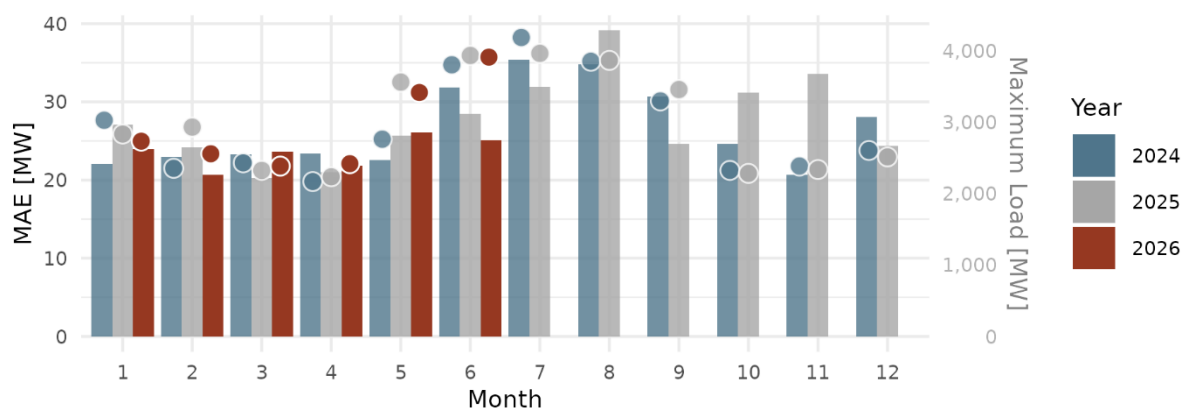
Data current to 2026-07-09. Quarter number on x-axis.

IPCO

IPCO T-60 MAPE

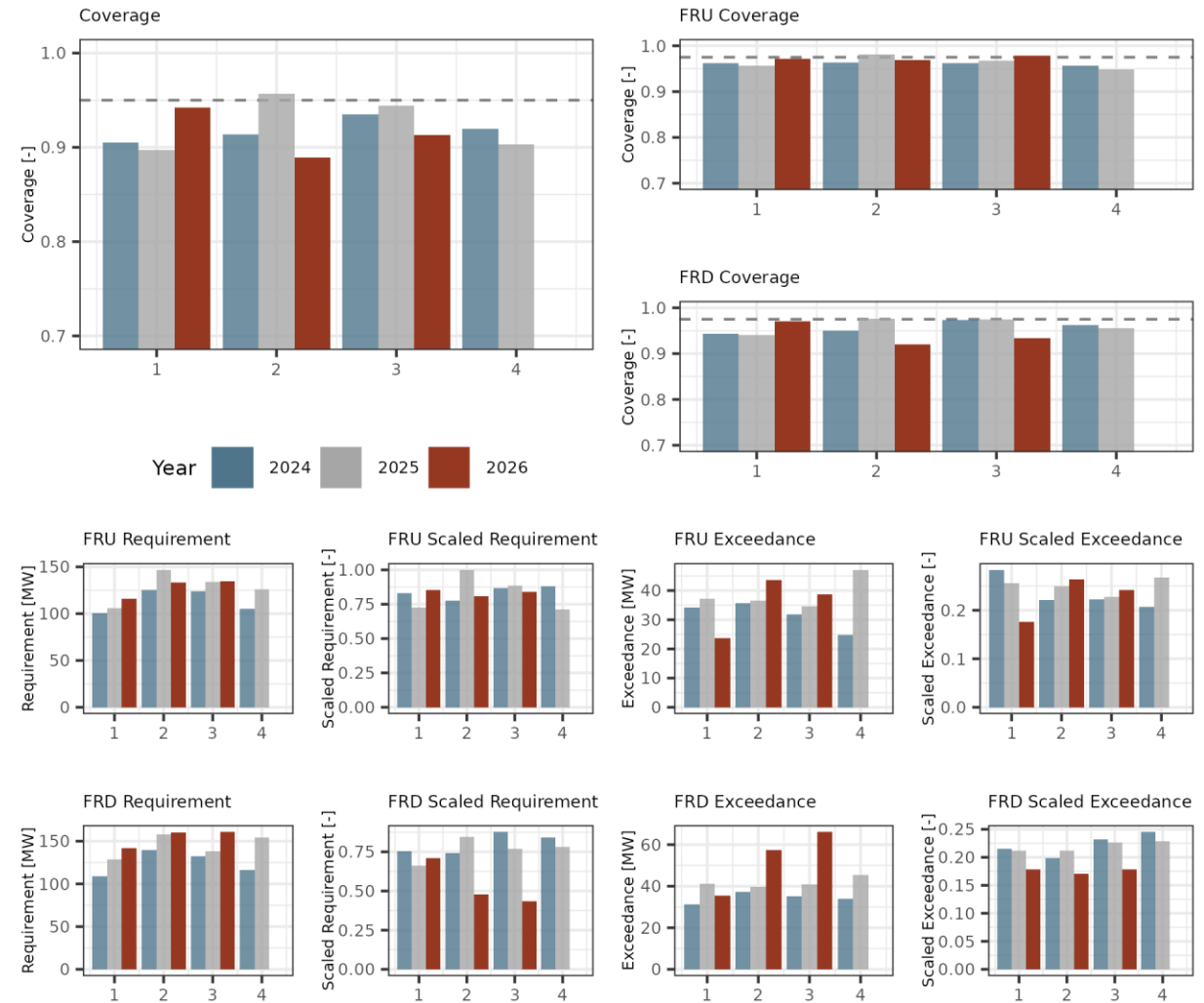


IPCO T-60 MAE



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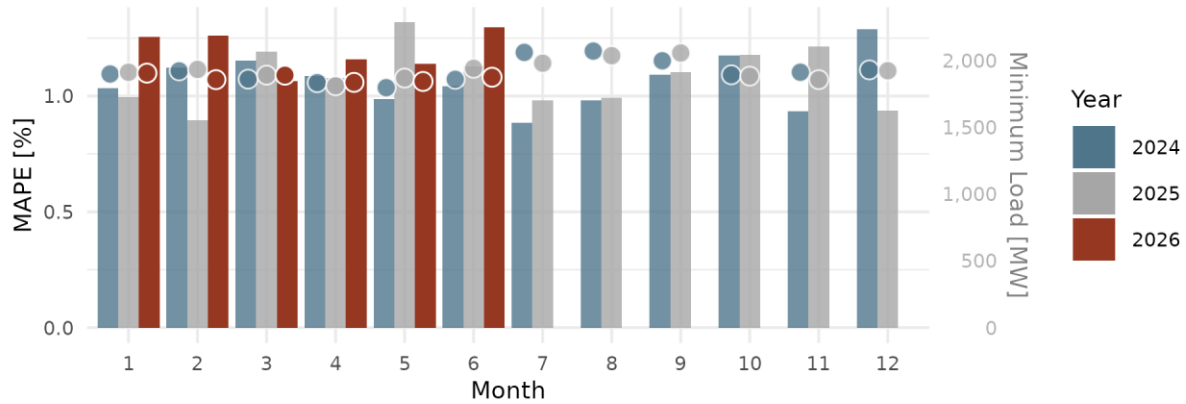
IPCO



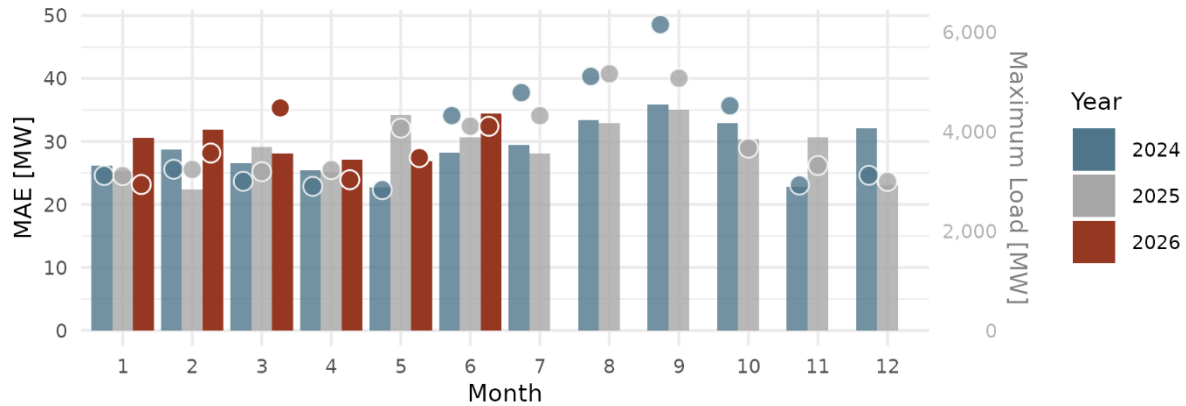
Data current to 2026-07-06. Quarter number on x-axis.

LADWP

LADWP T-60 MAPE

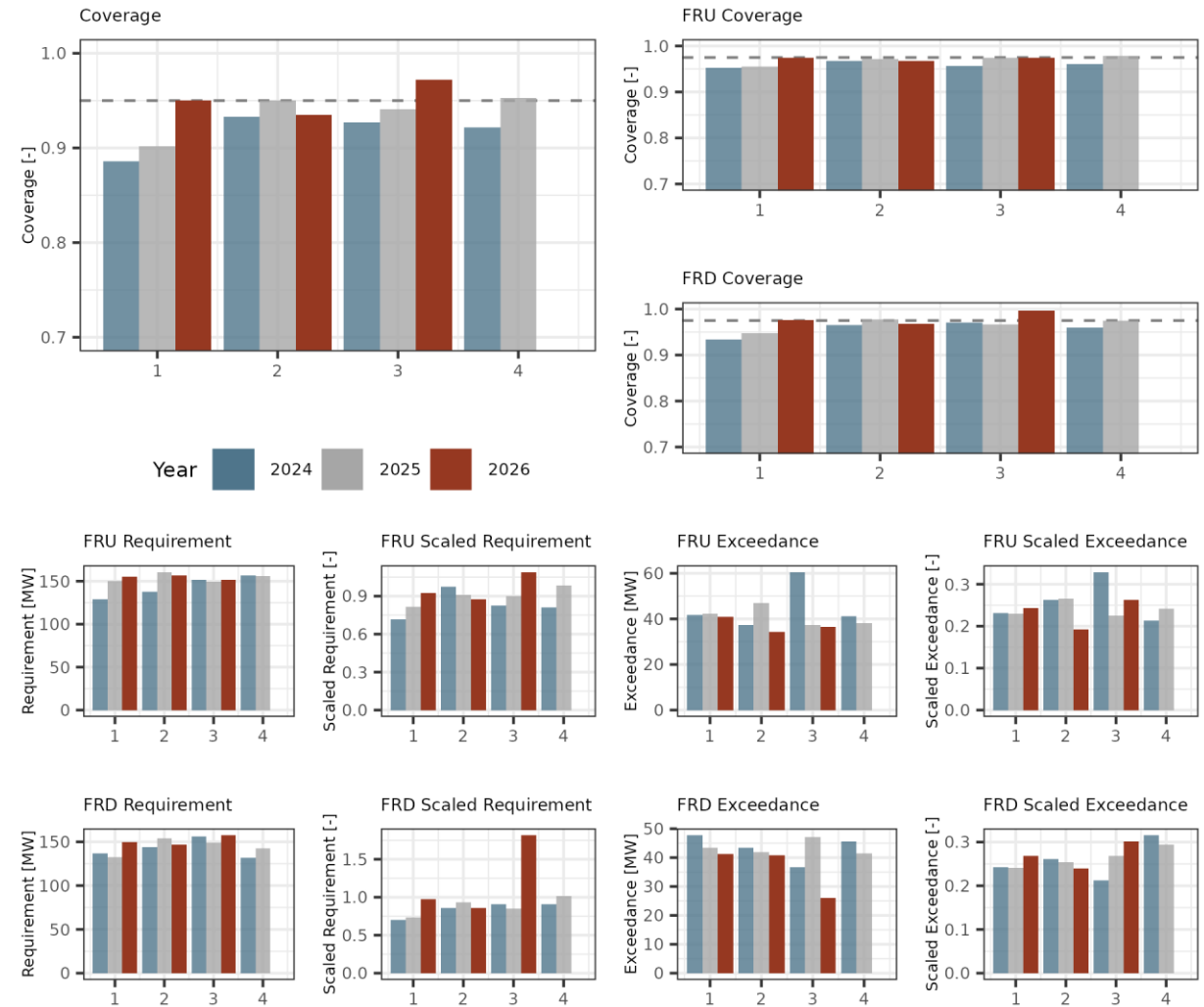


LADWP T-60 MAE



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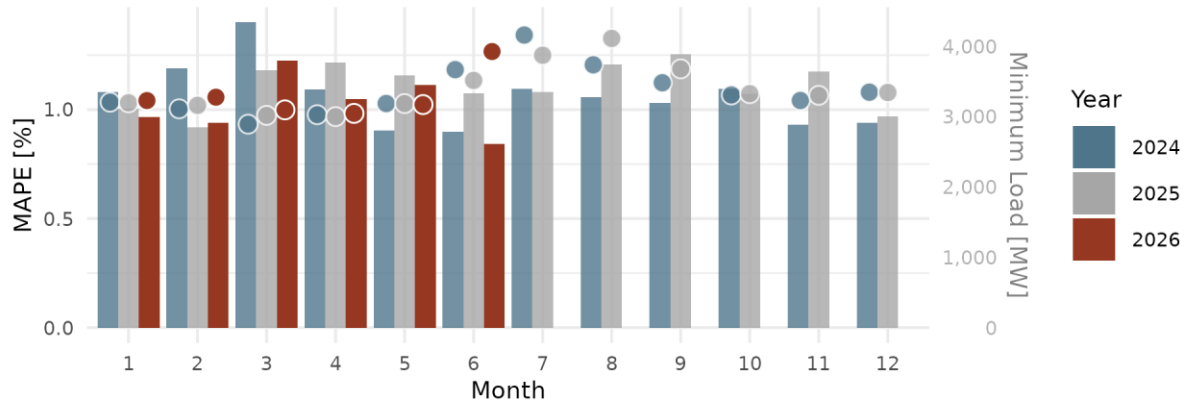
LADWP



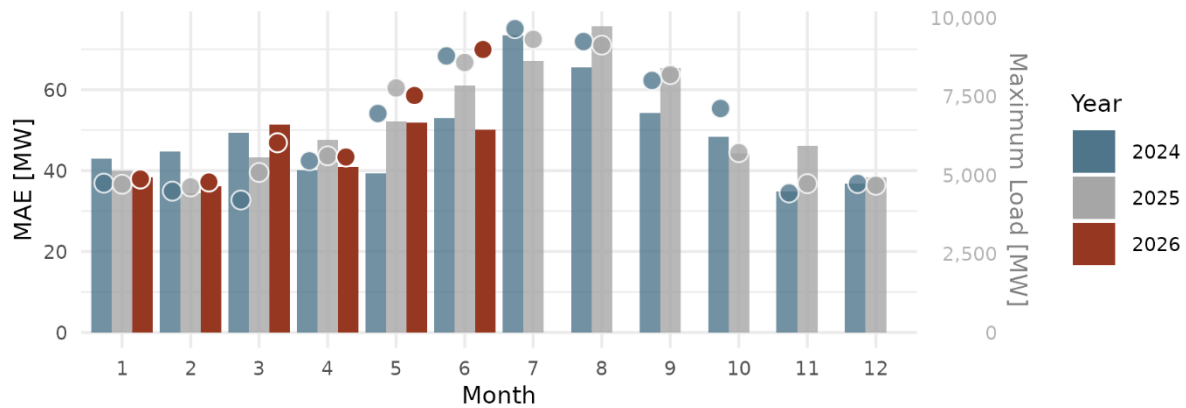
Data current to 2026-07-06. Quarter number on x-axis.

NVE

NVE T-60 MAPE

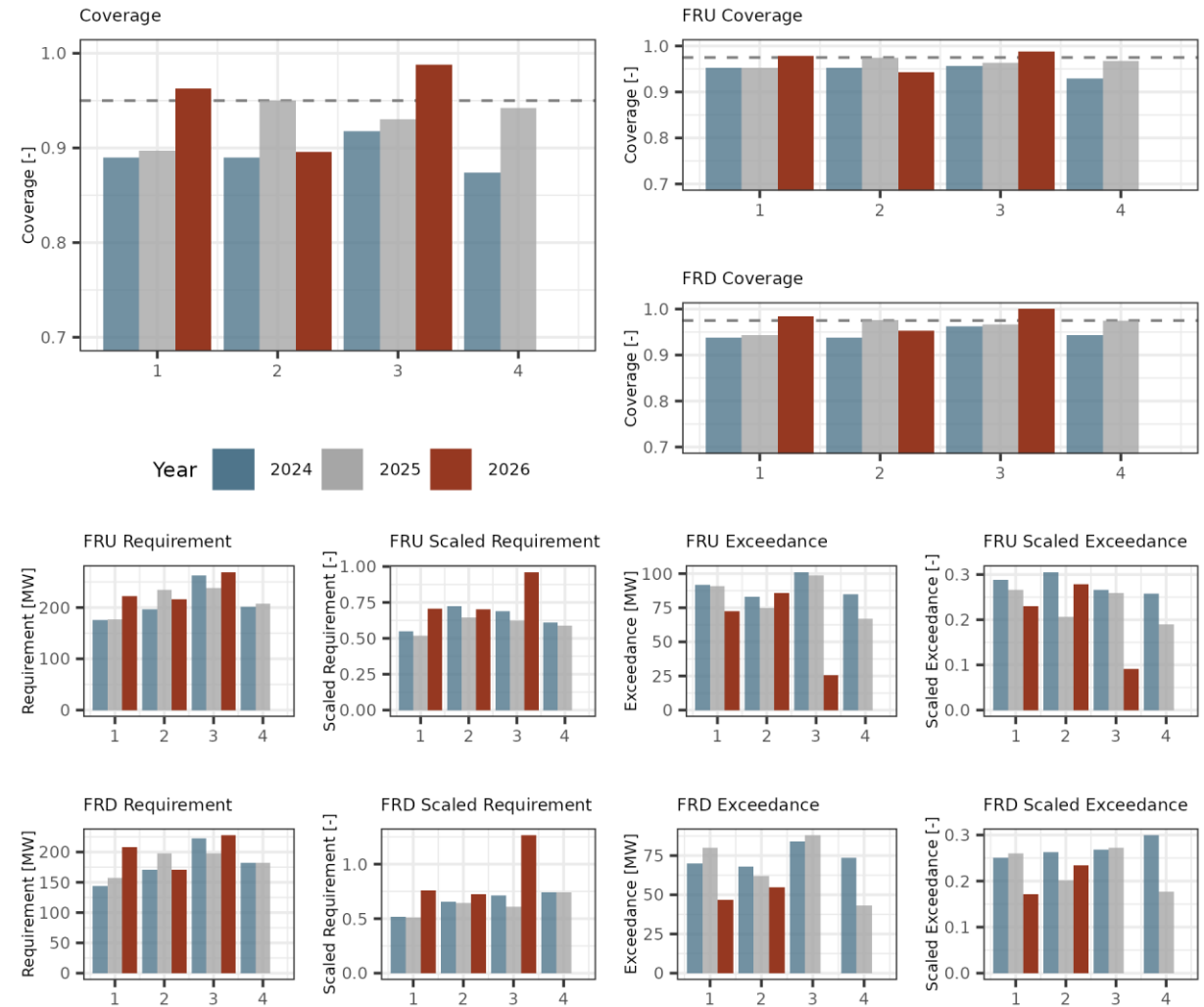


NVE T-60 MAE



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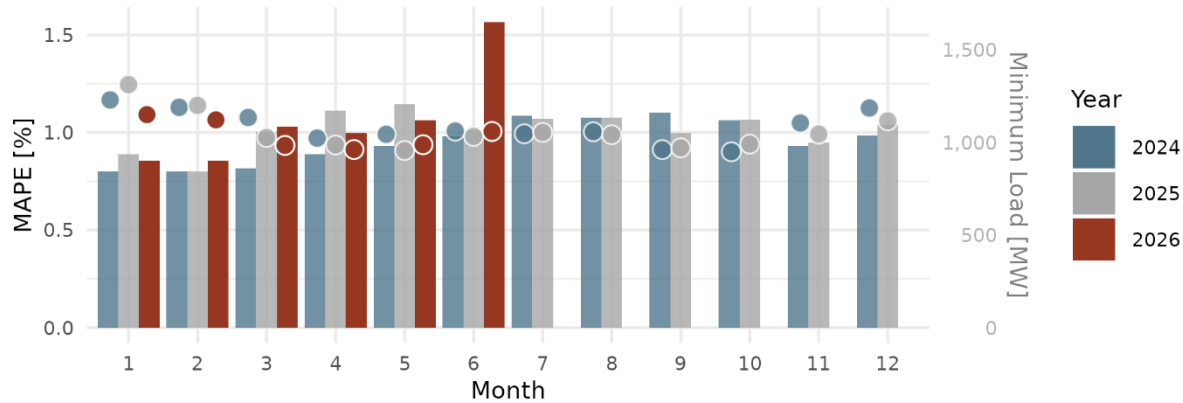
NVE



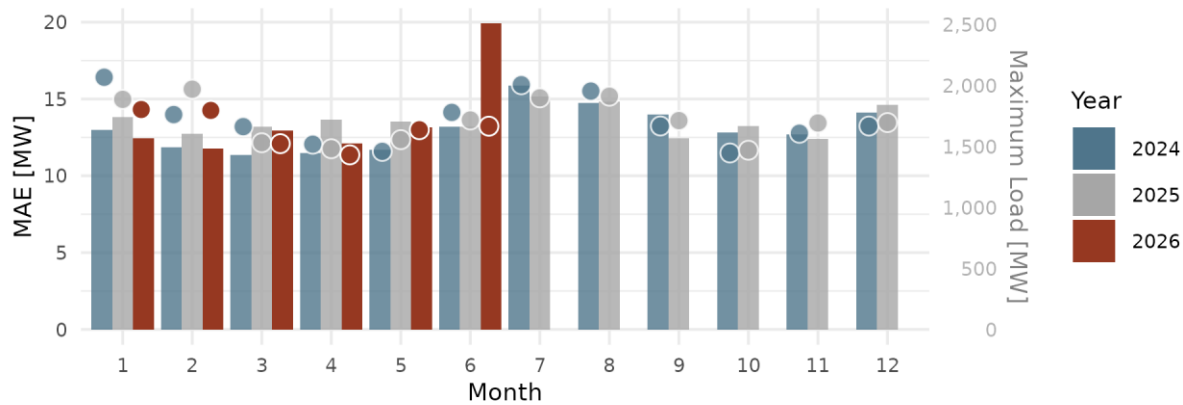
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NWMT

NWMT T-60 MAPE



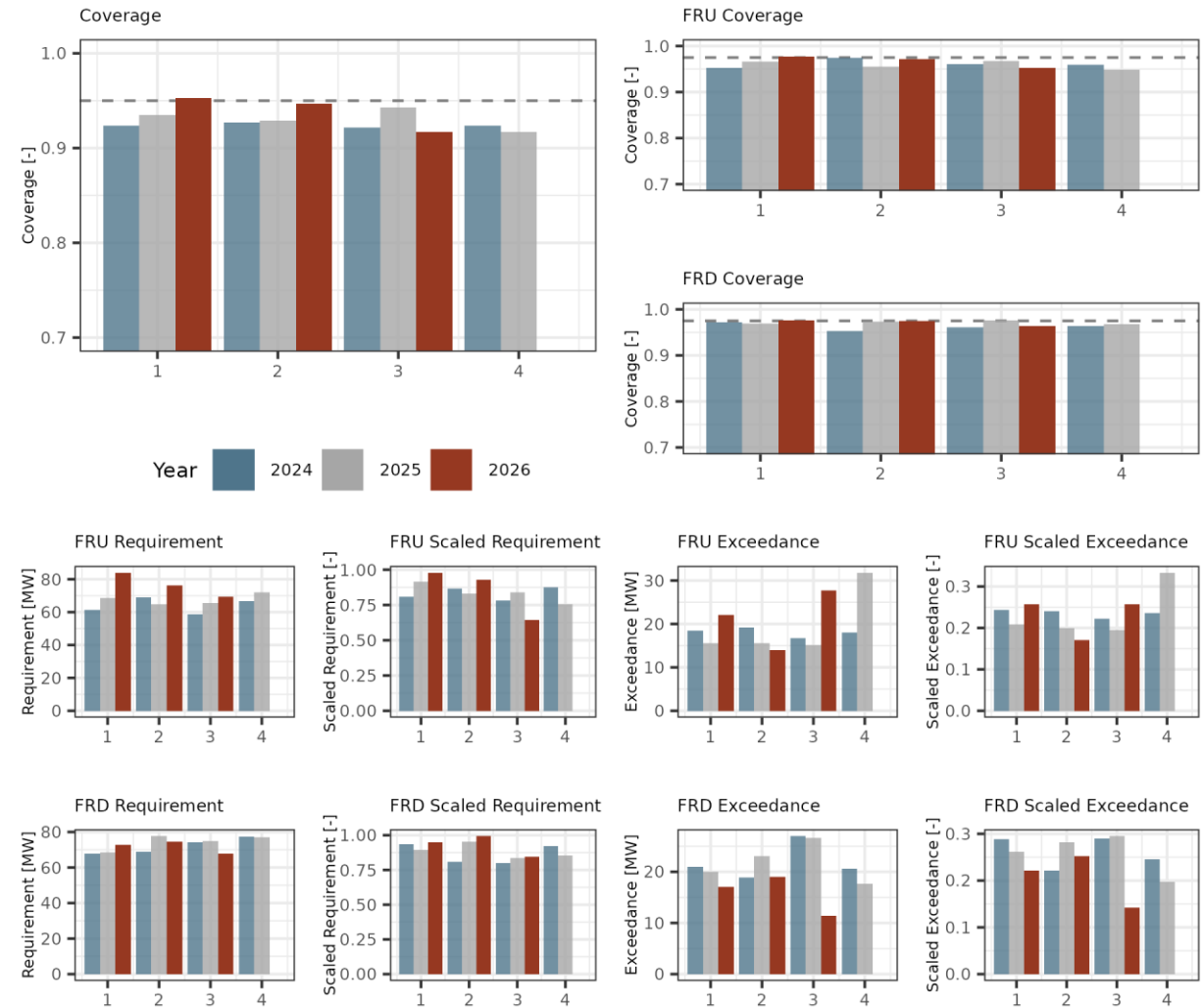
NWMT T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

STF is actively reviewing demand forecast performance. July metrics are trending higher than previous years as well.

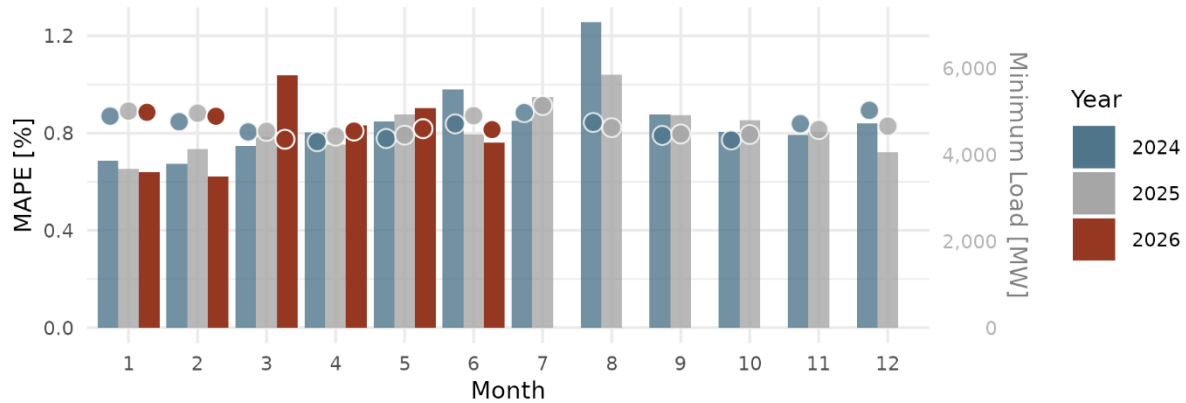
NWMT



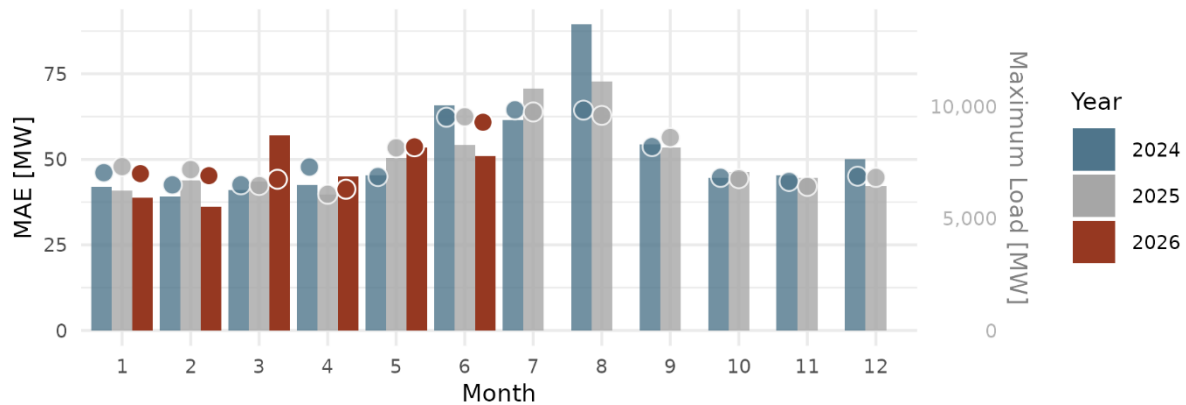
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PACE

PACE T-60 MAPE

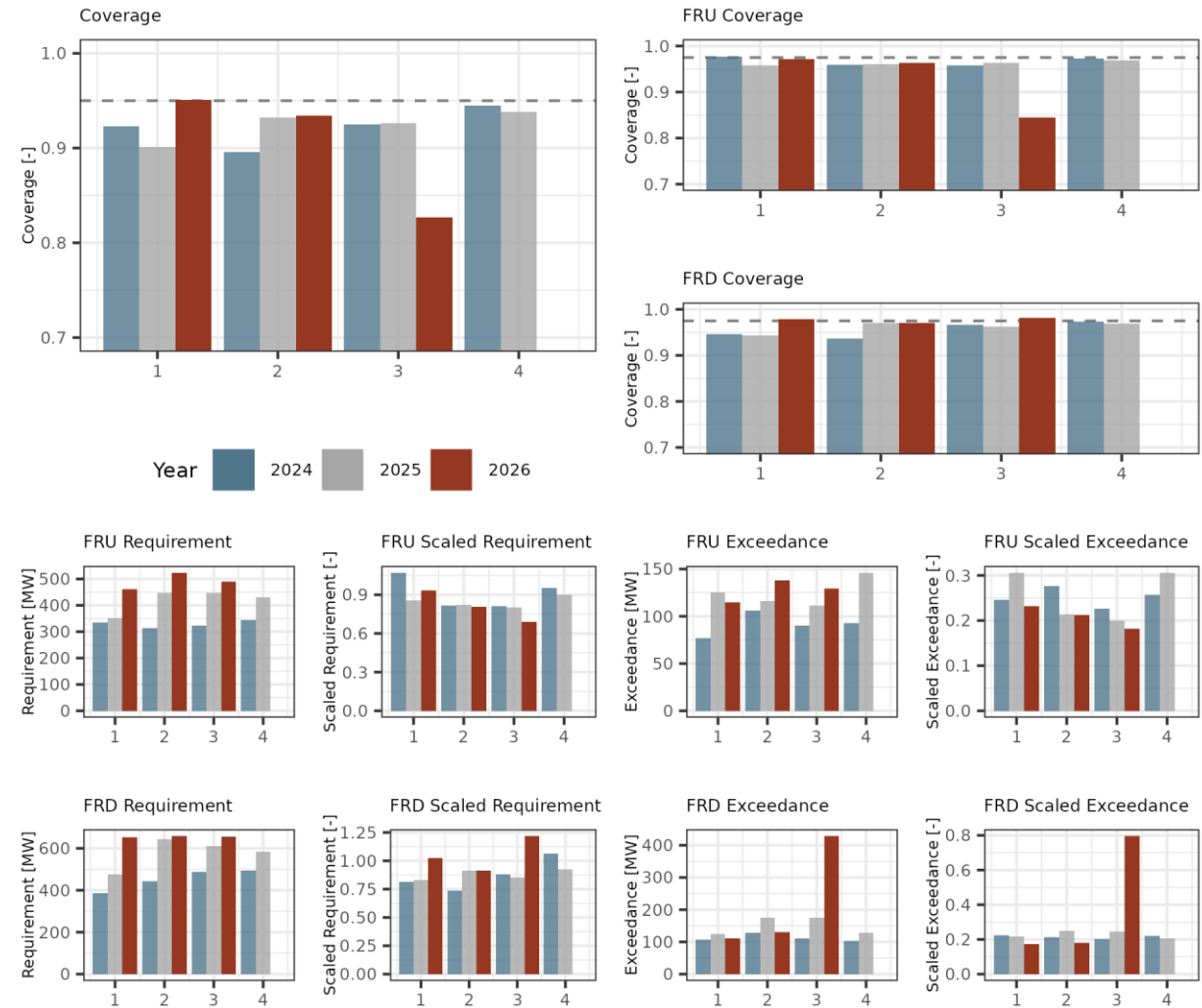


PACE T-60 MAE



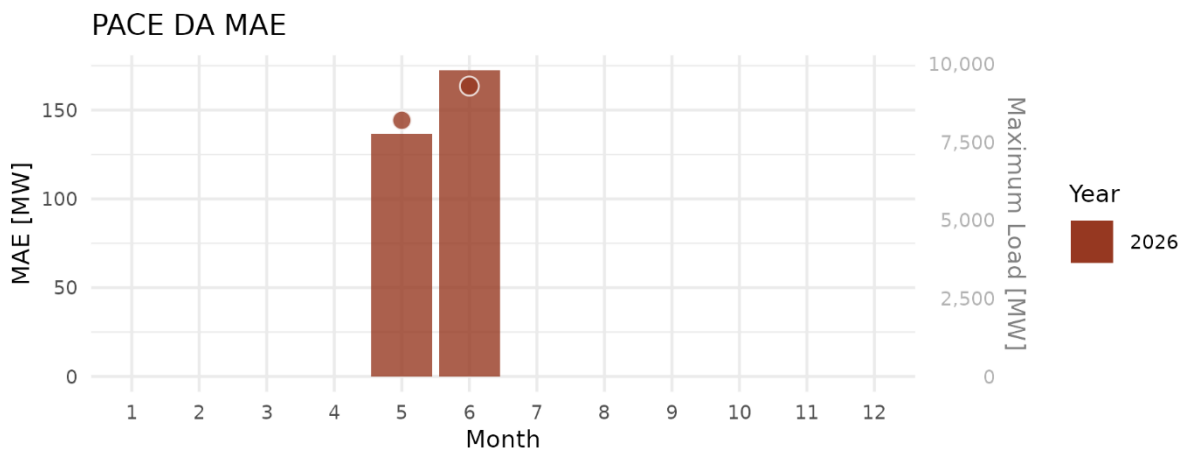
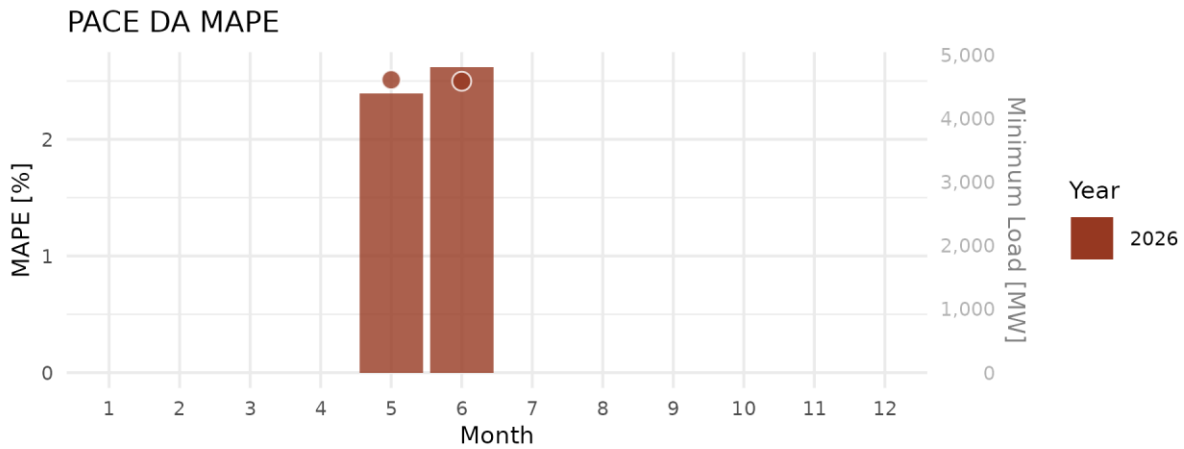
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PACE

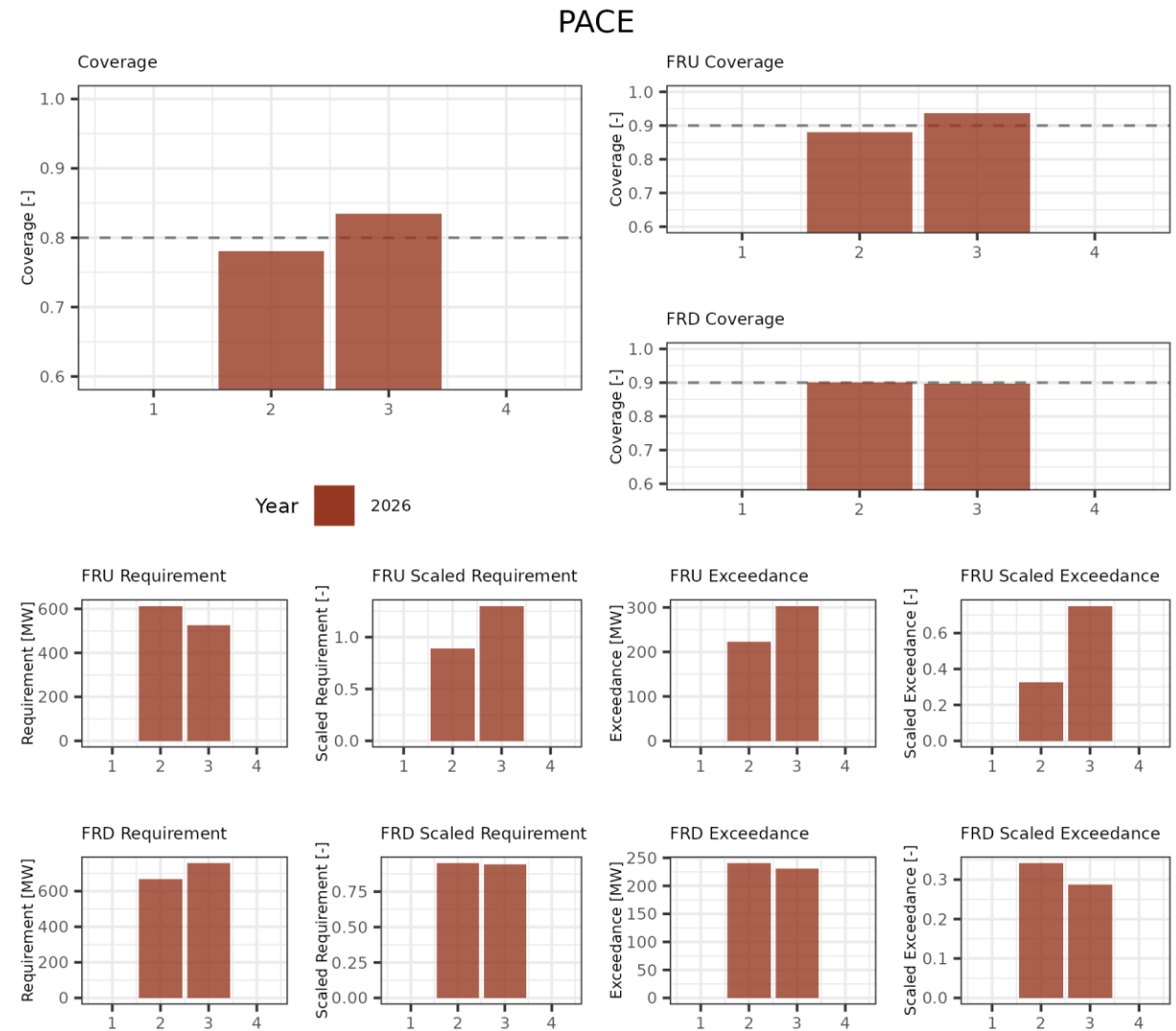


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PACE

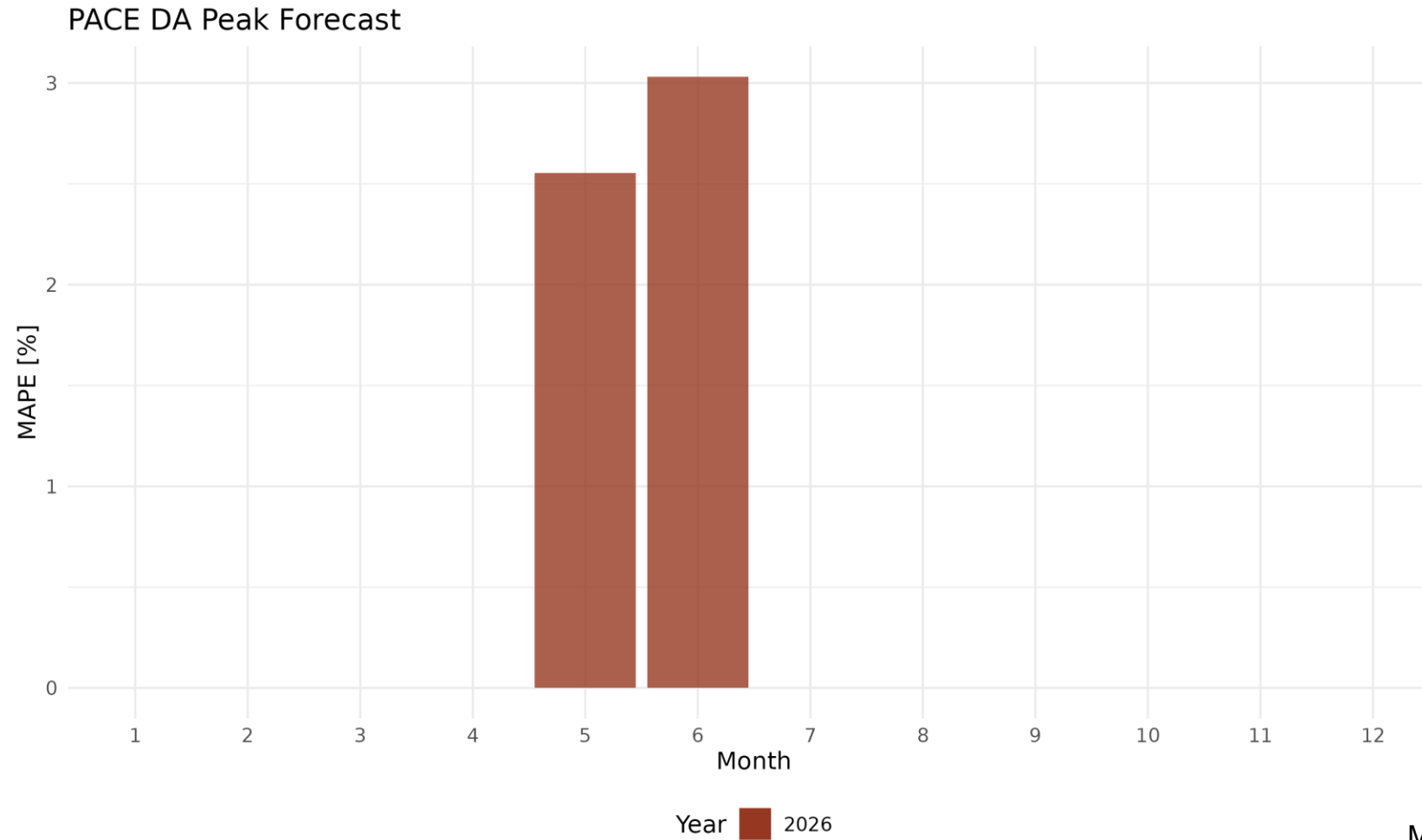


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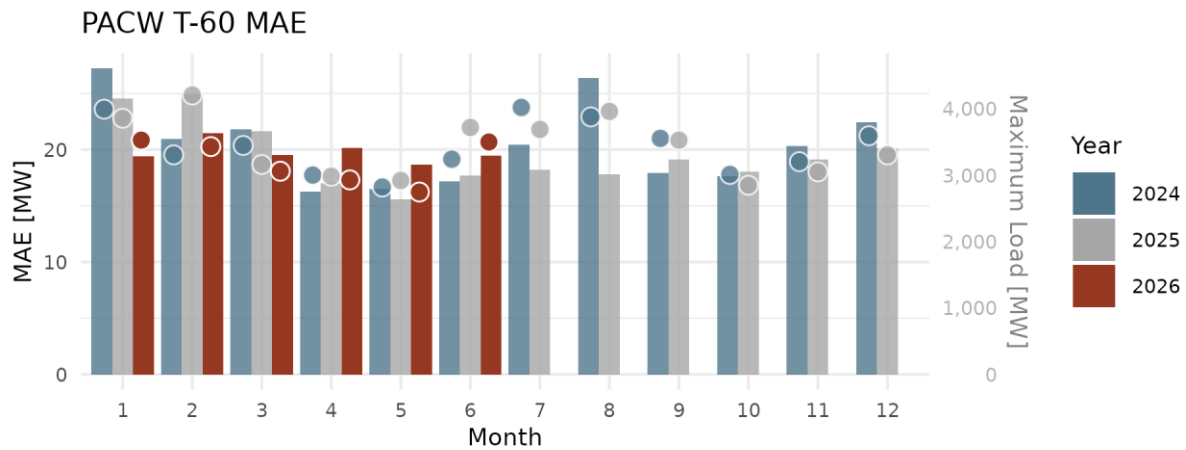
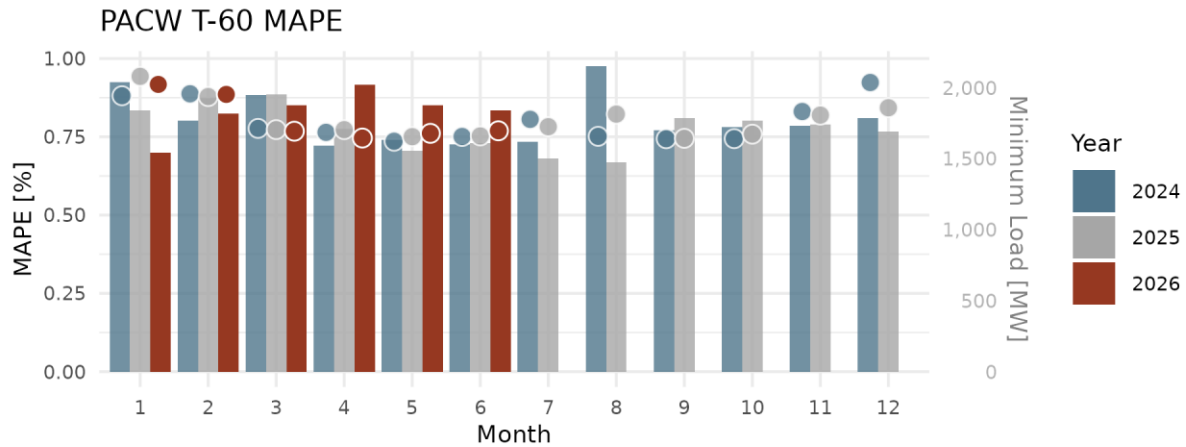
Data current to 2026-07-07. Quarter number on x-axis.

PACE DA peak



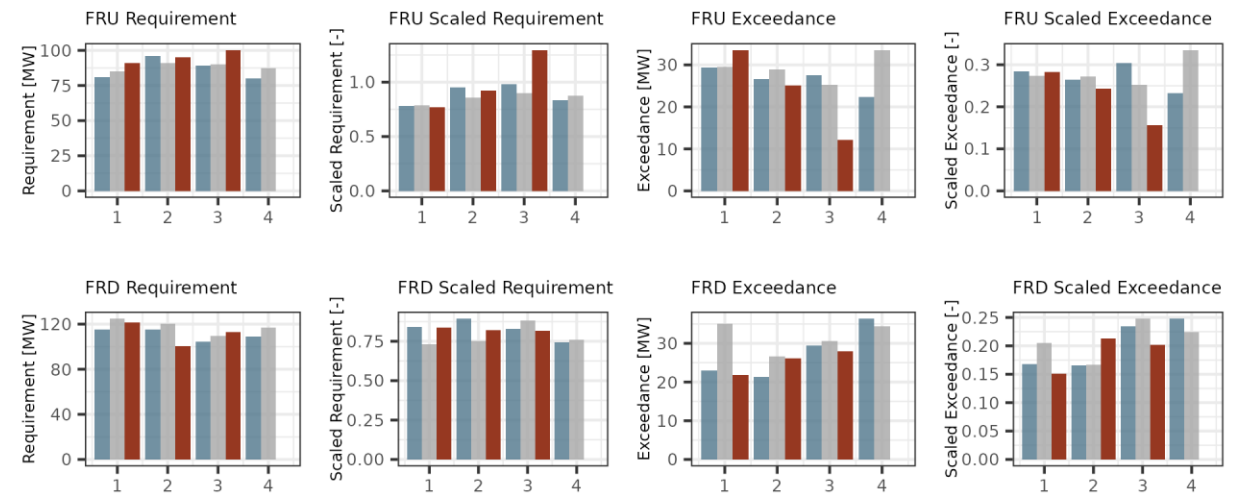
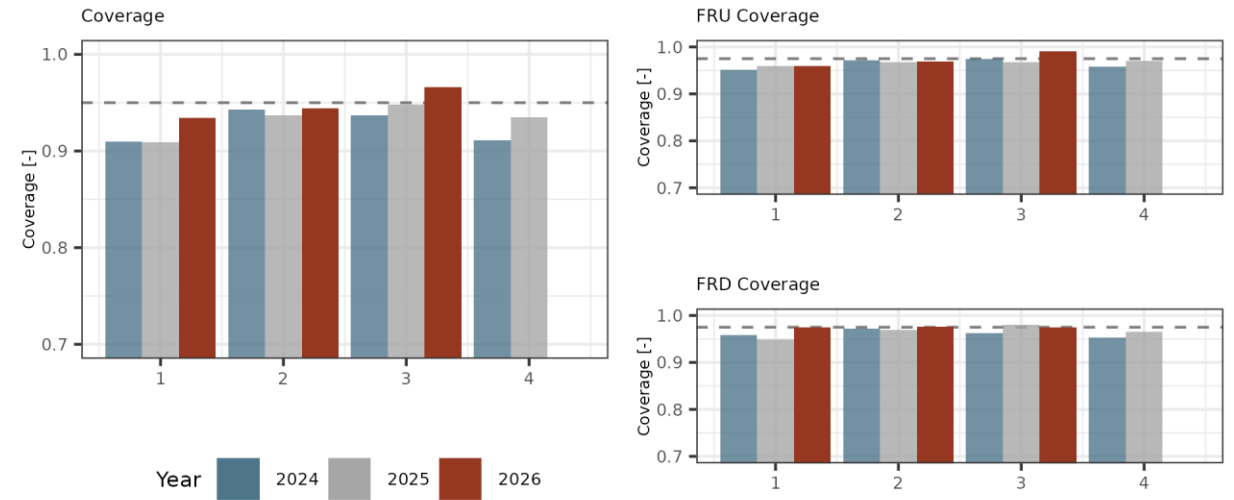
Monthly average DA forecast
MAPE in peak load hour

PACW



Bars use primary y-axis at left. Points use secondary y-axis at right.

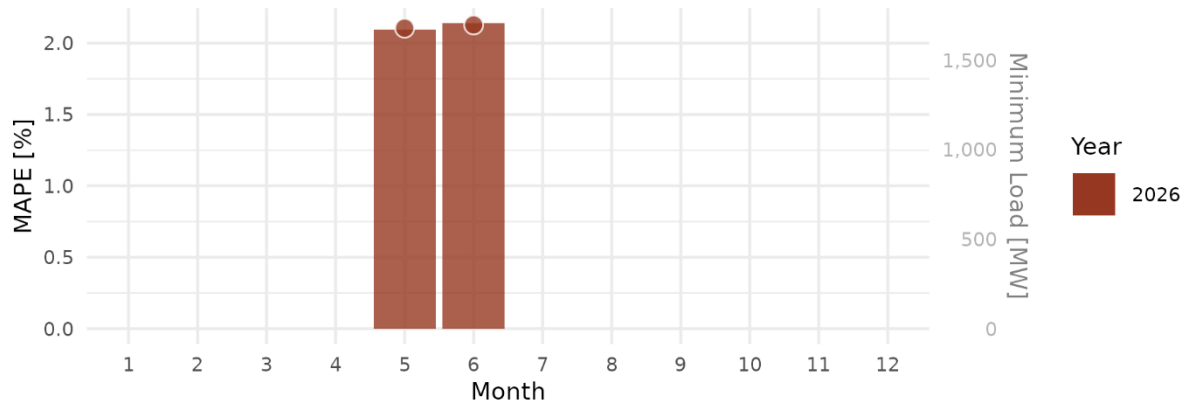
PACW



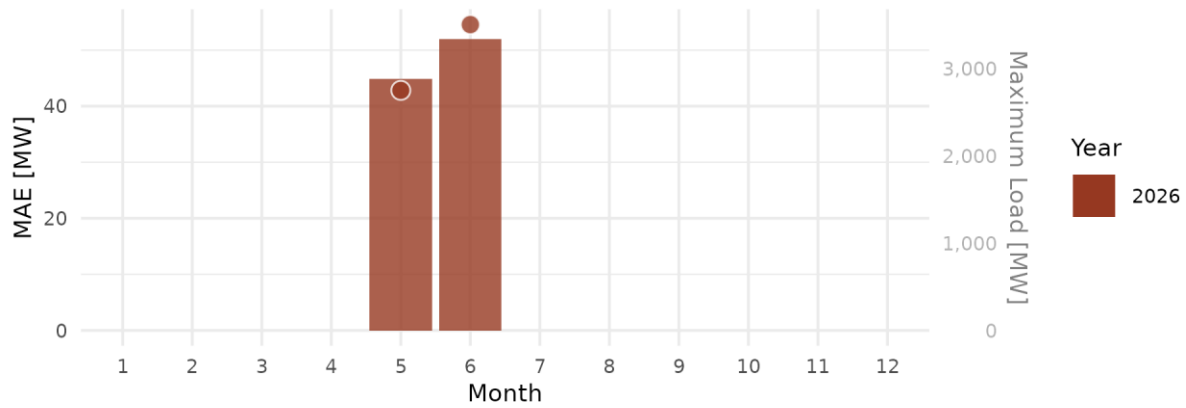
Data current to 2026-07-06. Quarter number on x-axis.

PACW

PACW DA MAPE

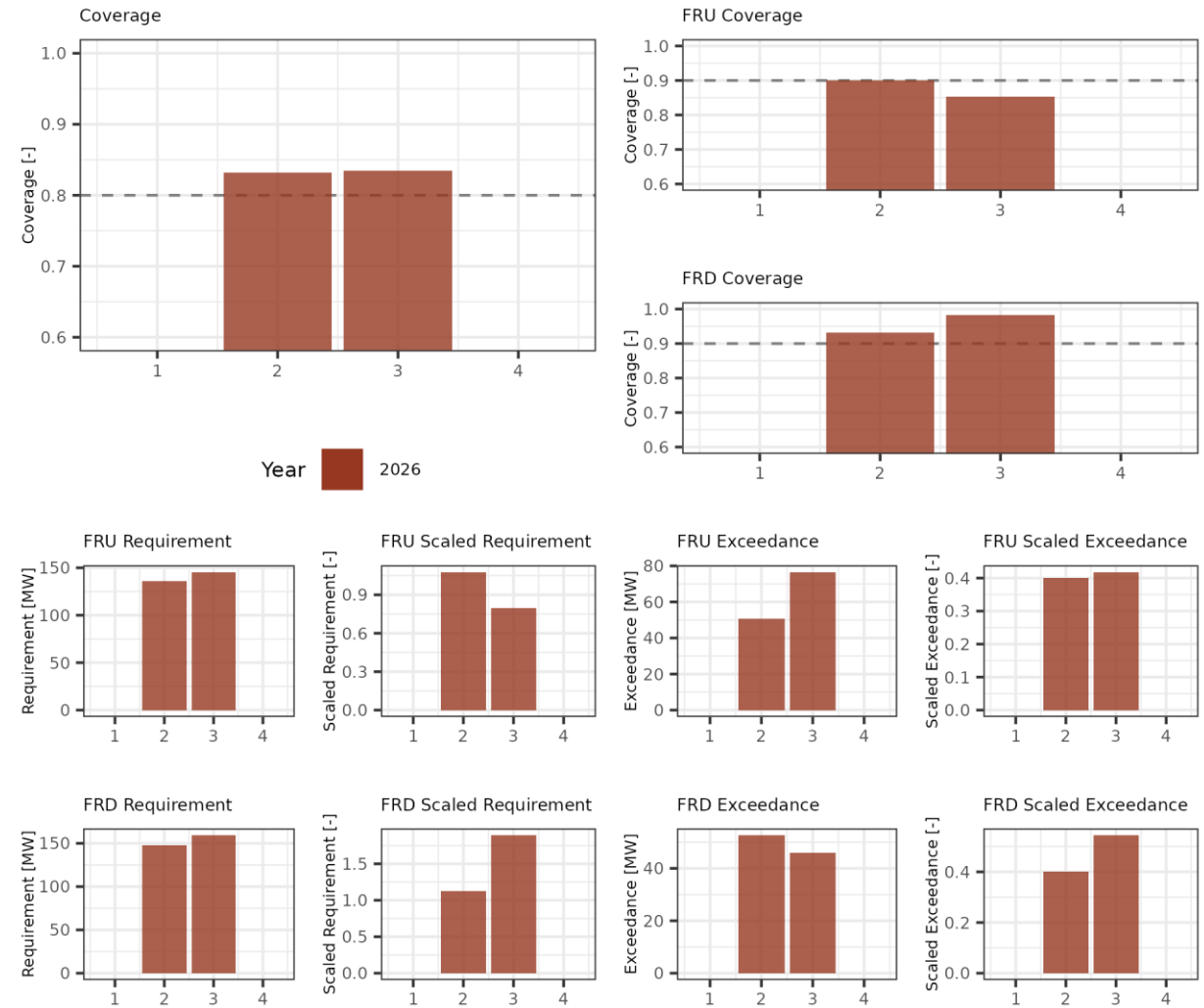


PACW DA MAE



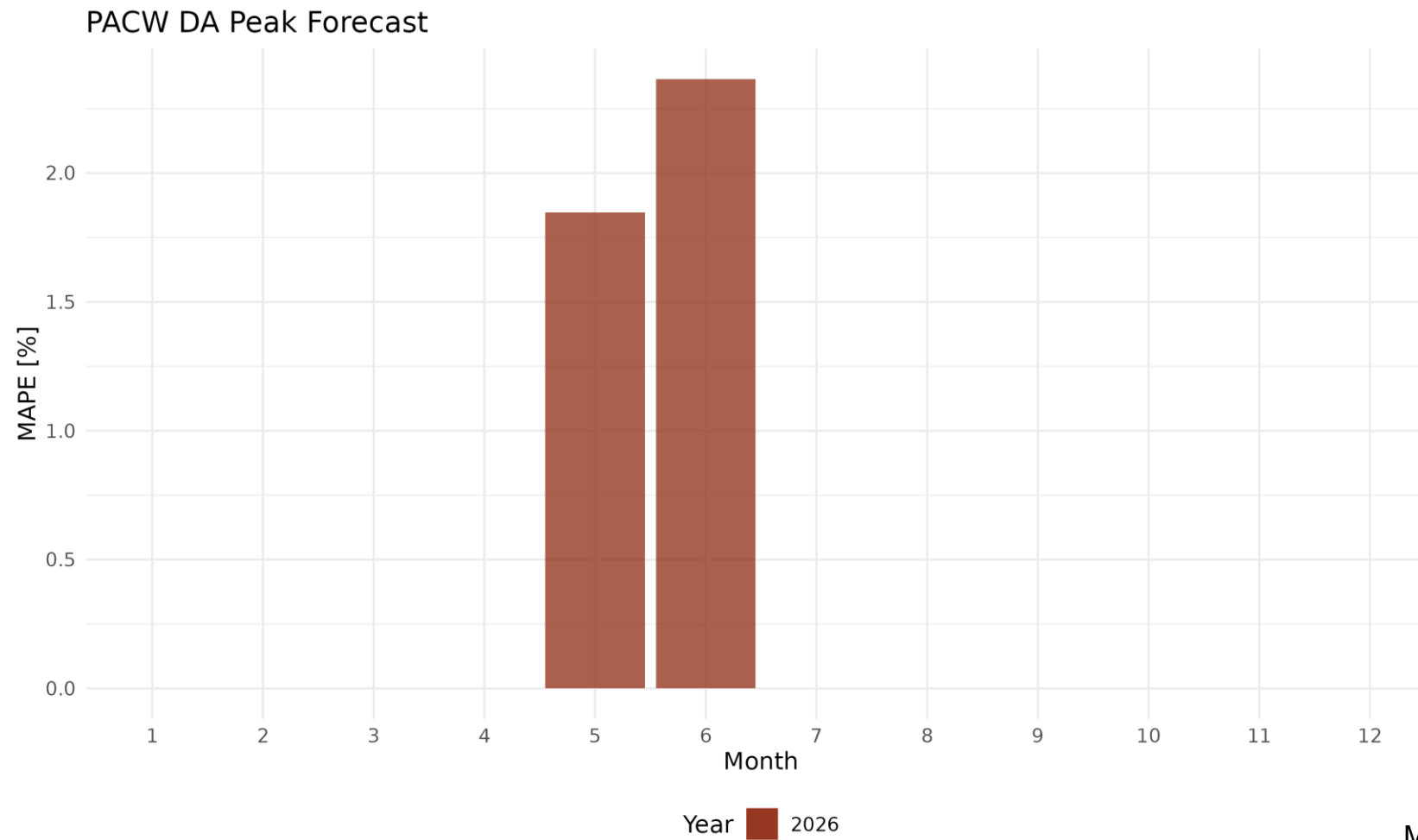
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PACW



Data current to 2026-07-07. Quarter number on x-axis.

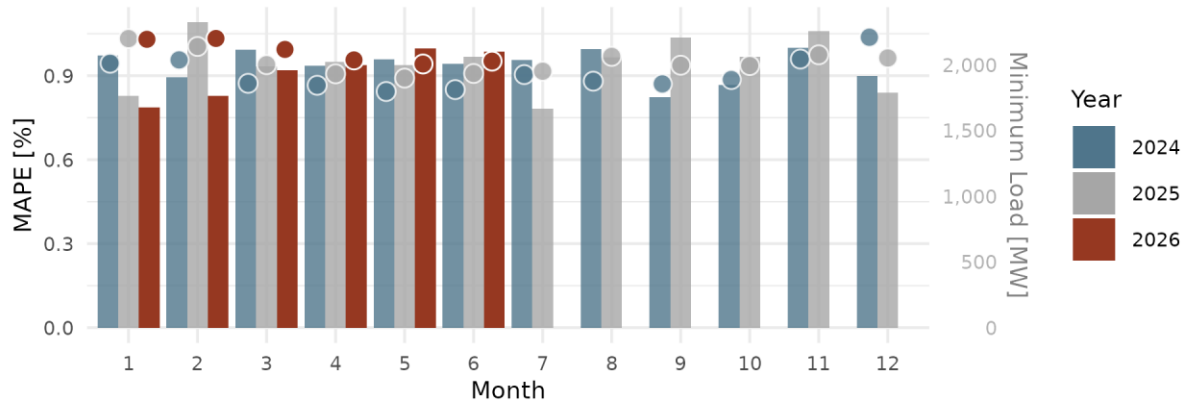
PACW



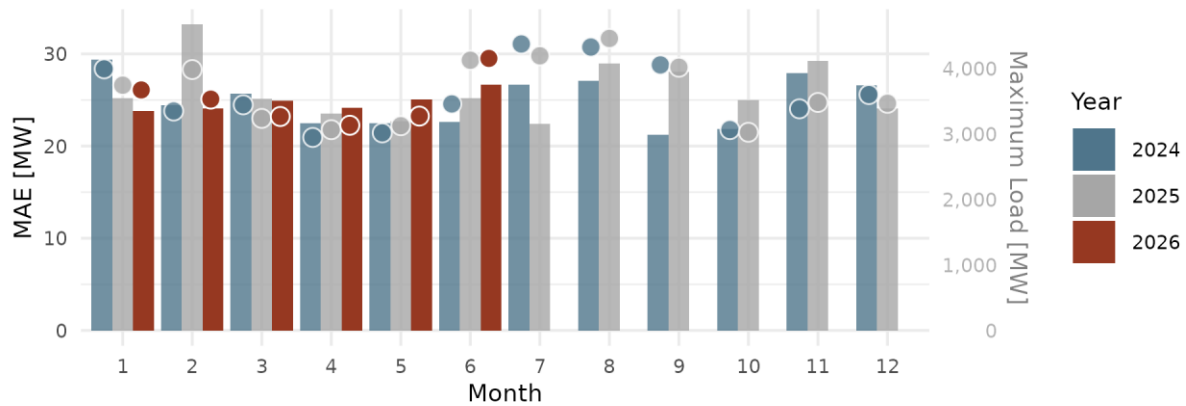
Monthly average DA forecast
MAPE in peak load hour

PGE

PGE T-60 MAPE

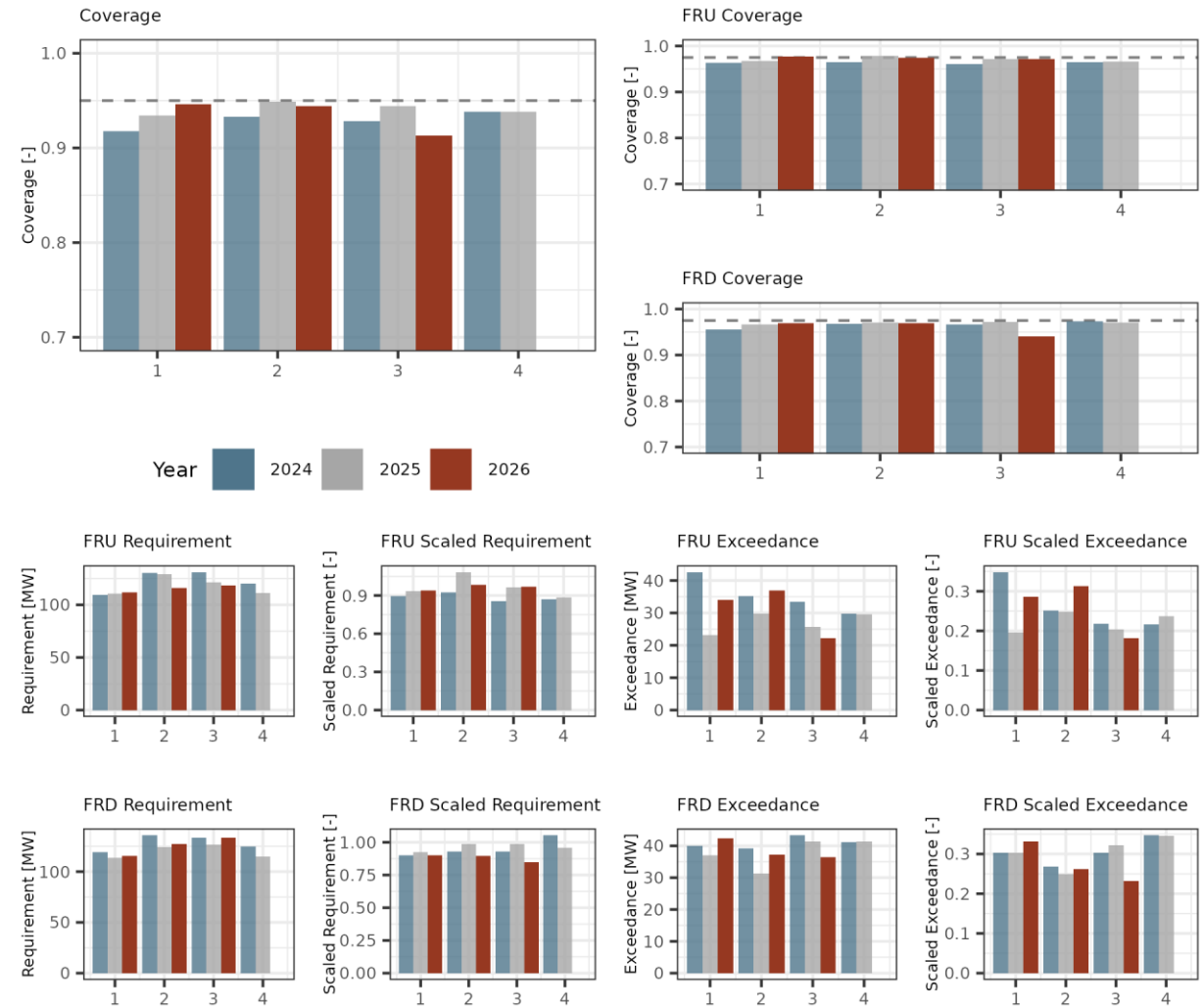


PGE T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

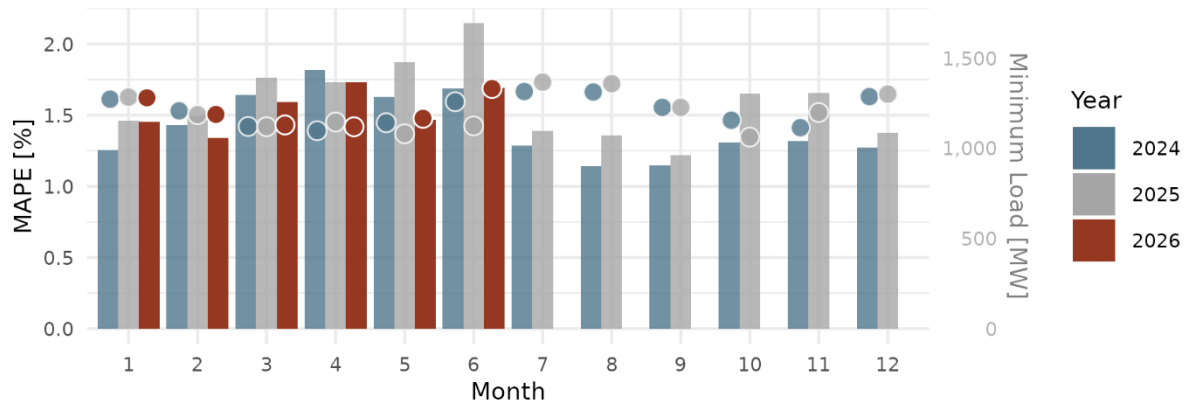
PGE



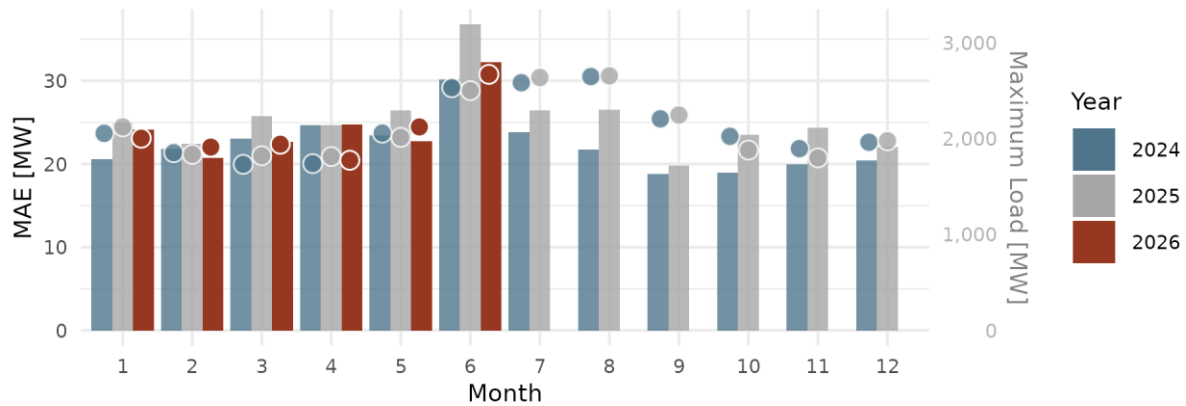
Data current to 2026-07-06. Quarter number on x-axis.

PNM

PNM T-60 MAPE

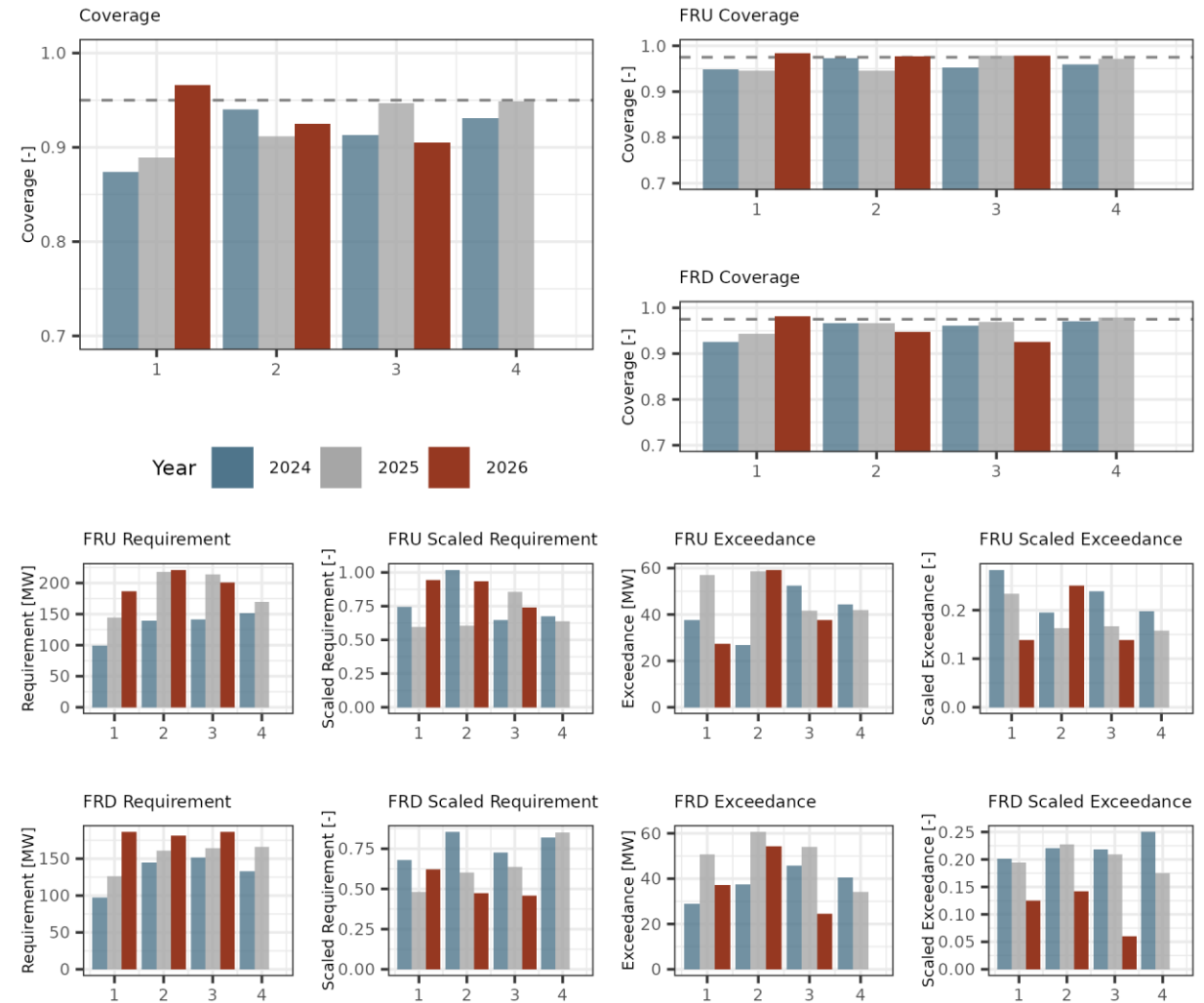


PNM T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

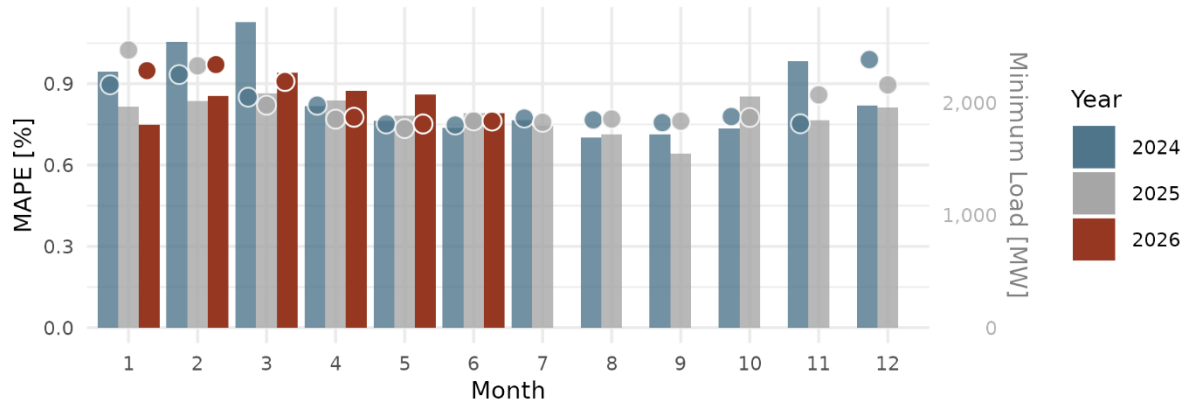
PNM



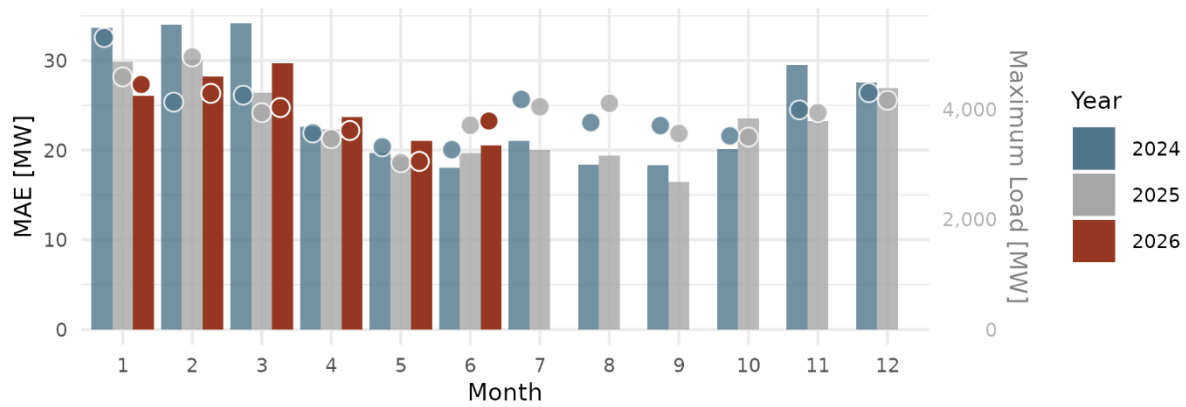
Data current to 2026-07-06. Quarter number on x-axis.

PSE

PSE T-60 MAPE

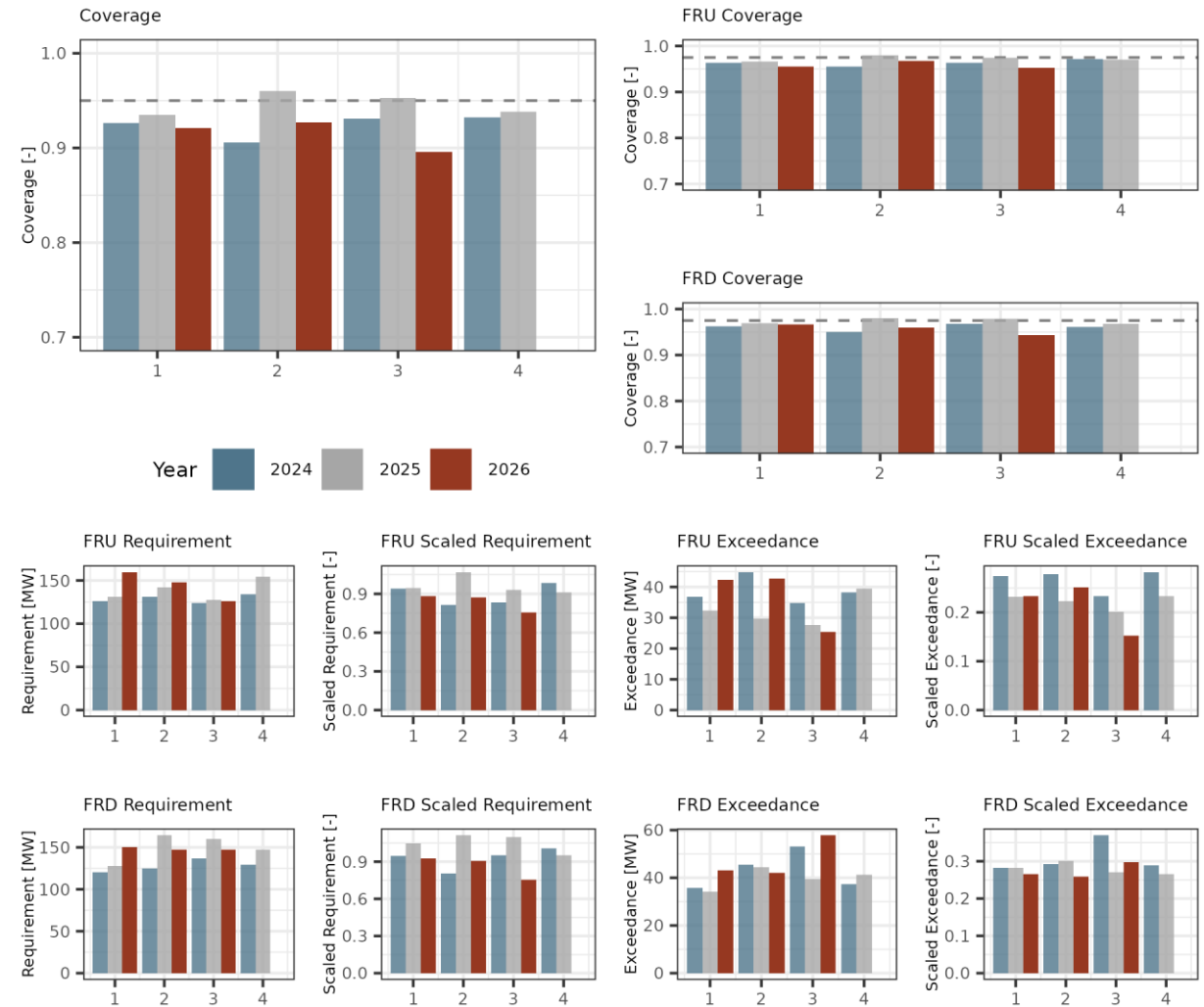


PSE T-60 MAE



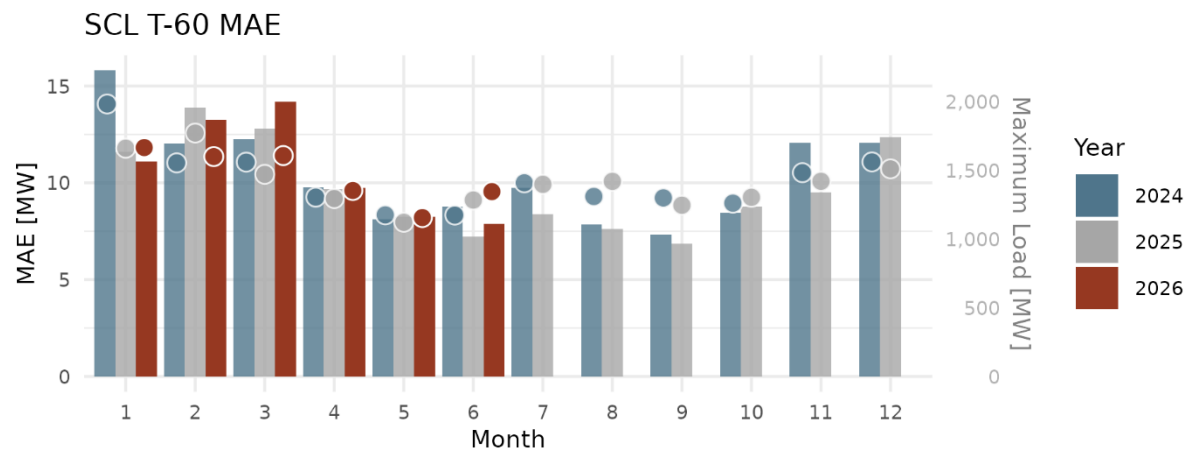
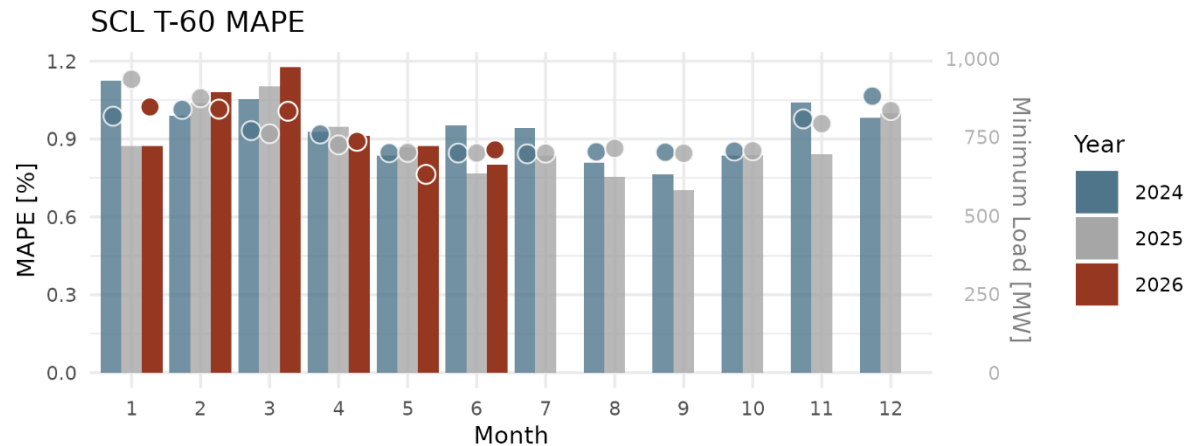
Bars use primary y-axis at left. Points use secondary y-axis at right.

PSE



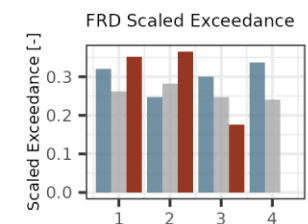
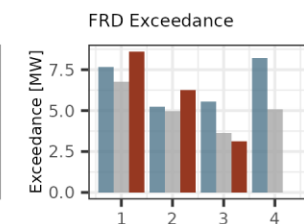
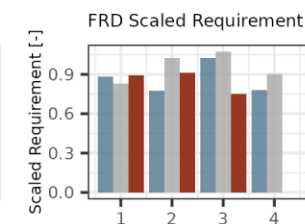
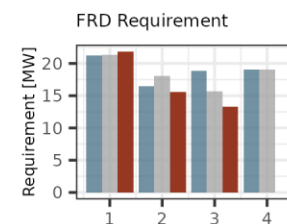
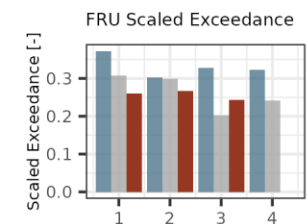
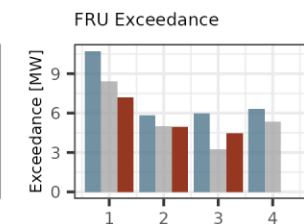
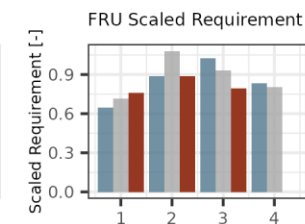
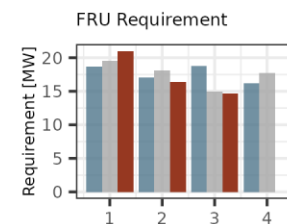
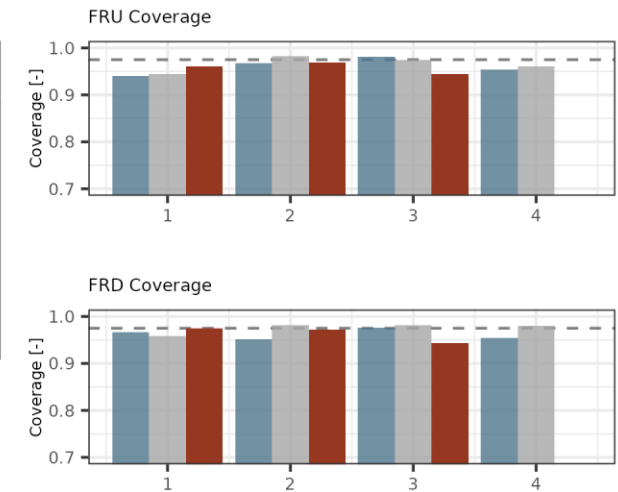
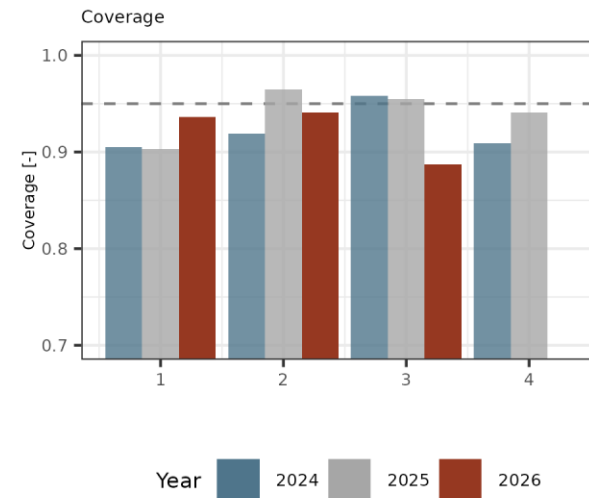
Data current to 2026-07-06. Quarter number on x-axis.

SCL



Bars use primary y-axis at left. Points use secondary y-axis at right.

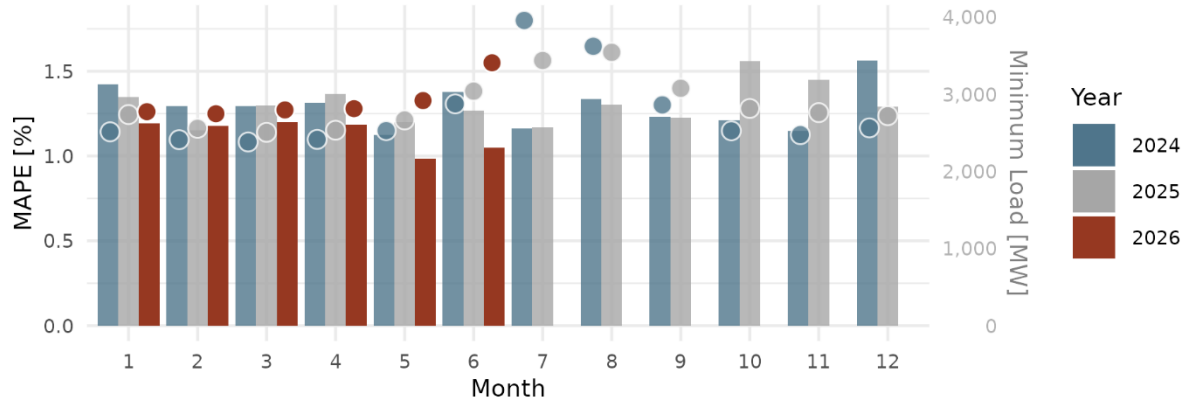
SCL



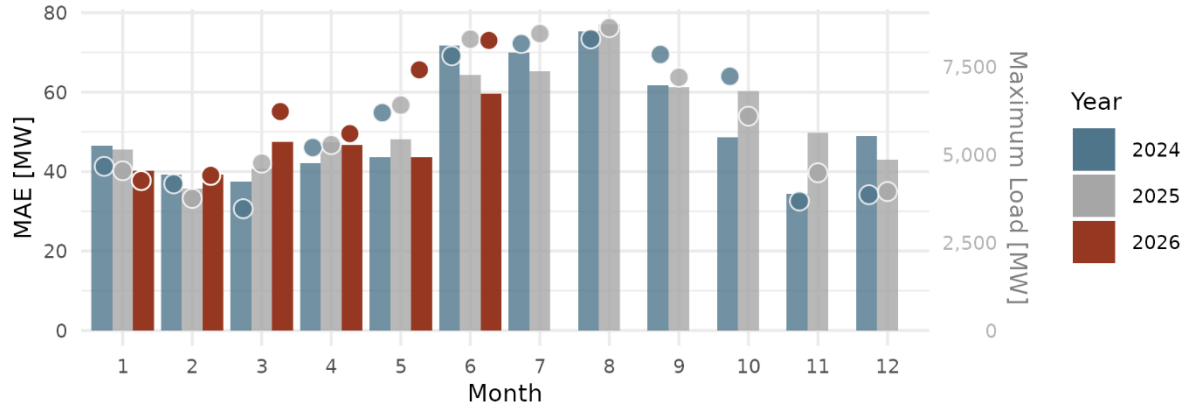
Data current to 2026-07-06. Quarter number on x-axis.

SRP

SRP T-60 MAPE

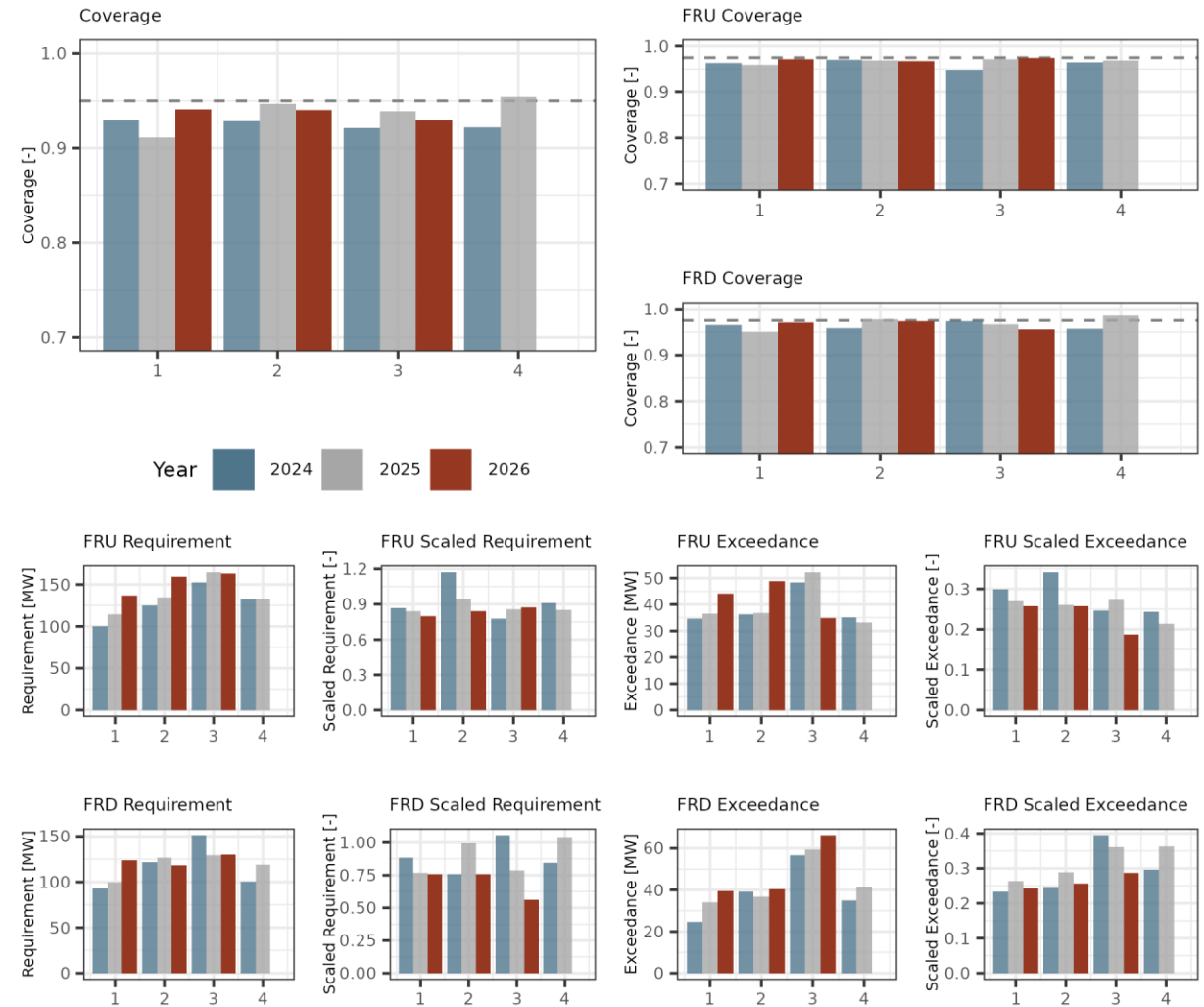


SRP T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

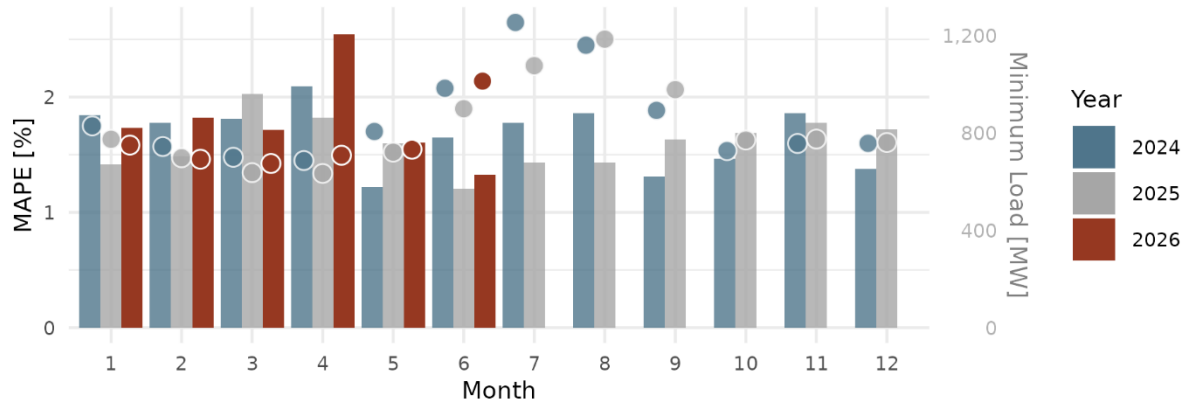
SRP



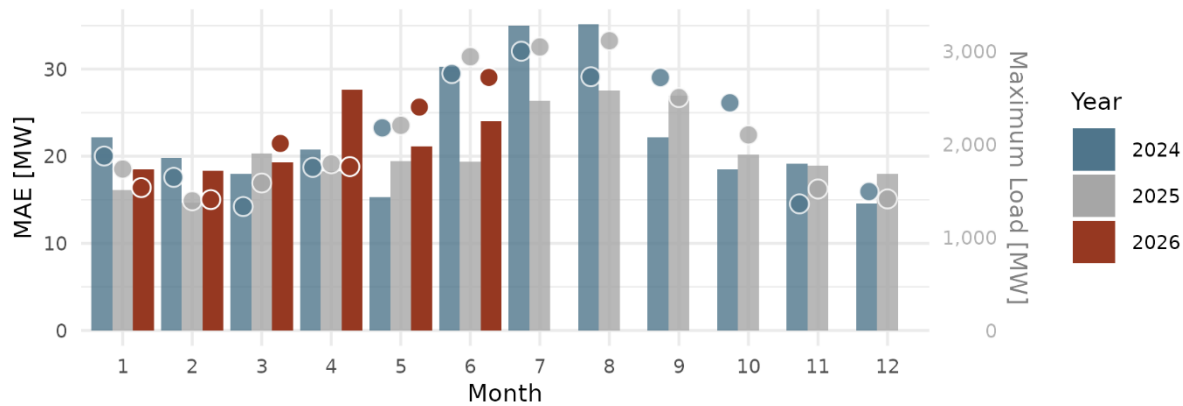
Data current to 2026-07-06. Quarter number on x-axis.

TEP

TEP T-60 MAPE

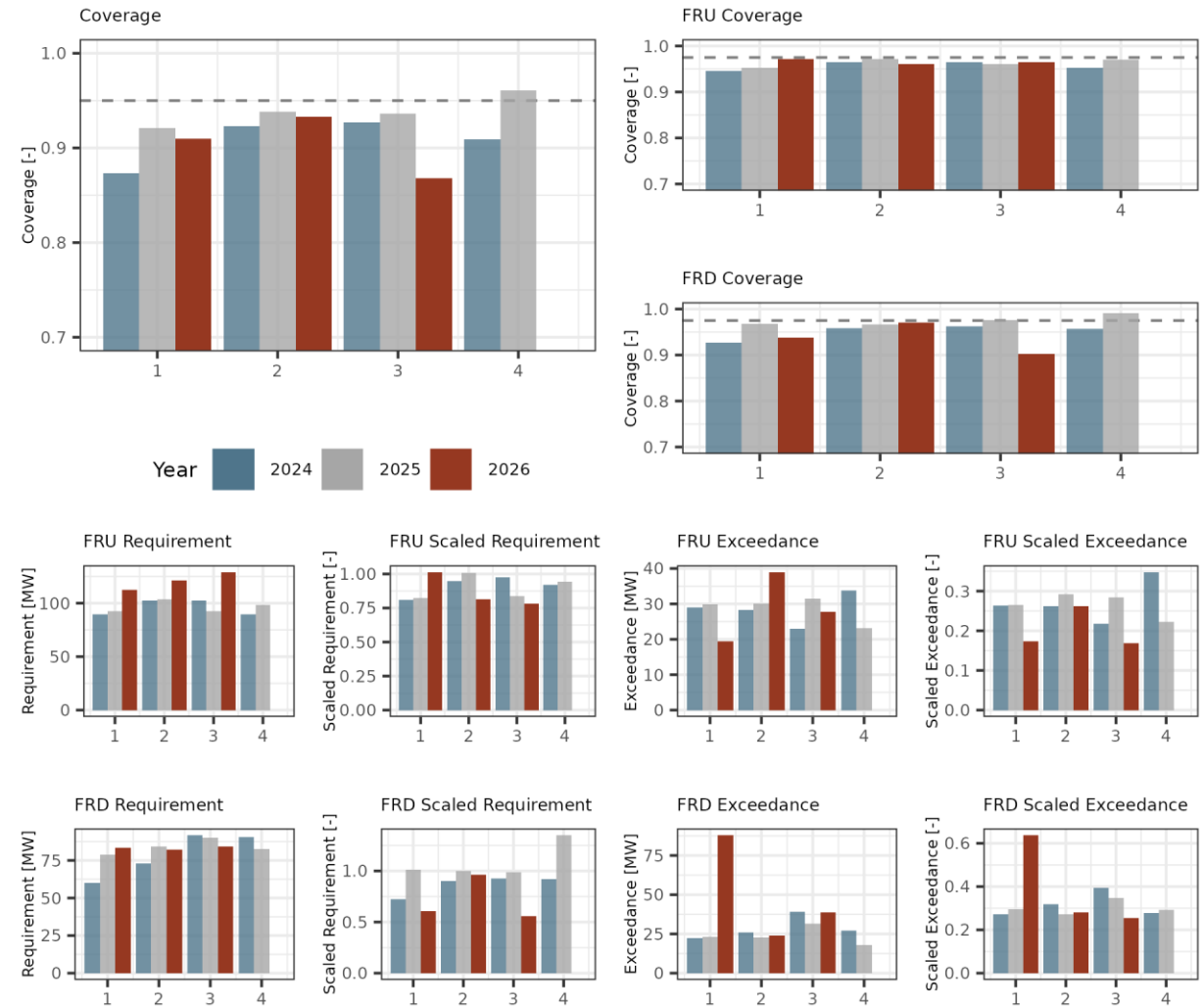


TEP T-60 MAE



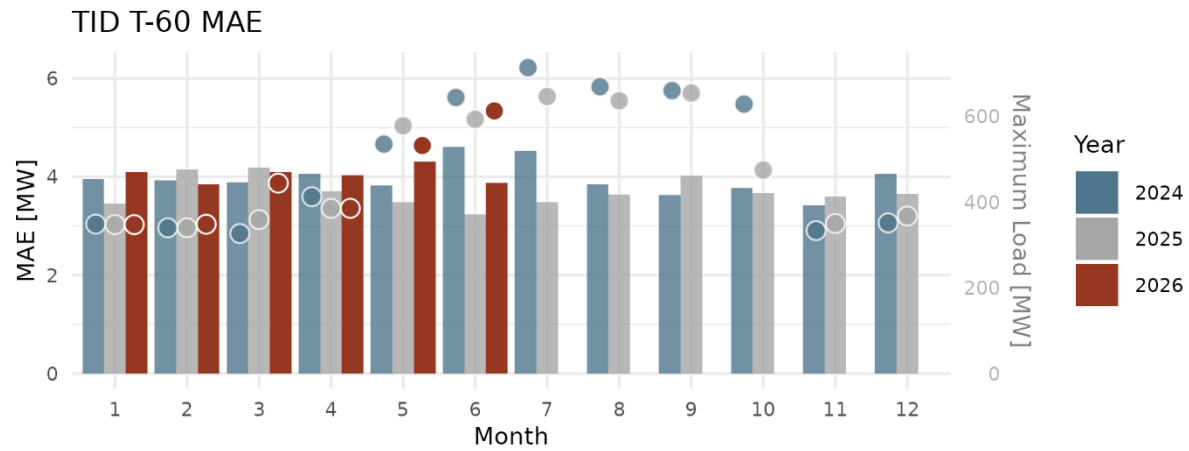
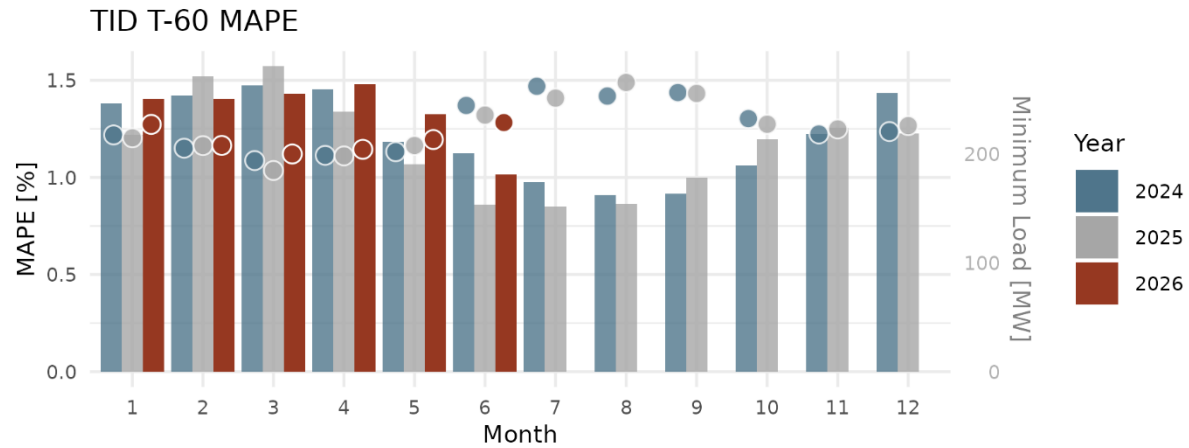
Bars use primary y-axis at left. Points use secondary y-axis at right.

TEP



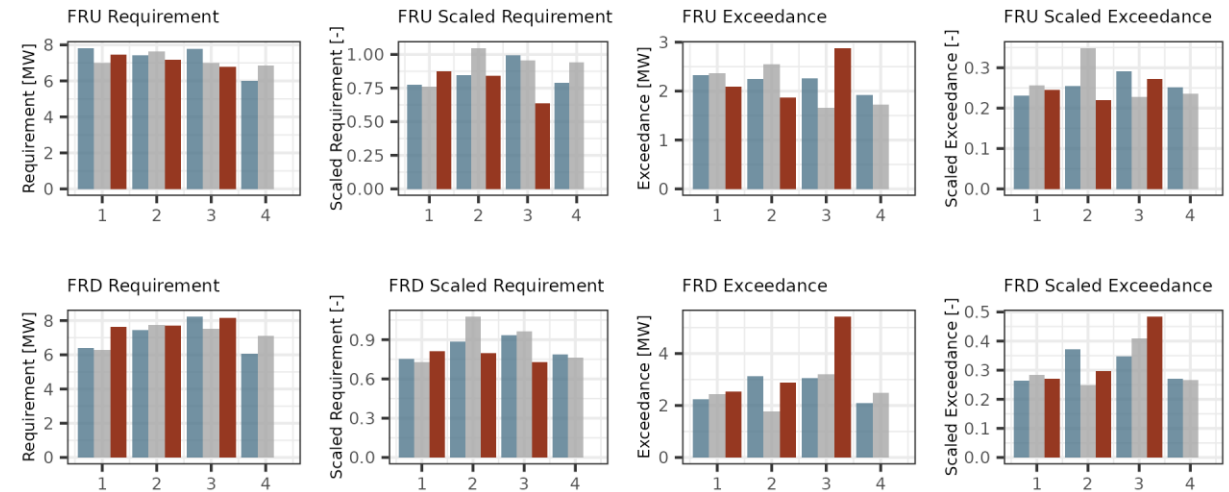
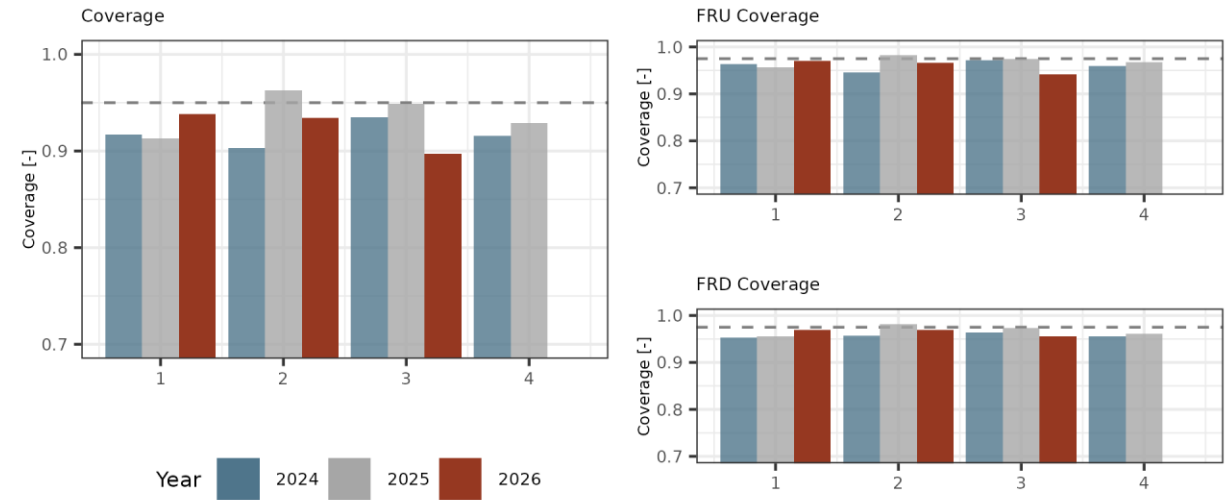
Data current to 2026-07-06. Quarter number on x-axis.

TID



Bars use primary y-axis at left. Points use secondary y-axis at right.

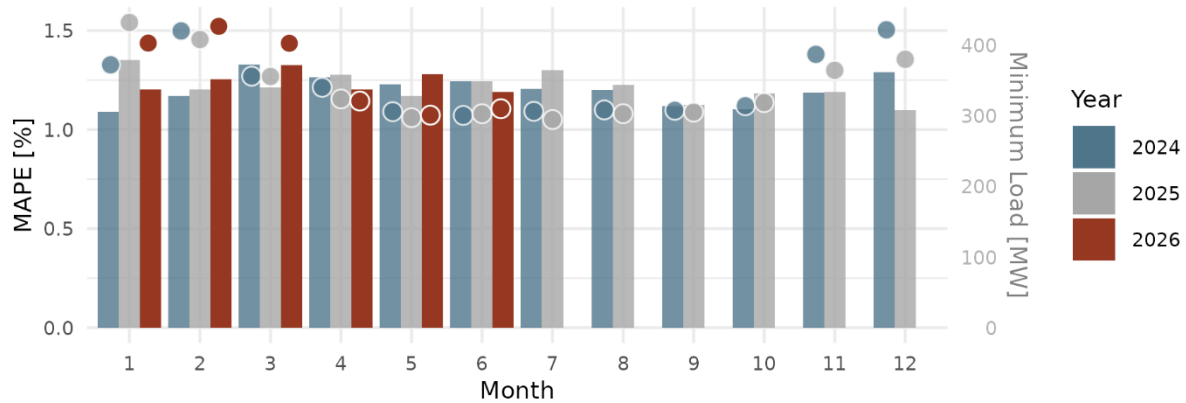
TID



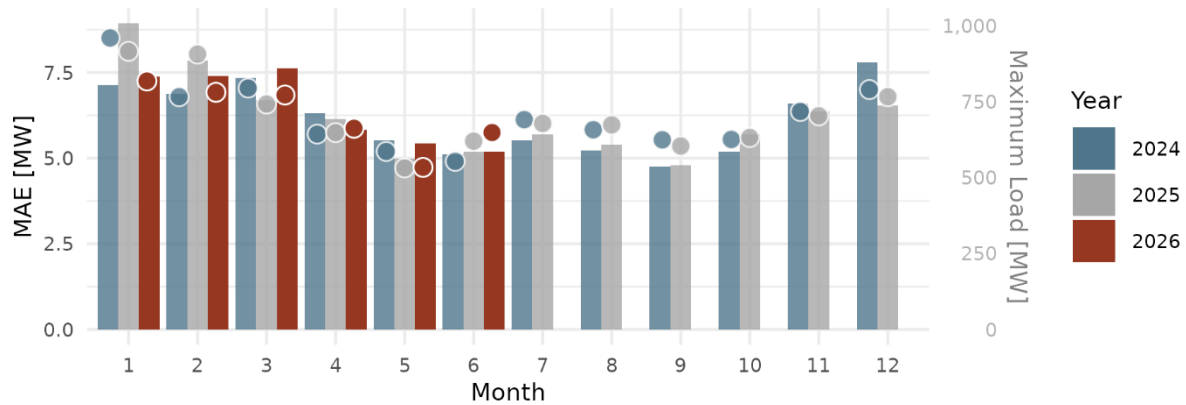
Data current to 2026-07-06. Quarter number on x-axis.

TPWR

TPWR T-60 MAPE

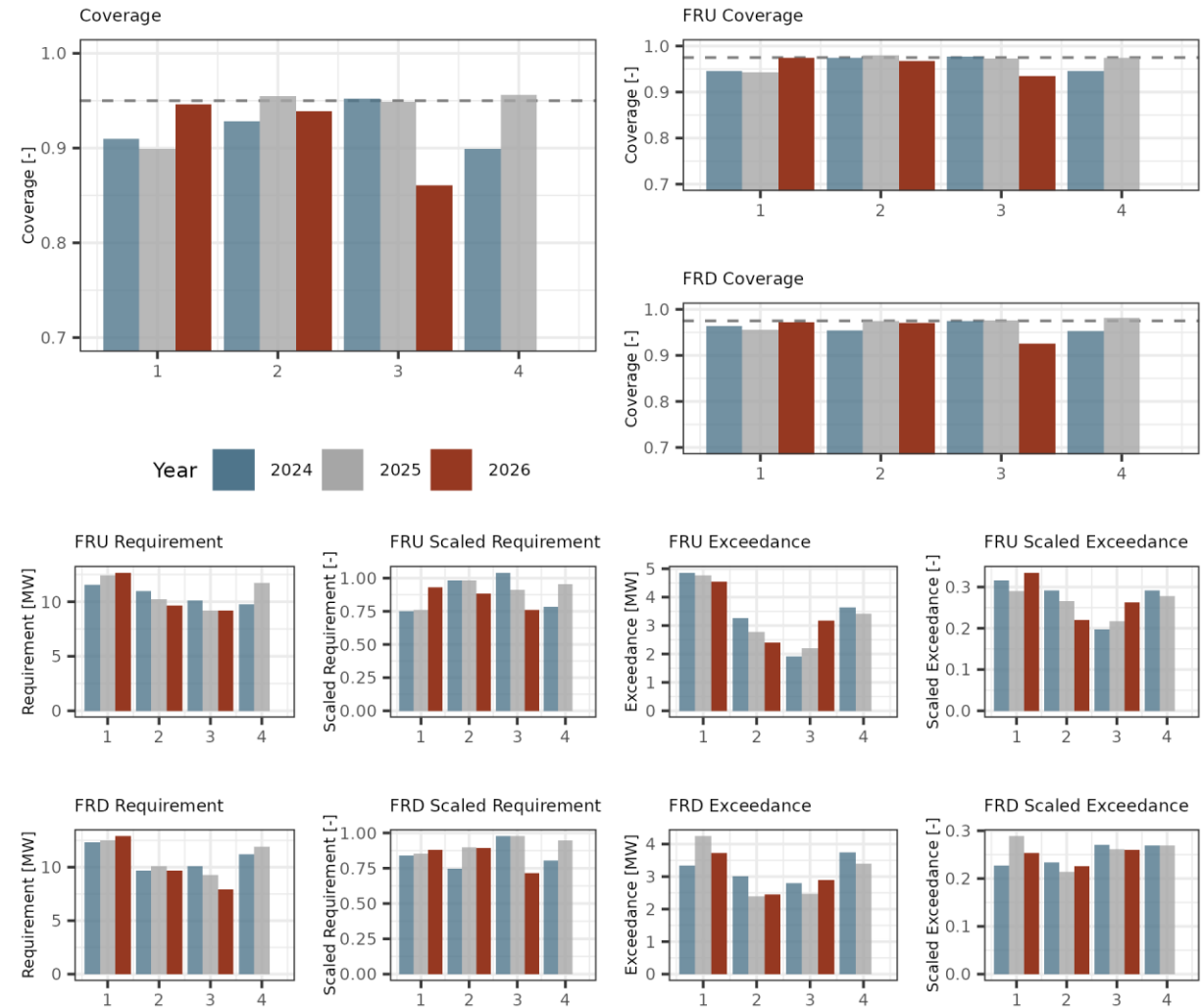


TPWR T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

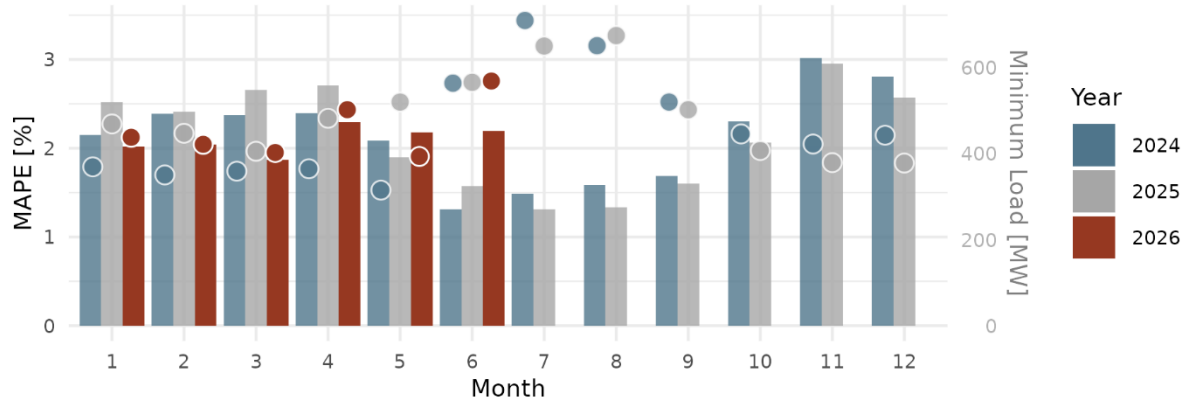
TPWR



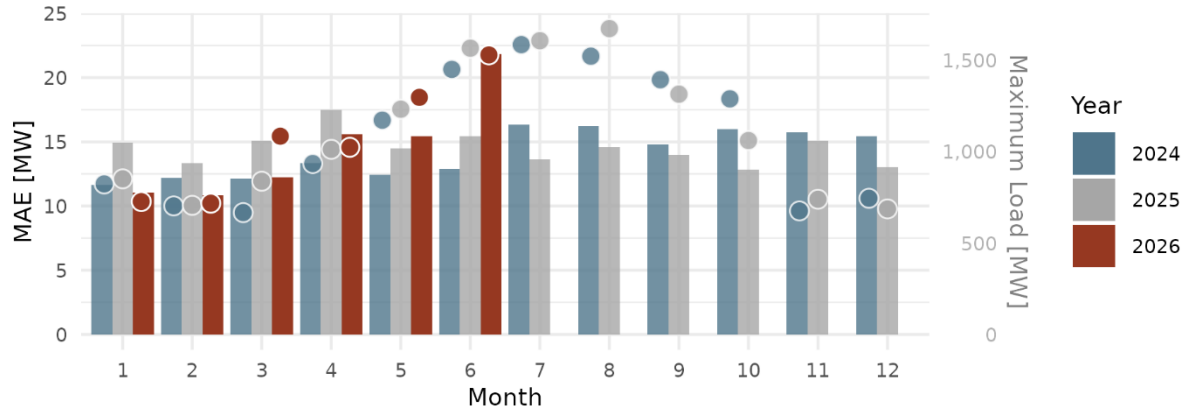
Data current to 2026-07-06. Quarter number on x-axis.

WALC

WALC T-60 MAPE

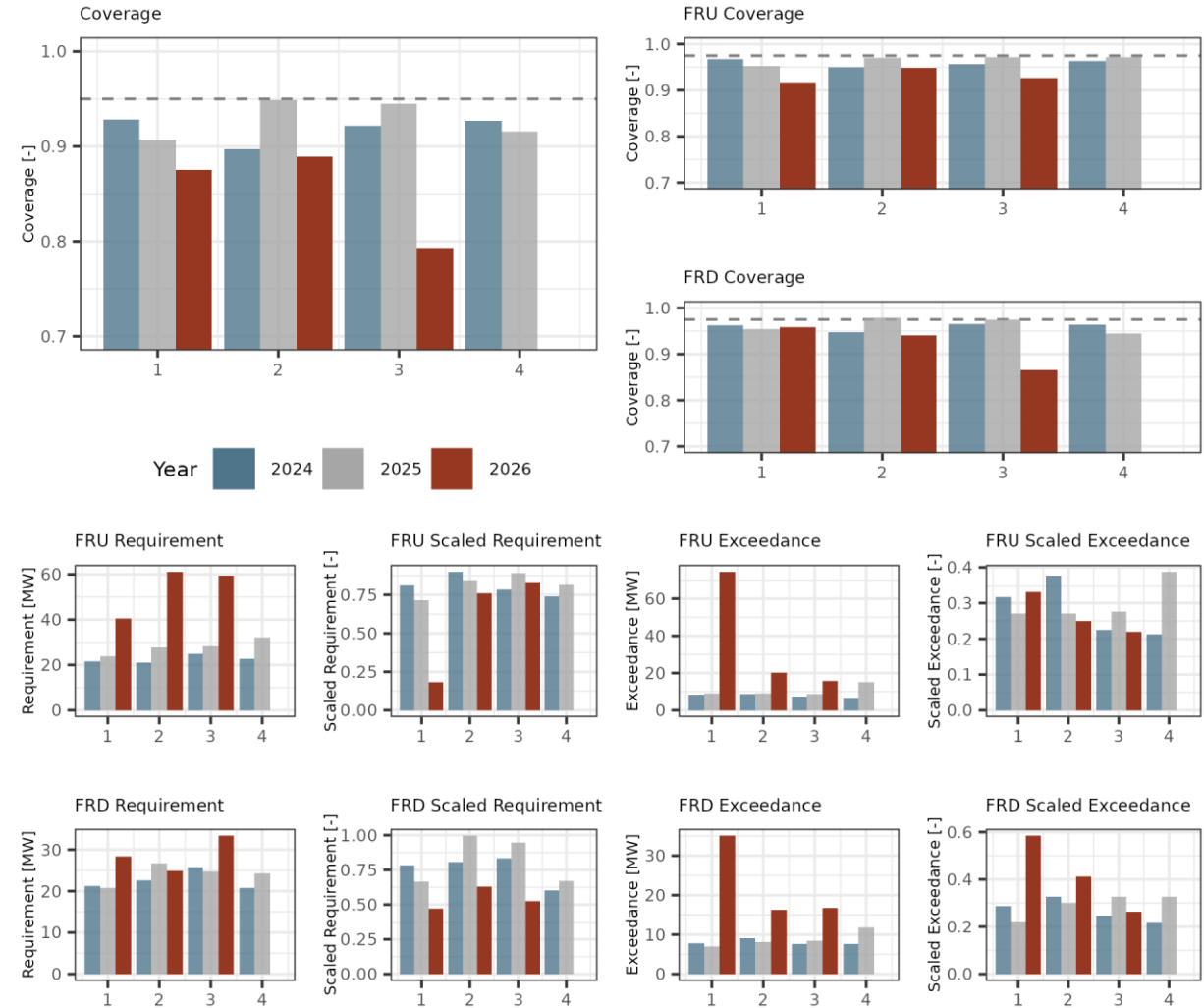


WALC T-60 MAE



Bars use primary y-axis at left. Points use secondary y-axis at right.

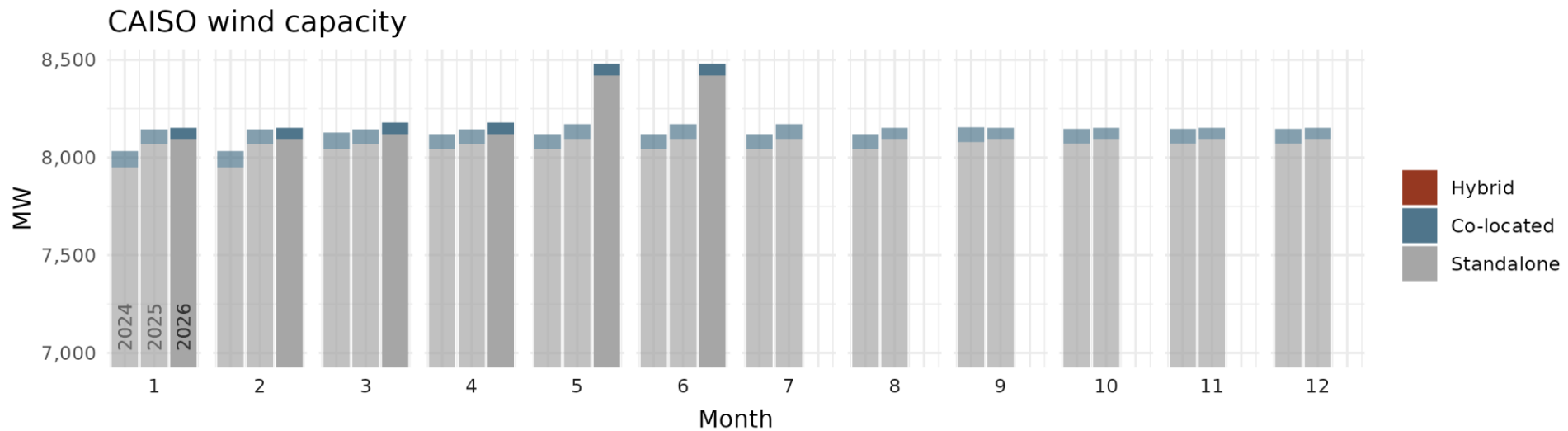
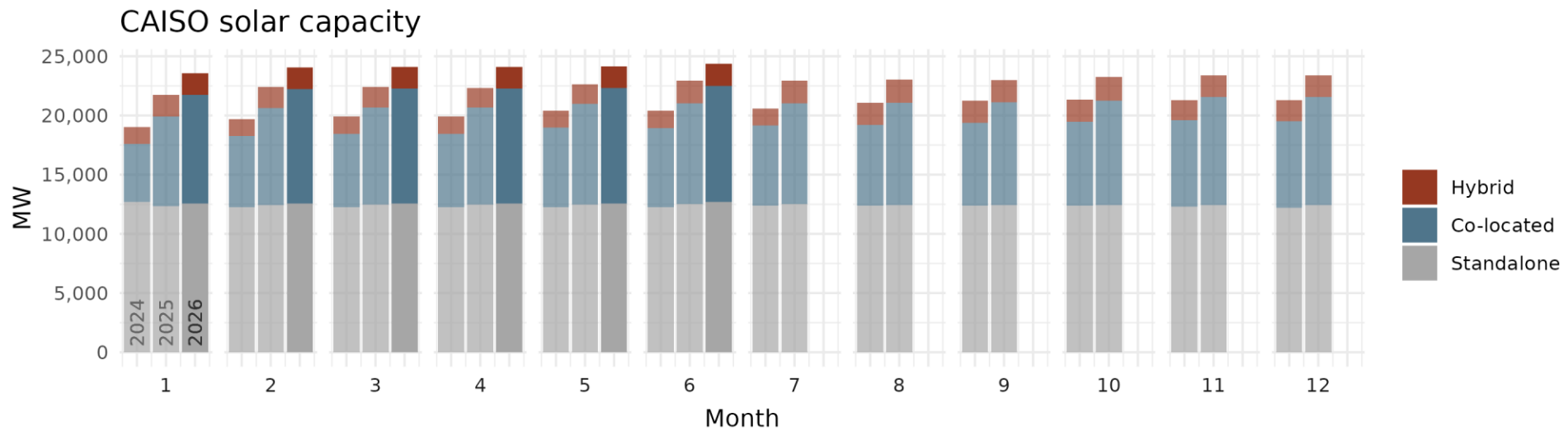
WALC



Data current to 2026-07-06. Quarter number on x-axis.

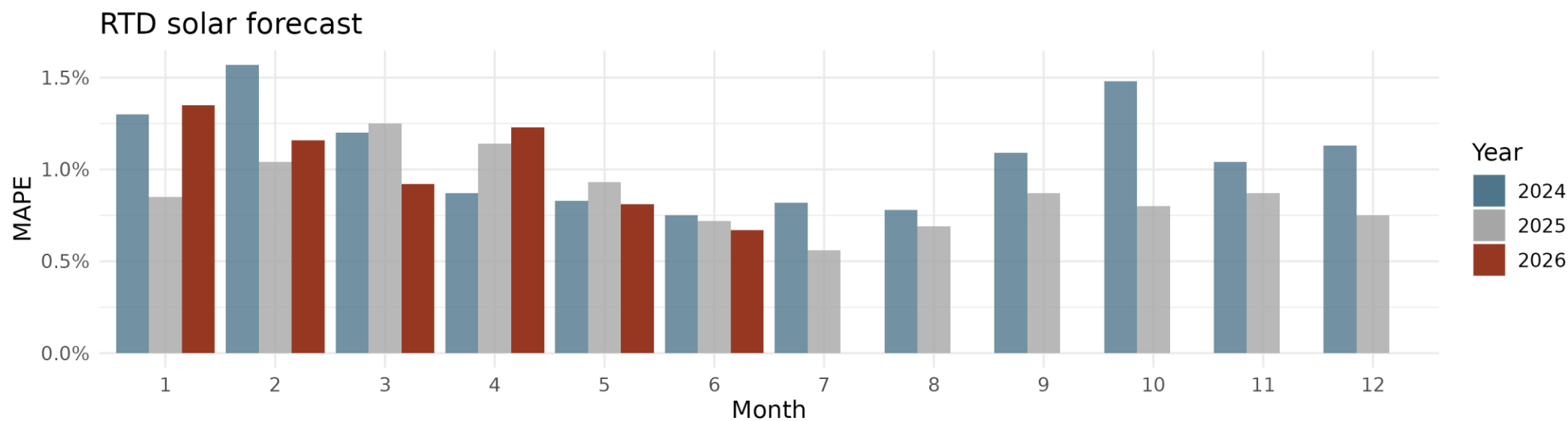
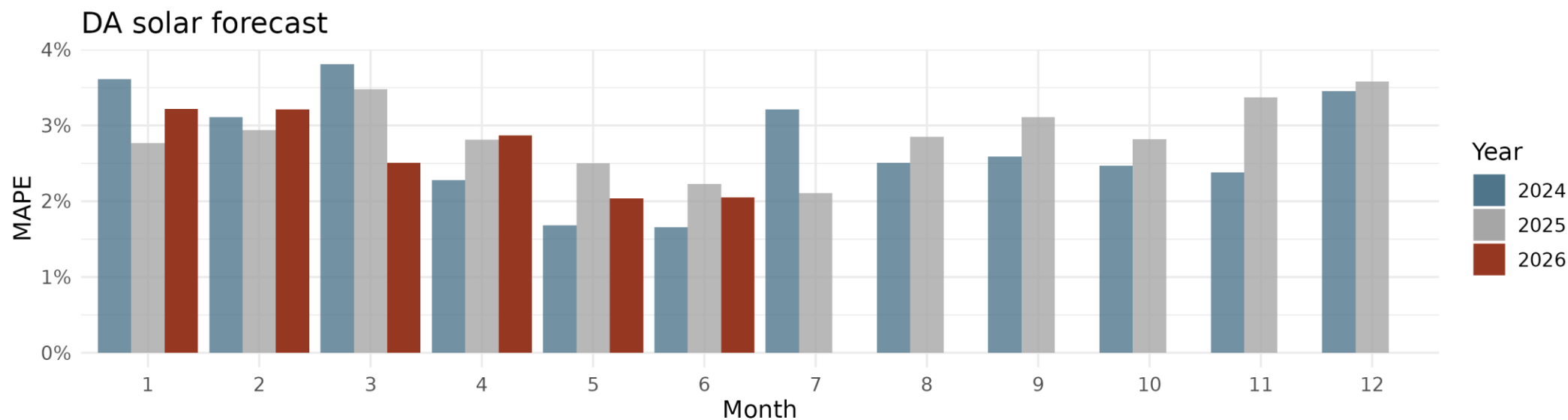
Issues in submitted VER forecasts led to lower coverage and higher exceedance metrics. STF working on communication to WALC. Performance has been trending better in recent months.

APPENDIX – CAISO VER METRICS



Note, the y-axis uses a non-zero baseline.

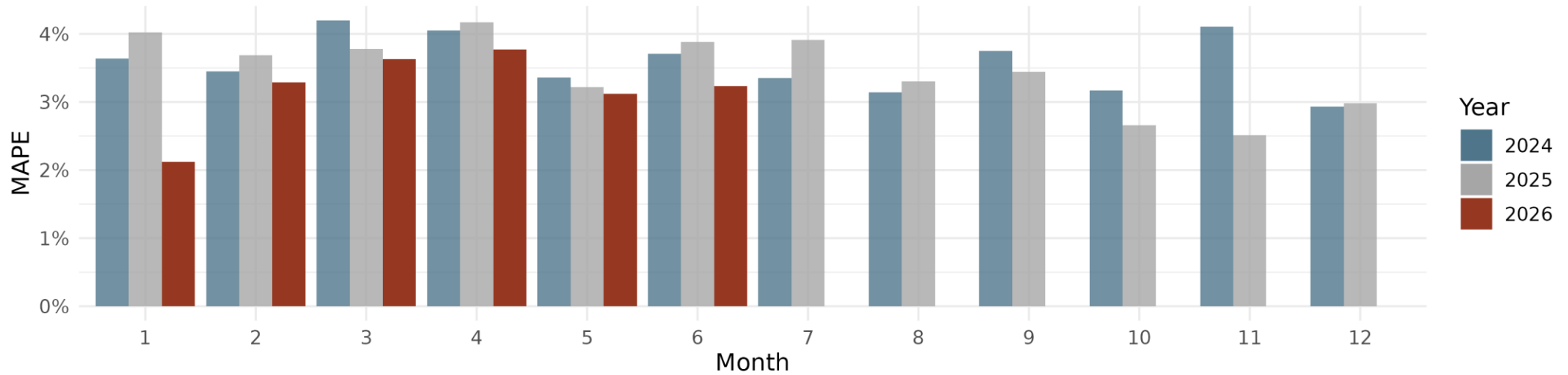
Note, plots reflect capacity at start of month



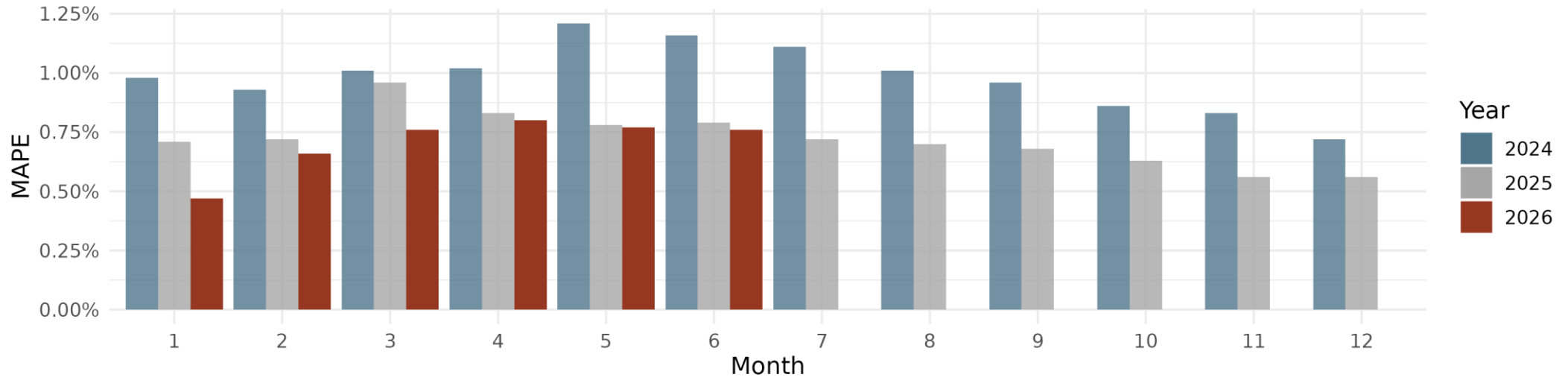
* MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Actual}$

** MAPE only calculated for intervals where Forecast > 0

DA wind forecast



RTD wind forecast

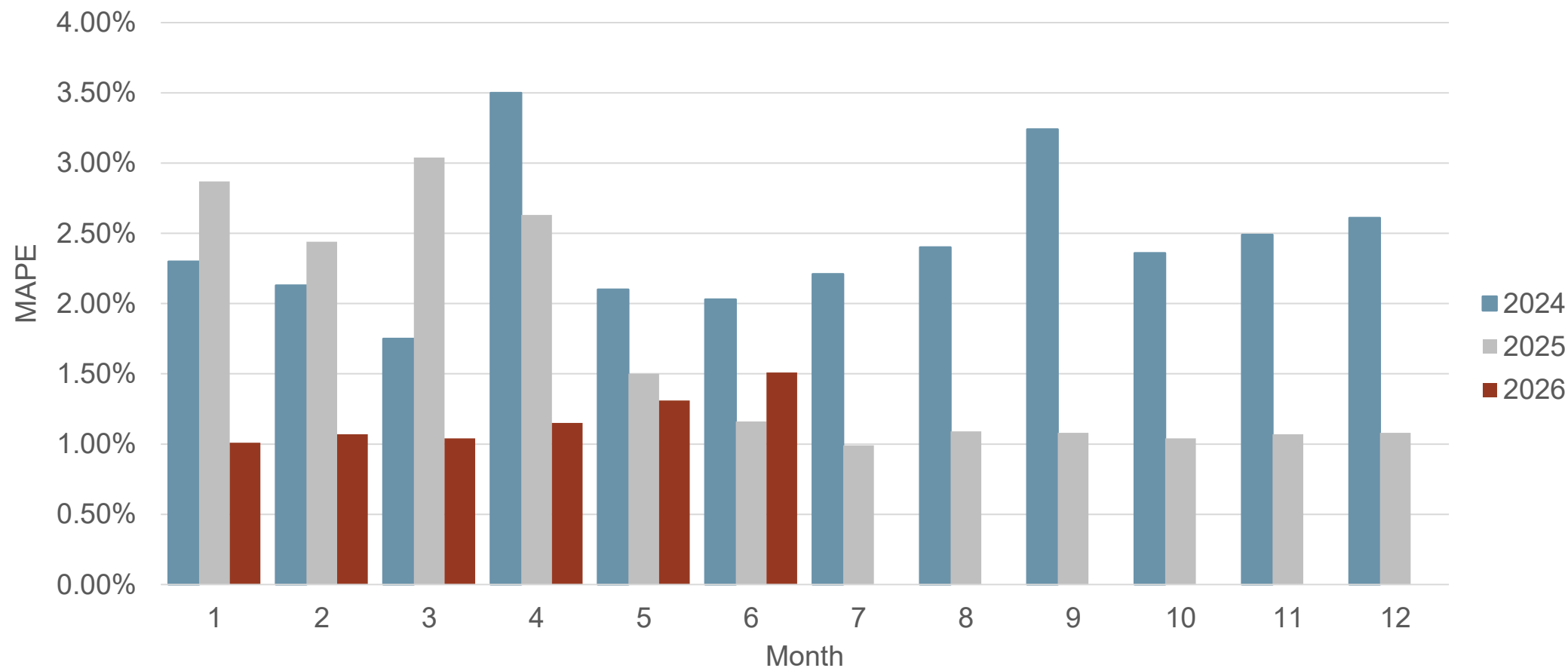


* MAPE = $\text{abs}(\text{Forecast} - \text{Actual}) / \text{Actual}$

** MAPE only calculated for intervals where Forecast > 0

Real Time Solar Hybrid Performance

*Comparison of DOT to MW Production



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