

# Renewable Forecasting Education

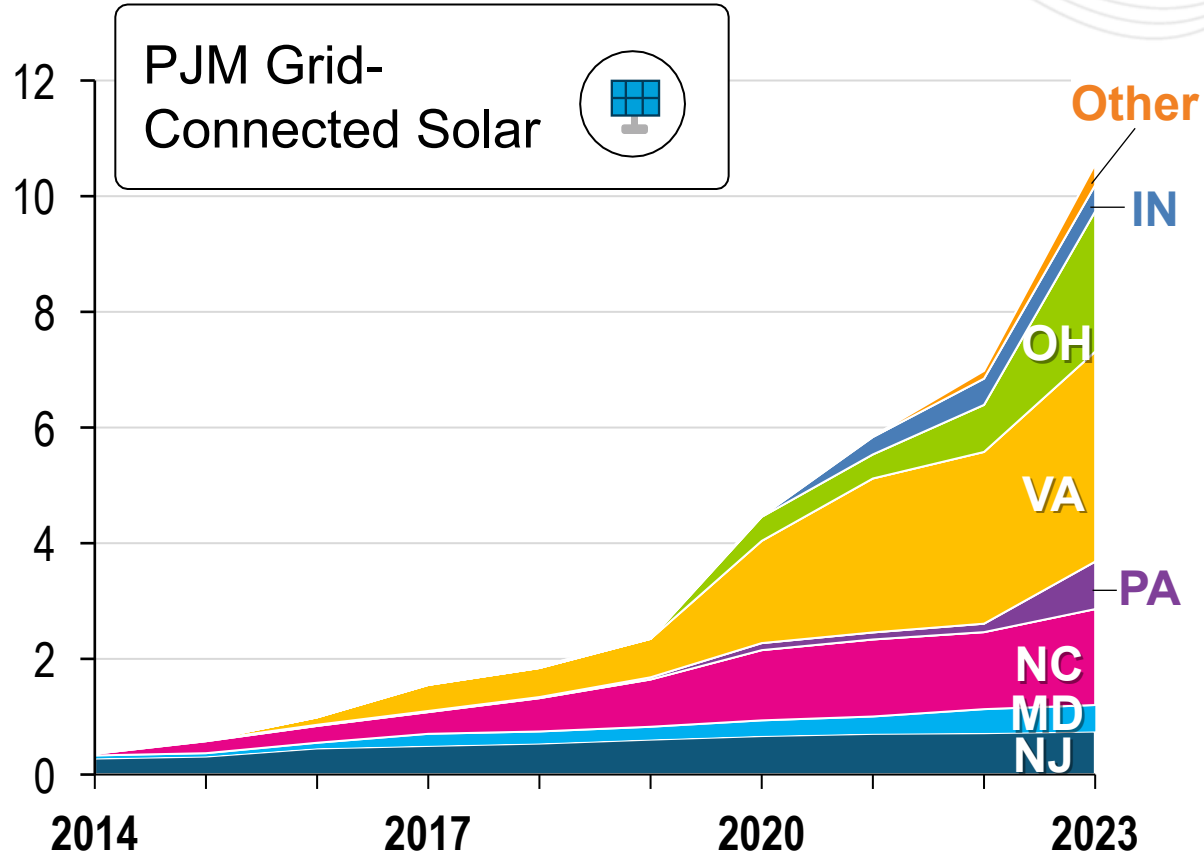
December 5, 2024

Michael Stewart

Joseph Mulhern

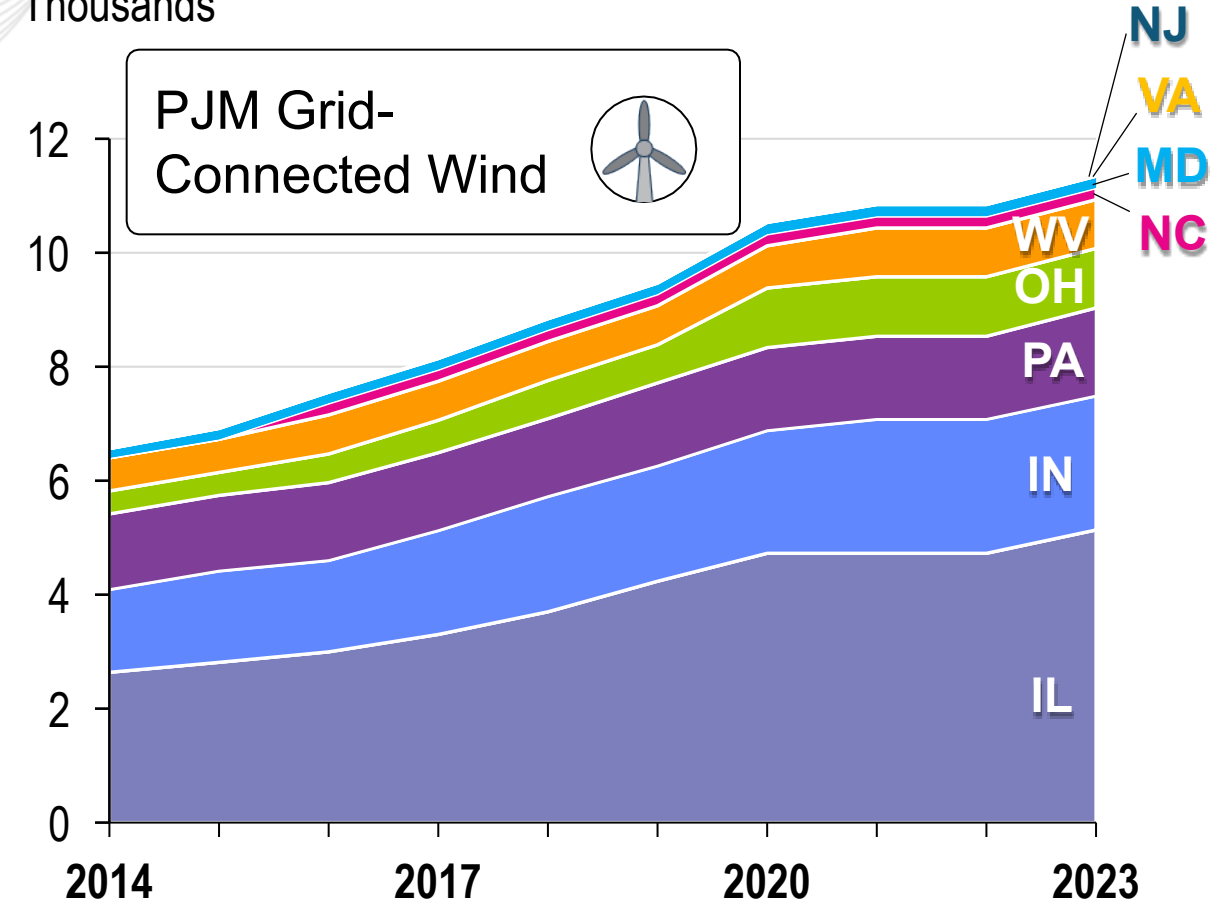
## Installed Capacity (MWDC)

Thousands



## Installed Capacity (MWAC)

Thousands



As of April 2024 | Source: GATS

## Weather Forecast

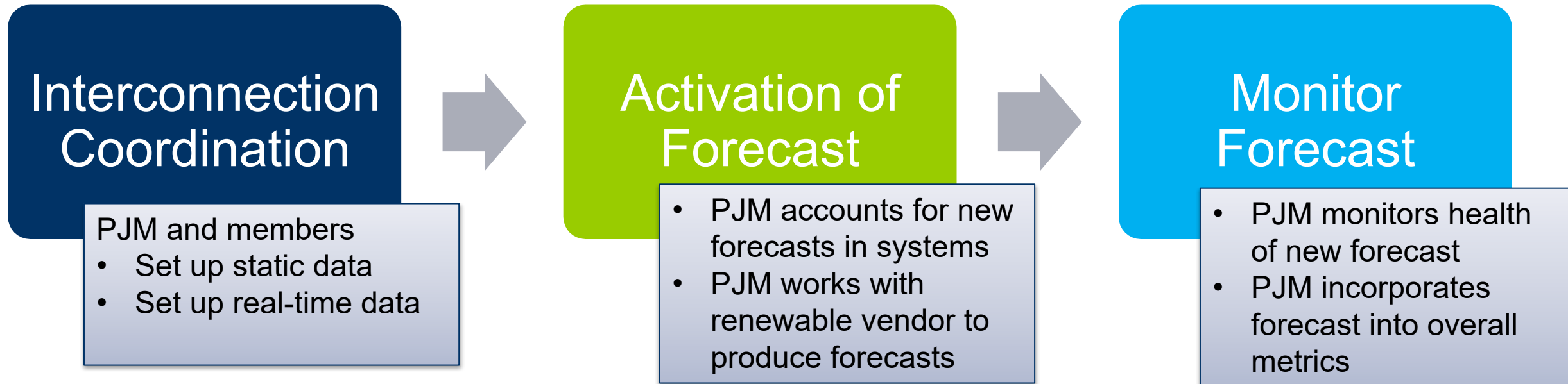
- Global and regional forecasts

## Dynamic Data

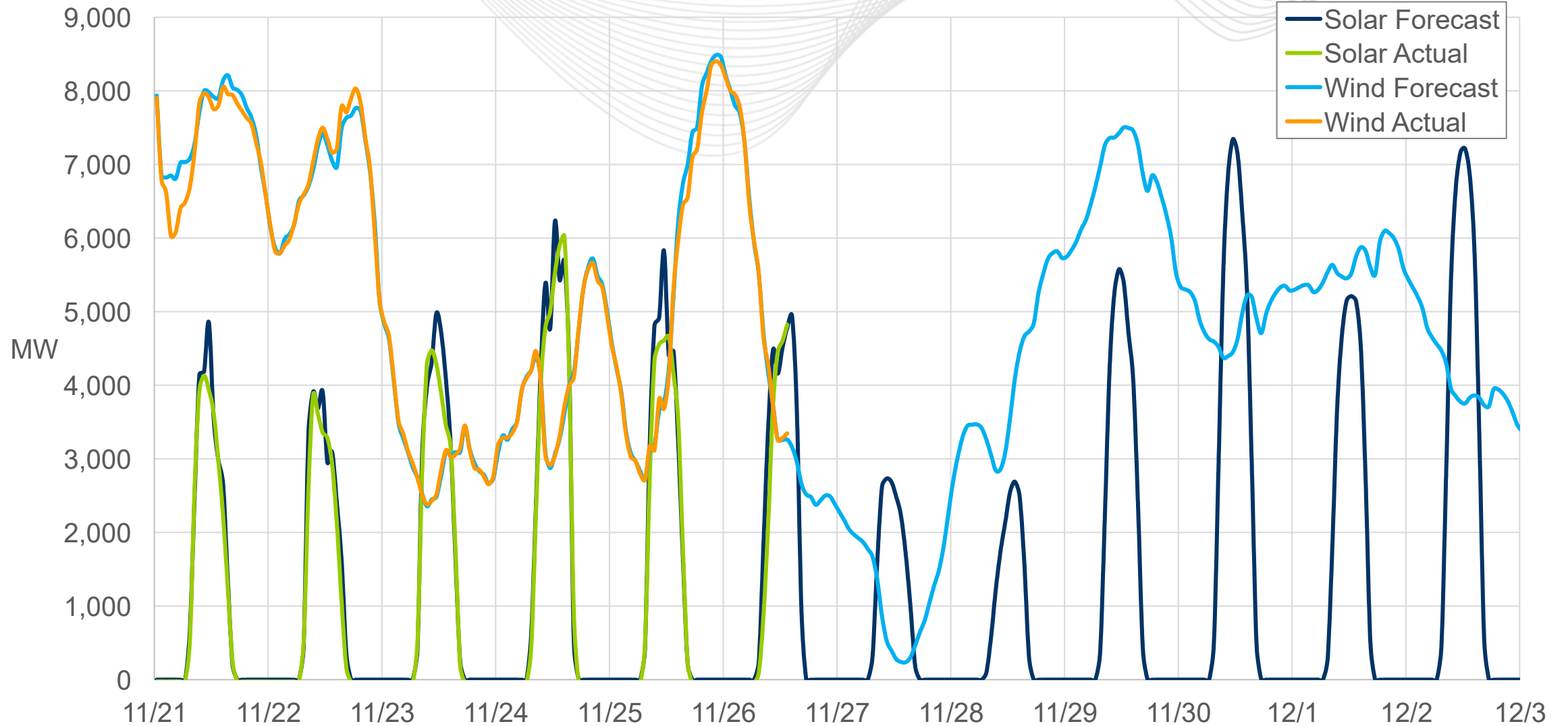
- MW/MVAR output
- Meteorological Data
- Outage/Derate

## Static Data

- MFO
- AC/DC Installed Capacity
- Locational Longitude /Latitude
- Panel Manufacturer and model
- Extreme Cold Operating Capability



# RTO Solar and Wind – Actuals and Forecasts

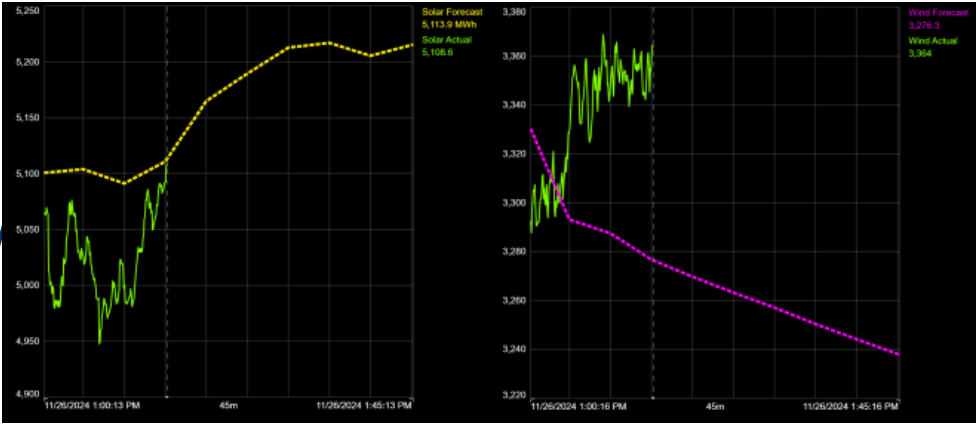


ITSCED

Long Lead Tool

Day Ahead Scheduling Reserve tool

Control Room Visualization



Performance Metric	Description	Uses
Daily RTO-wide Solar and Wind Performance	Single error value measured in MW for all hours in the day	Day-to day situational awareness and development of forecast
Daily RTO-wide Solar and Wind Performance at Peak Only	Error value measured in MW for peak hour only	Input into day-ahead scheduling reserves
Rolling 5-7 Day RTO-wide Solar and Wind Performance	Actuals compared to forecast for wind and solar with error measured in MW	Longer horizon situational awareness of renewable performance
Daily Zonal Solar and Wind Performance	Single error value measured in MW for all hours in the day by PJM zone	Understanding of zonal impact on RTO total
Daily Zonal Solar and Wind Performance at Peak Only	Error value measured in MW for peak hour only by PJM zone	Understanding of zonal impact on RTO total for day-ahead scheduling reserves input
Rolling 5-7 Day Zonal Solar and Wind Performance	Actuals compared to forecast for wind and solar with error measured in MW by Zone	Forecast accuracy relative to overall output
Daily Data Quality Tracking	Individual unit tracking of forecast data	Detects bad data/ data quality issues

# What Causes Renewable Forecast Error?



Weather  
forecast error



Sudden  
changes in weather



Data Quality



Extreme  
Weather (snow,  
icing)



Accurate Outage  
Reporting





Members able to view their unit's PJM forecast

# Renewable Forecast Posting

about pj | training | committees & groups | planning | markets & operations | library

Operational Data | Home > Markets & Operations > PJM Tools > Markets Gateway

Winter Storm Elliott Info

Data Directory

Interregional Data Map

**PJM Tools**

PJM Security

**Markets Gateway**

Markets Gateway is a PJM tool that allows members to submit information and needed to conduct business in the Day-Ahead, Regulation and Synchronized Rese

Production: [Sign In](#) | [Register](#)

Train Environment: [Sign In](#) | [Register](#)

**Data Miner 2**

Ancillary Services | Bid and Offer Data | Constraints | Credit | Financial | Transmission Rights | Generation

Data Miner 2 > Hourly Solar Power Forecast

search data dictionary

**Hourly Solar Power Forecast**

This feed contains the hourly power forecast within PJM area for metered- utility scale solar power and behind the meter solar power such as residential solar panels. Behind The Meter (BTM) solar power is aggregated and handled through Load Serving Entities (LSE), not directly through PJM. The forecast is updated every hour and is available for the next 48 hours. This feed represents data frequently updated throughout the operating day. In the event of a technical issue that prevents data from being updated, PJM will work to resolve the issue but typically will not update the data to replace the missed intervals.

Posting Frequency: Hourly  
Update Availability: Hourly

**Data Miner 2**

Ancillary Services | Bid and Offer Data | Constraints | Credit | Financial | Transmission Rights | Generation

Data Miner 2 > Hourly Wind Power Forecast

search data dictionary

**Hourly Wind Power Forecast**

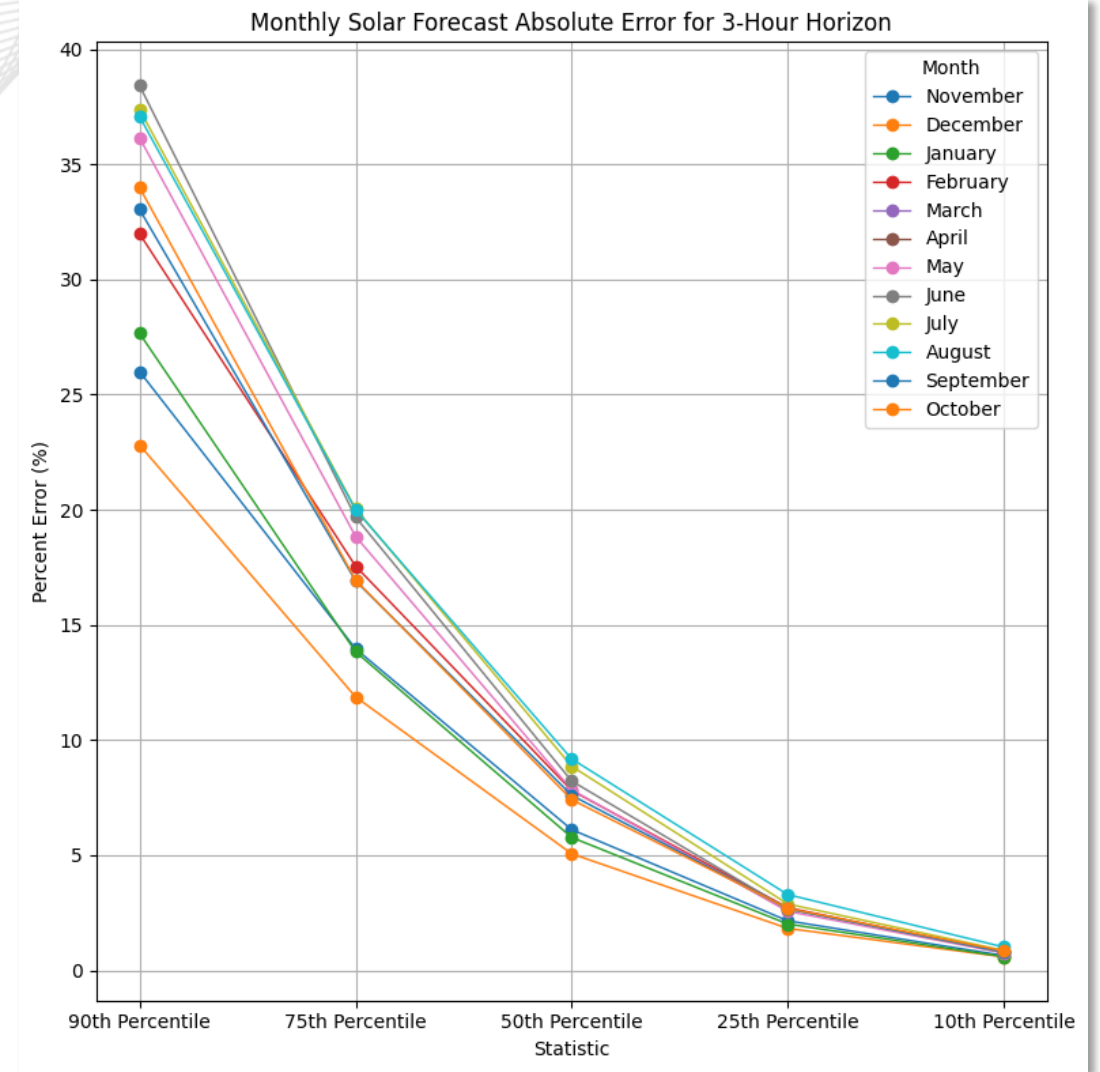
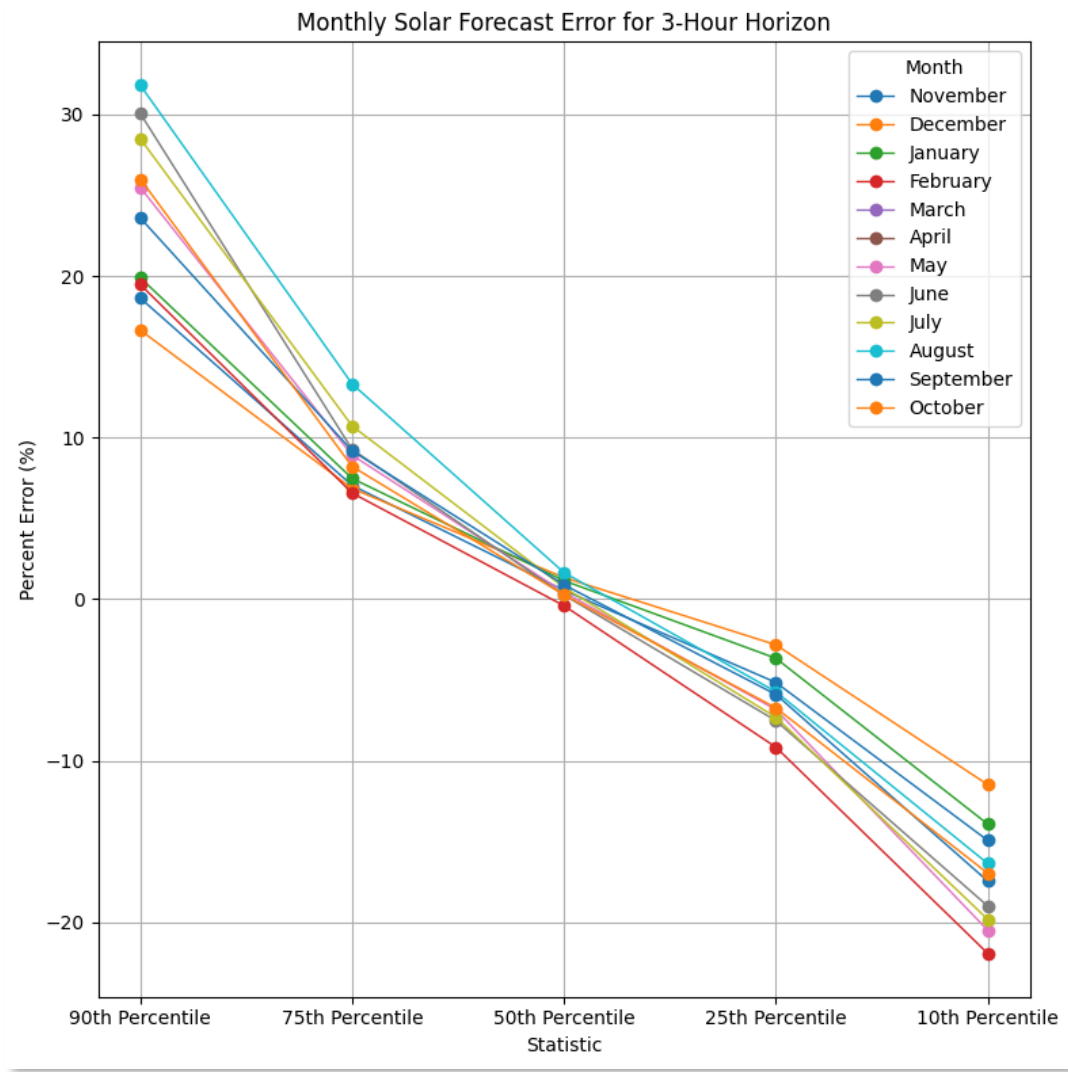
This feed contains the hourly Wind Forecast within PJM area. The forecast is updated every 10 minutes and is available for the next 46 hours. This feed represents data frequently updated throughout the operating day. In the event of a technical issue that prevents data from being updated, PJM will work to resolve the issue but typically will not update the data to replace the missed intervals.

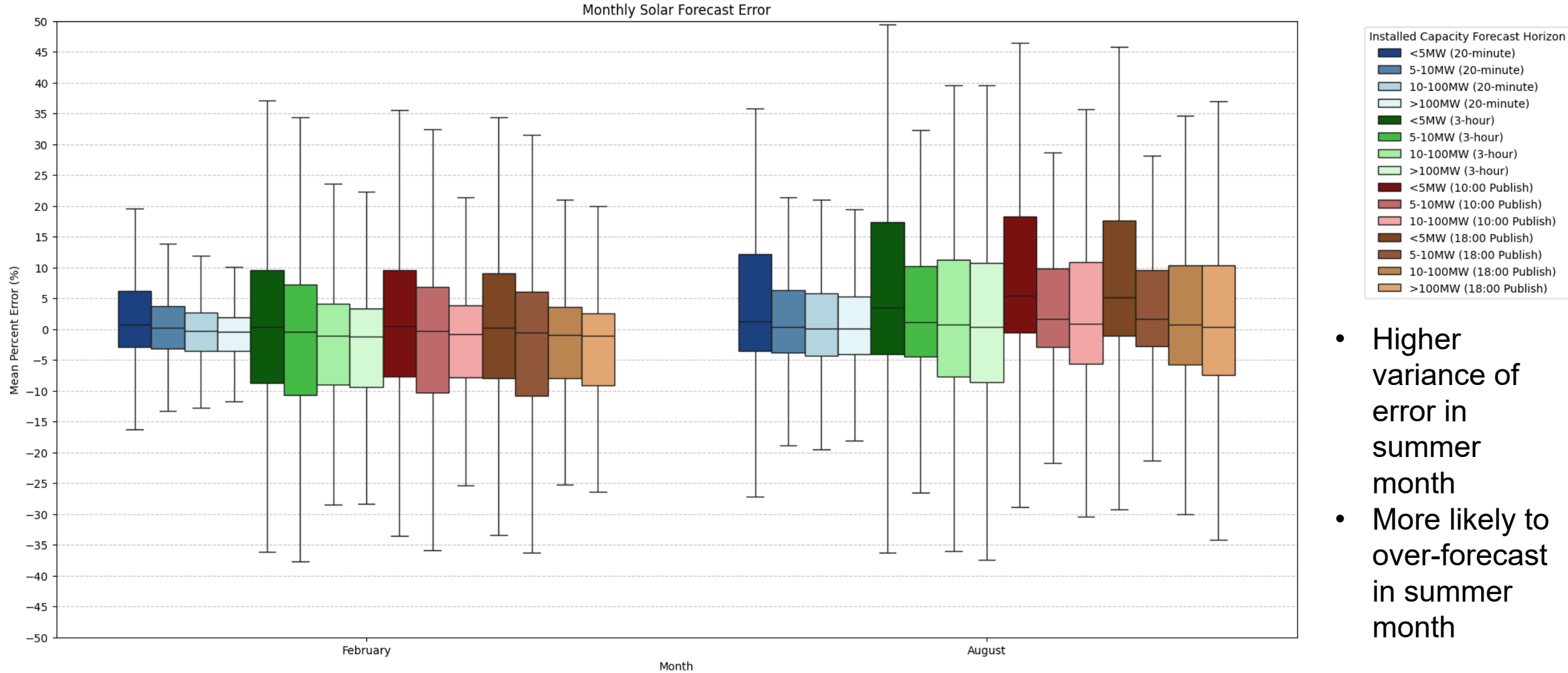
Posting Frequency: Every 10 minutes  
Update Availability: Every 10 minutes  
Retention Time: 30 days  
Last Updated: 11/6/2024 13:21  
First Available: N/A

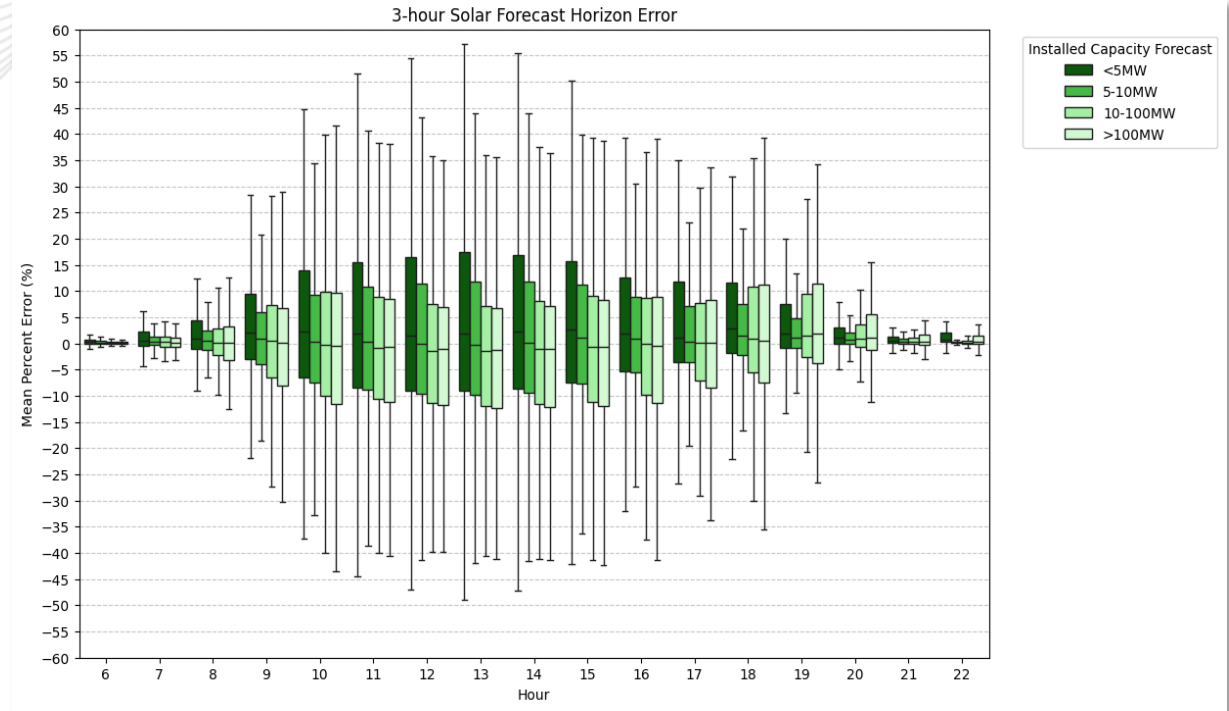
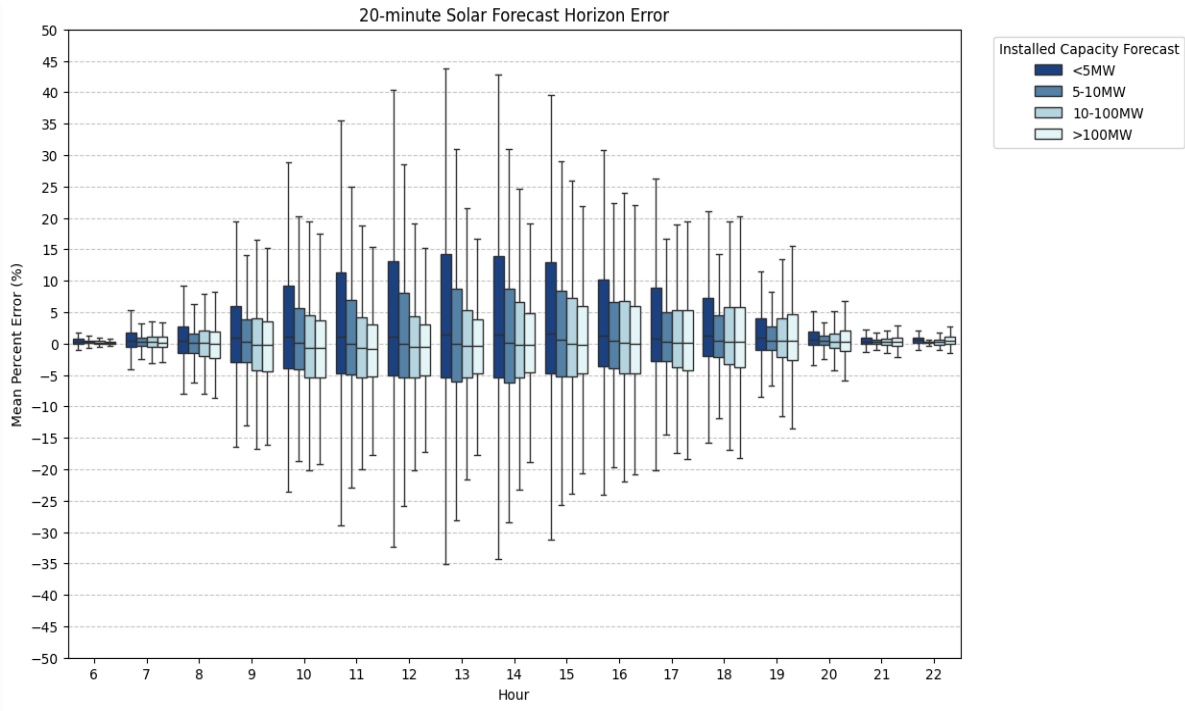
Public able to view RTO-wide Aggregate Forecast



# Monthly Solar Forecast Error for 3-Hour Horizon (11/1/2023-10/31/2024)

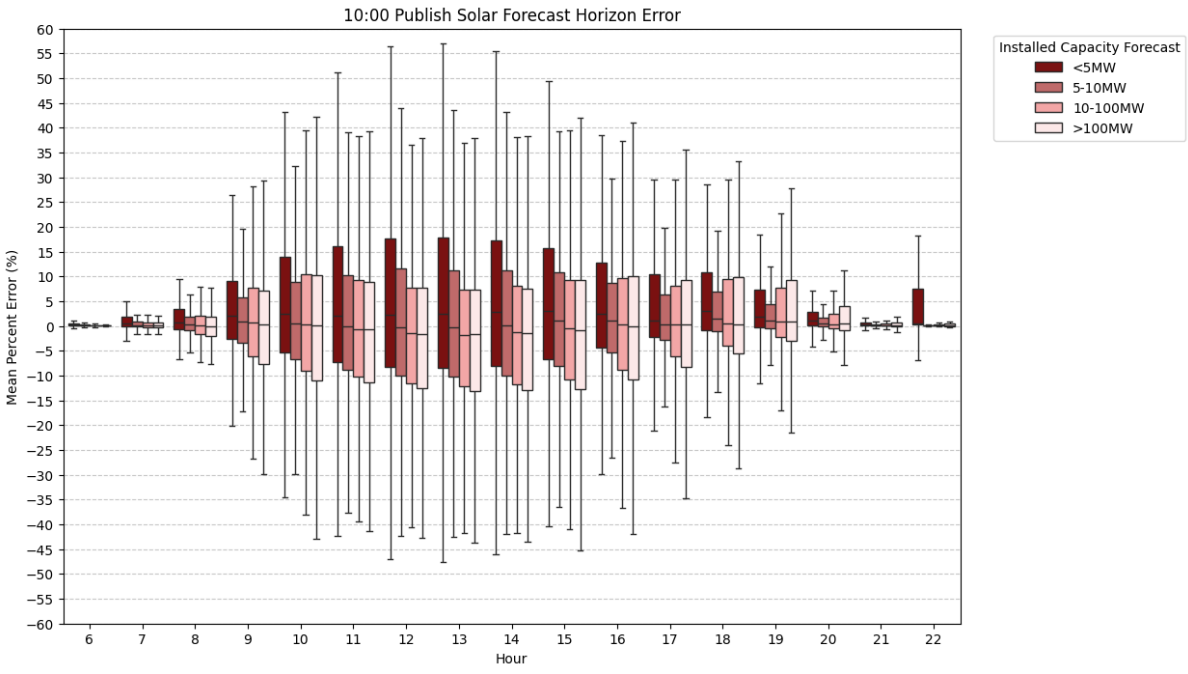




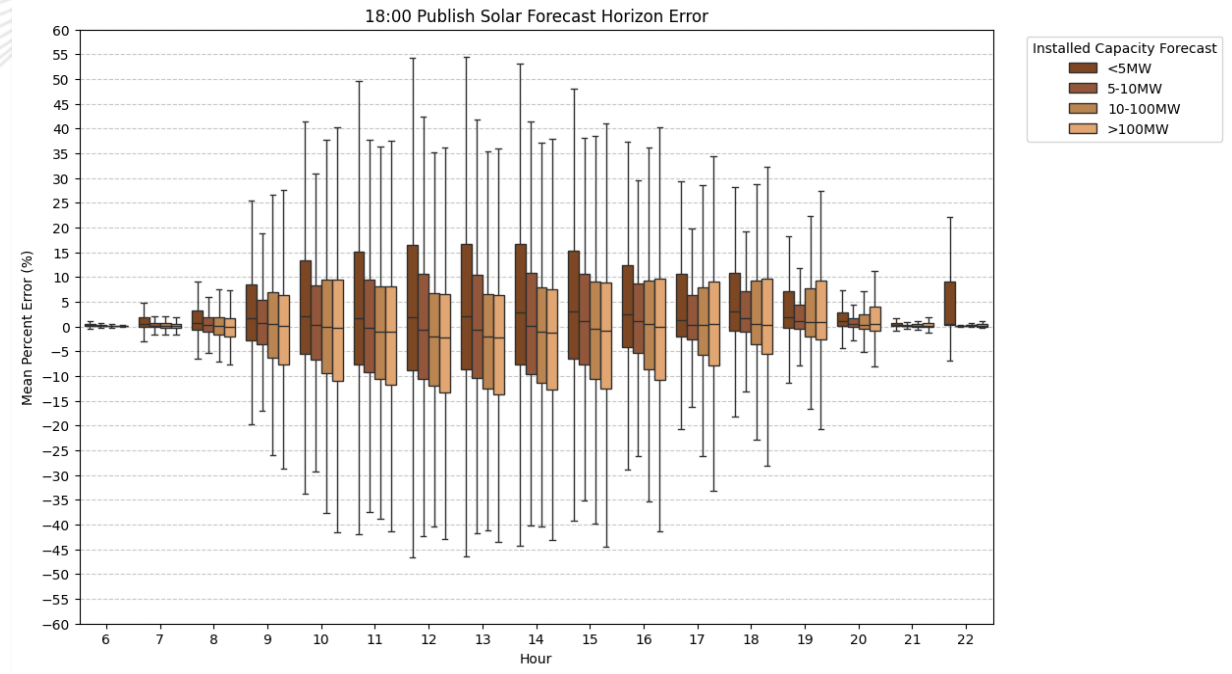


- Higher error/variance for smaller units

- Higher variance for further out horizon



- Higher error/variance for smaller units



- Marginal accuracy gain by 18:00 publish, mainly for larger units

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**Renewable Forecasting Education**



**Member Hotline**

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(866) 400-8980

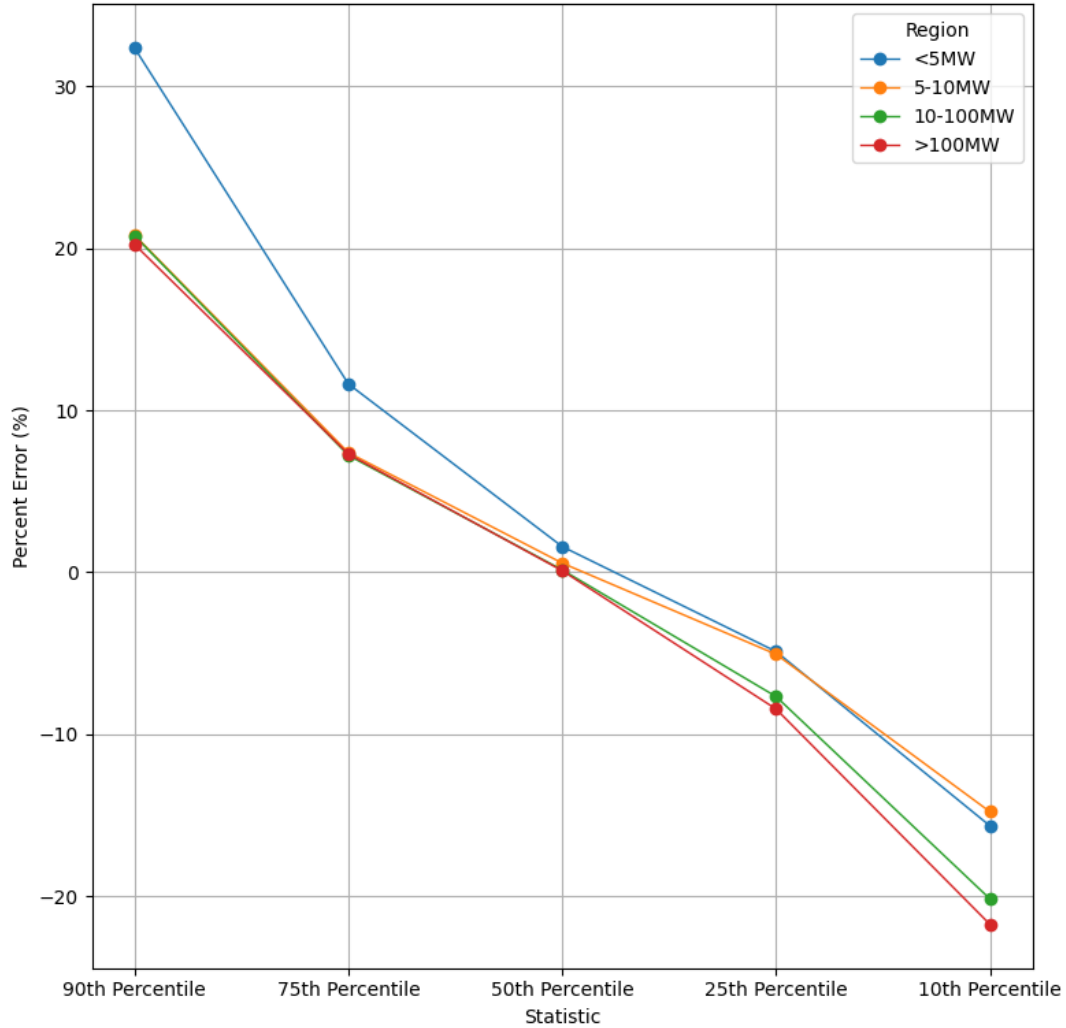
custsvc@pjm.com

# Appendix

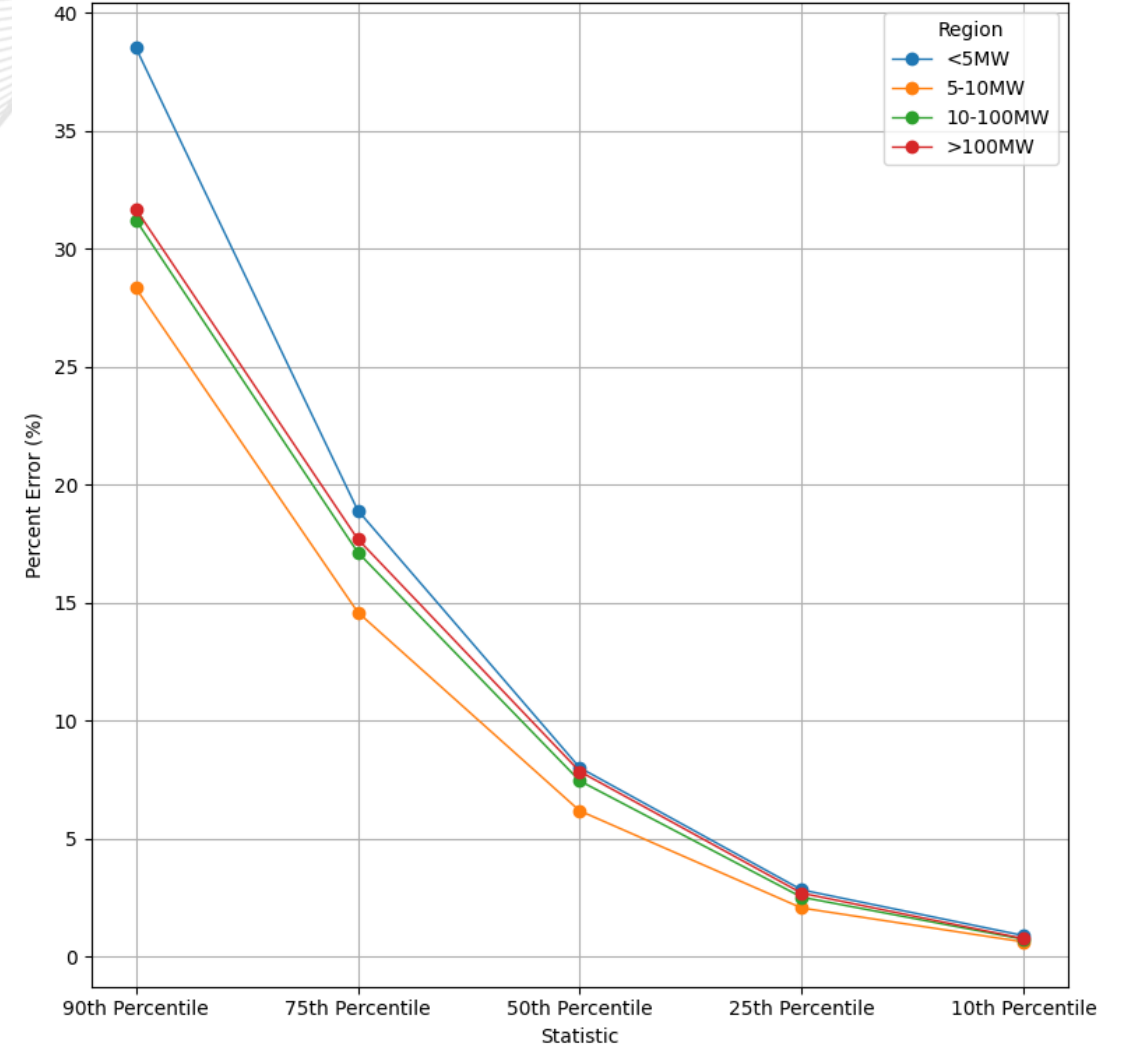


# Solar Forecast Error for 3-Hour Horizon (11/1/2023-10/31/2024)

Solar Forecast Error for 3-Hour Horizon by Installed Capacity

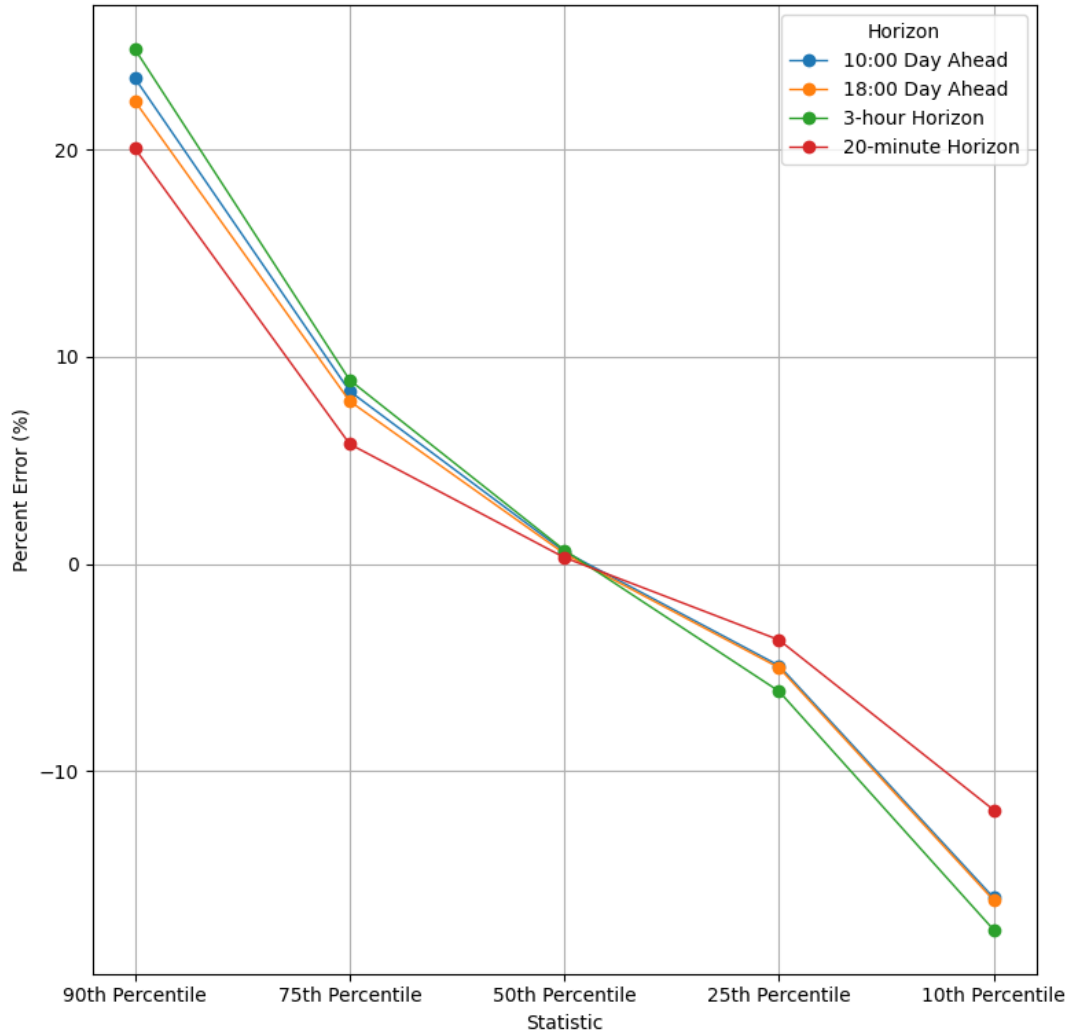


Solar Forecast Absolute Error for 3-Hour Horizon by Installed Capacity

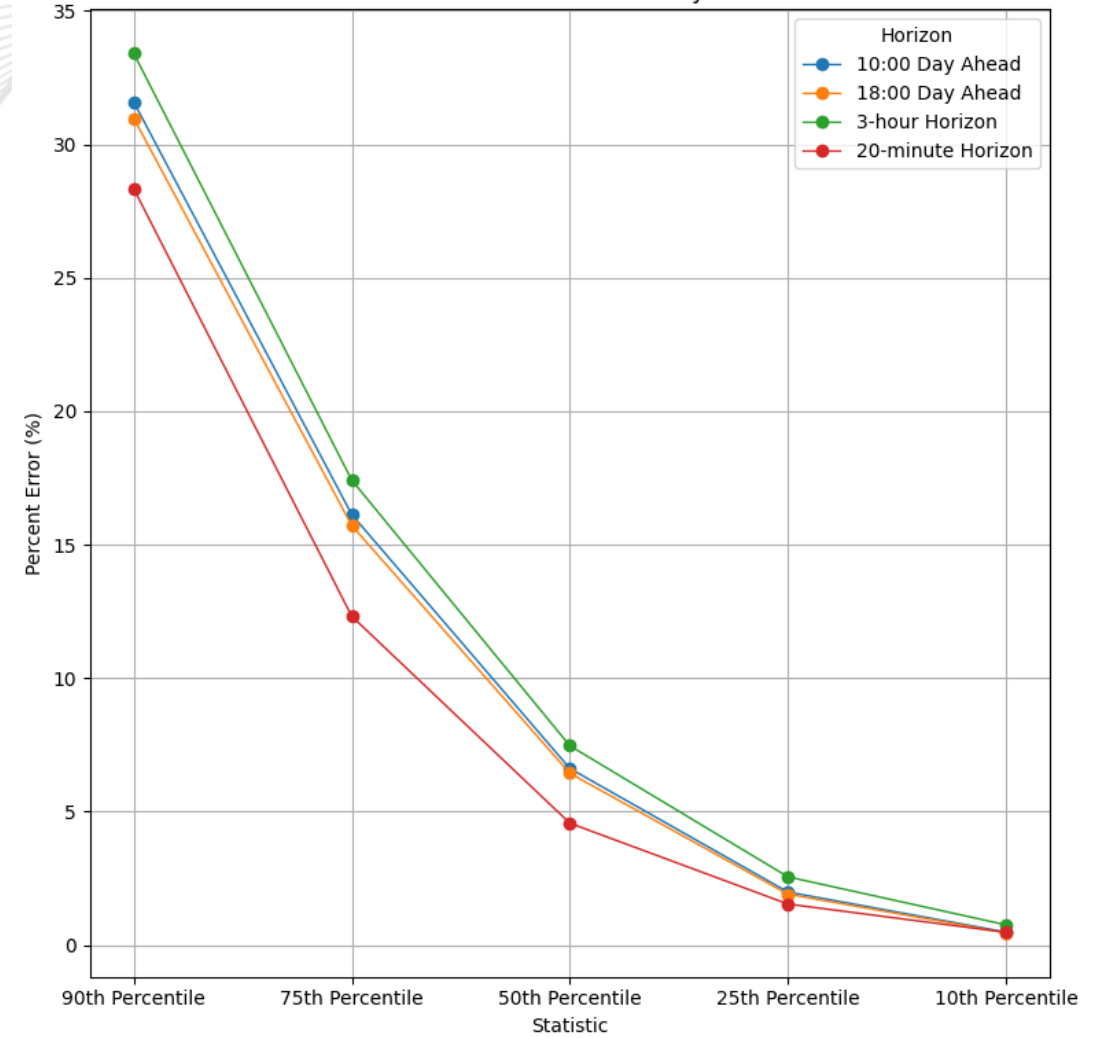




Solar Forecast Error by Horizon

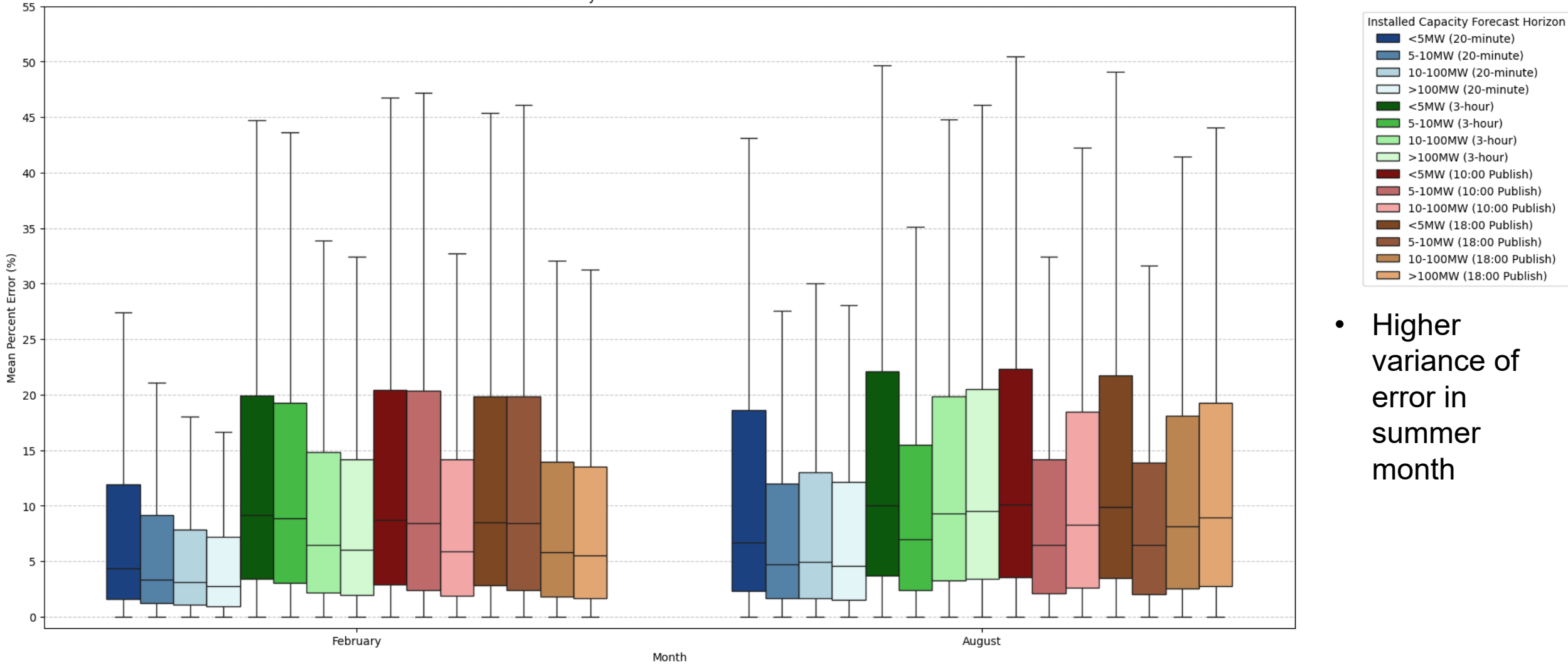


Solar Forecast Absolute Error by Horizon



# Monthly Absolute Error Comparison by Capacity/Horizon

Monthly Solar Forecast Absolute Error



- Higher variance of error in summer month



# Solar Forecast Error for 3-Hour Horizon (11/1/2023-10/31/2024)

Mean Percent Error	<5MW	5-10MW	10-100MW	>100MW
90th Percentile	32.36%	20.81%	20.77%	20.23%
75th Percentile	11.62%	7.38%	7.21%	7.29%
50th Percentile	1.58%	0.56%	0.14%	0.09%
25th Percentile	-4.90%	-5.07%	-7.68%	-8.45%
10th Percentile	-15.66%	-14.79%	-20.17%	-21.74%

- <5MW resources more over-forecast due to telemetry requirements
- Overall error consistency among other groupings of resources

Mean Absolute Percent Error	<5MW	5-10MW	10-100MW	>100MW
90th Percentile	38.52%	28.33%	31.22%	31.68%
75th Percentile	18.91%	14.59%	17.13%	17.69%
50th Percentile	8.00%	6.17%	7.44%	7.84%
25th Percentile	2.82%	2.05%	2.51%	2.68%
10th Percentile	0.88%	0.61%	0.72%	0.75%



# Solar Forecast Error for All Horizons (11/1/2023-10/31/2024)

Mean Percent Error	10:00 Day Ahead	18:00 Day Ahead	3-hour Horizon	20-minute Horizon
90th Percentile	23.45%	22.34%	24.85%	20.06%
75th Percentile	8.34%	7.86%	8.88%	5.79%
50th Percentile	0.60%	0.50%	0.67%	0.31%
25th Percentile	-4.91%	-5.01%	-6.15%	-3.67%
10th Percentile	-16.12%	-16.24%	-17.67%	-11.88%

- 20-minute horizon features highest accuracy
- Gain marginal accuracy between day-ahead publishes
- 3-hour horizon leads to increase in error between day-ahead and real-time

Mean Absolute Percent Error	10:00 Day Ahead	18:00 Day Ahead	3-hour Horizon	20-minute Horizon
90th Percentile	31.59%	30.98%	33.41%	28.34%
75th Percentile	16.13%	15.72%	17.42%	12.32%
50th Percentile	6.62%	6.44%	7.47%	4.57%
25th Percentile	1.99%	1.91%	2.56%	1.54%
10th Percentile	0.49%	0.46%	0.76%	0.48%