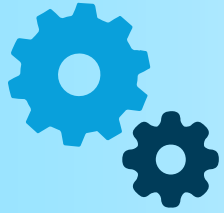


Day-Ahead Uncertainty Quantification

RCSTF

September 17, 2025



**Forecast Net
Uncertainty Using
Machine Learning
Model**



Quantification of solar and
wind, load, weather,
interchange, generation
performance uncertainty



**Risk
determination** to
set reserve
requirements

Step 1: Forecast daily
uncertainty measured in
MWs

Step 2: Assess Risk to
the System and Set
Reserves

Input

Forecast and Actuals:

- **Weather**
(Cloud Cover, Wind Speed, Dew Point, Effective Temperature, THI, Heat Index)
- **Wind**
- **Solar**
- **Load**

Interchange (day-ahead/actuals)

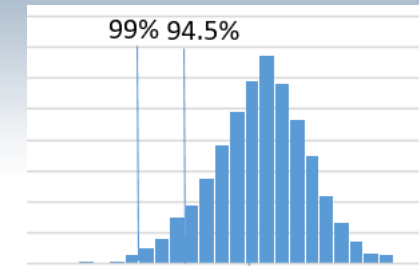
Generation Performance

Machine Learning Model (Python)

- Detect patterns between the input variables
- Establish correlation
- Predict total net uncertainty for a future horizon (hourly/peak hour)

Output

Total Hourly Net Uncertainty for Next Seven Days



Distribution of Total Calculated Uncertainty at Peak Hour

Looking at 7 Years of Historical Data:

Calculated Total Net Uncertainty for every hour for 7 years

Established an uncertainty distribution

Distribution will assist in establishing H/M/L thresholds

Total Uncertainty = LFE - IE – WFE –SFE – GenLoss		
LFE	Load Forecast – Actual Load	Forecast values are all 14:00 Day-ahead forecast.
IE	DA Interchange – Actual Interchange	
WFE	Wind Power Forecast – Actual Wind Power	
SFE	Solar Power Forecast – Actual Solar Power	
GenLoss	Tripping and derating happened after 15:00 previous operating day and within the operating day	

$$\text{Total Uncertainty} = \text{LFE} - \text{IE} - \text{WFE} - \text{SFE} - \text{GenLoss}$$

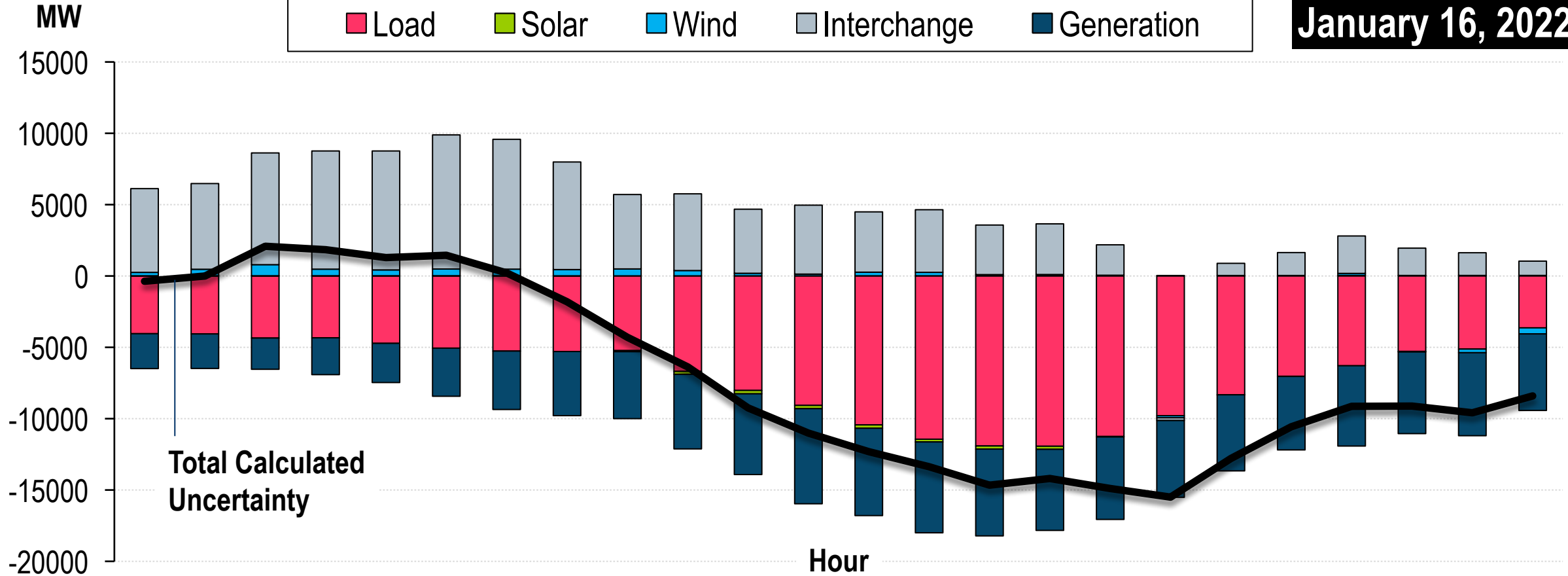
HE 18 of Jan. 16, 2022

total uncertainty = LFE (-9794) – IE (192) – WFE (145)
– SFE (-15) – GenLoss (5383)= **-15,499 MW**

HE 2 of May 18, 2025

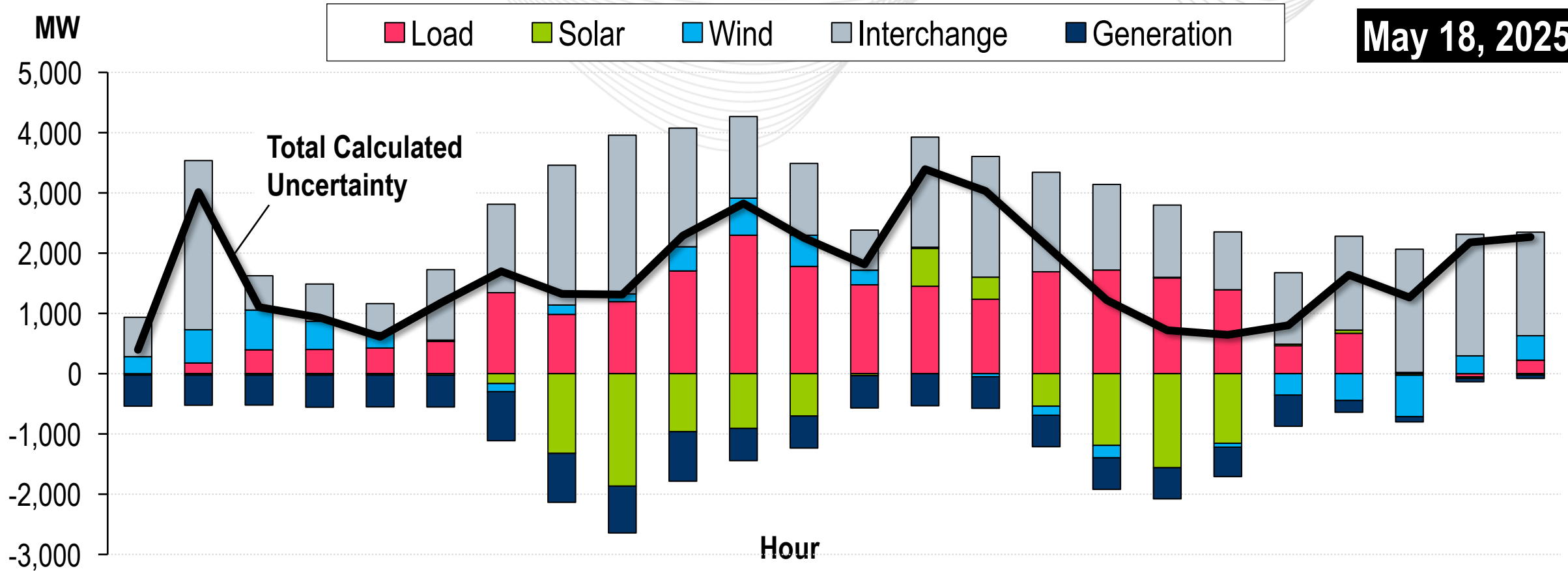
total uncertainty = LFE (177) – IE (-2807) – WFE (-552)
– SFE (24) – GenLoss (500)= **3,012 MW**

January 16, 2022



Key Takeaways:	Uncertainty MWs:		This day would have been High Risk Day	
	• Are not Reserve MWs • Will determine H/M/L Risk		Existing OR: 3,000 MW	Proposed OR: 7053 MW

May 18, 2025



Key Takeaways:	Uncertainty MWs: • Are not Reserve MWs • Will determine H/M/L Risk	May 18 would have been a Low Risk Day	
		Existing OR: 3,000 MW	Proposed OR: 4833 MW

- Load actuals: https://dataminer2.pjm.com/feed/hrl_load_metered/definition
- Load forecast: https://dataminer2.pjm.com/feed/load_frstd_hist/definition
- Solar actuals: https://dataminer2.pjm.com/feed/solar_gen/definition
- Solar forecast:
https://dataminer2.pjm.com/feed/hourly_solar_power_forecast/definition
- Wind actuals: https://dataminer2.pjm.com/feed/wind_gen/definition
- Wind forecast:
https://dataminer2.pjm.com/feed/hourly_wind_power_forecast/definition