

# Uncertainty Management Panel



*Jeff Billo*  
*Director of*  
*Operations Planning,*  
*ERCOT*



*Garrett Crowson*  
*Manager of*  
*Uncertainty Response,*  
*SPP*



*Jason Howard*  
*Director of Operations*  
*Risk Management,*  
*MISO*



*Guillermo Bautista Alderete*  
*Director of Market Performance*  
*and Advanced Analytics,*  
*California ISO*

# Southwest Power Pool Uncertainty Response Team

Garrett Crowson

Manager, Uncertainty Response Team,  
System Operations



- Garrett Crowson
- BSEE, Arkansas Tech University
- Worked for SPP for 13 years
- Helped in development and implementation of Integrated Marketplace
- Worked on both markets and reliability sides of company
- Current role: Manager, Uncertainty Response Team
- Currently charged with identifying capacity risks to the Balancing Authority based on forecast uncertainty



# Uncertainty Response Team (URT)

- March 2018 instantaneous wind penetration of BA load > 60% with installed wind capacity over 17 GW
- Retirements of traditional resources

## Changing Generation Mix

## New Challenges

- Increases in installed variable energy resources created increased risk associated with forecast error

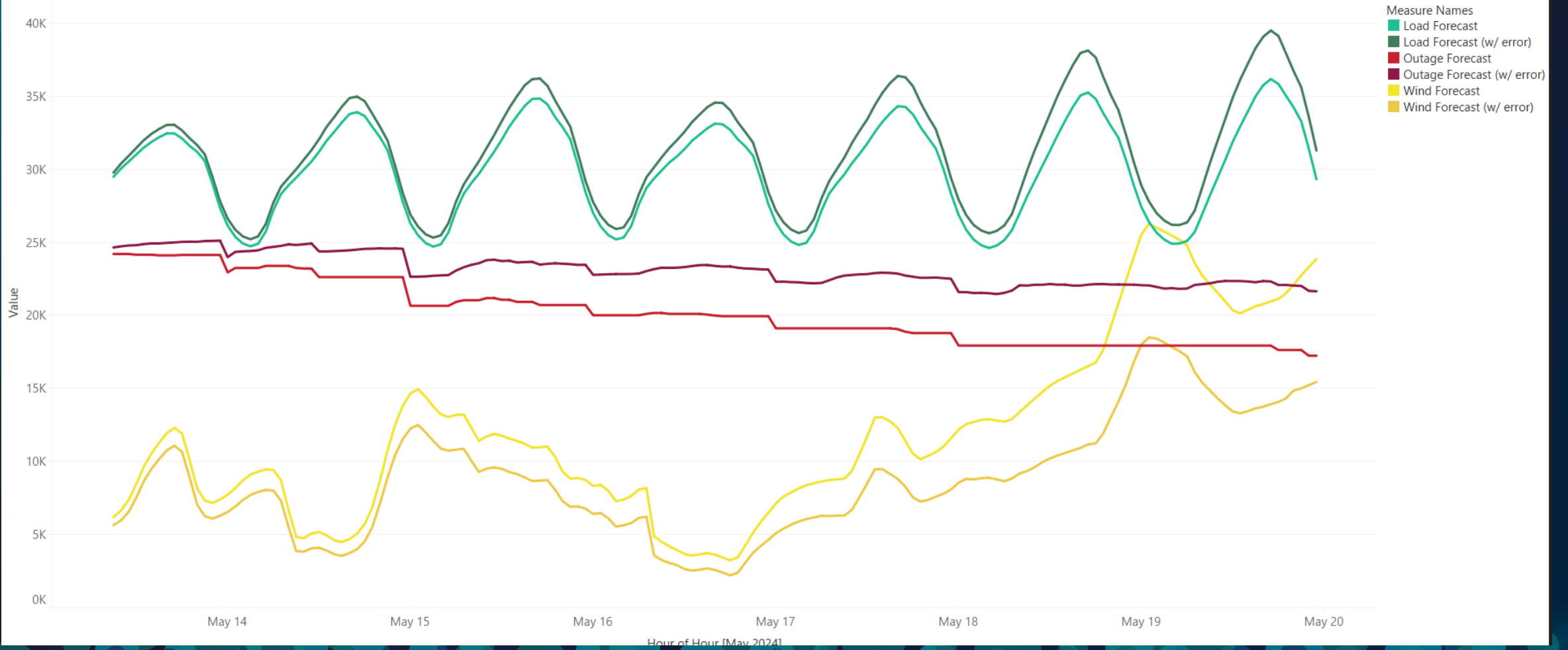
- Operations staff evaluated near miss events and determined high risk situations could at times be detected in advance

## Uncertainty Response Team

# Uncertainty Forecast Estimations

## Error Trends

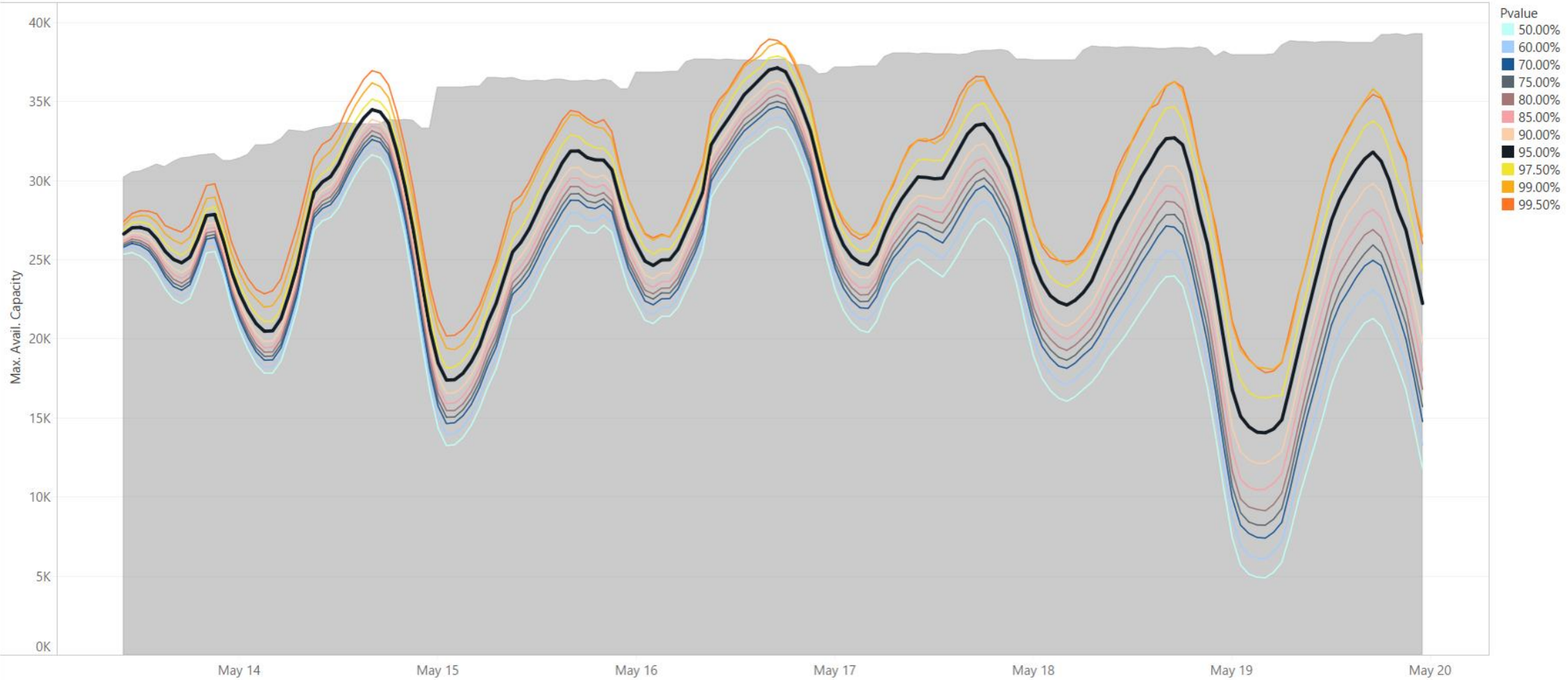
Forecast Run Time: 5/13/2024 8:00:00 AM





# Capacity vs. Uncertainty

Capacity vs Uncertainty  
Run Time: 5/13/2024 9:00:00 AM



# Uncertainty Management: Net Uncertainty Forecast and Dynamic Reserve

Jason Howard

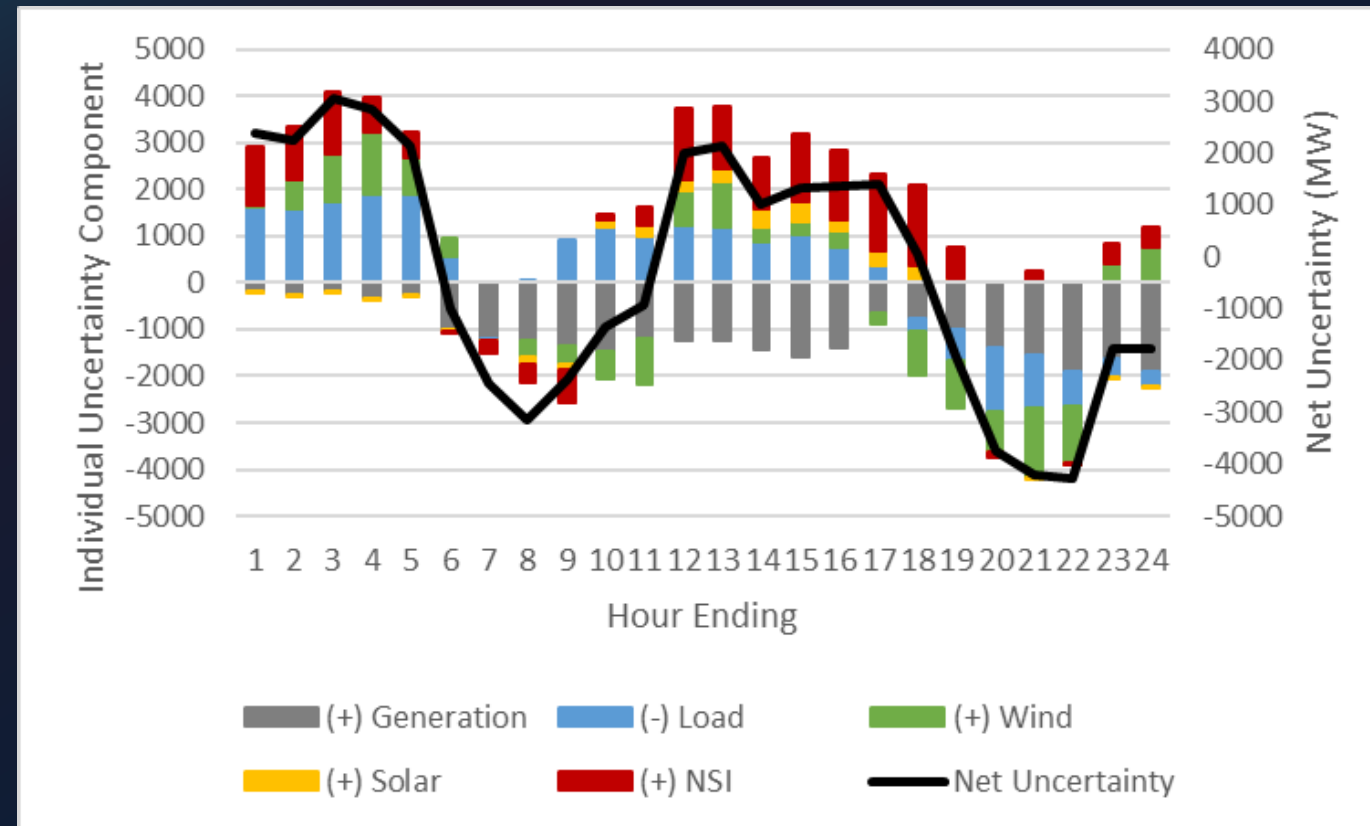
Director Operations Risk  
Management



# Components in Net Uncertainty Quantification

- For the Net Uncertainty Forecast and Dynamic Reserve application, MISO defines and quantifies the Net Uncertainty as the difference between Next-Day FRAC and Real-Time.
- MISO quantifies uncertainty of the following components
  - Load
  - Wind
  - Solar
  - Net Scheduled Interchange
  - Generation Availability

A sample day of materialized uncertainty





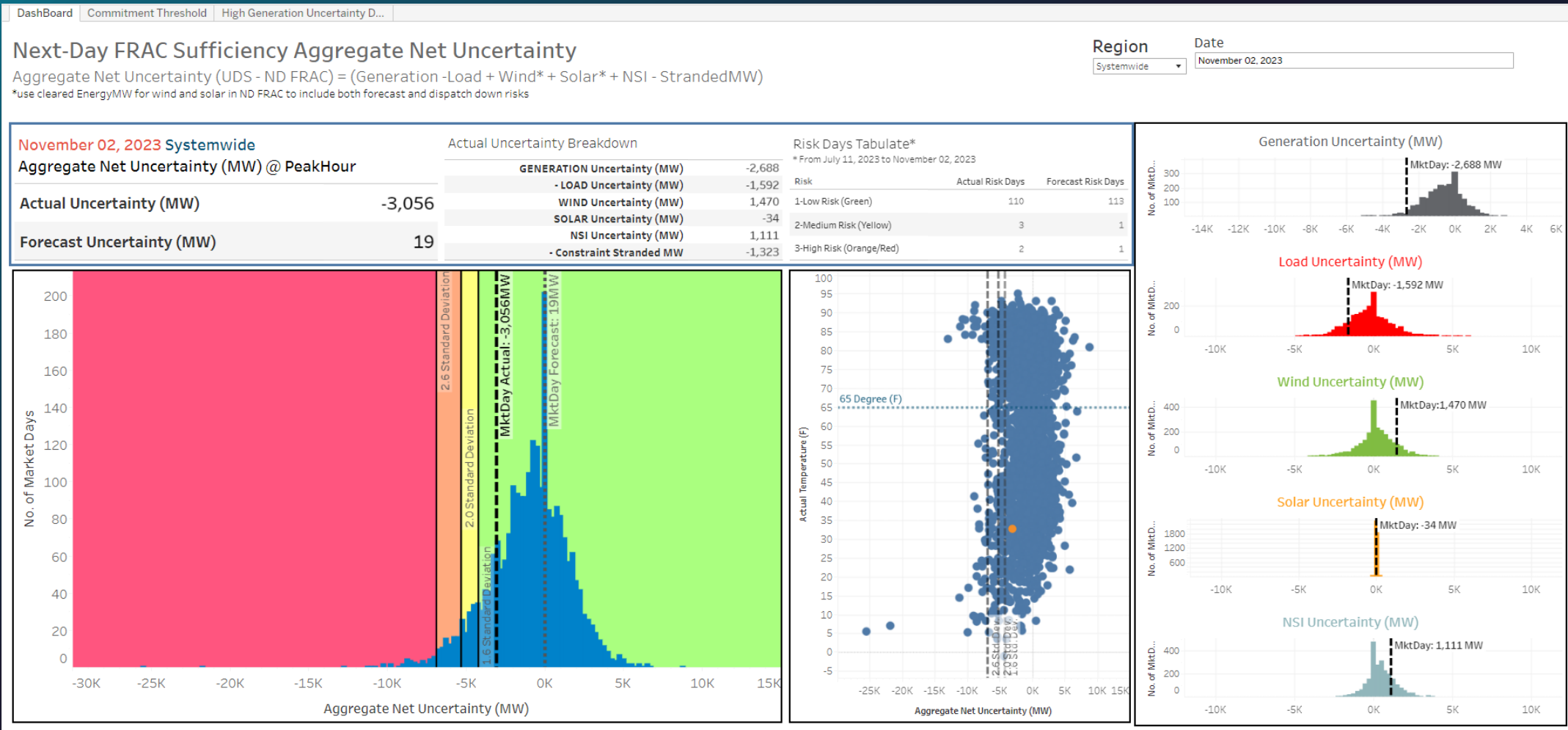
# Net Uncertainty Forecast Strategy

- Leveraging the forecast information we already have and build a model for Net Uncertainty forecast
- Establish the relationship between materialized Net Uncertainty and corresponding historical forecasts of key components, including load, wind, solar, and weather



Hourly TimeStamp	Load Frct	WIND Frct	SOLAR Frct	Weather Frct					Materialized Net Uncertainty
				CloudCover	DewPoint	DryBulb	RainFall	WindSpeed	
3/12/2024 18:00	69637	6780	392	34.37	40.39	64.07	0.00	11.46	-183
3/12/2024 19:00	71145	7737	1	32.62	40.59	61.31	0.00	9.36	-1134
3/12/2024 20:00	70380	8853	0	32.17	40.60	58.97	0.00	8.86	-1751
3/12/2024 21:00	68148	9397	0	31.89	40.89	57.04	0.00	8.68	-402
3/12/2024 22:00	65466	9664	0	32.17	40.99	55.30	0.00	8.50	1223
3/12/2024 23:00	62573	9769	0	38.48	41.09	54.40	0.00	8.37	2714
3/13/2024 0:00	60372	10142	0	36.66	40.79	53.60	0.00	7.49	2399

# Net Uncertainty dashboard displays several key metrics



# Applications of Net Uncertainty Forecast

*A progress toward quantified, data-driven decisions to better manage uncertainty*

To set the following requirements dynamically on a daily basis:

## Next-Day FRAC

### Commitment Threshold Recommendation

- Reliability Assessment and Commitment process is conducted daily to ensure sufficiency resources are able to satisfy forecasted system conditions and reserve obligations for the next operating day.
- Assess optimized engine-executed Commitment solution against Threshold recommendation.

## Short-Term Reserve (STR)

### Requirement

- STR is MISO's rampable generation capacity product, co-optimized with energy and ancillary services products.
- For addressing market-wide, sub-regional and local short-term reserve needs (30-minute to 3-hour).

\* [STR Primer](#)

# Set Next-Day STR requirements and commitment threshold recommendation based on uncertainty risk prediction (L/M/H) for Next-Day

## Commitment threshold recommendation (% and MW)

- Low risk (green zone): 90% risk coverage (1.6 standard deviation)
- Medium risk (yellow zone): 95% risk coverage (2.0 standard deviation)
- High risk (orange/red zone): 99% risk coverage (2.6 standard deviation)

## Multi-day tracking

Systemwide Multi-Day Net Uncertainty Forecast: Risk Prediction						
Forecast Horizon	5/21/2024	5/22/2024	Marketday		5/25/2024	5/26/2024
			5/23/2024	5/24/2024		
1 Day Ahead	3-High Risk (Orange/Red)					
2 Days Ahead	3-High Risk (Orange/Red)	1-Low Risk (Green)				
3 Days Ahead	3-High Risk (Orange/Red)	3-High Risk (Orange/Red)	1-Low Risk (Green)			
4 Days Ahead	3-High Risk (Orange/Red)	2-Medium Risk (Yellow)	1-Low Risk (Green)	1-Low Risk (Green)		
5 Days Ahead	3-High Risk (Orange/Red)	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)	
6 Days Ahead	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)	1-Low Risk (Green)

Systemwide Multi-Day Net Uncertainty Forecast: MW						
Forecast Horizon	5/21/2024	5/22/2024	Marketday		5/25/2024	5/26/2024
			5/23/2024	5/24/2024		
1 Day Ahead	-6,666					
2 Days Ahead	-6,856	-1,491				
3 Days Ahead	-7,461	-5,463	1,013			
4 Days Ahead	-7,097	-5,116	1,438	328		
5 Days Ahead	-7,270	322	1,397	-725	443	
6 Days Ahead	-3,237	-20	-2,968	549	1,902	-285

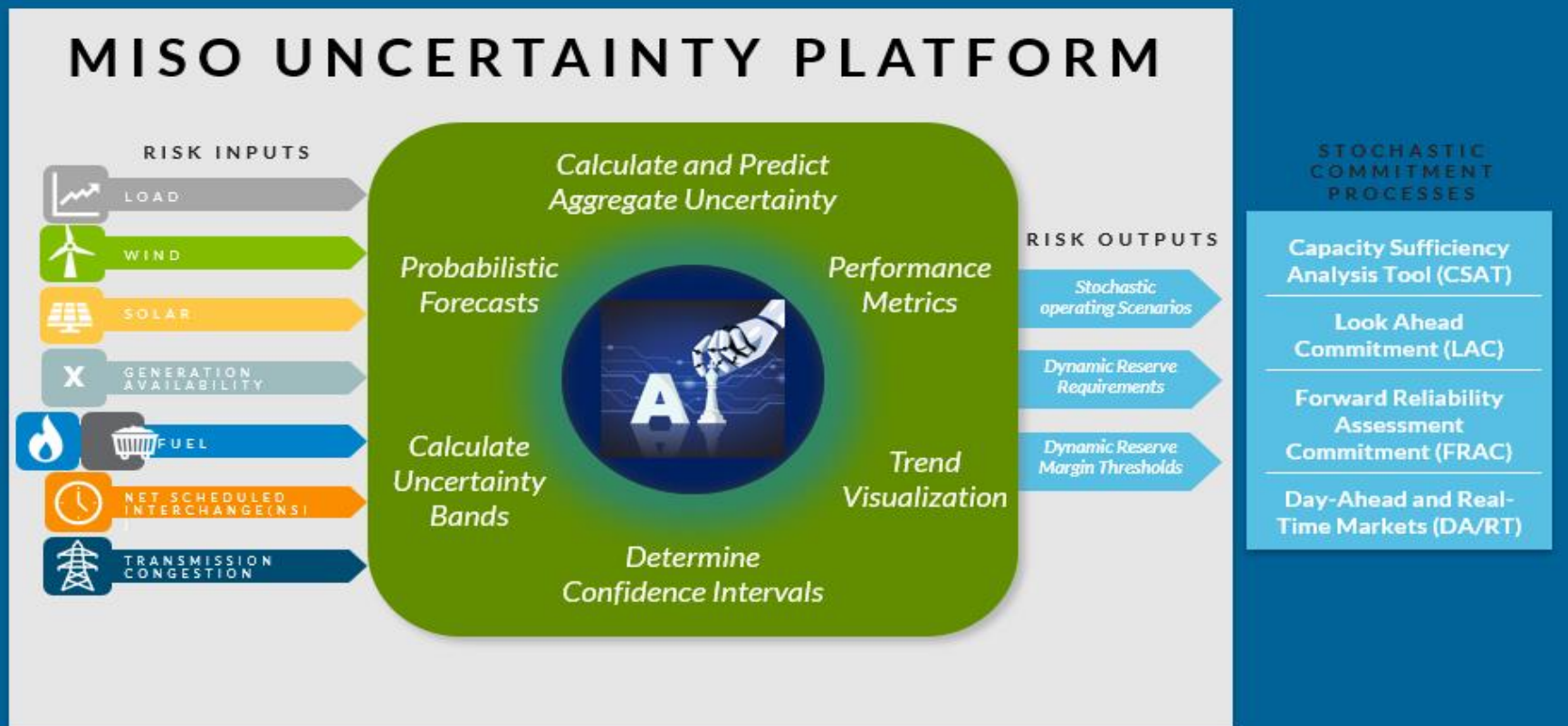
## Next-Day implementation

March 16, 2024

Next-Day FRAC Commitment Threshold Recommendation

Region	Frct PeakHE	Forecast Risk	Commitment Threshold (Percentage)	Commitment Threshold (MW)
North/Central	9	1-Low Risk (Green)	6	3,700
South	17	1-Low Risk (Green)	6	1,400
Systemwide	20	1-Low Risk (Green)	5	4,300

# MISO's initiative is to build an Operations Uncertainty Platform that provides capability, flexibility, scalability to manage variability and uncertainty in Operations



- Transform MISO's operations from a deterministic approach to a probabilistic approach
- Address pain points across ISOs/RTOs: automation and scalability; and no off-the-shelf product
- Deployment and validation in MISO's risk assessment and control room starting from year 1