MISO Uncertainty Management

MISO

ESIG June 11-13, 2024

Transitioning fleet is driving a new risk profile for Grid and Market Operations



Reliability is not only to meet the projected load obligation but to manage uncertainties

Characterize risks	Integrate risks	Manage risks	
using data analytics and	into operations planning	through market products	
meteo techniques	and situational awareness	or dynamic reserves	
Individual risks range from	Establish centralized visual of risks dynamically and with	Quantify net uncertainty across different timeframes	
generation, Txx, etc.	regional granularity	and predict H/M/L risks	
Establish probabilistic	Provide risk updates for ops	Operate dynamic reserves	
forecasts	planning and unit commitment	for existing market products	



The cloud-based Uncertainty Platform is aimed to transform deterministic grid operations to probabilistic





The platform will establish probabilistic forecasts and risk analytics to quantify individual risk factors



- Weather scenario-based load forecast Derive load forecast scenarios from multiple NWP models and assess uncertainty spread
 - **Operationalize 2nd renewable vendor** Build infrastructure to host multiple vendors and multiple wind and solar forecast scenarios











- MISO
 - MISO (when PJM load is above 99 pecentile or 133.0GW
- MISO (when PJM load is above 99.9 pecentile or 145.0GW)



Dynamic requirements for Short-Term Reserve and Next-Day Reserve Margin threshold are operationalized

- MISO developed robust methodology to quantify Net Uncertainty
 - Short-Term Reserve: 30min-3hr net uncertainty managed by 30min rampable online capacity and eligible 30min offline fast start resources
 - Next-Day Reserve Margin Threshold: nextday net uncertainty managed by online capacity and 4hr offline short lead units^{*}
- Net Uncertainty prediction machine learning model is established in Azure to predict H/M/L risk profile
 - Net uncertainty quantified and predicted at both systemwide and sub-regional levels
- Operating Procedure and dynamic reserve process established and operated

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MISO's net uncertainty model considers the holistic risk profile including thermal generation outage/derates, imports/exports...

TRADITIONAL

Aggregate individual uncertainties with assumptions of correlations



Forecast Error on Example Da

Net Demand

E3 OLSON MODEL Net load forecast error assembled from load, wind, and solar

MISO MODEL

Net uncertainty constituted from load, wind, solar, generation derates/forced outages and NSI

Azure Data Strategy

Data Platform

Data Ingestion

Uncertainty Management



MM c

-500

-100



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INDUSTRY PRACTICES

Performed as expected during winter storm Heather, allowing pre-position with adequate reserves to manage uncertainties

- The Net Uncertainty prediction model successfully flagged HIGH risk based on historically experienced large uncertainty in like-weather conditions
- High STR requirement and Next-Day threshold were used accordingly to procure reserves
- Given Elliot/Uri like cold/precip, we further raised the requirements to cover 99.7 percentile (3-sigma) for Jan 16-17



Short Term Reserve Req	uirement Recommendation
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lour	STR Requirement (MW)	Override	
0	3,600		1,600
1	3,600	Data ad 000MW	1,600
2	3,600	Raiseu Juulvivv	1,600
3	3,600	(000) = d d = t + t =	1,600
4	3,600	(99%) adder to	1,600
5	4,300		1,600
6	4,300	1600MW (99.7%)	1,600
7	4,300		1,600
8	3,600		1,600
9	3,600		1,600
10	3,600		1,600
11	4,400		1,600
12	4,400		1,600
13	4,400		1,600
14	4,400		1,600
15	3,600		1,600
16	3,600		1,600
17	3,600		1,600
18	3,600		1,600
19	3,600		1,600
20	4,300		1,600
21	4,300		1,600
22	4,300		1,600
23	3,600		1,600

January 16, 2024

Next-Day FRAC Commitment Threshold Recommendation

	gion	Forecast Risk	Commitment Threshold (Percentage)	Commitment Threshold (MW)
Nor	rth/Central	3-High Risk (Orange/Red)	14	9,200
Sou	uth	3-High Risk (Orange/Red)	9	2,200
Syst	stemwide	3-High Risk (Orange/Red)	13	12,200



CSAT^{*} provides control room and members situational awareness of Operating Reserve Margin and supports scenario analysis

- Provides Operating Reserve Margin outlook every 15 minutes up to seven days for systemwide, South and North/Central
- Establishes source of truth for critical foresight including Resource availability, Load, wind/solar, NSI, etc. and Emergency resources
- Improves usability including graphic and tabular visualization and operator interaction for preliminary scenario analysis
- External access to CSAT data enabled by MISO website to provide dynamic view of system conditions







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