MISO Update

Wisconsin Legislative Council Study Committee

December 5, 2024

Executive Summary

- The transition to a new resource fleet and more frequent extreme weather events are introducing unprecedented challenges, including uncertainty, variability and congestion.
- These trends demand innovative approaches to grid operations. As industries adopt Artificial Intelligence (AI) and Machine Learning (ML), the energy sector is leveraging these technologies to tackle grid complexities and deliver smarter, more efficient solutions.
- MISO is actively engaging with members and digital partners to explore and develop AI/ML applications across markets, operations, and transmission planning, fostering collaboration and innovation in grid management.

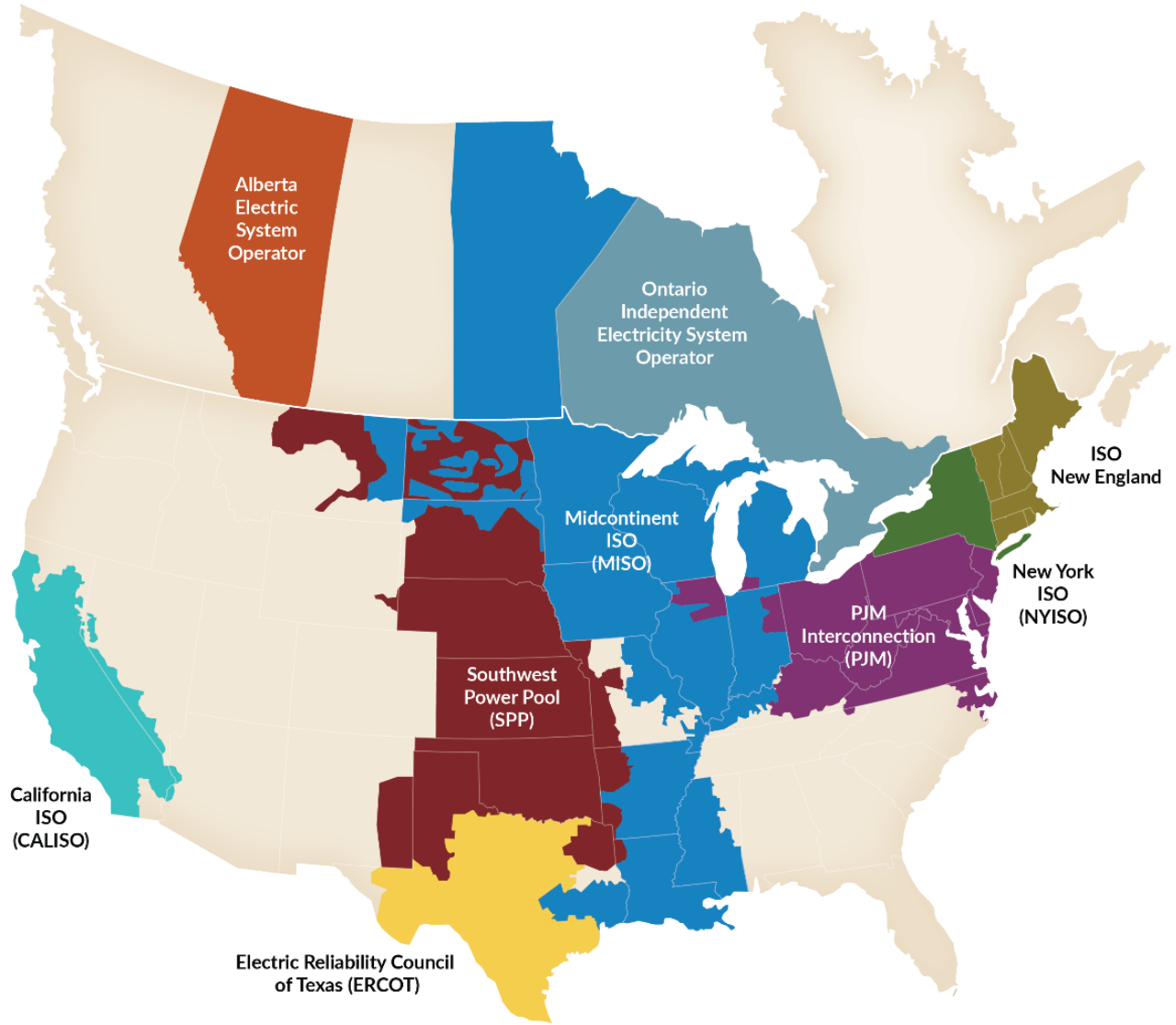
MISO is an independent, not-for-profit Regional Transmission Organization serving 15 U.S. states and one Canadian province

MISO's reliability footprint and regional control center locations

MISO KEY FACTS

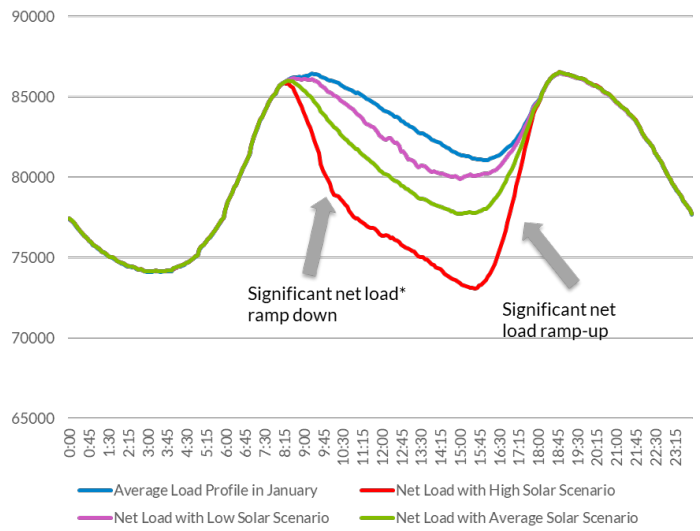
Area Served	15 U.S. States and Manitoba, Canada
Population Served	45 Million
Transmission Line	77,000 Miles
Generating Units	> 1900
Record Demand	127.1 GW 7/20/2011
Wind Peak	25.6 GW 1/12/2024
Solar Peak	8 GW 10/16/2024
Members	54 Transmission Owners
	143 Non-transmission Owners
Market Participants	> 500
Market Transactions	> $40 billion
Carbon Reduction	Approximately 32% since 2014

MISO has the largest geographical footprint of all Regional Transmission and Independent System Operators in North America

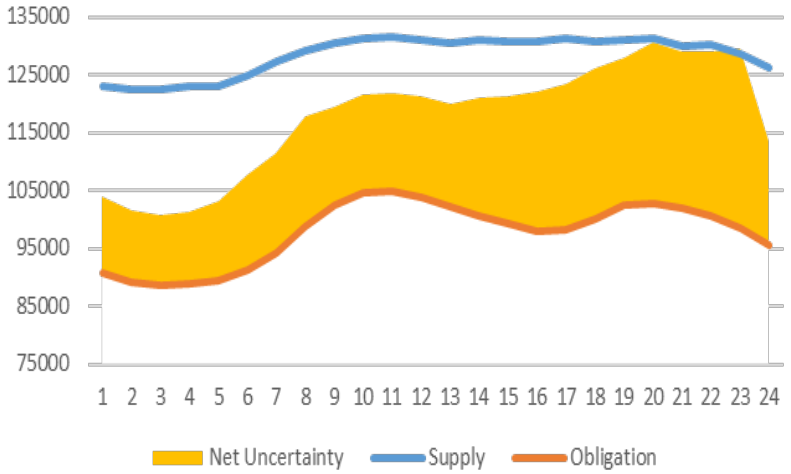


The accelerating pace of the energy transition and increasing extreme weather events are challenging the traditional way we operate the grid

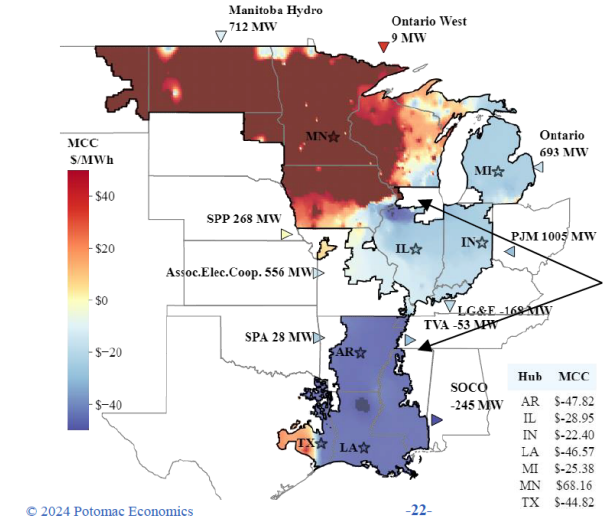
Steeping Net Load Ramp



Winter Storm Net Uncertainty



Volatile Congestion Pattern



"Duck curve" materializing this winter with 12 GW projected solar

40GW renewable (wind + solar) at MISO with additional 45GW (mostly solar) with signed GIA

Winter storm Elliot, adequate resources projected day(s)-ahead

25GW uncertainties materialized leading into Emergency Procedures

More complex and volatile congestion

Intermittent wind and solar energy coupled with transmission or generation outages

Data and analytics strategy empowers MISO to become an intelligence driven organization while leveraging data, AI and ML capabilities

MISO DATA & ANALYTICS

Vision
Empower MISO to improve and enhance data-driven decision-making.

Mission
Advance enterprise strategic priorities through effective utilization of quality data.

Goal
Deliver a holistic framework to establish new ways of organizing, delivering and managing data that facilitates the best possible basis for decision-making.

Objectives
- Provide a curated environment that enables intuitive data exploration and utilization.
- Deliver a process framework to advance analytical capabilities and trusted decision-making.
- Build an enterprise culture where robust data standards are embedded and embraced.

MISO's is making significant progress in leveraging AI techniques to transform our decision making

	Production	Development	Exploration

Markets	• Net Uncertainty ML Models for dynamic reserves	• Improve load and renewable forecasting
		  • Vendor switching
		  • Forecast model/scenario ensemble
		  • Stanford load forecasting model	

Operations	• Interconnection chatbot
	• Outage (return) forecasting
		• Forecast historically unknowns
		  • NSI forecasting
		  • Price forecast for Storage state of charge optimization
			• Digital assistant for control room operations and intelligent logging using NLP and LLM

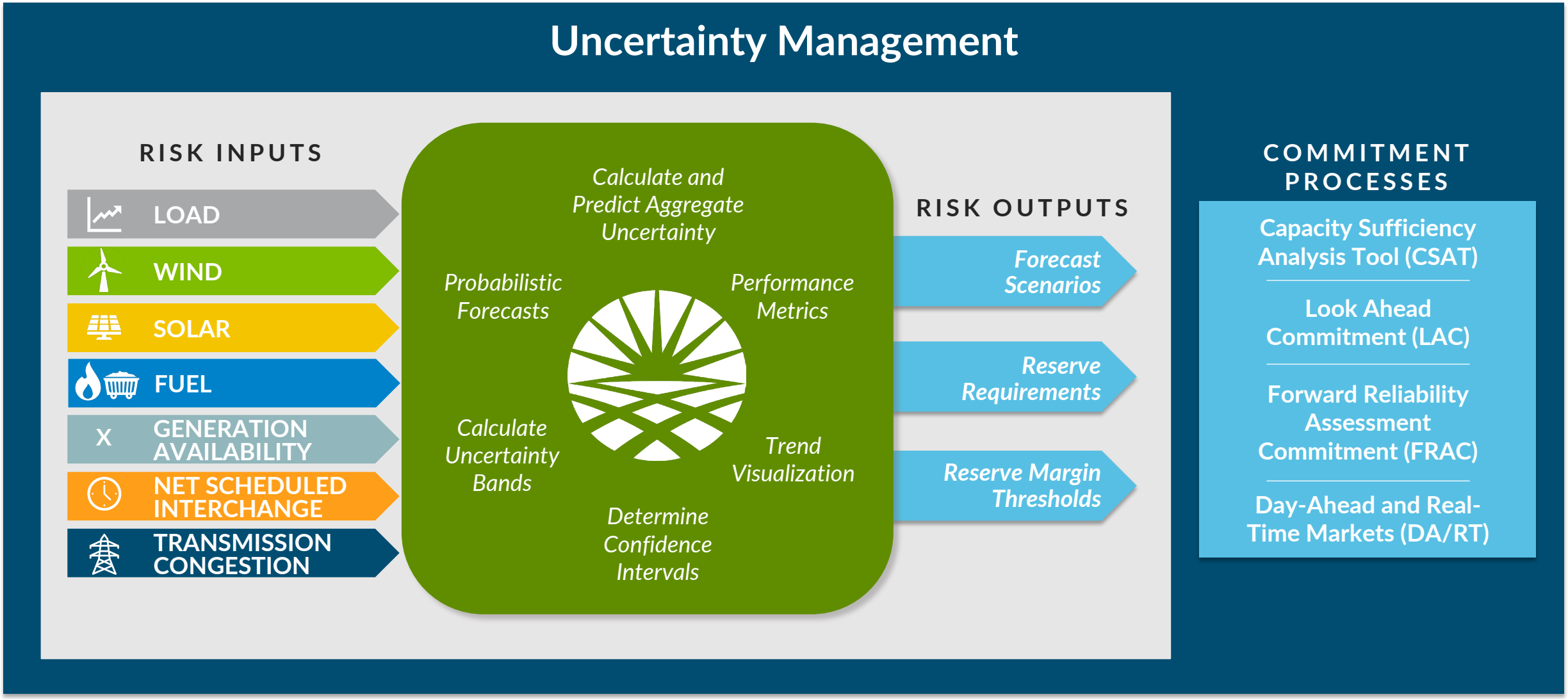
Transmission Planning		• Improve Economic Base Model • Key Impacts to Congestion	• Leverage AI/ML to understand how do we manage the integration of new resources • Retiring Units Prediction

• Predictive congestion forecast and management

NSI: Net Scheduled Interchange; NLP: Natural Language Processing; LLM: Large Language Model

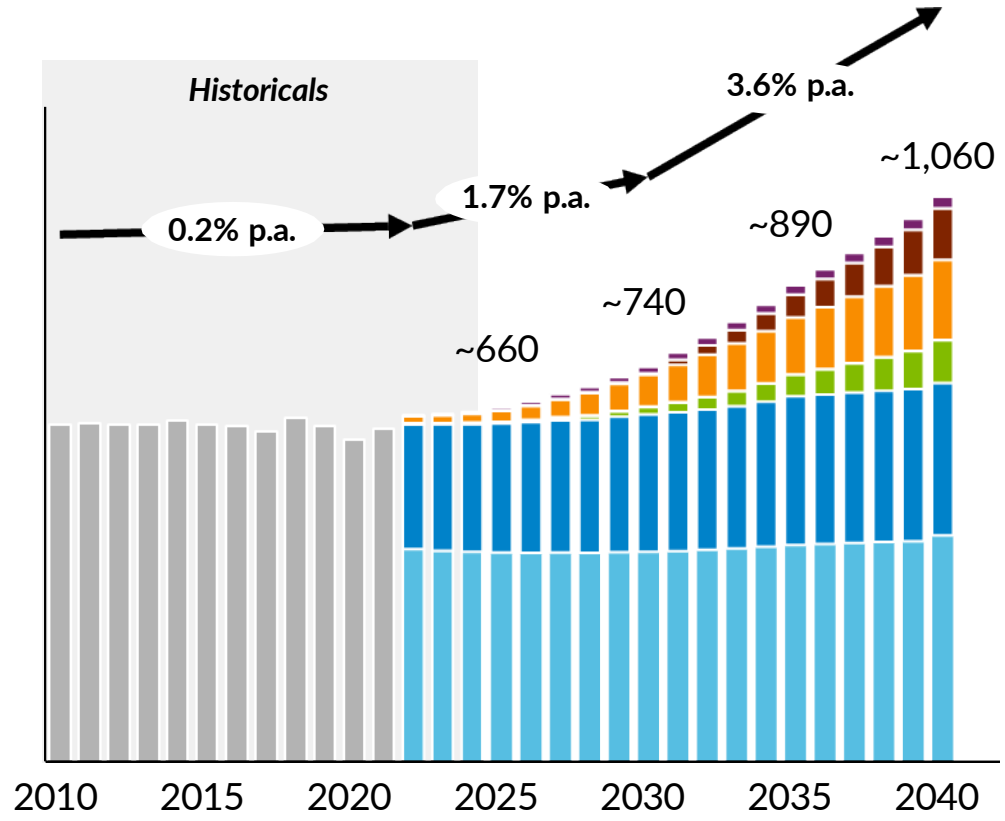
Development

A cloud-based Uncertainty Platform is being built to automate the forecasting and net uncertainty analytics



MISO region load could grow ~60% through 2040, exacerbating existing reliability challenges and requiring additional firm, controllable resources

MISO power demand[1] by sector 2023-2040, (TWh)



	CAGR '23-'40	TWh '23-'40	Level of certainty[2]
Industrial IRA-boosted	13%	19	
Green hydrogen	61%	97	
Data Centers	14%	136	
Transport	29%	79	
Industrial conventional	1.1%	49	
Buildings	0.4%	29	

Source: leverages McKinsey's Global Energy Perspectives.

1. *Volumetric power demand load is total downstream gross. Historical actuals are from EIA 861*
2. *Likelihood of change in demand materializing*