



Large Load Reliability Requirements in MISO

ESIG Spring Technical Workshop

About MISO



KEY FACTS

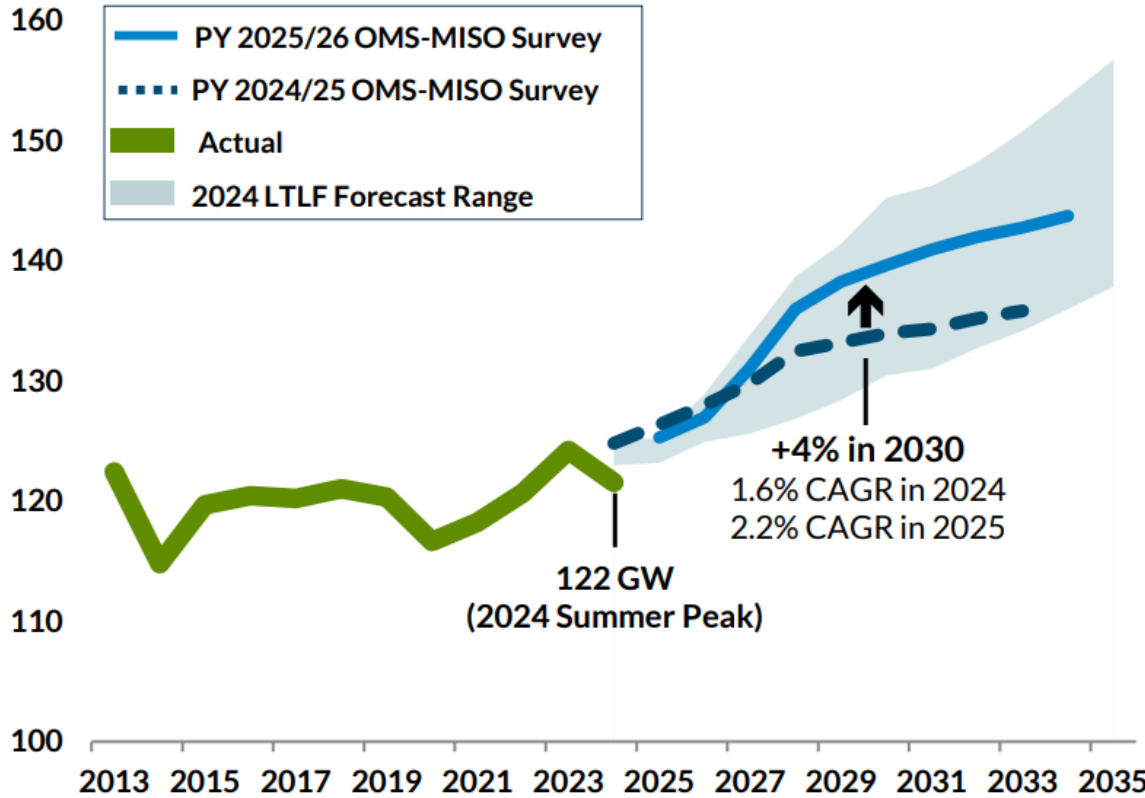
Area Served	15 U.S. States and Manitoba, Canada
Population Served	45 Million
Transmission Line	79,000 Miles
Generating Units (Commercial Model)	1,979
Record Demand	127.1 GW 7/20/2011
Wind Peak	25.6 GW 1/12/2024
Solar Peak	14.5 GW 9/7/2025
Members	57 Transmission Owners
	176 Non-transmission Owners
Market Participants	>550
Carbon Reduction	Approximately 32% since 2014

MISO TRANSMISSION EXPANSION PLAN (MTEP24)

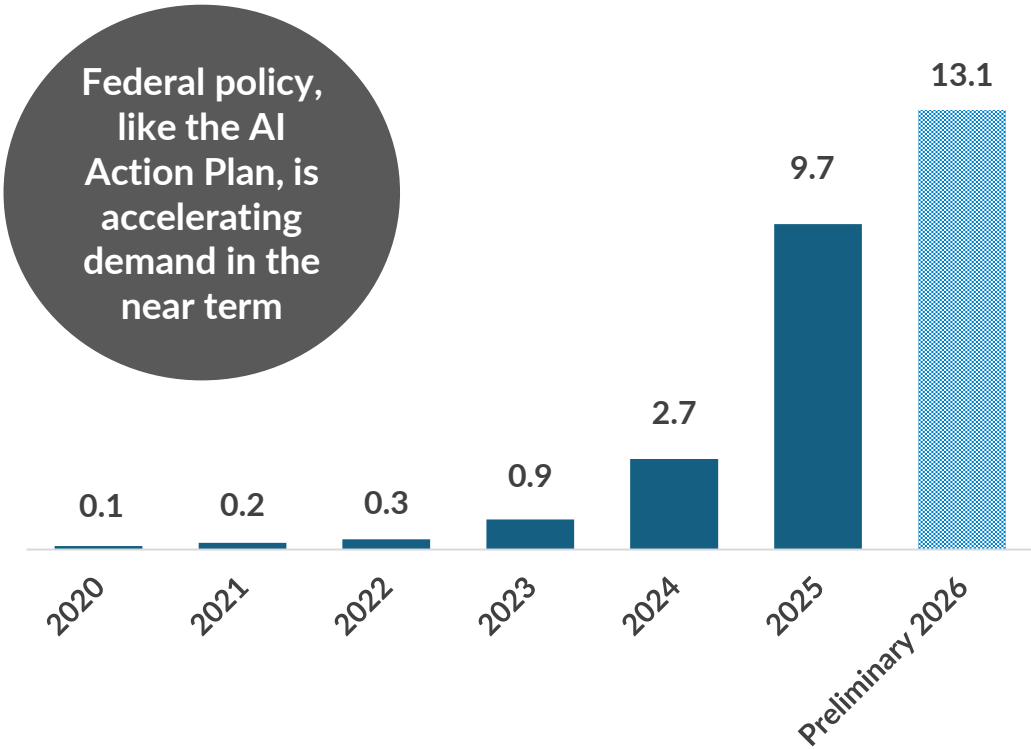
	MTEP25	MTEP24
Approved New Projects	432	482
Miles of Transmission Line	1,901	5,053

MISO's long-term forecasts and projects submitted through MTEP's EPR process project accelerating requests for large load additions

2024 Long-Term Load Forecast (GW)
Based on OMS-MISO Survey Submissions



Large Load Additions (GW)
Based on MTEP's Expedited Review Projects (EPRs)



* Preliminary MTEP data based on MISO member submissions and prior to studies and approvals.

MISO has already responded to the urgent need, but more action is needed

GENERATION INTERCONNECTION

Expediting processes to get generation online faster

ERAS

Targeted process for generation serving new load

JTIQ

Facilitates interconnection of large amounts of new generations more efficiently and cost effectively

Interconnection Queue

Numerous enhancements create efficiencies in standard processes, driving to a 373-day cycle

CROSS FUNCTIONAL

Providing continuity across resource and transmission planning

GI Options

Standard, provisional, surplus, replacement, and ERAS generation interconnection requests provide options to customers

Load Forecasting

Improved load forecast capabilities support proactive transmission and resource planning

New Tools

Automation enhances transparency and provides improved tools for study across processes, enabling more transparent and efficient results delivery

TRANSMISSION PLANNING

Evaluating the transmission system to meet near- and long-term system needs

MTEP

Transparently review near term needs and evaluate alternatives

EPR

Quickly analyze emerging needs, such as large loads, to reliably enable speed to power

LRTP

Provide a backbone to enable energy and lower total transmission costs on the system

MISO is working towards three desired outcomes that warrant stakeholder consideration



Interconnection reliability requirements

A set of guidelines and requirements needed to support reliability are defined for large load at the time of interconnection.



Speed to reliable power

Large load can secure service quickly and without compromising reliability, accounting for the unique characteristics and commitments of the facility.



Reliable operations

The grid is operated reliably and efficiently with substantial levels of large load.

As load shifts from passive to dynamic, the modern grid must evolve with updated assumptions that anticipate new behaviors and enable more adaptive planning

New Behaviors

Massive + concentrated
+ fast-arriving data
centers

Power-electronics
nature + fast variability

Complex fault
ride-through behaviors

Oscillatory and
subsynchronous
interactions

New + Unique design

Evolving Assumptions

Forecasting
Assumptions

Load Behavior
Assumptions

Protection Assumptions

Stability Assumptions

Modeling Assumptions

Until NERC sets standards governing large loads, MISO distilled the requirements down to five themes, informed by the reliability universe



Themes	Examples
<p>Performance & Ride-through</p> <p>Ensure large loads remain connected and operate reliably during system disturbances</p>	<p><i>Voltage ride-through</i> <i>Frequency ride-through</i> <i>Reactive power & voltage control</i></p>
<p>Flexibility & Reliability Limits</p> <p>Prevent sudden large changes that could destabilize the system</p>	<p><i>Ramp limit</i> <i>Block load limit</i> <i>Controlled energization and load pickup</i></p>
<p>Operational Readiness</p> <p>Ensure large loads provide real-time data and coordination for forecasting, outage planning, and system protection</p>	<p><i>Telemetry & metering standards</i> <i>Forecasting (short-term and long-term)</i> <i>Outage Coordination Protocols</i></p>
<p>System Stability</p> <p>Avoid adverse impacts on system dynamics and maintain system strength</p>	<p><i>Control Interaction & Controller Stability</i> <i>Oscillation Sensitivity</i> <i>Voltage Stability</i></p>
<p>Resilience & Security</p> <p>Ensure large loads withstand disruptions and maintain secure operations</p>	<p><i>Cyber & Physical Security Compliance</i> <i>Restoration Coordination</i> <i>Block Loading for Recovery</i></p>

As renewable generation and electronic loads increase, the dynamic behavior of power systems is becoming increasingly driven by fast-response power electronic devices—factors that are not well represented in current stability study processes

