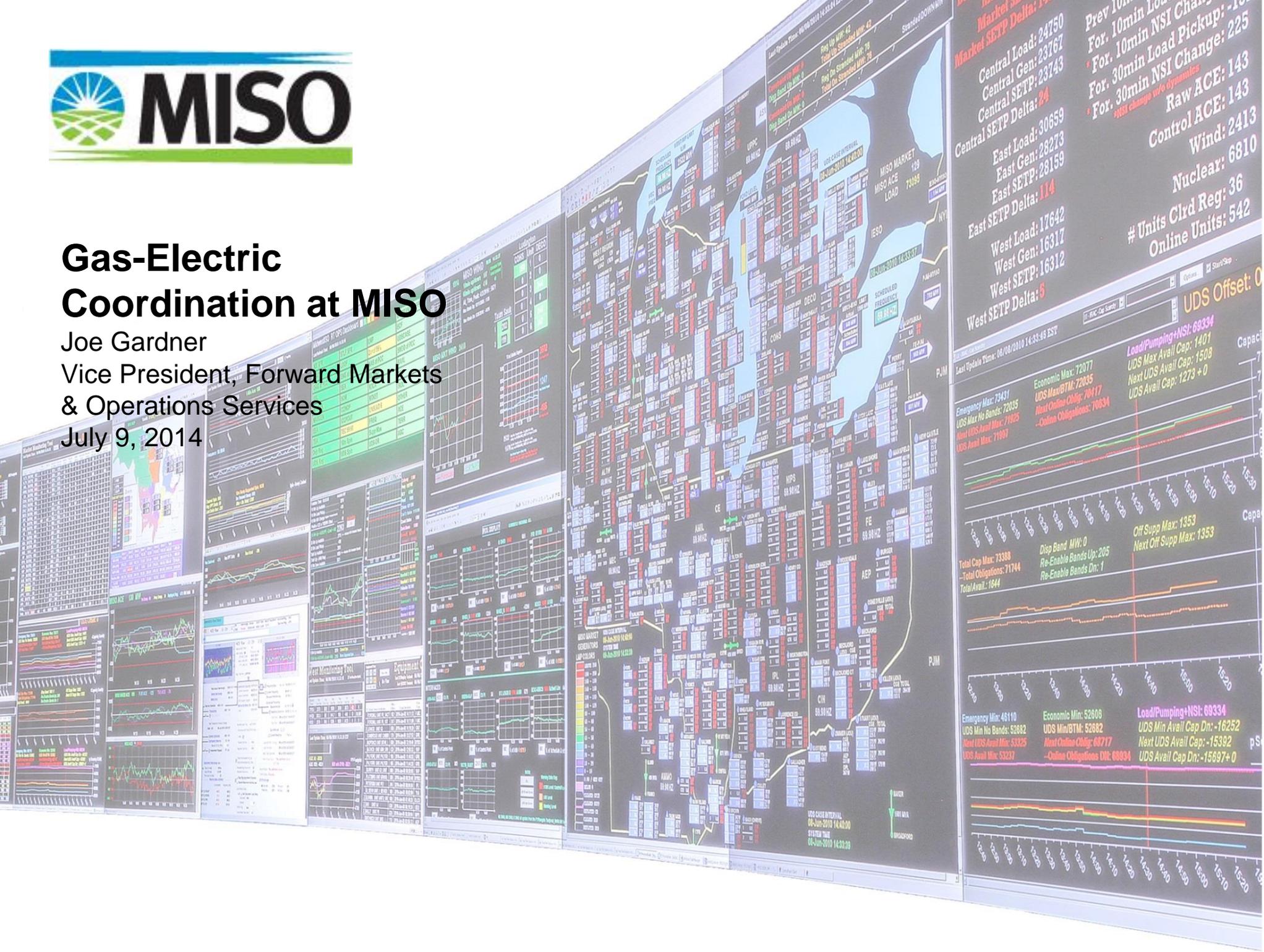




Gas-Electric Coordination at MISO

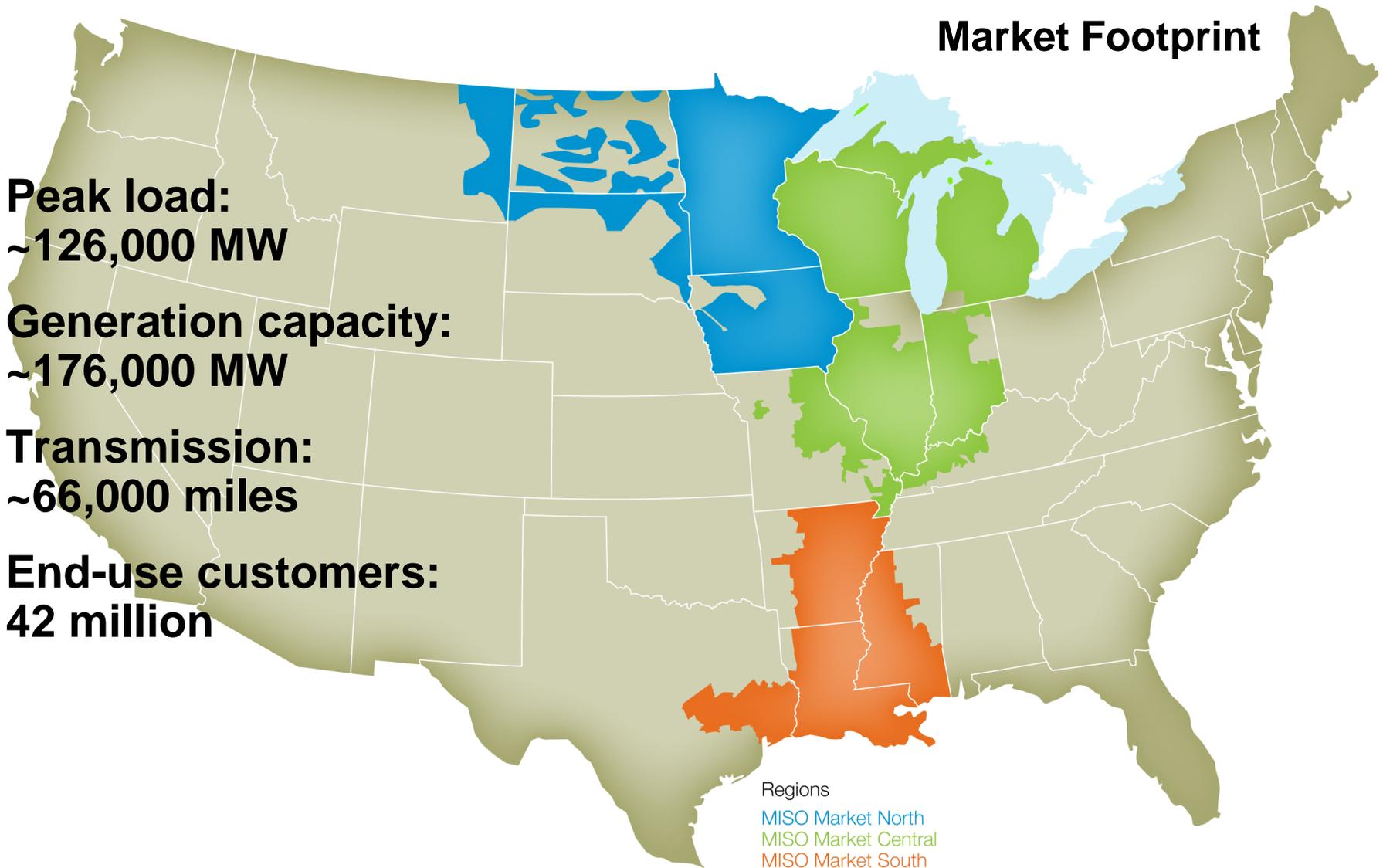
Joe Gardner
Vice President, Forward Markets
& Operations Services
July 9, 2014



The Midcontinent Independent System Operator (MISO)

Market Footprint

- **Peak load:**
~126,000 MW
- **Generation capacity:**
~176,000 MW
- **Transmission:**
~66,000 miles
- **End-use customers:**
42 million



The energy landscape is evolving, as reflected in a transitioning generation fleet and changing dispatch...

The annual contribution to total energy served by gas-fired resources in MISO over the past 4 years has increased from 3% to 7%.

MISO's Q4 2013 Quarterly Survey projects the retirement of approx. 10 GW of coal-fired capacity in MISO by 2016.

MISO's Generator Interconnection Queue indicates that generation added to the system in the next 3-5 years will largely be gas and wind.

Increased natural gas supplies are driving forecasts for sustained, competitive gas prices.

Future environmental regulations also have the potential to significantly alter the generation fleet.

State RPS mandates and goals are leading to increased penetration of renewables.

...and reliance upon natural gas resources to meet energy needs is expected to continue to grow.



MISO's Electric and Natural Gas Coordination Task Force was formed to investigate gas-electric interdependencies and to foster cross-industry education and cooperation.

The Task Force has identified, prioritized and explored a number of critical gas-electric topics. This work effort has been memorialized in a series of collaborative papers and continues in 2014.

2013 Topics

Resource Adequacy (Fuel Risk)

Coordinated Operations: Procedure & Protocol for NG/EL Communications

Misalignment of Gas-Electric Scheduling & Market Timelines

Examination of Market Signals for Reliability (cont. in 2014)

2014 Topics

Polar Vortex Experiences: NG Availability & Enhanced RTO / Pipeline Communications

Polar Vortex Experiences: Analysis of Projected 2016 Retirements

Potential Competition between Generator Demand & Upcoming Gas Storage Injection

Process & Timeline for NG Infrastructure Build-out



The Task Force also serves as a forum for discussion of MISO-commissioned study of gas infrastructure adequacy.

- Results of the Phase III gas infrastructure study commissioned by MISO and performed by EnVision Energy were published in Dec. 2013.
- **Major gas industry trends:**
 - Increasing gas infrastructure interconnectivity
 - Shifting supply and demand fundamentals
 - Increased retention of supply in the Midwest
- **Remaining challenges:**
 - Identify and model gas system contingencies, including potential localized constraints in the MISO footprint
 - Capture fuel risk in planning and market constructs
 - Further improve communications with natural gas industry
 - Translate gas industry data into relevant info for MISO Operators
 - Address schedule misalignment between gas and electric industries



Several on-going Task Force initiatives align with recommendations from the Phase III report, including...

- Extension of MISO's 6-month Coordination Field Trial through 2014
- Installation of a natural gas infrastructure overlay display in MISO Control Rooms along with the development of an online platform for gas pipeline Operational Flow Orders (OFOs) and Critical Notices
 - Both will be linked to a database of gas-fired generators and their fuel supply sources
- Investigation into methods to increase transparency around fuel contracting, dual-fuel unit operations and fuel-related outages
- Participation in the North American Energy Standards Board (NAESB) process to reach consensus on the recent FERC gas-electric scheduling NOPR



The FERC NOPR on the Coordination of the Scheduling Processes of Interstate Natural Gas Pipelines and Public Utilities was released March 20, 2014.

FERC Notice of Proposed Rulemaking (NOPR)

- Changing the natural gas operating day to start earlier
- Moving the Timely Nomination Cycle later
- Increases number of intra-day nomination opportunities

Section 206 Orders Investigating RTO Scheduling Practices

- Ensure that MISO implements reciprocal changes, if needed, to our posted Day-Ahead Market and reliability unit commitment results

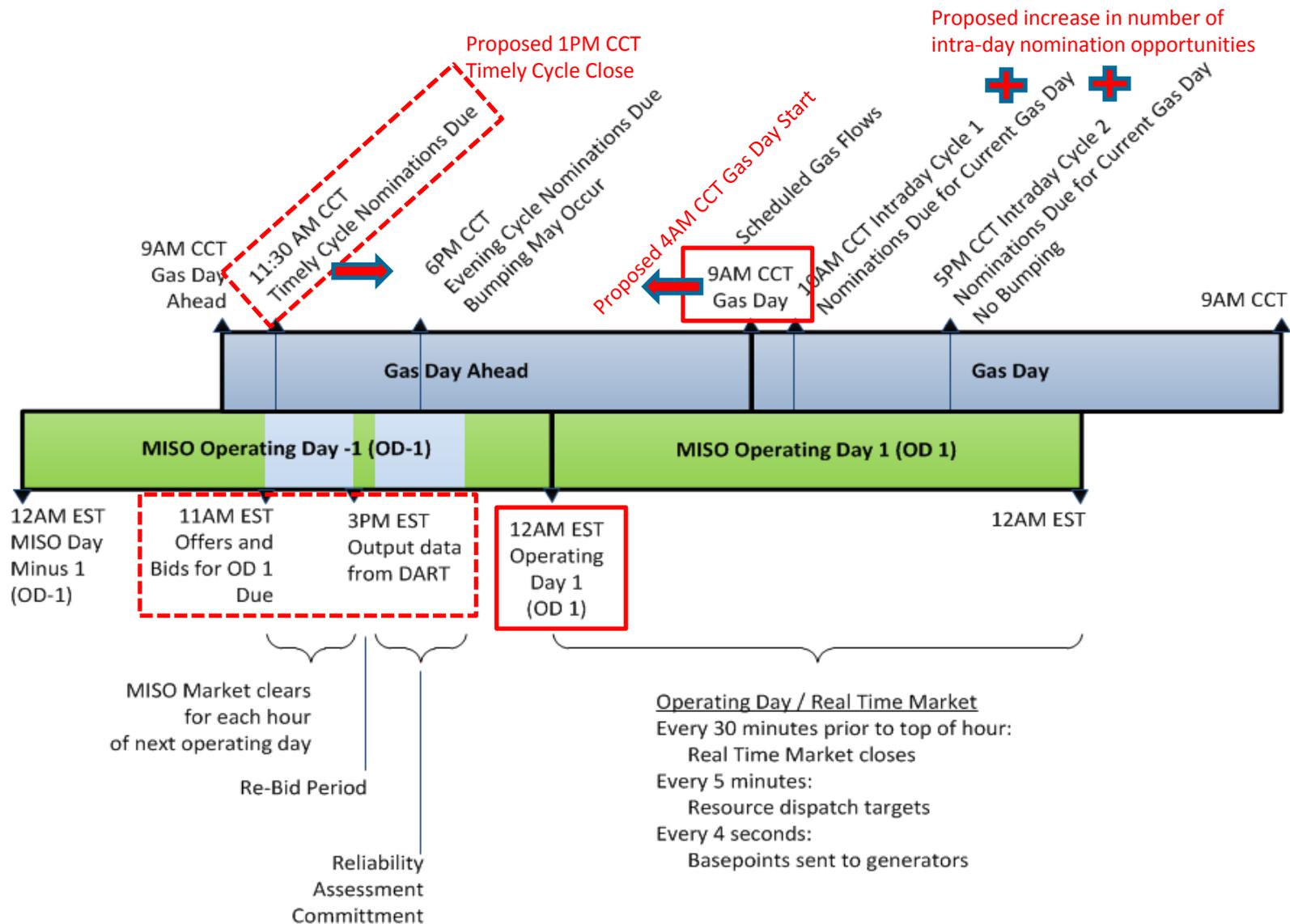
Show Cause Proceeding (for Gas Pipelines)

- Requires pipelines to “provide notice of offers to release or purchase capacity” along with the terms and conditions of such offers on an internet website for a reasonable time

MISO is actively engaged in the NAESB process to review the NOPR, discuss alternative proposals, and reach industry consensus on standards.

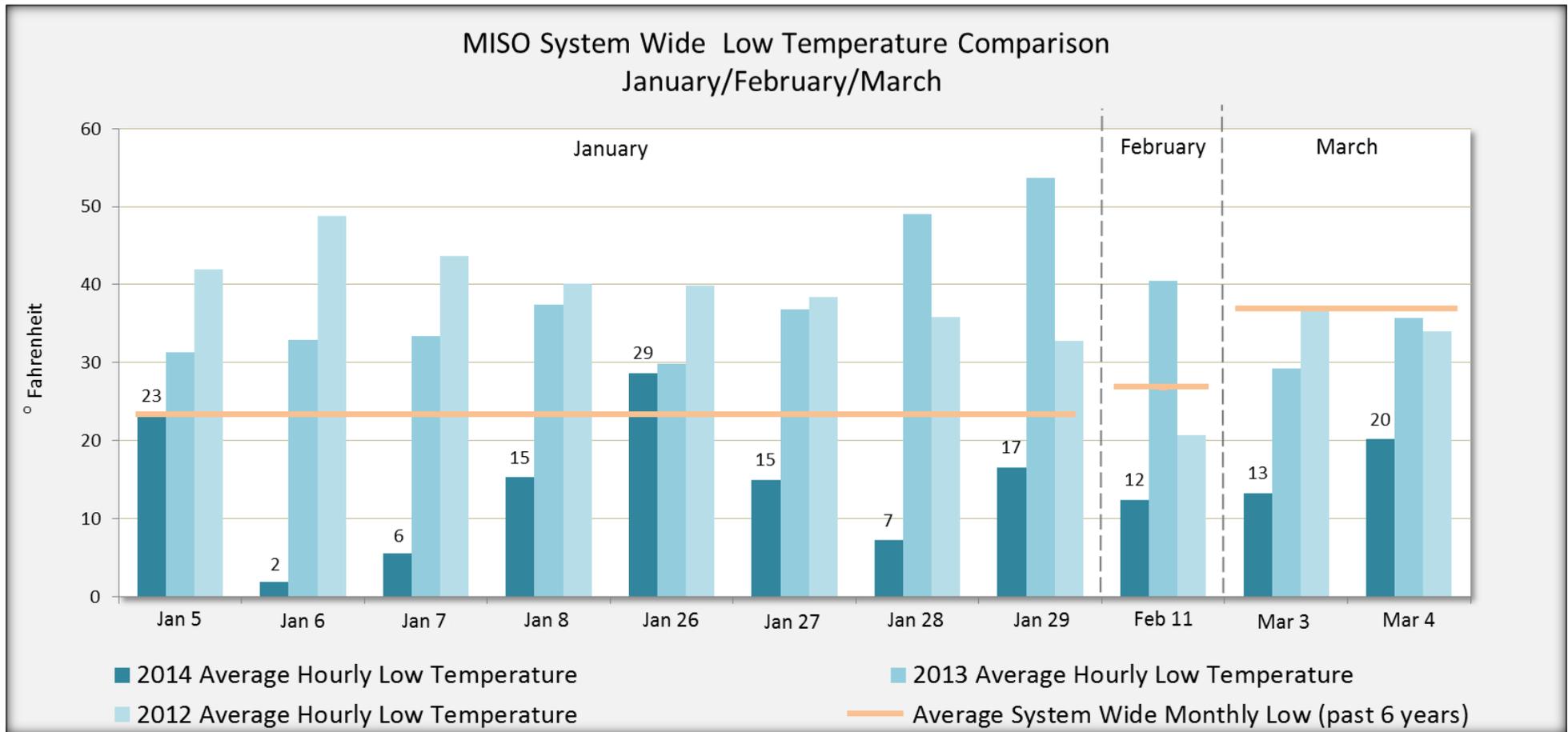


The scheduling NOPR could impact the timing of the MISO Operating Day and Day Ahead Market.



THE POLAR VORTEX & NG/EL COORDINATION

Impacts of extreme low temperatures were experienced across the footprint this past winter.

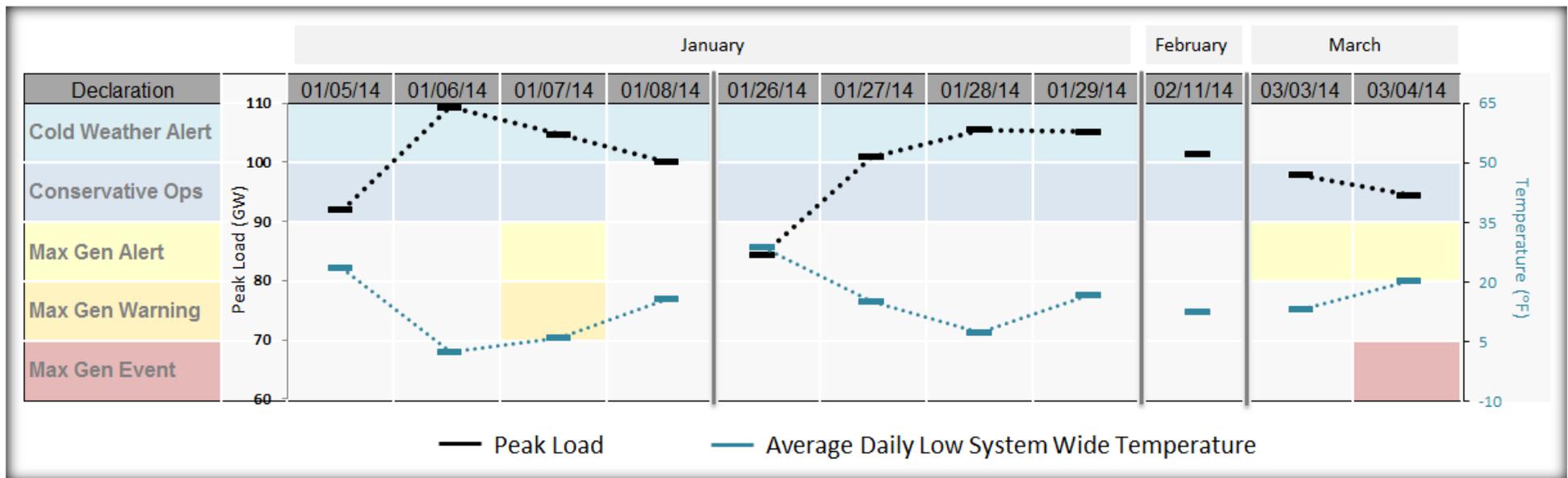


Temperatures in many areas were the coldest experienced in 20 years.



The extreme weather drove multiple emergency declarations by MISO Operations.

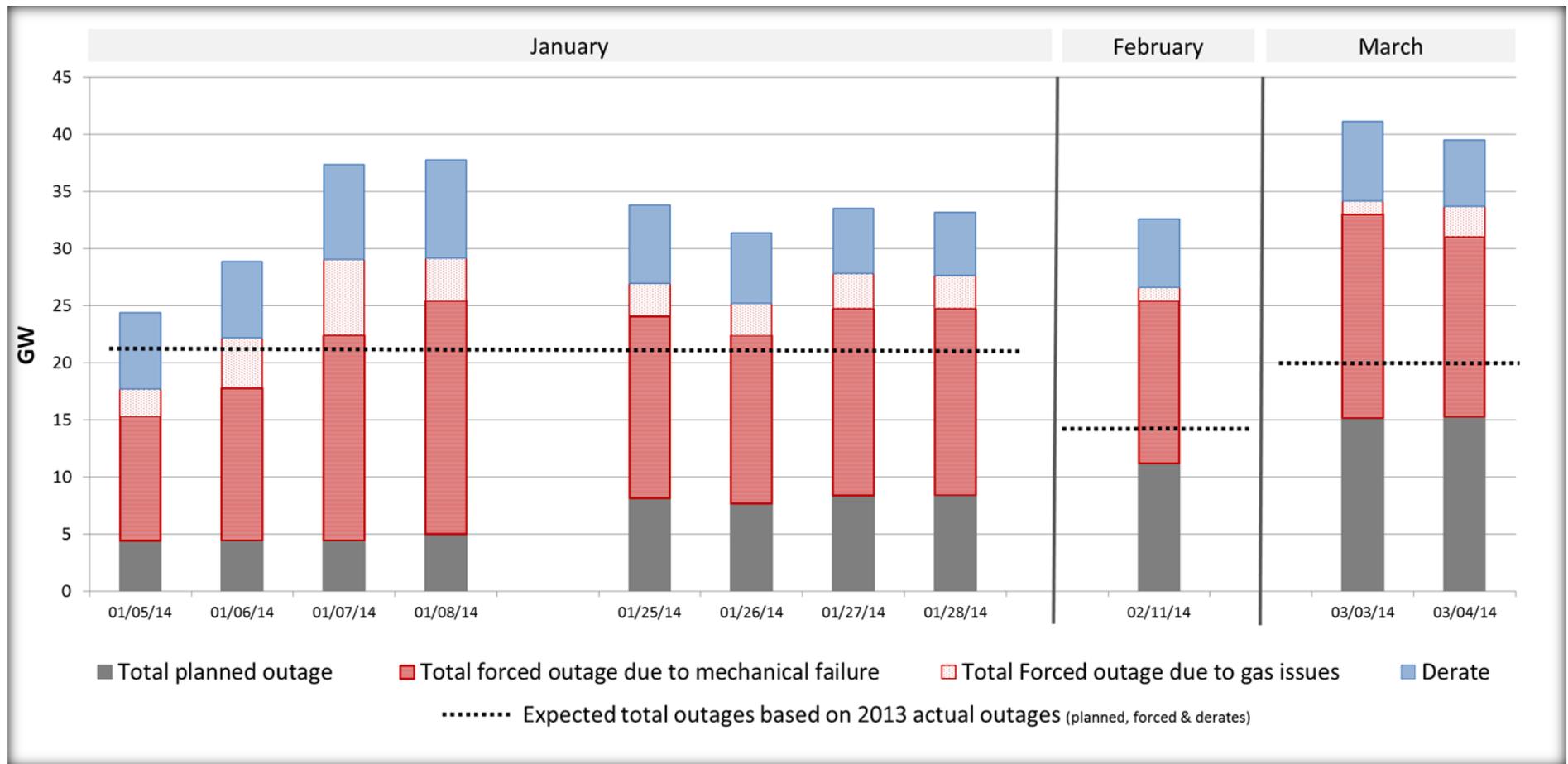
System load exceeded 100,000 MW on 13 days in the 2013/2014 winter.



A new all-time (Market footprint) winter peak load of ~109,300 MW was set on Jan. 6th, which was ~9% higher than the prior winter peak for MISO's current membership



Forced outages escalated this past winter as severe weather conditions moved into the MISO footprint.



Freezing components and fuel restrictions caused challenges for many units.



Extreme conditions were managed successfully due to preparation and significant coordination.

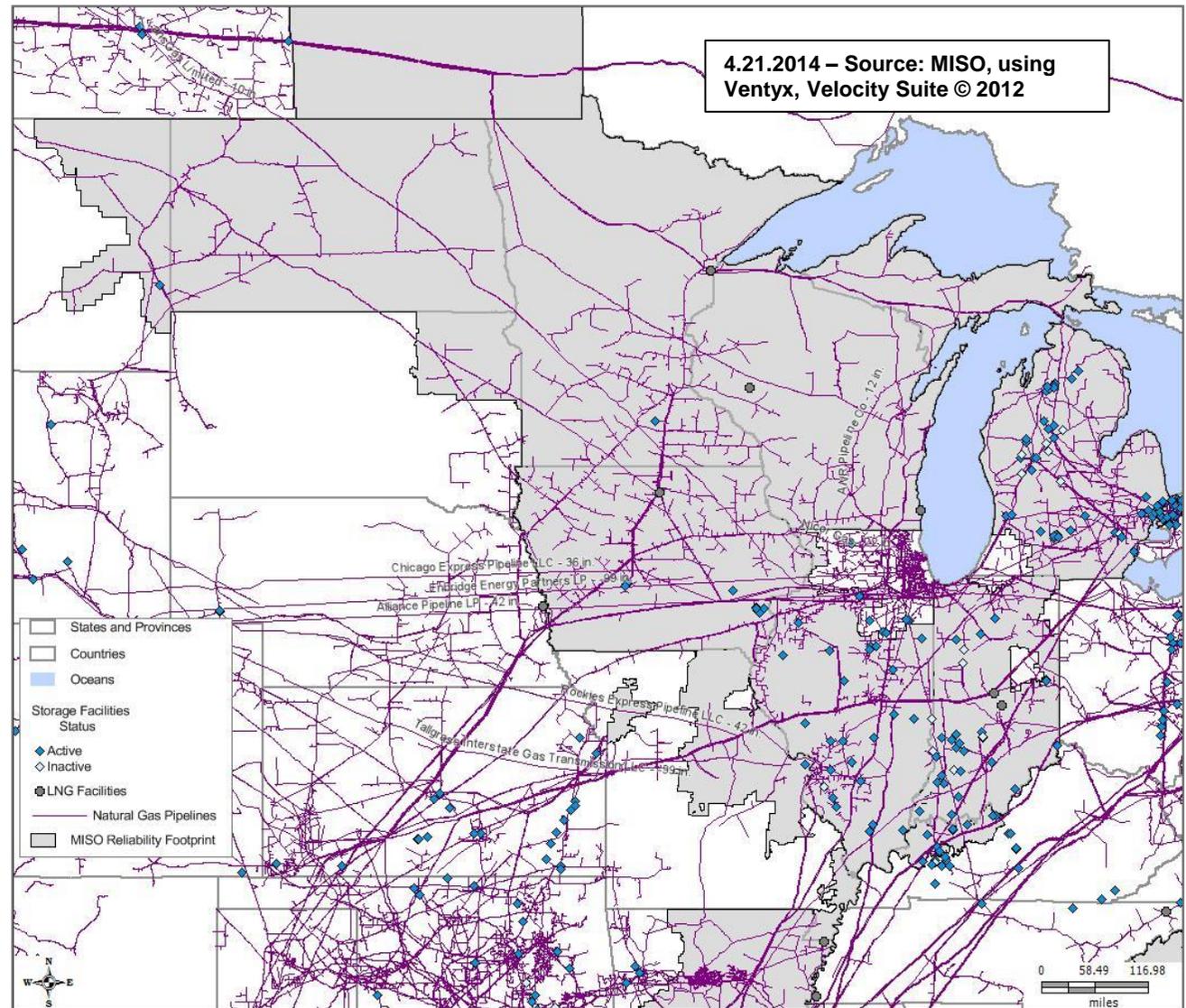


APPENDIX: GAS INFRASTRUCTURE IN THE MISO FOOTPRINT

There are 39 interstate gas pipeline systems in the MISO footprint...

...each with its own tariff, and with variations in operational capabilities and services offered.

20 interstate pipeline systems deliver gas to the MISO North and Central Regions, shown at right.



The MISO South Region is also served by extensive natural gas infrastructure.

There is ~32,000 MW of gas-fired electric generation capacity in MISO South.

Many of these generators are interconnected with several natural gas fuel supply sources.

