

NCSL – Electricity Markets and State Challenges

June 27, 2018

MISO Overview



MISO by-the-numbers		
High Voltage Transmission	65,853 miles	
Installed Generation	177,388 MW	
Installed Generation	1,594 Units	
Peak System Demand	127,125 MW	

- MISO is an independent, non-profit organization in 15 U.S. States and one Canadian province, including:
 - Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Manitoba, Michigan, Minnesota, Mississippi, Missouri, Montana, North Dakota, Texas, South Dakota, and Wisconsin



MISO's Role Focuses in Key Areas

What We Do

Implications

Provide independent transmission system access

> Equal and non-discriminatory access> Compliance with FERC requirements

Deliver improved reliability coordination through efficient market operations

> Improved regional coordination

- > Enhanced system reliability
- > Independent lowest cost unit commitment, dispatch, and congestion management

> Eliminate transmission rate pancaking

Coordinate regional planning

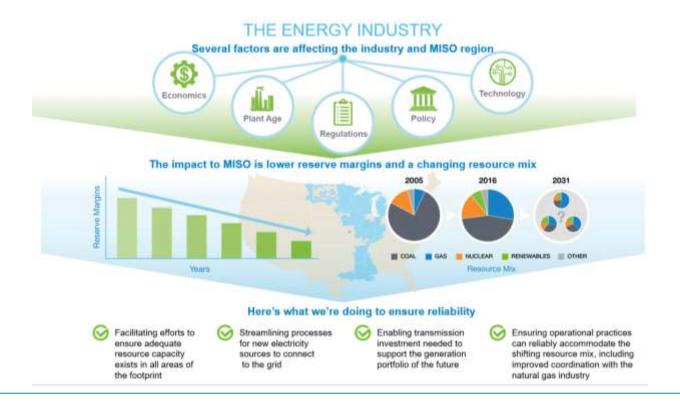
- > Integrated system planning
- > Broader incorporation of renewables
- > Balance transmission and generation tradeoffs

Foster platform for wholesale energy markets

- > Encourage prudent infrastructure investments
- > Facilitation of regulatory initiatives
- > Market price/value discovery



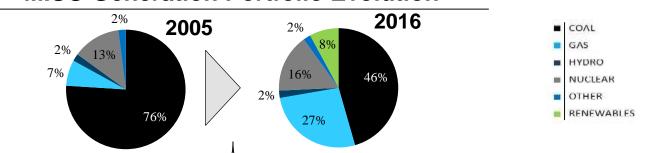
Response to the Changing Energy Landscape

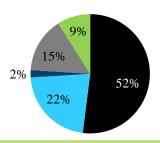




Significant Growth in Renewable and Gas-Fired Generation

MISO Generation Portfolio Evolution

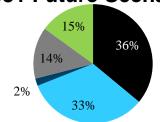




Existing Fleet

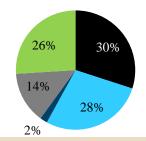
No carbon regulations modeled but some reductions expected due to RPS and economics.





Policy Regulation

Carbon regulations targeting a 25% reduction across all aggregated unit outputs are enacted.



Accelerated Technology

Increase in carbon emissions results in carbon regulations targeting a 35% reduction across all aggregated unit outputs are enacted.

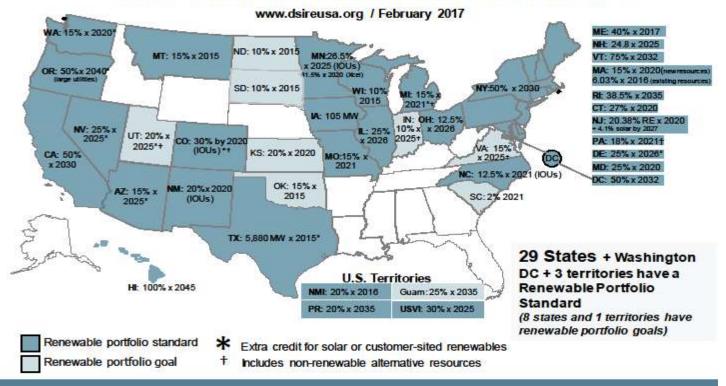








Renewable Portfolio Standard Policies

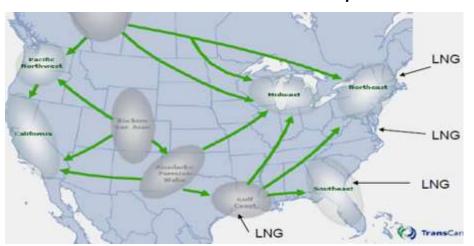




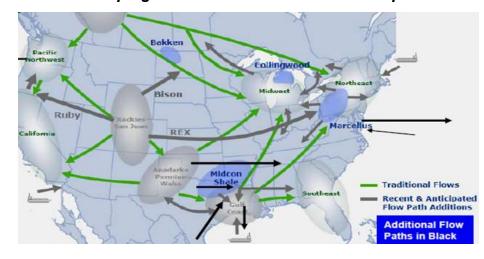
Gas flows are shifting due to shale gas, calling for gas/electric coordination

- Increased flows to MISO from Marcellus/Utica on new-build pipelines and pipeline reversals are improving MISO supply diversity
- U.S. gas production from non-traditional supply regions continues to be favorable, causing flatter prices

Historic Flow Patterns and LNG Imports



Developing "Grid" Flow Patterns & LNG Exports

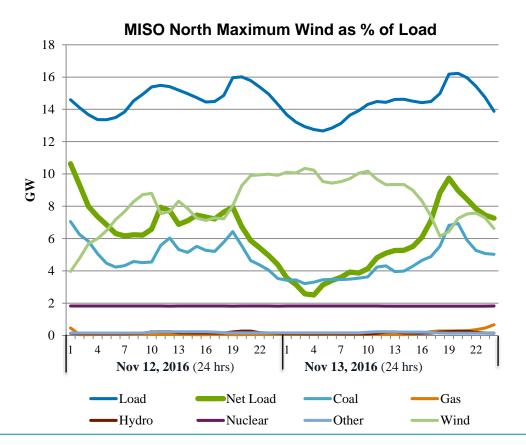




MISO is already experiencing high wind levels

	MISO Total	MISO North*
2016 wind % of annual energy	8%	27%
2016 hourly wind peak (Dec. 7 th 11pm)	13.6 GW	11.6 GW
2016 maximum wind as a % of load (Nov. 13 th 4 am)	22%	80%

*MISO North has roughly the same annual energy as ISO New England



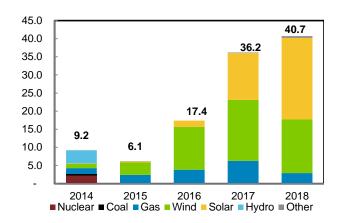


Generator Interconnection

MISO Active Queue by Study Area East Area (ATC/UP) Size: 6.9 GW Requests: 48 East Area (ITC) Size: 13.7 GW Requests: 76 West Area Size: 32.2 GW Requests: 198 **Central Area** Size: 23 GW **Total Queue:** Requests: 121 92.5 GW South Area

37

42 .7



Notes:

- The current generator interconnection queue consists of 554 projects totaling 92.5 GW
- The queue size grew by 239 projects and 40.7 GW of projects in 2018
- Detailed queue cycle information can be found on MISO's website

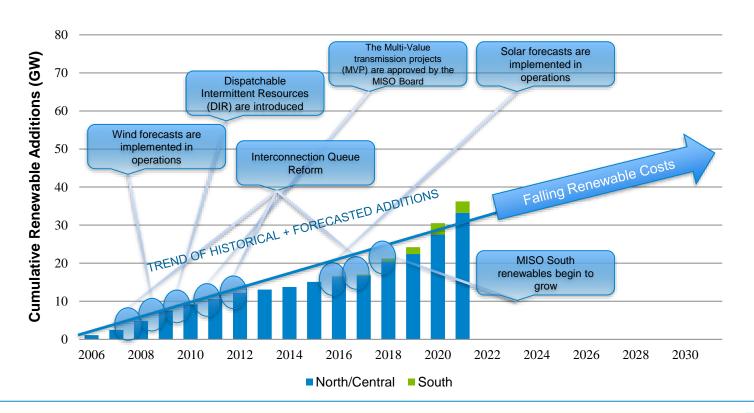


Size: 16.7 GW

Requests: 111

Wind Gas Solar Other

Renewable Energy Is Growing; When Could It Impact The Grid?



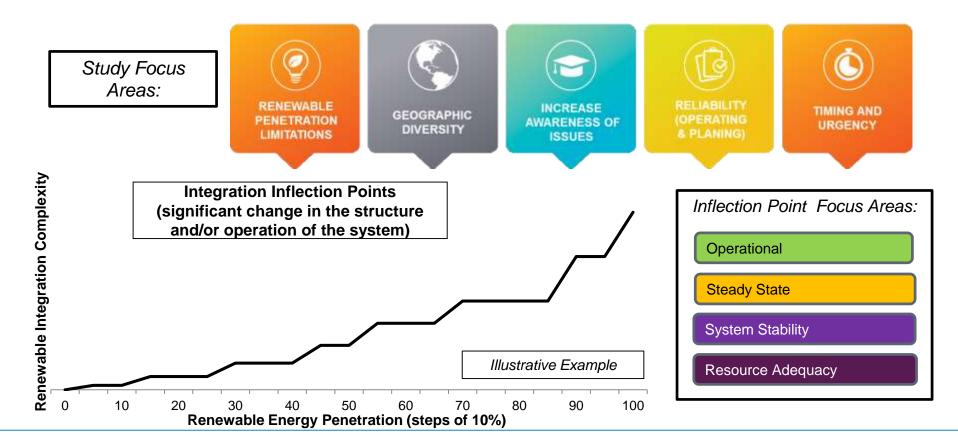


Renewable Integration Impact Assessment

- Goal = To better understand the impacts of renewable energy growth in MISO over the long term
- Provide technically rigorous, concrete examples of integration issues and examine potential solutions to mitigate them
- Inform areas of focus and the sequencing of actions required as penetration increases
- Facilitate a broader conversation about renewable energy-driven impacts of fleet change on the reliability of the electric system



Identify "Inflection Points" and Complexity





State/Federal Developments Affecting Markets

State "subsidy" Issues **RPS** ZECs Other

Federal Issues Capacity market reform "Resilience" initiative • FERC • DOE

Market **Impacts** Zero/negative marginal costs Capacity crediting RAN ????





Questions?

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