

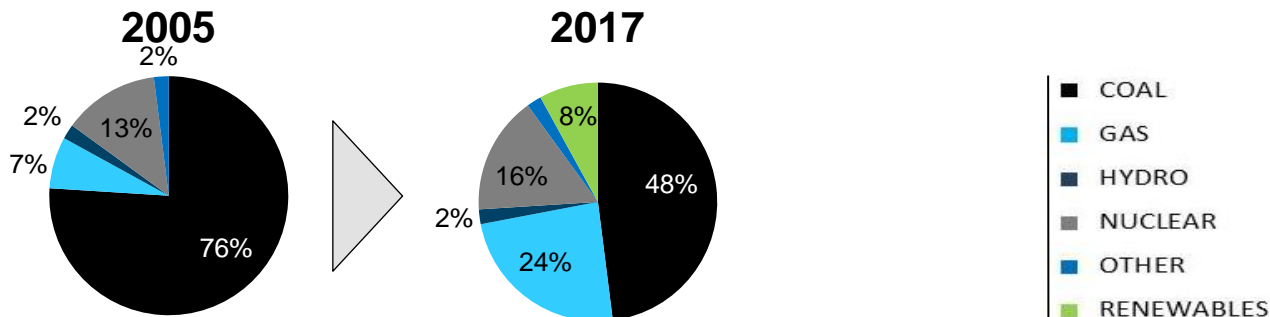


Reliability of the Gas/Electric Interface in MISO

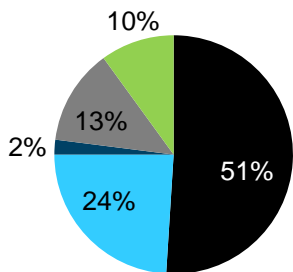
NASUCA
June 2018

The generation fleet in the MISO region has been evolving; MISO efforts continue to anticipate and plan for the future

MISO Generation Portfolio Evolution

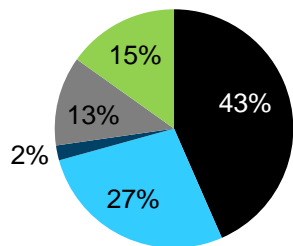


2032 Future Scenarios



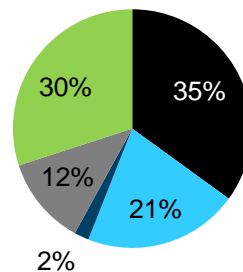
Limited Fleet Change

Stalled generation fleet changes. Limited renewables additions driven solely by existing RPS under limited demand growth.



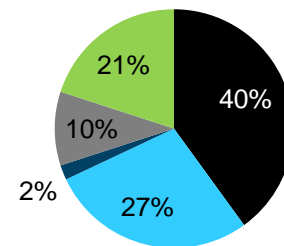
Continued Fleet Change

Continuation of the renewable addition and coal retirement trends of the past decade.



Accelerated Fleet Change

Renewables and demand side technologies added at a rate above historical trends. Fleet changes result in a 20% CO₂ emission reduction¹.



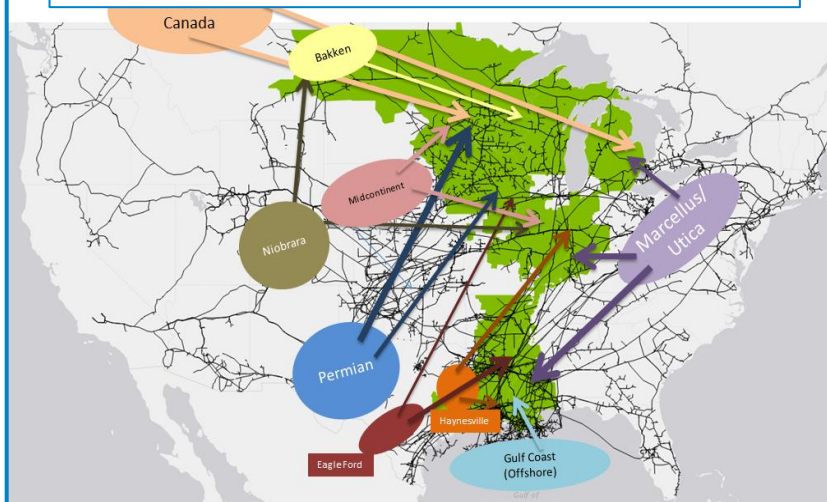
Distributed & Emerging Tech

New renewable additions largely distributed and storage resources co-located with largest sites.

1. Emission reductions from current levels by year 2031

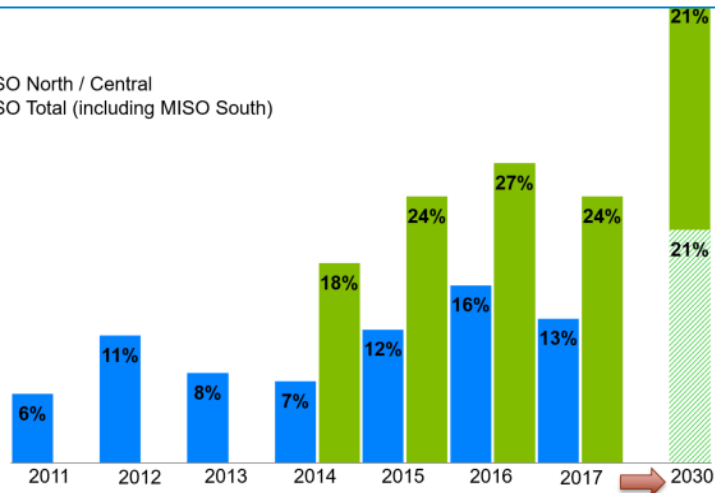
Though MISO is favorably situated in the gas grid, there are challenges with increased reliance on gas

MISO Favorable Location on Gas Grid

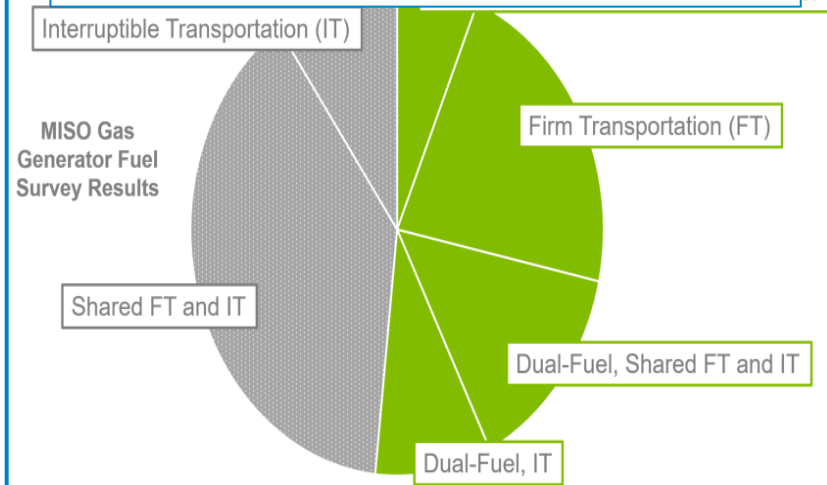


Increasing Reliance on Gas

■ MISO North / Central
■ MISO Total (including MISO South)



Fuel Assurance Issues



Gas-Electric Challenges

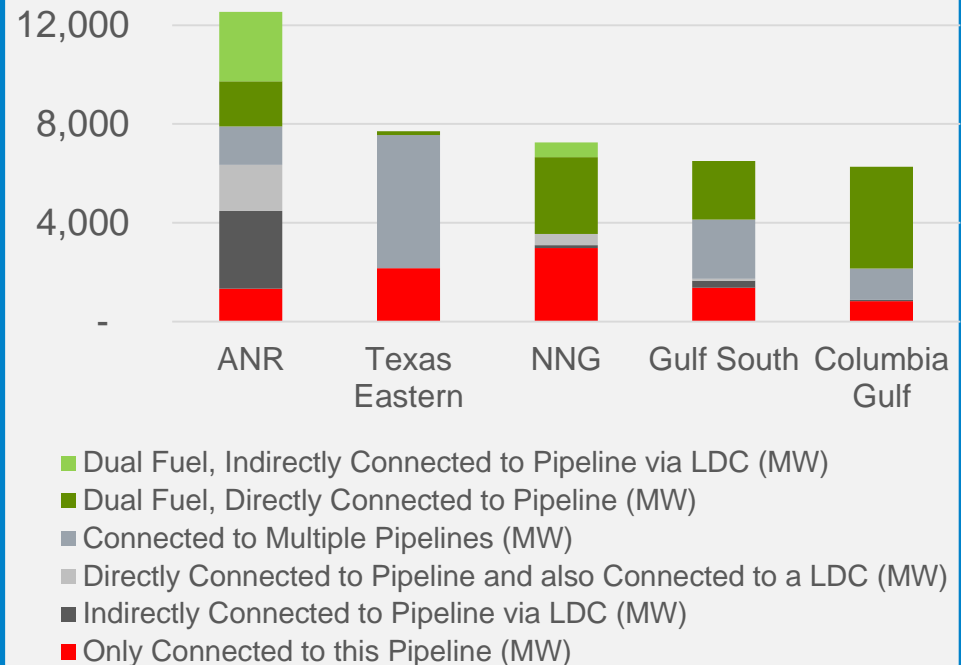
- Just-in-time delivery
- Various fuel risks and mitigation across the region
- Potential common mode of failure
- Gas infrastructure project challenges
- Major industry differences between gas and electricity

MISO continues to make steady progress on gas contingencies to assess potential reliability risk

- Incorporated in planning studies since 2015, involvement in industry studies and dialogue
- Using the gas generator survey, MISO can help scope vulnerability
- Exposure to gas contingencies is greatly dependent on gas topology and mitigation levers
- Access to accurate data in a useful format helps support system reliability and resilience

Top-5 Gas Pipelines

MISO Connected MWs



MISO has incorporated natural gas disruptions in various planning studies since 2015

- Assess system impact of extreme events for TPL-001-4 standard compliance

NERC TPL-001-4 Extreme Event Analysis



- Evaluate potential LOLE impact under largest gas pipeline contingencies

Resource Adequacy Impact Analysis



- Assess the system reliability performance for anticipated operating horizon

Coordinated Seasonal Assessment



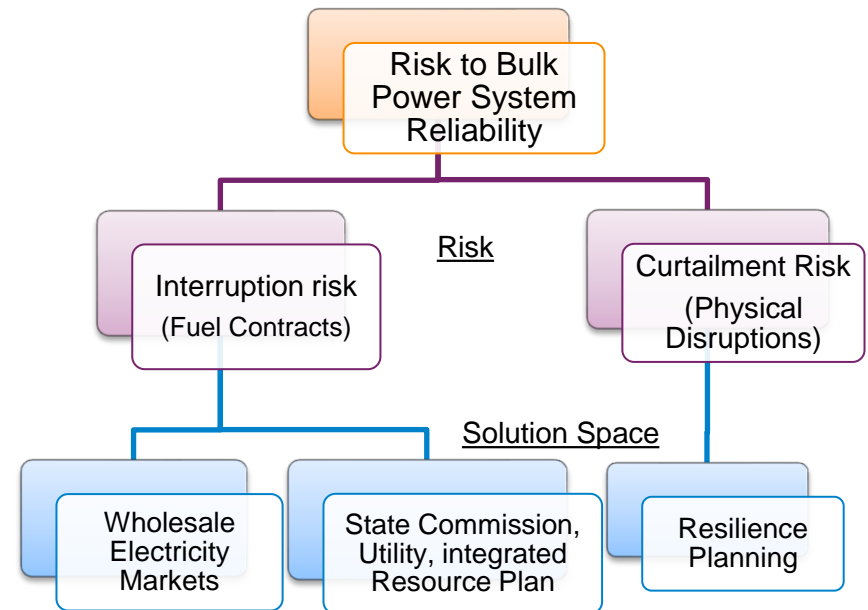
Current planning studies have found no major reliability risk driven by gas pipeline contingencies evaluated

Study

- MISO currently uses 31 gas contingencies, as extreme events, to evaluate transmission needs and risk
- Contingencies list is reviewed and updated annually based on geographic clustering, external studies, historic events, and transmission owner/planner feedback

Results

- No cascading resulted from gas pipeline events in MTEP15,16,17 TPL analyses
- No impact found in 2017/18 Winter CSA assessment
- No meaningful reliability limitations found in LOLE analysis of one extreme event (full pipeline outage in current resource portfolio), as annotated in FERC resilience responses*



MISO's ongoing activities include study initiatives to assess additional gas disruptions

Collaboration with Industry and Stakeholders

Create detailed catalogue of historical events and refine gas system contingency list

Estimate probability and impact and identify possible mitigations

Update information on gas topology and system parameters

To help address:

How to ensure data accuracy and transparency in a useful format ?

At what point does increased dependence on gas create a severe contingency risk?

How could such risks be integrated into operations and planning to improve reliability?



Questions?

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Want to know more about MISO Gas-Electric Planning?

<https://cdn.misoenergy.org/20170818%20Gas%20Electric%20Planning%20Workshop%20Materials128847.pdf>