# ENERGY INFRASTRUCTURE INTERDEPENDENCY TRAINING TO ENHANCE SYSTEM OPERATOR SITUATIONAL AWARENESS AND IMPROVE RESTORATION RESPONSE

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Argonne National Laboratory, Argonne, Illinois

Session B – Restoration/Recovery
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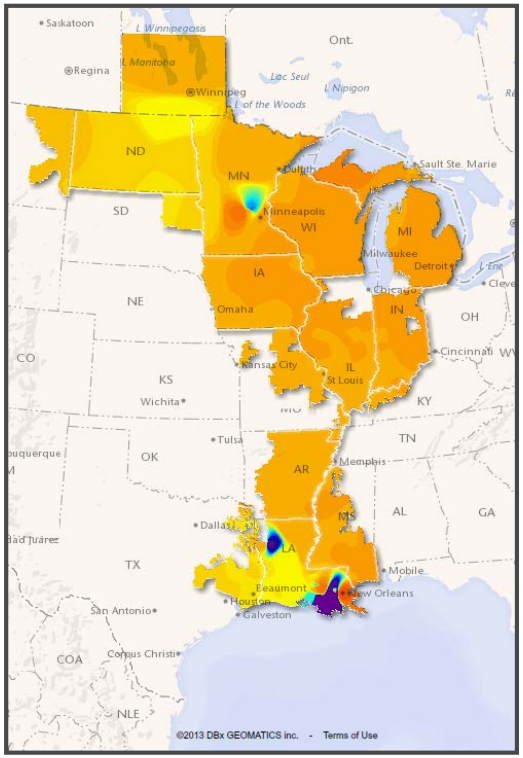
# OBJECTIVES

- Respond to our DOE Statement of Work that calls for the Development of a National Electric Grid Resiliency Framework:
  - Increase grid owner and operator stakeholder engagement
  - Increase grid resilience through operator engagement and increased situational awareness

- Collaborate with an electric grid stakeholder to enhance grid resilience
  - Proactive grid stakeholder identified an immediate concern focusing on the system dependencies and independencies of the electric power and natural gas subsectors in the form of an operator training course
  - The course would be offered as part of the stakeholder's standard system operator training cycle

# OVERVIEW OF PARTNERS

- Midcontinent Independent System Operator – MISO
- MISO assures cost-effective delivery of electric power across all or part of 15 U.S. States and Manitoba
- MISO operates the grid and is responsible for reliability coordination and restoration
- Argonne backs infrastructure assurance and interdependence assessment capabilities with diverse energy system expertise and advanced modeling capabilities
- Benefit from complementary talents and mutual information sharing




*Source: www.misoenergy.org*

*Source: www.eenews.net*



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# KEY TRAINING CONCEPTS

## PART I – Overview and Presentation of Concepts

- Review of MISO Electric and Natural Gas Coordination Task Force
- MISO Capacity and Generation Profiles and Trends
- Increased Reliance on Natural Gas and Historical Events
- Overview of Natural Gas Infrastructure and its Components
- Issues that Impact Natural Gas Service to Generation Providers
- Electric Power and Natural Gas Interdependence Concepts
- Natural Gas Infrastructure Concepts Relative to MISO

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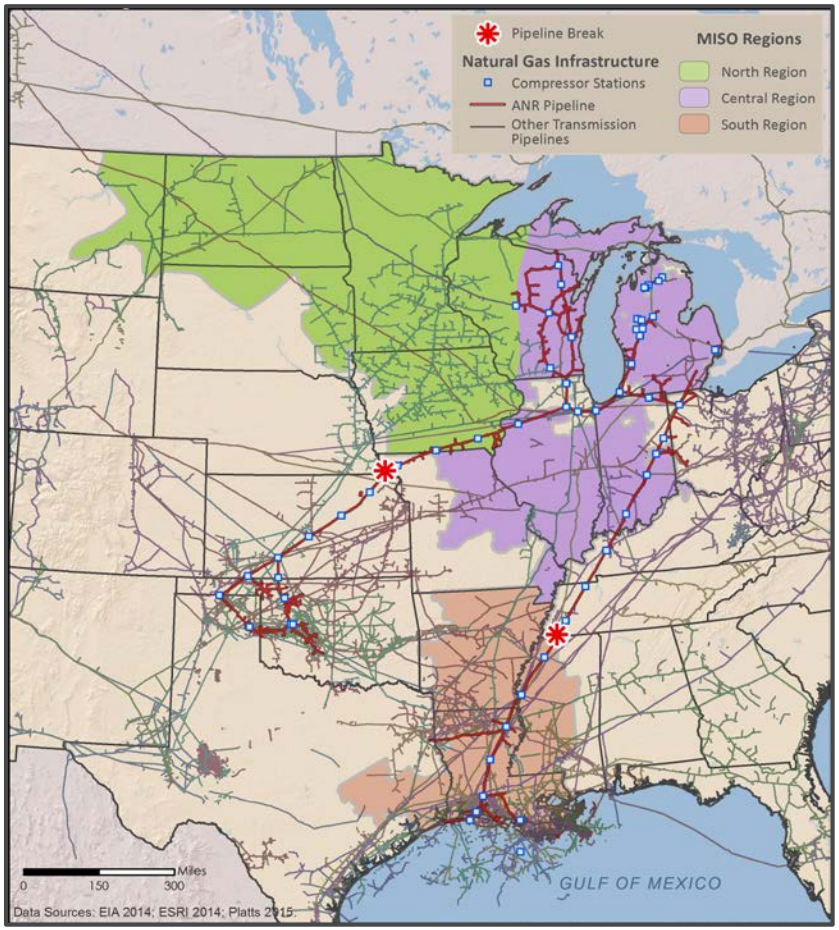
# KEY TRAINING CONCEPTS

## PART II – Situational Awareness Development via Scenario-based Exercises

- Application of Public Information and Bulletin Boards
- Application of *NGfast* Simulation Model to Assess Impacts and Mitigation Options
- Tabletop Discussions
  - Initiate atypical system conditions
  - Recognize abnormal operating conditions
  - React to events using MISO procedures



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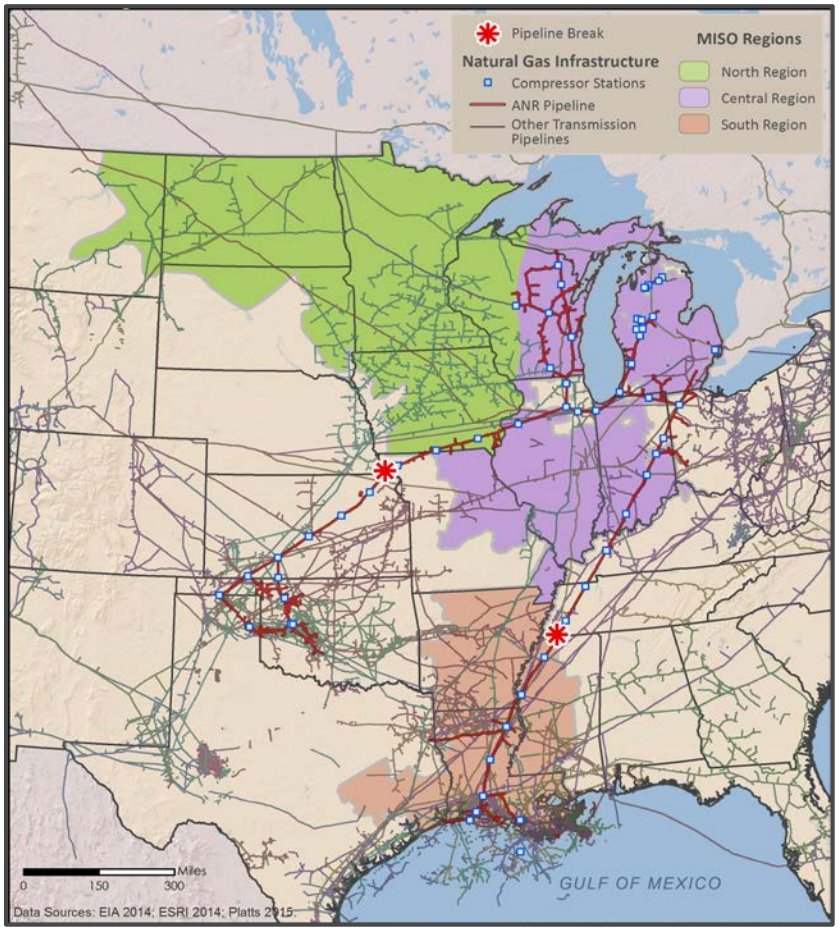




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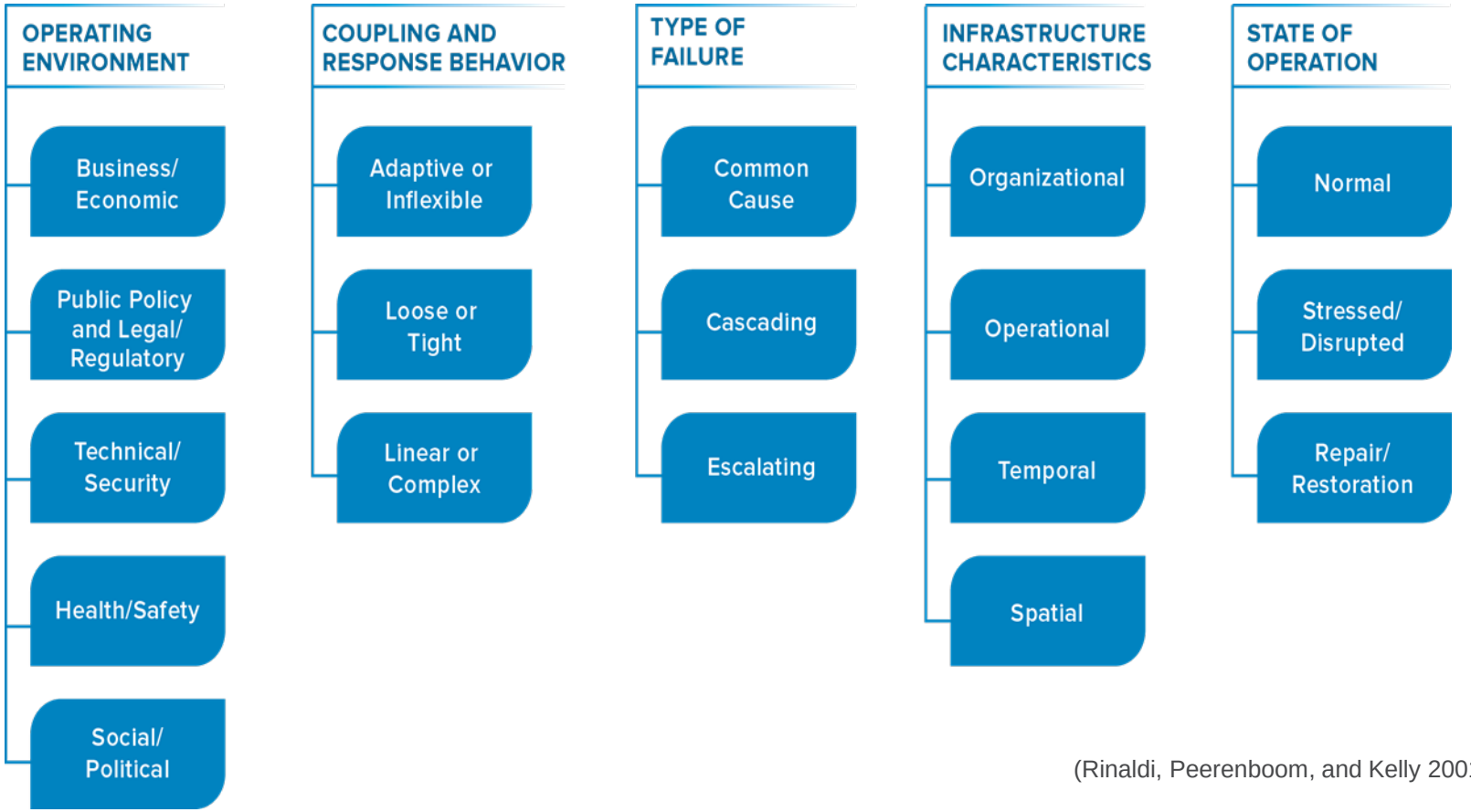
# POTENTIAL INTERACTION SPACE

## Natural Gas and Electric Power Dependencies and Interdependencies




(Rinaldi, Peerenboom, and Kelly 2001)



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# SPECIFIC QUESTIONS AND DISCUSSION POINTS OF INTEREST

## Elements to consider given a disruption in natural gas supply

1. What fuel supply trends are exacerbating my reliance on natural gas as a fuel?
2. Are there alternate natural gas contract options that I can choose?
3. How will I be notified of a potential gas supply or deliverability disruption?
4. As a generation provider, how much time do I have before I must shut my plant down?
5. If I have multiple fuel options at my plant, will I be able to switch over smoothly and quickly?
6. As a coal-fired generation provider, if my plant goes down for operational reasons, will I have natural gas to restart my plant?
7. As a plant operator, will there be sufficient natural gas supply and pressure to operate my plant?
8. If electric power goes out, will there be impacts to the natural gas supply or deliverability in the region?
9. Are there any critical natural gas components in my electric service territory?
10. Will those critical natural gas components likely have alternative electric power backup options?
11. How is electric reliability coordination further stressed by a natural gas supply disruption?

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# SUMMARY HIGHLIGHTS

- The two-hour, MISO-approved, and NERC-certified course was:
  - Offered as part of MISO's fall 2015 Emergency Preparedness/Power System Restoration training cycle
  - Presented to 274 MISO operators and associated utility members over six weeks from Carmel, IN

- Attendee feedback collected from training course critique forms stated:
  - "We have a better understanding of the impacts of an interruption on the gas pipeline and how it could impact MISO as a whole."
  - "I believe not only was the information from the 2015 Argonne Project very helpful to the entire industry but also created a greater awareness throughout the industry of the emergency scenarios and vulnerabilities which exist within MISO and the entire NERC footprint."

- This training opportunity has lead to further collaboration with MISO for additional training, scenario, and tool development opportunities

# CONCLUSIONS

- Instill a **deeper understanding of natural gas infrastructure operations and practices**
- **Further understand the consequences of dependencies and interdependencies** within and between the electric power and natural gas subsectors relative to natural gas supply issues
- **Bring issues and concerns to the surface** for further discussion
- **Identify mitigating activities** to counter potential consequences and enhance restoration
- **Facilitate information sharing** between industry providers within and between the subsectors to strengthen awareness of potential issues and consequences of service interruptions
- **Launch new development efforts** to enhance cross-subsector situational awareness
- **Thankful to MISO for this opportunity and follow-up collaboration**

# THANK YOU!

# QUESTIONS?


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