MISO recently published “MISO Forward” that looks at industry trends creating opportunities and challenges...and informing MISO needs for the future

Three Identified Key Needs

TRENDS
- De-marginalization
- Decentralization
- Digitalization

OPPORTUNITIES AND CHALLENGES
- Increased variability and uncertainty
- More coordination required
- Incentive structures and planning misaligned with reliability needs

NEEDS
- AVAILABILITY
- FLEXIBILITY
- VISIBILITY

Insights inform strategic action plans:

Explore
Decide
Do

Explore
Decide
Do

Explore
Decide
Do

https://www.misoenergy.org/forward/
Gas-fired generators play a key role in future MISO needs

<table>
<thead>
<tr>
<th>MISO NEEDS</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>AVAILABILITY</strong></td>
<td>The ability of transmission and energy resources to meet requirements at all hours</td>
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<tr>
<td><strong>FLEXIBILITY</strong></td>
<td>The ability to anticipate and adapt to frequent and significant changes in resource output and demand, including the enabling of new sources of flexibility</td>
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<tr>
<td><strong>VISIBILITY</strong></td>
<td>The ability to see and coordinate relevant resource, demand, and power flow attributes in operating and planning horizons</td>
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**Fuel Assurance Touchpoints:**

- Fuel assurance in severe winter weather
- Should month availability
- Increased ramp rates
- Short-notice starts; multiple starts
- Planning assumptions
- Situational awareness
- Tools and coordination
Looking forward... how to best harness MISO’s 70 GW of gas-fired resources and also assess/mitigate risk?

- Gas at 25% of annual generation and headed to 30-40%
- Key attributes - Availability and Flexibility
- Fuel assurance factors
  - Topology
  - Concentration
  - Timing
  - Duration
  - Generator and grid alternatives
- Gas role in broader MISO fleet

MISO is favorably positioned relative to U.S. gas supply and infrastructure with access to all major gas supply basins, 30+ interstate pipelines, 20+ gas utilities and over 50% of total US gas storage capacity.
Fuel risk has different components...with different solution spaces

MISO Historical Fuel Assurance Focus:

- **Operations**
  - Situational awareness and communications (pipeline notice website, control room displays of pipelines, generator surveys, daily “at risk” report, outage code changes, post event analysis, pipeline communications, etc.)

- **Planning**
  - 30+ gas contingencies evaluated annually
  - 2018 study on past gas system events and impacts
  - Changing fleet and exposures

- **Markets** – design, products, alignment

- **Policy/Outreach**
  - OMS, NERC, Industry, NAESB

**Future Focus:**

- Better align MISO planning, resource adequacy, and markets with needs of the future grid
- Advance risk assessments in analytics, metrics, and mitigation
- Harness regional strengths (collaboration with states, gas-side capability)