Impact of EPA Regulations on Coal-Fired Capacity

CCTR
July 24, 2012
MISO Overview

• The Midwest Independent Transmission System Operator, Inc. (MISO) is a non-profit, member-based organization committed to being the leader in electricity markets planning for long-term efficiency

• Updated for 2012-2016, MISO remains focused on continually finding ways to provide the least-cost delivered energy for all customers through the following Strategic Elements
  – Facilitate integrated Infrastructure Investment
  – Continue to deliver and communicate benefits identified in MISO's Value Proposition
  – Sustain and grow the membership
  – Enhance products and performance
  – Achieve high performance through people, process and technology
  – Expand our role as an independent public policy educator
Scope of MISO Operations

- Generation Capacity 131,581 MW
- Historic Peak Load (set July 20, 2011) 98,526 MW
- 49,670 miles of transmission 500kV, 345kV, 230kV, 161kV, 138kV, 120kV, 115kV, 69kV
- 11 states
- Control Centers Carmel, IN St. Paul, MN
- 594 TWhours annual billing (2011 transmission service)
EPA compliance issue is complex

- Stakeholders will face challenges to achieve compliance within specified timeframes
  - Ability to secure timely outages is critical
  - Availability of options (retire, retrofit, coal to gas conversion) may be limited by supply chain or gas infrastructure sufficiency
- Operations procedures will strive to maintain reliability despite uncertainty
  - Generators are not expected to operate in non-compliance
- MISO is focused on
  - Developing improved tariff rules and processes to manage risks
  - Providing information to policy makers and asset owners to facilitate coordination and minimize negative impacts
Complexities managing EPA rule compliance

- Asset Owner Surveys
- Mid-Term Operational outage coordination
- Retirement Rules
- Supply Chain Study
- Tariff Changes
- Resource Adequacy Calculations
- Off-peak outage limits
- EPA Impact Analysis
- Emissions Tracking
- Long-Term System Reliability
- Gas Infrastructure Study
- Capacity and Energy Markets
- Federal and local collaboration

Federal and local collaboration

Asset Owner Surveys
Mid-Term Operational outage coordination
Retirement Rules
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Federal and local collaboration
Environmental Protection Agency Proposing Four New Regulations

- **Clean Water Act**
  - Develop Rule
  - Compliance Prep Period
  - Compliance

- **Coal Combustion Residuals**
  - Develop Rule
  - Compliance Prep Period
  - Compliance

- **Clean Air Transport Rule/Cross State Air Pollution Rule**
  - Develop Rule
  - Compliance

- **Mercury and Air Toxics Standards**
  - Develop Rule
  - Compliance Prep Period
  - State Extension
  - EPA Extension
  - Compliance
Overview of Impacts

• 12.6 GW of coal capacity identified as at-risk
  – Expected retirement dates to be in the 2014/2015 calendar years
  – 12.6 GW of retirement would erode MISO projected reserve margins by 12 percentage points, dropping system resources 6 to 7 percentage points below required targets.

• Capital investment of $33.0 Billion will be required to retrofit and/or replace units

• Average energy prices may increase by $5/MWh

<table>
<thead>
<tr>
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<th>12,652 MW of Retirements</th>
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<tbody>
<tr>
<td>Energy Cost Impacts</td>
<td>$5/MWh</td>
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<tr>
<td>EPA Compliance Retrofit Capital Costs</td>
<td>$22.5B</td>
</tr>
<tr>
<td>New Capacity Capital Fixed Charges</td>
<td>$9.6B</td>
</tr>
<tr>
<td>Fixed O&amp;M Capital Costs</td>
<td>$0.0B</td>
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<tr>
<td>Transmission Capital Costs</td>
<td>$0.9B</td>
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<tr>
<td>Total Capital Costs</td>
<td>$33.0B</td>
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6 GW of resource capacity may be needed by 2015 to maintain an appropriate planning reserve margin.

Capacity Resources, GW

- Reserves: 24
- Capacity Resources for Load: 90

<table>
<thead>
<tr>
<th>Year</th>
<th>Reserves</th>
<th>Projected Retirements</th>
<th>Additional Resource Needed</th>
<th>2015</th>
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<tbody>
<tr>
<td>2012</td>
<td>114</td>
<td>13</td>
<td>6</td>
<td>107</td>
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<tr>
<td></td>
<td>27.4%</td>
<td>Planning Reserve Margin</td>
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<td>16.5%</td>
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MISO
Key Issues Affecting Compliance (3-5 years)

• Operational issues associated with the Cross State Air Pollution Rule (CASPR) delayed due to Court action
  – Also greater reliance on gas fleet
• MATS related - coordination of outages required to install compliance equipment
• Sufficient manufacturing, engineering and other resource availability to meet necessary timelines
• Ability of the natural gas infrastructure to meet the anticipated fuel switching requirements
Unit commitment changes will effect unit dispatch

• A general reduction in unit availability and commitment flexibility could drive greater reliance on emergency procedures in the operating timeframe, including during non-peak periods. MISO is addressing with stakeholders by evaluating and enhancing:
  – Capacity emergency procedures
  – Minimum and maximum generation procedures
  – Enhanced load management procedures
  – Communications procedures and protocols

• Unit offer prices will likely increase to reflect increased environmental costs

• Changes in unit flexibility and offer prices will result in higher dispatch cost and market prices
MISO outage management is under further review

- Generators being retrofitted will require extended outages
- Given the limited number of maintenance seasons and the length of construction schedules prior to the deadline (Spring 2015) MISO expects significant levels of outage requests in each season
- MISO’s current Generator Outage Coordination Process
  - Analysis of local constraints to ensure system reliability
  - Coordinate with generation/transmission entities to reschedule requested outages as needed
- MISO is reviewing its outage management processes and tariff authority to identify and manage the risk of supply shortfalls
  - Expanding reliability monitoring to include sub-regional constraint impacts
  - Add a sub-regional supply sufficiency check based on monthly loss-of-load expectation analysis
  - Enhancing coordination processes with neighboring entities
Supply chain analysis suggests that if decisions are not made soon, options become limited.
May 2012 through May 2017
Daily Planned Maintenance Compared to Monthly Maintenance Margin

CROW Planned Outages as of 5/1/2012
Survey Outages
Available Maintenance Margin
Maintenance Margin
Maintenance Margin w/o Non-Dual Fuel CT (17 GW)
Natural gas availability issues center around need for additional gas storage and pipeline infrastructure

• MISO commissioned an initial gas and electric interdependency study. Key findings include:
  – Gas supply availability at the wellhead is not an issue
  – Additional gas storage, either underground or on-site, will be needed to provide firm winter generation capability.
  – New pipeline infrastructure is needed to manage volatility and ensure reliability if retiring units are replaced with gas units
    • ~$2 billion investment in new main lines needed
    • ~$1 billion investment in lateral lines (lines from the main line to the power plant) will be needed
  – Timing for pipeline build may preclude fuel switching as a viable compliance option
    • Planning, regulatory, design and construction schedules for pipeline development is nominally 5 years or greater

• Analysis of gas supply to support increased usage of current fleet indicates limited ability to increase existing gas-fired unit capacity factors
2nd Quarter Survey

Coal Resources Affected 2nd Quarter Survey
Capacity, GW

- Total Coal: 295 Units
- Total Affected: 243 Units
- No Action Required: 52 Units (18.1 GW)
- Control Required: 101 Units (48.1 GW)
- Uneconomic/Replace: 4.3 Units (45 Units)
- TBD: 6.3 Units
- No Response: 1.3 Units (66.2 GW)
Lower Capital Cost Technology Options

Technology Selections 2nd Quarter Survey
Capacity, GW

- **Total Controls**: 101 Units
  - **DSI and/or ACI**: 66 Units, 36.2 GW
  - **FGD**: 16 Units, 8.3 GW
  - **TBD**: 15 Units, 3.6 GW
  - **FF**: 1.2 GW
MISO Tariff Revisions

- Attachment Y (Change of Status)
- Outage Coordination
- Real Time Ops
- Resource Adequacy
MISO efforts continue in areas of planning, reliability and market operations

• MISO’s leadership and direction on issue has focused on analysis of EPA impacts to generation
  – EPA impact study
  – Natural gas infrastructure study

• Given dynamic nature of issues surrounding EPA compliance, continued emphasis must be placed on ensuring both short and long-term system reliability
  – Outage management
  – Unit commitment
  – Resource adequacy and generation retirement
  – Emissions tracking

• MISO collaboration with stakeholders as they work to comply remains a critical component