Long Term Reliability Challenges and Considerations: A Bulk Power System Perspective

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Reliability Finding: A changing resource mix requires additional measures and approaches for assessing future reliability

- 21 GW of coal-fired units were retired between 2012 and 2014
- An additional 27 GW are scheduled to retire by 2025
- (excludes impacts of EPA’s proposed Clean Power Plan)
An increased dependence on natural gas for generating electricity can amplify the bulk power system’s exposure to interruptions in fuel supply, transportation, and delivery.

- Gas pipeline reliability impacts electric generation
- Electric system reliability impacts gas pipeline operations
- Pipeline planning and expansion are different from the electric equivalent
- Communications between pipeline operators and electric Reliability Coordinators are generally weak—though improving!
• Results of NERC study show that with a 90/10 operational risk assessment reserve margins are still attained
• However, a single point of disruption such as Aliso Canyon can have significant effects
• Aliso Canyon directly affects 9800 MWs of gas fired capacity
• Lack of firm transportation and adequate storage provide additional concerns
NERC’s Annual Long-Term Projection

Total NERC-Wide On-Peak Gas-Fired Capacity

- 2009 LTRA
- 2011 LTRA
- 2013 LTRA
- 2015 LTRA

GW
Total NERC-Wide On-Peak Gas-Fired Capacity
# Growing Reliance on Gas-Fired Capacity

## Gas-Fired Capacity as a Percent of Total Capacity (Eastern)

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<tr>
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<th>MISO</th>
<th>New York (NYISO)</th>
<th>New England (ISO-NE)</th>
<th>PJM</th>
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<td>39%</td>
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<td>55%</td>
<td>54%</td>
<td>43%</td>
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The final rule extended compliance to 2022 from 2020. Increased total reduction from 30% to 32% of 2005 levels. Envisions Significant Increase in Renewables and Energy Efficiency – Clean Energy Incentive Plan. Trading is projected by EPA to be a large mitigating factor for attainment of compliance goals.
The CPP is expected to accelerate a fundamental change in the electricity generation mix in the United States and transform grid level reliability services, diversity, and flexibility.
Coal Capacity is Expected to Decline

Coal Capacity declines by up to 27 GWs as a direct result of the CPP.
Declining Coal Generation as a Result of CPP

![Graph showing declining coal generation as a result of CPP](image-url)
Coal Capacity Factors – CPP Analysis

AuroraXMP Capacity Factor

- Capacity Factors: 50%, 55%, 60%, 65%, 70%, 75%, 80%
Infrastructure Build Out Risk

- **Gas Pipeline**: 3 Years
- **Bulk Electric Transmission**: 8-15 Years
- **New Transmission Build Time**
- **New Generation Build Time**
  - **Utility-Scale Wind and Solar**: 3 Years
  - **Combined-Cycle Gas Turbine Plant**: 5 Years
CPP is Expected to Flatten Annual Energy Demand Growth
Trading of Allowances Provides Market Flexibility
Integration of Large Amounts of Renewables are Expected to Occur

Tax credits and Renewable Portfolio Standards drive renewables.
Renewable BPS Implications

- Voltage
- Frequency Response
- Ramping Capability – Duck Curve
- Effects of increasing penetration of distributed energy resources
- Derates of wind for reserve margins
The Nuclear Paradox

- Growth in the Southeast
- Decline in the Northeast, Midwest, and West
- Effect of natural gas prices on the nuclear equation
Questions and Answers