

2006 Northeast Coordinated System Plan Fuel Diversity Assessment

IPSAC Meeting
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IPSAC Issues for NCSP2006

- Fuel Diversity – Previous Studies to Date:
 - Concerns raised over recent proliferation of gas-fired generation
 - Beginning in 2000, ISO-NE undertook various natural gas studies to assess potential impact on bulk power security
 - Several steady-state and transient analyses of regional interstate natural gas pipeline deliverability capability completed
 - NYISO has performed similar natural gas assessments
 - Charles River Associates – Interstate natural gas pipeline delivery capability into and within New York
 - Ontario Energy Board’s Natural Gas/Electric Interface Review
 - ISO-NE, NYISO, PJM, IESO & NERC – *“Multi-Region Assessment of the Natural Gas Infrastructure to Serve the Electric Power Generating Sector”*

Fuel Diversity – Experience and Actions

- New England experienced the January 2004 “Cold Snap” and supplemental investigations resulted in numerous remedial actions & recommendations
 - ISO-NE & Stakeholders develop Appendix H of Market Rule 1 – *Operations During Cold Weather Conditions*
- June 2005, 3 ISOs/RTOs Signed a MOU on Natural Gas
 - Creation of the Northeast Natural Gas and Electricity Interdependency Coordination Committee (NGEICC)
 - ISO-NE, NYISO & PJM now coordinate on natural gas issues
 - Working with the Northeast Gas Association (NGA) to continuously refine and improve communications

Fuel Diversity – Experience and Actions

- Hurricanes Katrina & Rita tested the nations' ability to accommodate abnormal or force majeure situations impacting energy supply, transmission and distribution
 - Its been over 30 years since the nation has experienced the ramifications of a energy supply shortage (1970/80s oil embargoes)
 - Need to examine Emergency Operating Procedures (EOPs) to ensure system reliability during short-term emergencies or prolonged energy shortages
 - ISO-NE, NYISO & PJM perform a joint assessment on Hurricane Katrina & Rita's impact on fuel supply chains feeding the Northeast
 - ISO-NE & Stakeholders develop Operating Procedure No. 21 – *Action During An Energy Emergency*

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 1) Perform operable capacity assessments for the entire NCSP region and its eight (8) sub-regions
 - 2) Input data obtained from NERC's Reliability Assessment Subcommittee's (RAS) Long-Term Reliability Assessment (LTRA)
 - 3) Assess future system timeframes:
 - Summer 2009 & 2011 // Winter 2008/2009 & 2010/2011
 - 4) Simulate the *"hypothetical and temporary"* loss of various types of supply-side capacity
 - Nuclear, Coal, Oil-Fired, Gas-Fired, Hydro-Electric, & Dual Fuel*
 - 5) Compile observations on results and findings
 - 6) Identify conclusions and propose recommendations

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

1) Perform operable capacity assessments for the entire NCSP region and its eight (8) sub-regions:

- NCSP Region
- PJM
- New York
- New England
- Ontario
- Quebec
- New Brunswick
- Nova Scotia
- Prince Edward Island

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 2) Input data obtained from NERC's Reliability Assessment Subcommittee's (RAS) 2006 Long-Term Reliability Assessment (LTRA) – EIA 411 Submission Form Excel Files – Demand & Capacity Tabs & Fuel-Type Breakdown Tabs (summer & winter)
 - Developed operable capacity assessments using two measures:
 - Existing Capacity = Net Capacity Resources (NCR)
 - Projected Capacity = Total Potential Resources (TPR)
 - The Total Potential Resources category is the larger set of supply-side assumptions which takes into account both energy-only transactions and well as uncommitted (queued) resources above and beyond the Existing Capacity defined within the Net Capacity Resources category
 - Resultant operable capacity margins are shown for (MW) & (%):
 - Based on Base Case
 - Based on Temporary Loss of Six (6) Types of Supply-Side Capacity

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 3) Assess future system timeframes:
 - Winter 2008/2009
 - Summer 2009
 - Winter 2010/2011
 - Summer 2011
 - Coincides with other NCSP06 Analyses:
 - Transmission Adequacy Assessment
 - Resource Adequacy Assessment

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 4) Simulate the “*hypothetical and temporary*” loss of various types of supply-side capacity
 - Temporary Loss of All Nuclear Capacity
 - Temporary Loss of All Coal Capacity
 - Temporary Loss of All Oil-Fired Capacity
 - Temporary Loss of All Gas-Fired Capacity
 - Temporary Loss of All Hydro-Electric Capacity¹
 - Temporary Loss of All Dual Fuel Capacity²

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- 1 Includes conventional (pondage) and run-of-river hydro capacity but does not include pump-storage capacity.
 - 2 While some assessments portray extreme scenarios on capacity loss, these assessments help gauge the corresponding amount of replacement capacity or imported energy required to maintain system reliability

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 5) Compile observations on results and findings
 - Identify fuel exposure to installed capacity within total NSCP region under scenario – *Base Case*

Total NCSP Region - Operable Capacity Margins: Base Case Scenario

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Base Case Operable Capacity Margin Based On Net Capacity Resources (MW) & (%)	90,185 MW 28.1%	52,746 MW 17.2%	85,007 MW 26.4%	46,642 MW 15.1%
Base Case Operable Capacity Margin Base On Total Potential Resources (MW) & (%)	96,179 MW 29.4%	58,626 MW 18.7%	90,200 MW 27.6%	52,341 MW 16.7%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 5) Compile observations on results and findings
 - Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Nuclear Capacity*

Total NCSP Region - Temporary Loss Of All Nuclear Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #1: Loss Of All Nuclear Capacity Operable Capacity Margin Based On Net Capacity Resources (MW) & (%)	37,485 MW 11.7%	-1,143 MW -0.4%	31,480 MW 9.8%	-7,862 MW -2.6%
Sensitivity Case #1: Loss Of All Nuclear Capacity Operable Capacity Margin Base On Total Potential Resources (MW) & (%)	43,479 MW 13.3%	4,737 MW 1.5%	36,673 MW 11.2%	-2,163 MW -0.7%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 5) Compile observations on results and findings

- Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Coal-Fired Capacity*

Total NCSP Region - Temporary Loss Of All Coal-Fired Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #2: Loss Of All Coal-Fired Capacity Operable Capacity Margin Based On Net Capacity Resources (MW) & (%)	9,923 MW 3.1%	-27,569 MW -9.0%	4,745 MW 1.5%	-33,616 MW -10.9%
Sensitivity Case #2: Loss Of All Coal-Fired Capacity Operable Capacity Margin Based On Total Potential Resources (MW) & (%)	15,917 MW 4.9%	-21,689 MW -6.9%	9,938 MW 3.0%	-27,917 MW -8.9%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 5) Compile observations on results and findings

- Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Oil-Fired Capacity*

Total NCSP Region - Temporary Loss Of All Oil-Fired Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #3: Loss Of All Oil-Fired Capacity Operable Capacity Margin Based on Net Capacity Resources (MW) & (%)	72,165 MW 22.5%	35,955 MW 11.7%	67,084 MW 20.8%	30,409 MW 9.9%
Sensitivity Case #3: Loss Of All Oil-Fired Capacity Operable Capacity Margin Based on Total Potential Resources (MW) & (%)	78,159 MW 23.9%	41,835 MW 13.4%	72,277 MW 22.1%	36,108 MW 11.5%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 5) Compile observations on results and findings

- Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Gas-Fired Capacity*

Total NCSP Region - Temporary Loss Of All Gas-Fired Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #4: Loss Of All Gas-Fired Capacity Operable Capacity Margin Based on Net Capacity Resources (MW) & (%)	35,464 MW 11.0%	949 MW 0.3%	30,016 MW 9.3%	-5,425 MW -1.8%
Sensitivity Case #4: Loss Of All Gas-Fired Capacity Operable Capacity Margin Based on Total Potential Resources (MW) & (%)	41,458 MW 12.7%	6,829 MW 2.2%	35,209 MW 10.8%	274 MW 0.1%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 5) Compile observations on results and findings
 - Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Hydro-Electric Capacity*

Total NCSP Region - Temporary Loss Of All Hydro-Electric Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #5: Loss Of All Hydro-Electric Capacity Operable Capacity Margin Based on Net Capacity Resources (MW) & (%)	31,511 MW 9.8%	1,113 MW 0.4%	26,230 MW 8.1%	-5,448 MW -1.8%
Sensitivity Case #5: Loss Of All Hydro-Electric Capacity Operable Capacity Margin Based on Total Potential Resources (MW) & (%)	37,505 MW 11.5%	6,993 MW 2.2%	31,423 MW 9.6%	251 MW 0.1%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work
 - 5) Compile observations on results and findings
 - Identify fuel exposure to installed capacity within total NSCP region under scenario - *Temporary Loss of All Dual Fuel Capacity*

Total NCSP Region - Temporary Loss Of All Dual Fuel Capacity

Study Case	Winter 2008/2009	Summer 2009	Winter 2010/2011	Summer 2011
Sensitivity Case #6: Loss Of All Dual Fuel Capacity Operable Capacity Margin Based on Net Capacity Resources (MW) & (%)	41,782 MW 13.0%	7,038 MW 2.3%	36,604 MW 11.4%	934 MW 0.3%
Sensitivity Case #6: Loss Of All Dual Fuel Capacity Operable Capacity Margin Based on Total Potential Resources (MW) & (%)	47,776 MW 14.6%	12,918 MW 4.1%	41,797 MW 12.8%	6,633 MW 2.1%

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 5) Compile observations on results and findings

- Identify largest fuel exposure to installed capacity within total NSCP region and eight (8) sub-regions:

- **NSCP Region = Temporary Loss of All Coal-Fired Capacity**
 - PJM = Temporary Loss of All Coal-Fired Capacity
 - New York = Temporary Loss of All Gas-Fired Capacity
 - New England = Temporary Loss of All Gas-Fired Capacity
 - Ontario = Temporary Loss of All Nuclear Capacity
 - Quebec = Temporary Loss of All Hydro-Electric Capacity
 - New Brunswick = Temporary Loss of All Oil-Fired Capacity
 - Nova Scotia = Temporary Loss of All Coal-Fired Capacity
 - Maritimes = Temporary Loss of All Oil-Fired Capacity

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 6) Identify Conclusions

- The wide footprint of the NCSP region provides benefits with respect to the diversification of the overall fuel supply and delivery portfolios of all NCSP generation assets versus that of any single control area
 - The interconnected systems comprising the NCSP region should be able to provide varying amounts of emergency assistance, should fuel supply chains be temporarily interrupted

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 6) Identify Conclusions – cont'd

- Although these assessments simulate hypothetical events that temporarily disrupt fuel supply chains, the total loss of some fuels such as water (for hydro-electric generation) would likely be available in quantities necessary to serve almost all system energy requirements. This situation could potentially be mitigated by emergency purchases from neighboring systems
 - Fuel diversity studies that may be performed for individual control areas may also provide insight into similar problems and/or solutions for other NCSP participants. Thus benefits exist from coordinating over a wider-area, which also reduces the potential for “*double counting*” or “*double studies*” on the same proposed projects

NCSP2006 – Fuel Diversity Assessment

- Scope of Work

- 6) Propose Recommendations

- The information used to develop the NCSP06 fuel diversity operable capacity analyses was obtained from each region's 2006 annual compliance filing for the NERC RAS LTRA. With respect to future interregional resource adequacy studies and/or related assessments, it is recommended that this type of information and/or similar methodologies be used in future NCSP or NERC analyses
 - Coordinate natural gas system and other related fuel system studies
 - Monitor issues related to the interchangeability of LNG with traditional North American natural gas composition, with respect to its potential impacts on gas-fired power generation
 - Continue to monitor regional and national fuel supplies, inventories, and deliverability constraints

NCSP2006 – Fuel Diversity Assessment

- Next Steps for NCSP07:
 - Bring closure to existing fuel diversity studies with NCSP06
 - Identify whether new or additional fuel diversity issues are in need of further study
 - Monitor future proposed natural gas pipeline expansion and regional LNG development

QUESTIONS

Mark Babula
Principal Engineer
ISO New England Inc.
System Planning – Resource Adequacy
(413) 535 – 4324
mbabula@iso-ne.com