



Wind Integration Study: Study Results And Final Report

NYISO Wind Study Workshop
June 18, 2010 – Final Draft

Workshop Agenda

1) Introduction and Workshop Overview

- *John Adams*

2) Evaluation of Transmission Upgrades – Continued

- *Bob Waldele*

3) Sensitivity Analyses

- *John Adams*

4) Summary of Study Findings

- *John Adams*

5) Review of Final Report and Comments

- *All*

Evaluation of Transmission Upgrades - Continued

- ◆ **Bob Waldele**

Wind Study Sensitivities

◆ Sensitivity Descriptions

- *Lower Central East Limit (2,300 MW)*
- *Fossil/Coal Generation Retirements*

◆ Sensitivity Results

- *Did not materially affect the reliability or operational findings*
- *Primary impacts were on congestion and LBMPs*
- *Retirement sensitivity did result in a small reduction in the wind plant output that was bottled before upgrades (approx. 1/2%)*

Summary of Study Findings

- ◆ **Wind Integration Issues**
- ◆ **Study Tasks**
- ◆ **Study Findings**
 - *Reliability*
 - *Operations and Dispatch*
 - *Resource Adequacy*
 - *Production Cost Simulation*
 - *Environmental*
 - *Transmission Planning*

Wind Plant Integration Issues

- ◆ **Transmission (Task 5 and 7)**
 - *Will local area limitations affect wind plant output?*
 - *Will transmission limitations be a major barrier to increasing wind plant penetration in some areas?*
- ◆ **System Flexibility (Task 4)**
 - *Will the intermittent nature of wind plant output result in increased system variability?*
 - *Will increased variability adversely affect system operations and reliability?*
 - *Will increased wind penetration affect regulation requirements, operating reserves and installed reserves?*
- ◆ **LBMP and Emissions Impacts (Task 6)**
 - *Will increased wind penetration affect system LBMPs and Production Costs?*

Study Tasks Descriptions

- ◆ **Task 1 - Develop study assumptions**
- ◆ **Task 2 - Develop and implement performance monitoring for operating wind generators**
- ◆ **Task 3 - Update other regions' experience with wind generators**
- ◆ **Task 4 - Study the impacts on higher penetrations of wind on system variability and operations**
- ◆ **Task 5 - Evaluate the impact of the higher penetration of wind generation on transmission infrastructure and system performance**

Study Tasks - continued

- ◆ **Task 6 - Evaluate the impact of the higher penetration of wind generation on energy production and production costs for NY system**
- ◆ **Task 7 - Additional Task – Generate a transmission upgrade list based on #6, refine the list by TOs, and feed back to #6 to assess effectiveness of these upgrades**

Reliability Finding

- 1. The addition of up to 8 GW of wind generation to the New York power system will have no adverse reliability impact. This finding is predicated on the following:**
 - *The NYISO's centralized wind forecasting system for scheduling of wind resources*
 - *The NYISO's wind energy management initiative*
 - *The NYISO's wind plant interconnection process, which will incorporate best practice technologies over time*
 - *The NYISO's installed resource base will have sufficient resources to provide the back-up needed to support wind plant operations*

Operational Findings

- 1. The average regulation requirement increases approximately 9% for every 1,000 MW increase between the 4,250 MW and 8,000 MW wind penetration level.**
- 2. A greater percentage of the committed dispatchable generation is there to respond to changes in the net-load.**
- 3. The NYISO security constrained economic dispatch processes are capable of managing and responding to the increase in the magnitude of the net-load ramps.**

Operational Findings (continued)

- 4. The level of operating reserves that are needed are not impacted by the 8 GW of wind studied.**

Resource Adequacy Findings

- 1. The addition of 8 GW of wind resources to the NYSRC 2009-2010 IRM study base case reduced the LOLE from the 0.1 days per year to approximately 0.02 days per year.**
- 2. At criteria, the reserve margin would have to increase from its current level of 18% to almost 30% with 8 GW of wind.**
- 3. The LOLE analysis resulted in an equivalent load carrying capability (ELCC) for the wind plants studied that exceeded 20%.**

Economic Findings

- 1. 8 GW of installed wind resulted in a 16.6% drop in production costs which totaled approximately 1.3 billion dollars.**
- 2. 8 GW of installed wind reduced system average LBMP prices by 9.1%.**
- 3. Addition of wind resources in upstate NY increase congestion while off-shore wind resources reduce congestion.**

Economic Findings (continued)

- 4. The predominate fossil fuel displaced by wind generation is natural gas.**
- 5. In general, the capacity factors for fossil plants are reduced by wind generation.**

Environmental Findings

- ◆ **8 GW of wind resources resulted in the following emissions reductions:**
 1. *A reduction of 4,907,246 short tons of CO₂ or an 8.5% reduction*
 2. *Each GWh of displaced fossil fired generation which primarily consisted of natural gas resulted in an average reduction in CO₂ of 316 tons*
 3. *A reduction of 2,734 short tons of NO_x or 7% reduction*
 4. *A reduction of 6,477 short tons of SO₂ or 9.7% reduction*

Transmission Findings

- 1. The 6 GW scenario determined that 8.8% of the energy production of the wind plants in three Zones in upstate NY would be “bottled” or “energy constrained.”**
- 2. The principal transmission constraints are the local 115 kV transmission facilities.**
- 3. The off-shore wind energy as modeled was fully deliverable and feeds directly into the superzone J-K load pockets.**
- 4. The study evaluated 500 miles of transmission lines and 40 substations to determine potential upgrades that would result in the “unbottling” of the wind energy.**

Transmission Findings (continued)

- 5. If all the upgrades studied were implemented, the amount of bottled wind energy could be reduced to <2 % of the upstate wind potential production.**
- 6. The cost of the upgrades could range from \$75 million to \$320 million.**
- 7. The study determined that approximately 460 MW of interface transfer capability needs to be added to the UPNY/SENY interface for all NY wind resources to participate in the installed capacity markets (CRIS).**
- 8. Transient Stability Analysis was conducted to evaluate the impact of high wind penetration on NYCA system stability performance and no indication of units tripping due to instability, over/under voltage or over/under frequency was observed.**

Study Conclusions

- 1. 8 GW of Wind generation can reliably supply clean energy at a very low cost of production to the NY power grid.**
- 2. Due to its intermittent nature and lower availability, Wind generation poses unique operating challenges such as responding to higher magnitude ramps.**
- 3. The NYISO's security constrained economic dispatch processes are capable of managing and responding to the higher magnitude ramps and system variability.**

Study Conclusions (continued)

- 4. Wind will increase the need for regulation resources.**
- 5. Transmission upgrades will be required to relieve wind energy bottling in three Zones of Northern and Central New York.**
- 6. Wind resources will generally result in lower overall energy production costs that could create challenging economic environment for future wind development and the conventional resources needed to back up the wind.**

Questions, Report Comments, Etc.

- ◆ All

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