



Integration of Wind into System Dispatch

A New York ISO White Paper

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1. Introduction

Wind power is growing as a generation resource in New York State. The number of wind plants operating in the state has increased significantly over the past two years. Wind-powered projects also comprise a dominant portion of the proposed new generation projects in the New York Independent System Operator's (NYISO) interconnection queue.

Wind capacity in New York is projected to grow to more than 1,200 MW by the summer of 2009. The projects currently under review in the interconnection queue indicate the potential for another 6,500 MW of wind capacity to be developed by 2011. Due to the location of these resources and their intermittent nature, this presents a new challenge for grid and market operations in New York. Many of the proposed wind plants are seeking to interconnect in concentrated clusters located in the northern and western regions of the state. These regions are supported by an existing transmission network that will not be capable of delivering all the potential wind output to the load centers in the southeastern regions of the state.

The expected level of wind penetration as well as the concentration or clustering of the wind plants in areas of the grid not built to accommodate that level of generation may require that wind output be re-dispatched when system security and reliability is threatened. Dispatching other resources around wind plant output may not alone be adequate to efficiently manage the expected levels of wind generation in New York. Long-term solutions may include the need for additional transmission to move wind power, energy storage devices to absorb excess power in off-peak hours, and new operational rules to protect system security.

To enhance the integration of existing wind plants and prepare for the influx of additional wind generation, the NYISO has taken the following steps:

- Funded and participated in the 2005 study, *The Effects of Integrating Wind Power on Transmission System Planning, Reliability and Operations*, sponsored by the New York State Energy Research and Development Authority (NYSERDA)
- Expanded the eligibility of intermittent resources for special market rules from 500 MW to 3,300 MW to accommodate increased penetration levels of wind plants on the system
- Initiated a centralized wind forecasting system integrating wind generation into the NYISO day-ahead and real-time market software systems in order to better predict the output of wind projects in the NYISO's system dispatch.

The NYISO can best optimize wind plant output by evaluating each plant's economic preferences within the NYISO's real-time Security Constrained Economic Dispatch (SCED) process, as it does other generating resources. If the wind plant's economic offers are not known, the NYISO or local system operators must take less efficient, out-of-market actions to protect the reliability of the system. Therefore, the NYISO proposes to extend its market-based SCED systems to optimize the scheduling of wind plants.

5. Longer-term Wind Integration Solutions

Greater integration of wind resources into the NYISO's economic dispatch will allow for increased wind penetration into New York. Just meeting New York State's 25% renewable energy mandate may require as much as 4,000 MW of wind capacity to be built in New York.¹² Further, wind plants are being developed in New York in order to sell energy as part of the renewable energy programs in place in neighboring states. It is therefore possible that New York's wind plant capacity may exceed 4,000 MW. With wind plants continuing to locate in the northern and western portions of the state it will become difficult to meet state RPS targets without additional transmission infrastructure to balance and move the wind energy southeast to the larger load centers. In the long-term, increasing the amount of wind that can be reliably integrated into the bulk power system and delivered to the load may require new operating procedures, market rules, new storage technologies, as well as transmission reinforcements.

Enhanced Centralized Wind Forecasting

The NYISO is concerned with high-speed wind events such as the one depicted in Figure III-1 due to the reliability implications resulting from the intermittent characteristics of wind turbines during such events. The geographic concentration of wind plants under development in the north and west regions of the state may impact the NYISO's ability to meet NERC's Balancing Authority reliability rules due to these high-speed wind events. As a result, the NYISO is evaluating potential steps to enhance its Centralized Wind Forecasting System in order to effectively predict the occurrence of such events and minimize the resulting impacts on the system.

Impact on Reserves and Regulation Requirements

A significant increase in intermittent resources in New York may increase the need for regulation and reserves services to maintain system reliability. For example, a recent wind study by the California Independent System Operator (CAISO) concluded that increased wind generation will increase the requirement for regulation, due to near-term wind forecast uncertainty.¹³ The requirement for regulation in the past has been mainly a function of the variability of electrical load. Wind plants may create a significant demand for increased regulation and reserves, thus making it imperative to look for new sources and new technologies for these services.

The NYISO is currently evaluating changes to its market rules and scheduling tools to better accommodate energy storage technologies, such as flywheels or batteries, into the regulation markets. These types of devices have limited energy storage, but they have a fast dynamic response rate that allows them to quickly switch from absorbing to injecting real power into the transmission system, and thereby provide frequency regulation and short-duration Area Control Error (ACE) regulation.

¹²This is based on Combined Targets of 12.3 million MWh, with an assumed a 30% capacity factor for wind resources, and 25% non-wind new RPS resources. Source for Combined Targets: *New York State Renewable Portfolio Standard Performance Report, August 2007*. NYSERDA

¹³ *Integration of Renewable Resources*, California ISO, November 2007.