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Wind Power in New York State

Introduction

Wind energy has become one of the world's fastest growing sources of electricity. Over the past two decades the cumulative wind power capacity has grown at a 25% or stronger annual rate and now supplies approximately 1% of the world's electricity demand. The modern era of wind energy development began in the United States in the late 70's and early 80's in response to federal and state government initiatives. These initiatives were responsible for the early California "wind rush" era that saw the first wind farms built in large numbers, but concentrated within a few windy mountain passes. Many of these projects are still operating today or have been "repowered" by newer and larger turbine models. The United States dominated global wind development, which amounted to less than 2000 MW of total installed capacity, until about 1990. Europe then became the world leader, not only in wind energy deployment but in wind turbine manufacturing as well.

In recent years wind energy development in the United States has experienced a strong resurgence and is now one of the world's strongest growth countries, together with China, Spain, and India. This growth has been fueled by a number of factors: government policies and incentive programs, technology advances and economies of scale, the development of clean energy markets, and concerns over climate change and energy security, among others. State renewable portfolio standards, which include New York, and the federal production tax credit (PTC) are the primary economic incentives driving wind energy's domestic growth. Any dramatic change to these incentives, such as the potential expiration of the PTC at the end of 2009, would likely impair wind's short-term growth trajectory. However, several long-term indicators point towards a long-term sustained growth for the wind energy industry.

The objective of this briefing paper is to outline the current status of the wind energy industry and the variables impacting its overall growth potential. Although there will be substantial background information provided on the national and international markets, the issues and implications relevant to New York State will be emphasized. Topics include a status of the technology, current trends, siting and environmental considerations, economics, policy issues, and transmission.

Description of Technology

Utility-scale wind farms account for the overwhelming majority of wind energy applications in terms of installed capacity. Today's wind farms are comprised of arrays of megawatt-scale wind turbines, requiring approximately 30-50 acres of non-dedicated land per megawatt, depending on turbine spacing, topography, and local land use/ownership patterns. Less than five percent of the land is occupied by or dedicated to turbine structures, roads, and other components; the balance is usually available for pre-existing uses such as agriculture. Most turbine tower heights range between 210 and 265 ft (65-80 m). The underground electrical collection system at a wind farm combines the output of the individual turbines and delivers it to an on-site substation where the voltage level is stepped-up to match the voltage at the interconnection point with the local transmission grid, which may be several miles away. Most wind farms interconnect using overhead conductors at voltage levels of 69, 115 or 230 kV, but relatively small projects (<20 MW) may interconnect with lines operated at lower voltage levels if available.

Small-scale, single customer-sited systems are the next leading type of wind energy application. Such systems are typically less than 100 kW in capacity and are designed to service a portion of the customer's electrical load. Residential/agricultural systems are generally 10 kW or smaller in size, while commercial/municipal-scale systems can range as large a megawatt or more. Tower heights for residential/agricultural systems are typically 80 to 120 ft (24-37 m), while heights for larger systems range between 120 and 200 ft (37-60 m). New York State has net metering legislation applicable to up to 2 MW.

Community wind systems fall in between, or are a hybrid version of, the utility-scale and small-scale types of applications and are just emerging as a potential market. The term "community" most commonly refers to an ownership structure that includes multiple local entities (public and/or private sector), but in some cases it can also refer to a project that is sited within or adjacent to a community.

Trends in Technology Scale: The average size of utility-scale turbines installed in the United States in 2007 was approximately 1.65 MW, compared to 0.9 MW in 2000. General Electric's 1.5 MW wind turbine has led the American market for the past few years—installing more than 1500 units in 2007—but it has been losing market share to several international manufacturers (Vestas, Siemens, Gamesa, Mitsubishi and Suzlon). Most manufacturers now offer wind turbines ranging between 2.0 and 2.5 MW. Hub heights have grown with power ratings to accommodate the larger blade assemblies and to tap the stronger winds found aloft. The prevailing hub height for new installations is 265 ft (80 m), with even greater heights proposed for near-term projects in the Great Plains.

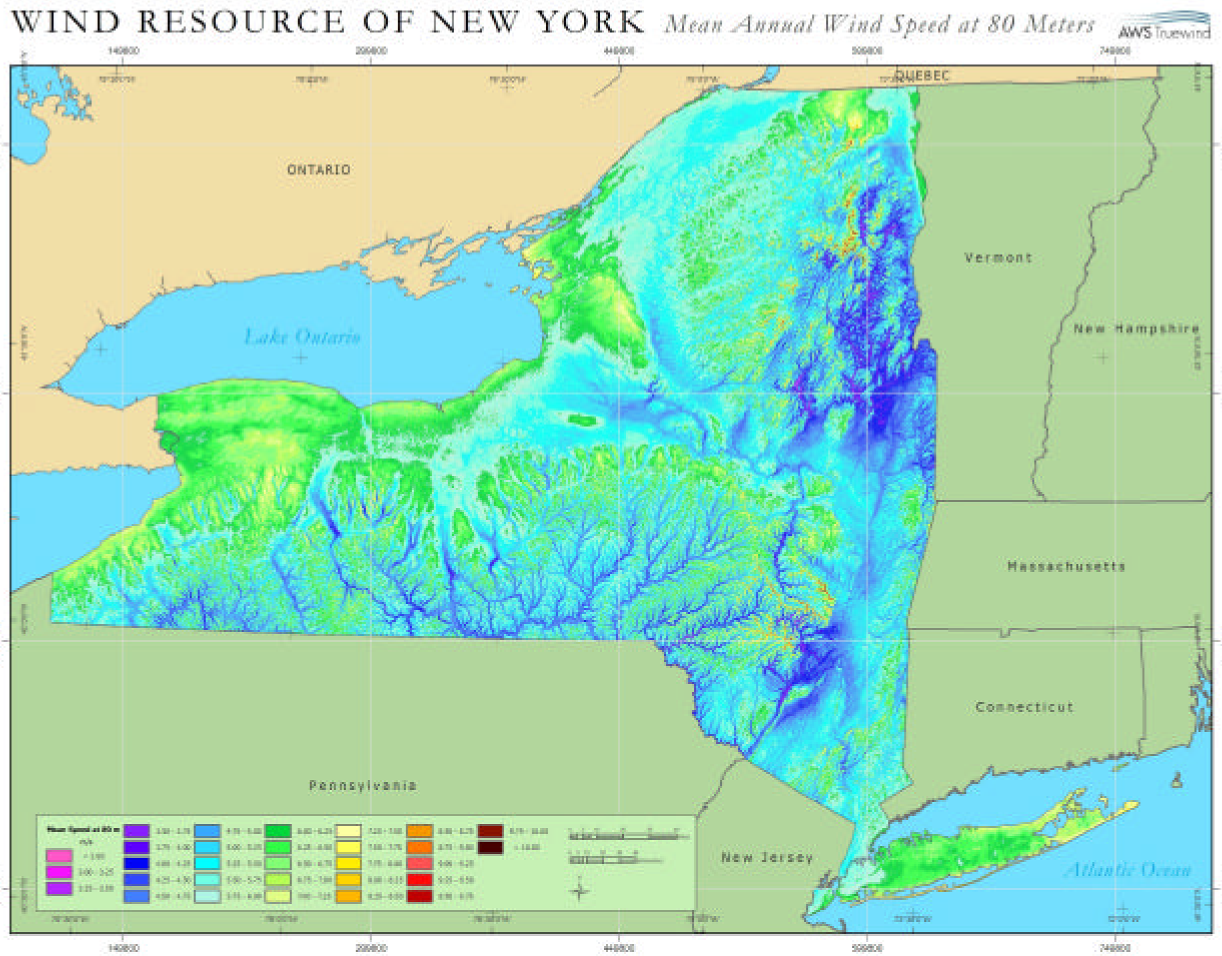
The wind industry's growth trend is also reflected in project size and performance. Wind farms installed in 2007 averaged nearly 120 MW in capacity, roughly double that from only three years earlier. Several gigawatt-scale projects were announced in the past year; one such project being developed in California has already secured a power purchase agreement with Southern California Edison. Oil man T. Boone Pickens is probably the most visible developer who is planning gigawatt-scale projects. Overall project performance in terms of capacity factor has also been on the rise due to higher hub heights, advanced turbine designs, and improved siting techniques. Typical capacity factors in the windiest parts of the country—in places like Texas, Montana, and Hawaii—range between 35% and 45%, whereas capacity factors in more moderate wind regimes like New York's are more commonly in the range of 28-34%. Capacity factors are primarily a function of the magnitude of the wind resource and turbine model.

Interest in offshore installations has also been growing worldwide. There are over 25 operating offshore wind farms located in northern Europe, totaling over 1000 MW in capacity. No offshore projects have been built or permitted yet in the United States, however several have been proposed in the states of Delaware, Massachusetts, New Jersey, New York, Delaware, and Rhode Island. The country's first power purchase agreement was recently signed for a proposed wind farm off the Delaware coast. Siting wind projects in offshore areas is seen as advantageous in areas where little or no windy land is available near major load centers. Offshore areas are generally much windier than adjacent coastal land.

Wind Resource and Siting Considerations: To achieve commercial viability, wind energy systems need to be sited in relatively windy locations. For wind farms on land, the *minimum* required average wind resource at hub height to compete in today's competitive power markets falls between 14.5 mph and 16.8 mph (6.5-7.5 m/s), depending on the state or transmission control area. Offshore projects require a minimum wind resource of 18.0 mph (8 m/s) due to the higher costs of construction and operations. The country's windiest lands are found in the Great Plains, which comprise much of the acreage between the Rockies and the Mississippi. Average wind speeds at most project sites there are between 7.5 and 9.0 m/s (16.8-20.0 mph). Windy lands can be found in most of the rest of the United States, although in lesser quantities and in a more scattered and fragmented fashion. Accurate depictions of the nation's wind resources are now available in the form of color-coded wind maps (see Figure 1 for a wind map of New York State). In New York, the windiest lands (after excluding the Adirondack and Catskill State Parks) are generally found on well-exposed hills and ridges and near shorelines where average wind speeds (at an 80 m hub height) exceed 7.0 m/s (15.6 mph). These windy lands comprise approximately 5 percent of the state's total land area. According to the National Renewable Energy Laboratory, New York ranks 15th among states in the amount of windy land.

When prospecting for potential project sites, developers seek areas that not only are predicted to be windy, but which also possess other attributes suitable for wind farms. These attributes include close proximity to an existing transmission line that has the capacity to accept new generation, compatible land use (such as agriculture), lack of obvious environmental conflicts, and the availability of enough contiguous land area to sustain a minimum desired project size. These early screening steps are followed by in-depth studies and community contacts, including the negotiation of lease option agreements with landowners. These agreements provide for a recurring annual compensation to landowners on whose land turbines are proposed, with this compensation typically totaling several thousand dollars per turbine per year. Many developers also negotiate separate compensation agreements with neighboring landowners who wouldn't have any turbines on their land but would otherwise be impacted by the close presence of a wind farm. The average acreage of properties in New York's rural areas is on the order of 75-200 acres, which requires that agreements be struck with numerous landowners before a viable project can be pursued. A 50 MW wind farm, for example, requires at least 2000 acres, which translates to agreements with 10-25 landowners. Other early stage development activities include the installation of one or more meteorological towers to measure wind conditions, scoping meetings with community leaders and permitting agencies, and interconnection feasibility discussions with the local transmission owner. The overall development cycle, including the permitting approval process, the securing of interconnection agreements and financing, and the equipment procurement and installation process, is on the order of four to six years.

Figure 1



As with all energy projects, there are environmental and siting issues that are technology specific, and wind projects are no exception. The primary issues raised as special concerns associated with wind energy development are visual and aesthetic impacts, bird and bat mortality, and noise. As tall moving structures, wind turbines are highly visible within their locales and are in many areas novel features in the landscape. This quality of wind power development is frequently raised during the public approval process and can be a source of community controversy. The potential for bird and bat impacts, including behavioral modifications, habitat alterations, and mortality, is another concern, particularly in locales where threatened or endangered species frequent. There is a rapidly growing body of scientific data being collected by wind projects throughout the country to better understand the interactions of birds and bats with wind turbines and ways to mitigate harmful effects. Noise emissions from wind plants are generally well understood and their impacts minimized by observing minimum setback distances from residences. Guidelines for siting wind projects that address these and other issues have been developed by various public agencies and by the wind industry itself. For example, the Siting Committee of the American Wind Energy Association has developed the *Wind Energy Siting Handbook* (www.awea.org/sitinghandbook) to assist wind energy developers in addressing the regulatory and environmental issues associated with utility-scale, land-based wind projects. It is intended to be a guidance document for use in conjunction with other available resources and consultations with environmental professionals and regulators.

Current Status of Technology

In 2007, the installed wind power capacity in the United States grew by 46% (5,329 MW) for a cumulative total of 16,904 MW. This was the largest single-year addition of wind capacity ever recorded by any country and was the third straight year that the United States led the world in wind capacity growth. The 2007 wind capacity addition comprised over a third of all new domestic electric generating capacity (vs 19% in 2006) and was second only to natural gas for the third straight year. Wind projects are now installed in at least 35 states, with 16 states having more than 100 MW of wind capacity, and nine exceeding 500 MW, as of the end of 2007. At that time Texas was the national leader with over 4400 MW of installed wind capacity, followed by California (2439 MW), Minnesota (1298 MW), Iowa (1271 MW) and Washington (1163 MW). At the outset of 2008 wind power represented about 0.8% of the country's electricity consumption, while wind power in Europe generated 3.7% of that continent's electric energy, up from 1% in 2000.

Globally, there was approximately 94,000 MW of wind capacity at the end of 2007, 27% (19,900 MW) more than a year earlier. Three-quarters of this growth occurred in five countries: United States, China, Spain, Germany and India. Wind power now contributes to the energy mix in more than 70 countries. After several years of strong growth, wind power provides significant fractions of electricity demand in several European countries such as Denmark (20%), Spain (12%), Portugal (9%), Germany (7%) and Ireland (5%).

In New York State, there was 425 MW of wind generation from nine wind farms by the end of 2007, which provided an estimated 0.7% of in-state electric generation. By the end of August 2008 with the completion of three new projects, the New York Independent System Operator (NYISO) reported a new total of 707 MW of wind capacity, with an additional 589 MW (six projects) under construction. The completion of these additional wind farms would raise the state's wind capacity to approximately 1300 MW by the summer of 2009. Proposed projects adding another 6,500 MW of wind capacity to be developed by 2011 are proceeding through the grid interconnection study process administered by the NYISO. As is customary with proposed projects in the NYISO queue, only a fraction are likely to be built depending on the ability of developers to obtain permits and financing, among other factors. The largest operating project is the Maple Ridge Wind Farm in Lewis County, which totals 322 MW. Three other operating projects exceed 80 MW in capacity and became operational in 2008: the Bliss wind farm in Wyoming County, the Clinton project in Clinton County, and the Ellenburg wind farm, also in Clinton County.

The strong demand for wind energy has created a supply shortage of utility-scale wind turbines. Manufacturers report that the backlog for turbine orders is now approximately two years. This situation has been caused in part by major developers buying large orders of turbines in advance to satisfy a long pipeline of projects under development. Another reason for the shortage is the inability of component suppliers to scale-up quickly enough to meet the demands of a heated market.

Capital Costs and Energy Prices: The capital (total installed) costs for wind farms average between $1900 and $2200 per kilowatt (offshore projects are estimated to be close to double in cost). Projects built in the Northeast are at the higher end of this range due to the greater siting and permitting challenges in this relatively populated region. These figures are inclusive of development and permitting activities and transmission interconnection. Project costs have risen about 40% over the past five years due to several factors: the weak dollar, higher prices and profit margins for turbines, higher hub heights, higher costs for commodities (such as copper, steel, resin, and cement), and supply chain shortages. This trend has countered the downward slope in prices during the 1990s, which was largely attributed to technological advances and economies of scale (in terms of turbine size and project size). This cost increase has impacted the broad energy and construction sectors and hasn't been limited to wind. Prices for coal plants, for example, have increased approximately 50% over the same timeframe. The higher costs for commodities are universal and are primarily caused by sharply growing demand and resulting supply shortages. Another factor applying upward pressure on prices for new power plants is the increased overall demand for new generating and other electric infrastructure projects. Engineering, procurement and construction (EPC) firms have a growing backlog of utility infrastructure projects in the pipeline, which is leading to higher bids for new jobs.

Compared to other conventional generation sources, wind entails higher initial capital costs, yet offers lower ongoing costs than conventional power plants for operations, maintenance and fuel. Operations and maintenance costs for wind farms are on the order of $10/MWh, and there is of course no fuel cost. Immunity from fuel supply and price volatility enables wind's long-term energy prices to be very predictable. Studies have shown that the addition of wind to the generation mix acts as a hedge against other price risks and can reduce the overall long-term price of electricity.

Energy prices for wind averaged between $30 and $65/MWh nationally in 2007, with projects built in the Northeast again at the higher end of the range. These are net prices after any available state and federal incentives are applied (including the sale of renewable energy credits). The PTC incentive is currently at $20/MWh, and the 2007 New York State RPS average auction price was approximately $15/MWh. The prices for wind have been competitive with wholesale power market power prices throughout the US—including the Northeast—in recent years. Until recently, the rise in project costs has been partially offset by the decline in the cost of tax equity, thereby alleviating upward pressure on wind power prices. With the current credit crunch, however, the cost of tax equity provided to wind projects is unlikely to fall further and indeed will likely increase.

Trends in Project Ownership and Financing: Private independent power producers (IPPs) own the vast majority (84%) of the country's wind capacity, followed by utilities (14%) and small-scale, customer-sited projects (2%). The dominant off-taker of wind-generated electricity in the US is the investor-owned utility sector. Publicly-owned utilities and power marketers are significant purchasers as well. Power purchase agreements with utilities generally range between 15 and 25 years, with somewhat shorter timeframes exercised by power marketers. In some areas of the country (like New York and Texas) there has been a growing trend for wind-based electricity sales from "merchant" wind plants to be tied to short-term contracted and/or spot market prices.

There has been a shift in the type of companies developing and owning wind farms in recent years, from relatively small IPPs toward international utilities (such as Iberdrola, Energias de Portugal, and E.ON) and multi-national oil & gas companies (like Shell and BP). These large companies have entered the US market through acquisitions, by their own independent development activity, and through development agreements with others. With this transformation of the wind power industry has come a variety of financing structures to allow projects to fully access federal tax incentives. The two most common structures are corporate balance-sheet finance and the "institutional investor flip" structure involving institutional "tax equity" investors. With the growing presence of foreign developers and owners with little appetite for US tax incentives, the need to attract institutional tax equity to the US wind sector has never been greater. The growing dependence on third-party investors has left the US wind sector vulnerable to the broader credit crisis that began in earnest towards the end of 2007. As a result of the large losses incurred by the banking industry, institutional tax investors have less taxable income to shelter. This shortage is being felt in the housing sector—one of the wind sector's main competitors for tax equity—where the yields on affordable housing credits have been driven sharply higher by lack of demand. Consequently is it expected that the current credit crunch will lead to higher financing costs.

Policy Issues

A variety of federal and state incentive programs, utility resource planning requirements, and green power markets has driven wind's expansion. The longest running incentive has been the federal production tax credit, which was first established by the Energy Policy Act of 1992. The PTC provides a 10-year credit at a level that equaled $20/MWh in 2007 (adjusted annually for inflation). The importance of the PTC to the US wind industry is illustrated by the pronounced lulls in wind capacity additions in the three years—2000, 2002, and 2004—in which the PTC lapsed. Capacity additions fell by an average of 80% in those lapsed years. The PTC, which was due to expire at the end of 2008, was extended for one year as part of the Emergency Economic Stabilization Act of 2008 in October 2008. The lack of a long-term and uninterrupted PTC horizon has been blamed for inhibiting investments in domestic manufacturing facilities and for restraining overall market growth during a large portion of the current decade.

State renewable portfolio standards (RPS) have been an important factor in creating sustainable markets for wind power and other renewable energy sources because of their relatively long time horizons. The majority of states, including the District of Columbia, now have RPS programs with renewable energy targets ranging from 10% to 30% of electricity consumption. Collectively, enacted RPS programs are projected to result in at least 67 GW of new renewable energy capacity by 2020. Wind is expected to comprise the lion's share of this capacity due to its low cost relative to other renewable technologies, its technological maturity, and its ability to be deployed as a utility-scale application on a widespread basis. New York's RPS, which calls for expanding the state's utilization of renewable energy sources to at least 25% (from 19%, most of which is hydro), was implemented by the state's Public Service Commission (PSC) in 2004 and is being administered by NYSERDA. In its original instituting order for the RPS, the PSC specified an annual collection schedule lasting through 2013 totaling approximately $741 million. These funds are collected by major investor-owned utilities from their customers through their routine monthly energy billings. According to the First Report of the Renewable Energy Task Force, the RPS program has thus far committed approximately $575 million to projects but the remaining budgeted funding will likely be inadequate to meet the state's 2013 goal. The Public Service Commission is currently conducting a revised cost study to assess the future needs to fully fund the RPS. On a related front, in early October 2008, the PSC issued two notices concerning significant potential changes to the RPS and requests public comment within 45 days. One notice concerns the base case forecasts, targets, tier allocations and collections while the other contemplates a significant increase in the target for photovoltaics and other on-peak resources in high cost areas and includes the possibility of utility acquisition of these resources.

Other incentives and markets that are promoting wind development include:

- Clean Renewable Energy Bond – This federal program, created in 2005, effectively offers interest-free debt to eligible renewable projects such as those developed by municipalities and other public entities that had previously been eligible to receive a production incentive from the Renewable Energy Production Incentive (REPI).

- Accelerated Depreciation - Wind power property may be depreciated for federal tax purposes over an accelerated 5-year period, with bonus depreciation allowed for certain projects completed in 2008.

- Net Metering – New York passed a new law in August 2008 that expands net metering to allow all customers (including businesses, non-profits and municipalities) to net meter wind and solar energy systems up to 2 MW in size (or the customer's historic peak, whichever is less).

- Green Credits –The credits are also referred to as renewable energy credits or certificates (RECs). They are a flexible market instrument that either be bundled with electricity and sold in the wholesale market (and sold as "green power " to retail customers) or unbundled and sold as a separate commodity. RECs are used in New York's RPS program to determine compliance. New York's current tracking system is the Environmental Disclosure Label.

- Executive Order 111 – In March 2008, Governor David Paterson continued this order requiring that 20% of the overall electric energy requirements of buildings used by State agencies and other affected entities by supplied by renewable energy sources by 2010. The original order was initiated in 2001 Governor Pataki.

- On-Site Small Wind Incentive – Cash incentives from NYSERDA are available for new wind systems for turbines up to 250 kW in size. The level of incentive depends on the wind turbine model, tower height, and customer class. Additionally, the New York Energy $mart Loan Fund provides interest rate reductions on loans for renewable technologies.

- Small Wind Investment Tax Credit – This 30% federal credit applies to qualified small ($\leq$100 kW) wind property and has a $4,000 cap per taxpayer.

In June 2007, a state task force—called the Renewable Energy Task Force—was assembled by then Lt. Governor David Paterson to assess New York's renewable energy and energy efficiency situation. The first report of the Task Force was released in February 2008 as a policy "roadmap" to reduce the state's dependence on fossil fuels, to stimulate investment in clean energy technologies, and to move toward a clean energy economy.

SEQR: Wind projects in New York are subject to approvals from local, state and, where applicable, federal agencies. The primary vehicle for obtaining approvals is defined by the State Environmental Quality Review Act (SEQR). Projects that receive state funding or require approval by a local government are subject to review under SEQR. Projects that are designated as Type I or unlisted actions are required to prepare and submit an Environmental Assessment Form to the lead agency. Guidance documents are available from a number of sources, including NYSERDA and the NYS Department of Environmental Conservation (DEC). During the past year, the DEC has also released proposed Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. The guidelines were developed through a stakeholder process sponsored by NYSERDA. The deadline for public comments was in March 2008, and the revised document has not yet been released. For offshore projects beyond the 3-mile state limit, lead agency status belongs to the US Department of Interior's Minerals Management Service.

Transmission System Issues

Modern wind turbine technologies meet power quality and other specifications required for interconnection to the grid. Most technologies also have low-voltage ride-through and reactive power capability, and studies have shown that modern wind farms can improve transmission system performance by damping power swings and supporting post-fault voltage recovery. All grid-connected projects are subject to interconnection review and approval following procedures established by the responsible entity. For small-scale or community wind systems connected at the distribution level, this review oversight normally belongs to the local utility; for wind farms connected to the transmission system, oversight is the domain of the transmission system operator (e.g., NYISO). Technical reviews—commonly referred to as interconnection feasibility studies and system reliability impact studies (SRIS)—are conducted by the overseeing entity for a fee paid by the applicant. Valid study requests are placed in a queue and may take up to a year or longer to complete. As of the end of August 2008, there were 135 proposed power projects in the NYISO queue, 70 of which represented wind power projects totaling over 7,700 MW of capacity. Nationally, there were 225,000 MW of wind power capacity proposed by the end of 2007 within eleven interconnection queues reviewed by the U.S. Department of Energy. This wind capacity was twice as large as the next largest resource in these queues—natural gas. Nearly two-thirds of this wind capacity was planned for the Midwest (MISO – 29%), Texas (ERCOT – 18%) and PJM (16%) regions. The surge in wind development activity in recent years has overburdened most queues, leading to unusually long delays in conducting the studies.

The anticipated addition of significantly more wind capacity to the generation mix has raised questions about the potential impacts on grid reliability and the costs of ancillary services, due to the fact that wind is a variable resource. In recent years, state and regional wind integration studies (including New York) have addressed these questions and have reached general agreement on several issues: regulation impacts (including requirements for additional spinning reserves) are relatively small; large balancing areas (such as ISOs) make it possible to integrate wind more easily and at lower cost than is the case in small balancing areas; and the use of short-term wind power forecasts (next-hour and next-day) can significantly reduce integration challenges and costs. Transmission areas that have established, or are in the process of establishing, wind forecasting systems include CA-ISO, ERCOT, MISO, PJM and NYISO. The New York grid integration study (completed in 2005 by GE Energy Consulting and AWS Truewind on behalf of NYSERDA and the NYISO) determined that 3300 MW or more of wind-based generation—equivalent to approximately 10% of the state's projected 2008 peak load—would have little impact on system reliability and would actually reduce grid operating costs. (This amount of wind capacity is also roughly equivalent to what is expected to be wind energy's share in fulfilling the state's 25% RPS objectives.) The NYISO has recently announced plans to conduct an updated wind integration assessment based upon where wind projects have been and are projected to be built.

One of the largest barriers to continuing additions in wind power capacity nationwide are limitations imposed by the aging and heavily-loaded power grid. While energy demand has steadily grown over the years, investments in new transmission and system upgrades have not kept pace. Consequently, both thermal and voltage-related constraints routinely impact regional power deliveries in many parts of the country, including New York. In addition to these congestion problems, there is also limited availability of existing transmission resources in the remote areas where most windy lands are concentrated. While the developer of a gigawatt-scale wind farm may be able to economically absorb all or most of the costs for a long-distance interconnection, such an investment would be untenable for the average developer. Therefore many resource-rich areas of the country will remain untapped or under-tapped until transmission solutions are reached. In the meantime, future development activities will tend to congregate in areas where excess transmission capacity is still available.

Efforts are underway to address the transmission access issue on various fronts. At the federal level, the 2005 US Energy Policy Act increased the incentives to construct transmission and to identify national corridors for high-voltage transmission to relieve congestion and deliver power from renewable resource-rich areas to load centers. State initiatives are also encouraging transmission investment to enable the expansion of renewable energy development and improve grid access to location-constrained resources. In Texas, ERCOT established "commercial renewable energy zones" (CREZ) where new transmission investments will be strategically targeted to enable further grow in wind development. In California, Southern California Edison has received state and FERC approval to build a new transmission line that will provide access to geographically constrained wind and solar resource areas. These initiatives have included alternative financing and compensation schemes that bypass the classical approach of requiring the first-in generator to capitalize the entire transmission investment.

Growth Projections & Issues

The US market's wind capacity is expected to triple to at least 60,000 MW by the end of 2012 compared to the start of 2008. In New York, where the wind market is largely driven by the state's RPS program, the wind capacity is predicted to grow to approximately 3000 MW by 2013, which is more than a four-fold increase from today's capacity. This robust growth is attributed to increasingly supportive policies at the federal and state levels, growing public interest in renewable energy, concerns over climate change, and continued improvements in wind technology and performance. Notably, the majority of states have already implemented long-range RPS program and have created climate action plans (such as the Regional Greenhouse Gas Initiative). All of these state and regional efforts include wind energy as part of a portfolio strategy to reduce overall emissions from energy production.

In May 2008, the US Department of Energy issued a document titled "20% Wind Energy by 2030", which identifies a set of challenges, possible solutions, and potential impacts of providing 20% of the nation's electricity from wind. The US Energy Information Agency estimates that domestic electricity demand will grow by nearly 40% between 2005 and 2030, reaching about 6 billion MWh. To meet 20% of that demand using wind power would require more than 300 GW of wind capacity. This growth represents an increase of more than 290 GW within 23 years, or a 13% compounded annual growth rate (which is lower than the historical growth rate of the past 20 years).

The 20% study estimates that the country has more than 8,000 GW of available land-based wind resources, or more than 26 times the 300 GW figure, that can be captured economically ($60-$100/MWh). A vast offshore resource, including the Great Lakes, is available at a higher price. The same study estimates that, under the 20% scenario, wind would supply enough energy to displace about 50% of natural gas electric utility consumption and 18% of coal consumption by 2030. The cumulative reduction in CO2 emissions would be 7,600 MM tons over this time period.

Sustained growth of the wind energy industry will require significant changes in transmission, manufacturing and markets, and the removal of barriers. Such growth will also require enabling policies and regulations that guide this growth is an environmentally responsible manner. In New York, potential pathways that would likely encourage sustained wind development include:

- An extension and expansion of the RPS that establishes a higher target over a longer time horizon (such as 30% by 2015 or 40% by 2020);
- Incentives for offshore wind development off the shores of Long Island and the Great Lakes. The development potential rivals that on land. Involvement by the New York Power Authority and the Long Island Power Authority could facilitate offshore development, which has different challenges and higher costs compared to development on land;
- Transmission planning to accommodate New York's expanding clean energy economy. Expansion of and upgrades to the transmission system are necessary to support ongoing economic growth, reduce constraints in power flows across the state, mitigate energy price volatility, and avoid delays in achieving RPS targets. This effort will require coordination among the State's power industry stakeholders.
- Greater certainty in permitting. State agencies should establish reasonable and well-documented procedures that are supportive of the goal of environmentally and economically sound wind energy development. Such procedures should be developed with stakeholder input. The prospect of re-establishing a power plant siting law that includes wind (similar to the expired Article X) should also be considered.