Wind Power in Vermont:
A Primer

Wednesday, August 9, 2006

Published by

VermontEnergyPartnership
Working for Reliable Affordable Clean Energy for Vermont

Introduction

Electricity is critical to maintaining public health and safety as well as a vibrant economy. This issue is "generating" heated debate amongst Vermonters, most notably, on what sources will be used to meet our growing electricity needs.

Wind power is one of the most intriguing and passionately debated alternatives, yet it currently accounts for less than one percent of Vermont's electricity portfolio. Many think it can and should play a much larger role in the near future.

How viable is wind power for Vermont? How much of our portfolio could it supply? There are no clear answers to these questions. Many claim that by 2025 wind could account for 15 percent of Vermont's electricity portfolio, while others say that number is much lower.

Like all energy sources there are pros and cons to wind power. Opponents fear the wind turbines will negatively impact the aesthetic value of the land, driving tourists away. Proponents argue that wind naturally fits into Vermonters' commitment to maintaining our environmental heritage, especially since it is a renewable and non-carbon emitting power source.

In any event, the future of wind power in Vermont today is tentative at best. Projects in development at the beginning of the year have been placed on hold, some indefinitely, due to intense regulatory hurdles and fierce outcries from the Not-In-My-Back-Yard ("NIMBY") activists.

It is undeniable that to meet out growing electricity demands Vermont must move forward with developing new sources of in-state power generation, including wind. A recent statement by ISO New England, the not-for-profit operator of the region's transmission grid, noted that, "While demand for electricity continues to grow across New England, construction of new generating resources has stagnated. Without new investment in power infrastructure New England could soon be consuming more electricity than it can produce or buy from its neighbors."[1]

In-state sources have a clear advantage over "imports." In the case of wind power, the economic advantages include jobs building and operating wind facilities, and potential lease revenues to those who provide land for the sites. In-state generated electricity is also generally more reliable and stable, and offers greater energy independence in the long-run.

Currently, Vermont imports over half of its electricity portfolio from Canada and other states. With the growing concern in the region over electricity supply falling behind consumer demand, it may be risky for Vermont to rely so heavily on out-of-state sources.

This document outlines key facts about wind power, its advantages and limitations. It is a primer for policymakers, the news media, and other opinion leaders as the issue is debated going forwarded.

[1] Stephen G. Whitley, ISO New England's Senior Vice President and Chief Operating Officer, Press Statement, 2006.

Wind Power – An Overview

Besides being a renewable source of energy, with a long history of use, what are some of the key attributes of wind power?

- ***Usage has been significantly expanding.*** According to the American Wind Energy Association, the U.S. wind energy industry has grown by an average of 29 percent per year from 2000-05. There were 9,149 megawatts (MW) of installed capacity for wind power production in 2005. This is the equivalent amount of power that would come from approximately four and half Hoover Dams if the wind facilities were operating at 100 percent of capacity.

  One megawatt of power is enough electricity to power approximately 800 to 1,000 homes. However, wind facilities on average generate 30-35 percent of what would be generated if they ran at full power all the time.[2]

- ***Wind power growth is projected to increase sharply.*** Amid high energy prices and a push to find more environmentally friendly, non-carbon based fuels, wind usage in the U.S. and internationally is expected to grow quite sharply in the near future. Even leaders among energy industry service providers like General Electric recognize this noting, "Today, more than 39,000 megawatts of wind energy are installed throughout the world, and forecasts for wind power continue to be favorable with more than 83,000 cumulative megawatts predicted worldwide by 2007."[3]

- ***The cost of wind power varies significantly.*** The cost of producing wind power, as well as its end market price, will be determined by several factors including: the wind speed at a given project site; the size of the wind farm; the configuration of the turbines; financing costs; the proximity to transmission lines; environmentally-related costs; federal tax incentives (there is currently a 1.8 cents/kilowatt hour (KW) incentive to support utility-scale wind turbines for the first 10 years of the operation); and other factors.[4]

- ***The amount of wind on the ground does not necessarily indicate an area's wind power potential.*** The power in the wind may be five times greater at the height of a 40-story building (the height of the blade tip on a typical, large modern wind turbine) than the breeze on your face. Furthermore, the wind is altered by major land forms, so that entire areas of the country may be very windy while other areas are relatively calm.[5]

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[2] American Wind Energy Association, "Fast Facts" document on website: http://www.awea.org/newsroom/FastFacts2006.pdf.
[3] General Electric, "About Wind Power," on website: http://www.gepower.com/businesses/ge_wind_energy/en/about_wind_ener.htm.
[4] American Wind Energy Association, "The Economics of Wind Energy," http://www.awea.org/pubs/factsheets/EconomicsOfWind-Feb2005.pdf.
[5] American Wind Energy Association, "Wind Power Today," http://www.awea.org/pubs/factsheets/WindPowerTodayFinal.pdf.

History in Vermont

Vermont is home to the very first utility wind turbine site in the world. In 1941, the Central Vermont Public Service Corporation installed a 1.25 MW Smith-Putnam turbine on Grandpa's Knob in southwestern Vermont.[6]

In 1997, Vermont's Searsburg wind farm became the largest commercial wind farm in the eastern United States. Owned and operated by Green Mountain power, there are in total, 11 turbines that stand atop the ridge in Searsburg generating six MW of power. This produces enough energy to serve over 1,600 homes in Vermont.[7]

The Searsburg wind facility has been a *de facto* laboratory, studied by researchers throughout the years to gauge whether a cold climate, such as Vermont's, could produce energy by harnessing the wind. It has also been used as an educational center, providing tours to the public and those interested in understanding how wind can generate power.

Today, Searsburg remains the largest utility-owned wind facility in New England, and the only commercial wind farm in the State. However, other wind projects at various stages of development could raise that number in the near future.

Why should Vermont consider wind as a viable option?

Wind power has a number of environmental and economic benefits. As mentioned above, wind is a clean energy source that does not pollute the air, streams, or land with toxic emissions. When wind farms generate electricity, there is less need for larger power plants such as those that burn coal. Thus, there are lower levels of harmful emissions pumped into the environment.

There are economic benefits to wind farms as well. The Department of Public Service noted in its 2005 Vermont Electric Plan, "Wind can provide a steady income through lease payments to the landowners. Wind projects also pay significant property taxes and state taxes each year and create local jobs."[8] These benefits can include new jobs in the construction of wind facilities and other positions necessary for their continued operation. Farmers and others may be able to gain lease revenues from providing some land for these facilities.

As wind does not always generate electricity, it must be used in tandem with base-load sources, which can include coal, nuclear, natural gas, or oil generation that typically produce electricity 24 hours a day, seven days a week. In Vermont, the state's two base-load sources are Vermont Yankee and Hydro-Québec, each of which provides one-third of the state's electricity.

Wind can complement these base-load sources of power and contribute to a diversified state electricity portfolio, from an electric power source standpoint.

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[6] Asmus, Peter, "Reaping the Wind". Island Press, 2001.
[7] Vermont Environmental Wind Associates. August 2006, http://www.northeastwind.com/whatwevedone/searsburg.html
[8] Department of Public Service, "Vermont Electric Plan," 2005, pg. 5-5.

What are the challenges associated with wind power?

Like all energy sources, there are challenges to using wind for power generation. For instance, the aesthetics of wind facilities are often the key rallying point against their construction.

One of the most formidable challenges is the intermittent nature of wind power, as facilities typically only function at 30-35 percent of capacity.

Some opponents have claimed that the federal tax incentives the wind industry receives are unfair. However, the U.S. Department of Energy has stated in its fact sheet on wind that, "Every energy source receives significant federal subsidies; it is disingenuous to expect wind energy to compete in the marketplace without the incentives enjoyed by established industries."[9]

Land usage is another challenge since it takes more land to produce wind power compared with other base-load sources. For example, Vermont would need 75,000 acres of land to replace the electricity produced by Vermont Yankee (which encompasses 125 acres) with wind turbines. This is 18,000 acres larger than all of Grand Isle County.[10]

What factors are considered when determining a possible wind site?

Contrary to what some people claim, not all of Vermont's ridgelines will be covered with turbines. Commercial developers must take into account a number of factors when determining potential sites for wind farms.

One of the most important criteria is the strength of the wind in a given area. Studies have shown that in Vermont the north-south ridgelines[11] hold the most potential. The vast majority of potential sites in Vermont are found in the higher elevations typically over 2,500 feet above sea level, with wind speeds at 15.6 miles per hour or greater.[12]

Other factors that go into determining whether a site could support a wind farm include:

- Existing roads – Developers look to see how close a site is to existing roadways in order to keep to a minimum the environmental impact of constructing new roads to access a potential site.

- Existing transmission lines – Transmission lines must be in place to transport the power generated from the wind farm to the intended recipients. If these lines are not near a potential site, then new ones would have to be built. Thus additional land would have to

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[9] U.S. Department of Energy, "Wind Powering American Fact Sheet Series," http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/wpa_factsheet_myths.pdf .

[10] Nuclear Energy Institute, "Keeping the Green Mountain State Green," http://www.nei.org/documents/insight98_09sup.pdf.

[11] Department of Public Service, "Vermont Electric Plan" 2005, pg. 5-6.

[12] Vermont Environmental Research Associates, "Estimating the Hypothetical Wind Power Potential on Public Lands in Vermont," p. 4.

be cleared, increasing the environmental impact on the land, as well as the cost of the project.

- Land use – Potential sites that would be situated on land that is protected, conserved or known to be the habitat for endangered species must be ruled out. Public and private land that is not restricted or prohibited can be considered.

What are the current wind projects being considered in Vermont?

In July 2006, there were six wind farms in various stages of development. Each project is required to obtain a Certificate of Public Good (CPG) from the Public Service Board. Below is the list of the projects under consideration with brief descriptions of each.

Deerfield Wind Project/Searsburg Expansion

The Deerfield Wind Project is an expansion in the area of the Searsburg wind farm allowing power to flow into the existing Y-25 line into Bennington. The proposed project will add 20 to 24 wind turbines generating 1.5 to 2.0 MW of electricity each, totaling between 30 and 45 MW, enough electricity for approximately 14,000 to 16,000 average Vermont homes.[13]

East Haven Wind Farm

East Haven Wind Farm would be comprised of four turbines, 329 feet tall, on the summit ridge of East Mountain in East Haven, Vermont. This is the site of a former radar base used by the United States Air Force during the Cold War.

These turbines would each produce 1.5 MW of power, for a total contribution of six MW, which would be enough to power 3,000 homes.[14]

On July 17, 2006 the project was denied a CPG by the Public Service Board based on the lack of avian and bat data to adequately evaluate the impact to these species. However, the Board also indicated the project would not have an undue adverse effect on the scenic or natural beauty of the area and on aesthetics. The farm would be positioned next to thousands of acres of conserved wilderness.

Equinox Wind Farm

This project would be located near Manchester, Vermont on Little Equinox Mountain, and would site five turbines. Each turbine would produce 1.8 MW of power, accounting for nine MW total. This would be enough to power 4,000 homes.[15]

Glebe Mountain Project

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[13]Vermont Environmental Research Associates, http://www.northeastwind.com/whatwevedone/expansion2.html .
[14] NRG Systems, http://www.nrgsystems.com/facts/vermont.php.
[15] NRG Systems, http://www.nrgsystems.com/facts/vermont.php.

The Glebe Mountain Project, located in Londonderry, would have seen up to 27 turbines, with a total potential output of 47.5 MW of power. More than 15,000 homes would have been served by this power.[16]

On June 15, Catamount Energy Corporation and Marubeni Power International officially announced the end of this project due to opposition from the local community.[17]

Lowell Wind Project

At this time, the Lowell Wind project could include 12 to 26 wind turbines. Each turbine would produce 1.5 MW of power or more. The combined output would be between 18 and 39 MW, and would be used by approximately 13,000 homes.[18] The wind farm would be located in the Lowell, Eden and Irasburg vicinity in Vermont.

Sheffield Wind Power Project

UPC Vermont Wind filed an application for a permit to construct a wind farm in and around Hardscrabble Mountain in Sheffield, Vermont. This farm would consist of 20 turbines standing 398 feet tall in Sheffield, and six turbines in Sutton.

In February 2006, UPC submitted its petition for a CPG to the Public Service Board, and a decision should be reached in the spring of 2007.

What is the role that commercial wind power could play in a future energy portfolio?

While there has been some debate over the extent that wind power could contribute to the future energy portfolio for Vermont, there are simply no concrete answers. The Vermont Public Interest Research Group (VPIRG) estimates in its "Clean Energy for Vermont: A Plan Today for Tomorrow" that by 2025 wind could comprise 15 percent of our energy portfolio.[19]

The Vermont Environmental Research Associates found that, once general factors are taken into consideration (i.e., wind speed, proximity to transmission lines, and available land), only 0.8 percent (or 82 square miles) of Vermont's total land mass would be categorized as having wind farm potential. If all of this were to be developed, wind would account for 10 percent of Vermont's energy portfolio.[20]

Another reason it is difficult to determine the extent that wind could contribute to Vermont's future energy portfolio is that developers must go through a lengthy approval process with the Public Service Board while battling fierce Not-In-My-Backyard or "NIMBY" activists.

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[16] NRG Systems, http://www.nrgsystems.com/facts/vermont.php.
[17] Catamount Energy Corporation, Press Release, "Catamount Energy Corporation and Marubeni Power International, Inc. End Development of the Glebe Mountain Wind Energy Project," June 15, 2005, http://www.catenergy.com/press_061506.html .
[18] NRG Systems, http://www.lowellwind.comp.
[19] Vermont Public Interest Research Group, "Clean Energy for Vermont: A Plan Today for Tomorrow," 2004, pg 25.
[20] Martha Staskus, Speech at the Vermont Energy Partnership's Issue Forum, November 2005.

In fact, some communities in the state want to impose the extensive Act 250 process on wind developers in addition to the Act 248 process. This is occurring even though the more streamlined Act 248 process is more clearly intended to address energy project issues. The uncertainty and bureaucratic hurdles that the Act 250 process creates is stifling proposed projects and inhibiting new project proposals from being made at a time when Vermont needs additional power.

The cost of building wind farms is expensive, and the ongoing approval process and battle with opponents makes it more so. Already one project has been put on hold until the developers are assured Vermont is serious about developing wind and adding it to its energy mix.

Conclusion

With the on-going advancements in wind technology and changing energy markets, it is not yet clear exactly how much power wind could contribute to the overall energy portfolio. Wind will not be the "silver bullet" answer to the state's electricity challenges, nor is it expected to replace 24/7 base-load power generation sources. However, like the rest of the country, and even the rest of the world for that matter, wind power should increase substantially in Vermont in the coming 20 years and be an increasing part of our electricity portfolio.

The Vermont Legislature, working in concert with the Department of Public Service, should establish clear parameters by which wind projects can receive timely decisions. This should be a top priority of the 2007 legislative session.

Intermittent, renewable energy sources like wind do have an important role to play and can help offset some of the demands placed on base-load sources. Especially during the peak periods of demand typical in winter months, if the wind is blowing and producing electricity, then less power has to be bought on the high-priced spot market outside the state when the base load supply may be stretched past the margins required of the grid operator.

Vermont needs to decide now on whether the state is serious about developing wind as a part of the energy mix. It should be. The permitting process is quite lengthy, and Vermont can no longer continue to put the energy situation off with the hopes it will resolve itself someday.

Vermont can either develop its own in-state sources of power and increase its energy independence, or it can be at the mercy of the market and the volatile prices that come with it.

Unfortunately there are no simple solutions to solving Vermont's energy needs. Through strong leadership and constructive public input, however, Vermont can begin to shape a future energy portfolio that incorporates in-state renewable sources of electric power generation. This should certainly include wind power.

Appendix A

To learn more about wind power please visit the following websites:

American Wind Energy Association
http://www.awea.org/

General Electric
http://www.gepower.com/corporate/ecomagination/offShoreWind.htm

Green Mountain Power – Searsburg Wind Power
http://www.gmpvt.com/whoweare/searsburg.shtml

NRG Systems
http://www.nrgsystems.com/facts/vermont.php

United States Department of Energy
http://www.energy.gov/energysources/wind.htm

Vermont Environmental Wind Associates
http://www.northeastwind.com/index.html

Vermont Public Interest Research Group – "Clean Energy For Vermont: A Plan Today for Tomorrow"
http://www.vpirg.org/downloads/2004.08.27_Clean_Energy_for_Vermont_final_version.pdf