



www.susvalleypolicy.org

717-361-8905

PO Box 338, Hershey, PA 17033

AMERICA'S ALTERNATIVE ENERGY SOURCES

Wind Power

By Marianne Clay, Research Associate, Susquehanna Valley Center for Public Policy

Part One: Current State of Wind Power

A. How much used?

Worldwide, wind power generates 30,000 megawatts of electricity, with about one-third of this amount produced in the U.S. According to the American Wind Energy Association, the industry trade group for the nation's \$4-billion-a-year-wind-power industry, the 10,000 megawatts generated in the U.S. can supply the power for three million homes or a bit less than 2 percent of the nation's energy needs. (One megawatt of wind power meets the electricity needs of about 300 homes.) Even though wind power provides just a fraction of our electricity, it is expanding rapidly.

According to the U.S. Department of Energy (DOE), wind energy is the nation's fastest-growing energy generation technology, expanding by 30% to 40% annually. In 2005, wind power became the second-largest source of new electricity generation installed in the world, trailing only natural gas. The British Wind Energy Association predicts an additional 40,000 windmills or wind turbines will be installed in the next 10 years, and these will be able to generate an additional 22,000 megawatts of electricity.

Pennsylvania is a player too, generating the most wind power of any state east of the Mississippi. Before the end of the year, according to initiatives announced by Governor Edward Rendall, the state will be able to produce enough electricity from wind to power 75,000 homes.

Amid all this flurry over wind, you can forget wind power has been around for thousands of years, ever since someone attached a sail to a boat. Wind power is also not making its first appearance in the U.S. Beginning in the middle of the 19th century and

lasting through the 1940s, thousands of American farms used windmills to pump water and generate electricity. While a few of these old-style windmills are still in use, most fell out of service when even rural locations became connected to the grid. Today wind power is back in a big way: just one of the new large-scale wind turbines can soar to more than 400 feet and generate enough electricity to power hundreds of homes.

B. Where?

Everyone, everywhere, seems to be seizing the wind, as windy locations all over the state, the nation, and the world are being tested for their potential worthiness for wind farm sites. According to the DOE, Germany leads the world in the amount of megawatts of electricity generated by wind power. But the other world leaders in wind power include Denmark, which gets 20% of its electricity from the wind; Spain, where 20% of the electricity distributed by at least one of its regional utilities comes from wind power; India; China, and the U.S. Last year the U.S. became number one in the world for the amount of new wind power capacity installed in a year, though the U.S.'s 9,149 megawatts from wind power is about half Germany's total of 18,100. This year, in another example of the increasing importance placed on wind as a renewable energy source, the DOE's National Renewable Energy Laboratory in Golden, Colorado, signed a \$27 million, multi-year contract with General Electric to develop an offshore wind power system. Although there are currently no offshore wind farms in the U.S., plans are in the works for ones to be located three to five miles off the coast of Long Island, New York; for two offshore wind farms off the Gulf coast of Texas, and for the Cape Wind Project off Cape Cod in Massachusetts.

In the U.S., Texas now leads the nation for its generation of wind power followed by California, Minnesota, Iowa, and Wyoming, but wind-powered turbines operate in 34 states including Pennsylvania. According to the latest wind resource map for the state from the DOE's Wind Program and its National Renewable Energy Laboratory, Pennsylvania has wind resources consistent with utility-scale production. These good-to-excellent wind resource areas are concentrated on ridge crests in the southwestern part of Pennsylvania, southwest of Altoona and southeast of Pittsburgh, and these are the spots where Pennsylvania's wind farms are located. But more wind farms are in the works across the state including Harrisburg Mayor Stephen Reed's plan for a wind farm of some 30 or more towers on the ridges above the city's DeHart Reservoir. In addition, thanks to state grants, 15 small-scale wind turbines, capable of generating only 1.8 kilowatts of electricity, are being installed throughout the state to raise the public's interest in wind power.

Recently Governor Rendell made the largest renewable energy purchase by a state government when he announced Pennsylvania had entered in a new two-year agreement with Community Energy, Inc., a company based in Wayne, PA that develops and markets wind power, to purchase 200,000 megawatt hours or 20 % of the state's electricity from two renewable sources, wind (40 percent) and hydroelectric (60 percent). After this deal was struck, [the Environmental Protection Agency moved Pennsylvania from 25 to 12](#) on its Top 25 Green Power Partner list. But even a bigger energy coup came when Pennsylvania convinced the second largest wind energy company in the world, Gamesa of Spain, to locate its North American headquarters in Philadelphia. Gamesa also will

operate four manufacturing plants for wind turbines here and is testing a mountain ridge in Dauphin County for a wind farm.

C. Cost?

The cost to develop and build a wind energy facility is approximately \$1.3 million to \$1.7 million per megawatt, compared to \$550,000 to \$700,000 per megawatt to develop and build a gas-fired energy plant. Since 1980, research and testing sponsored by the DOE's Wind Program has helped reduce the production cost of wind energy from 80 cents (in current dollars) per kilowatt hour to between 3 and 6 cents per kilowatt hour today. The offshore megawatt wind farms being planned are expected to produce electricity for five cents per kilowatt hour.

D. Who is using it?

Both individual property owners, who can install a small-scale wind turbine to provide electricity for one home, and big partnerships, forged among corporations, manufacturers, and government agencies to power communities, are harnessing the wind to generate electricity. FPL Energy, LLC, a subsidiary of FPL Group, Inc. of Juno Beach, Fl. Is the largest generator of wind power in the U.S., and FPL owns and operates 47 wind farms in 15 states including five in Pennsylvania and is actively seeking more locations within our state. The five FPL already owns and operates in PA. (Green Mountain Energy, Meyersdale, Mill Run, Somerset, and Way Mart) can generate enough electricity for 37,000 homes. FPL is also proposing to build an offshore wind farm three to five miles off the shore of Long Island, N.Y. This wind farm, known as the Long Island Offshore Wind Park, is being designed to produce enough electricity for 44,000 homes on Long Island.

E. How does it work?

Today wind energy is produced by three-bladed wind turbines that sit atop tall towers and work like fans in reverse. Rather than using electricity to make wind, turbines use wind to make electricity. The wind turns the blades and the blades spin a shaft that is connected through a set of gears to drive an electrical generator. The blades may face into the wind, called an upwind turbine, or they may face away from the wind, called a downwind turbine. Large-scale turbines for utilities can generate from 750 kilowatts (a kilowatt is 1,000 watts) to 5 megawatts (a megawatt is 1 million watts). In wind plants or wind farms, groups of turbines are linked together to generate electricity for the utility grid. The electricity is sent through transmission and distribution lines to consumers.

Part 2: Outlook for Wind Power

A. Pros and cons

Wind has become the fastest growing source of electricity generation in the world and is now a major option for utility-scale power generation. Up until recently, much of this growth took place in Europe, where conventional energy costs are higher than the United

States and fossil fuel sources are scarcer. Spurred by rising energy costs and declining wind energy costs, the United States lead by the National Renewable Energy Lab has been working to accelerate the progress of wind technology and to further reduce its costs. But wind power is not without problems and detractors.

A major problem with wind power is its reliability, as wind speeds are neither steady nor predictable. Denmark, for example, relies heavily on wind power, and this nation has at times had to fire up its coal-powered plants to generate electricity during days when the wind dropped. In addition, building a wind facility is very expensive when compared to the cost per generated megawatt from other sources. A wind facility costs \$1M to \$1.3M per generated megawatt compared to the \$700,000 per generated megawatt to build a natural gas-fired power plant. In addition, the construction of wind farms on land and on sea can become very controversial as people express concerns about birds flying into the rotating blades of the turbines, about disrupting other animal and marine life, and about how a row of wind turbines can destroy a scenic location. Senator Ted Kennedy, for example, opposes Cape Wind, the offshore wind farm of 130 wind turbines planned for Nantucket Sound. Kennedy cites danger to airplanes and boats, the destruction of the natural scenery, and potential harm to marine life and the fishing industry. In fact, opponents to Cape Wind have spent more than \$1M on Washington lobbyists hired to squash the project.

In addition, the tallest wind turbines have been faulted for creating radar interference. Senator John Warner, chairman of the Armed Services Committee, mandated a Department of Defense study to determine whether or not wind farms located within a radar's line of sight interfere with radar signals. DOD's report, just released on September 28, concluded that large wind turbines generating electricity in a radar line of sight can harm the ability of air defense radars to detect and track aircraft or other aerial objects. In response, the American Energy Association argues that radar interference problems can be and have been corrected by relocating turbines or upgrading radar systems.

B. Barriers

Certainly this DOD report about wind turbines creating radar interference will slow the speed at which the Federal Aviation Agency, which regulates our nation's air space, approves new wind farms. That process, especially since the FAA also has so many more applications to review, is already slow. In addition, industry leaders convening in Pittsburgh last June at the Windpower 2006 Conference cited two more major barriers to the growth of wind power: the lack of a stable federal policy to assure wind-energy companies of the government's commitment and the lack of a plan for transmission lines to bring the electricity from wind-rich areas to the market.

C. Incentives

Since the early 1990s, the federal government has offered a tax credit of 1.8 cents per kilowatt hour produced by a wind farm in its first ten years of operation. This production tax credit or PTC, originally to have expired in 1999, has been extended through 2007. Many states also provide incentives such as exemption from property tax; mandates, such as the one in Pennsylvania that require a percentage of in-state power be generated from renewable sources like wind, and "green credits." In addition, the federal government is providing \$44M in its 2007 budget for wind energy research. To further the acceptance of

wind technology around the country, DOE's Wind Powering America (WPA) team works with industry partners to provide state support, develop utility partnerships, conduct outreach, and develop ways to support large- and small-scale wind systems. Through such efforts, the WPA plans to increase the nation's use of wind energy; their goal is to have at least 30 states with 100 megawatts of wind capacity by 2010.

Part 3: Costs

A. Infrastructure

Building a wind farm is very expensive. According to FPL Energy, LLC, the largest generator of wind power in the U.S., it costs between \$1.3 million to \$1.7 million per megawatt to build a wind energy farm. In fact, wind farms require so capital that small companies must often merge with the big guys to stay in business. For example, Spain-based Iberdrola, the world's largest wind power company in terms of installed capacity, bought Community Energy Inc. of Wayne, Pa. "One reason for the marriage with Iberdrola was the wind turbine shortage and attendant price increases for the turbines," said Brent Alderfer, Community Energy's president and chief executive. "When you work on a project-by-project basis, you can't compete for equipment."

B. Cost per kilowatt hour

Capital costs for wind projects are \$1,300 - \$1,700 per kilowatt hour. Since 1980, research and testing sponsored by the DOE's Wind Program has helped bring down the cost of producing electricity from wind to a competitive cost of 3 and 6 cents per kilowatt hour today.

C. Environmental costs

Some question whether wind farms mar the landscape, create noise pollution, upset animal life, and kill birds. If a bird flies too close to the rotating blades on a wind turbine, it can be killed. While most wind farms do not pose a huge danger to birds, some do. Locating wind farms away from known migratory paths and nesting areas, seems necessary. For example, the wind turbines on one large wind farm in California's Altamont Pass, where many hawks and eagles live, have killed 300 red-tailed hawks and 60 golden eagles in one year. Norwegian wind farm on the Smøla islands has raised concern after nine sea eagles, all that year's chicks, died after colliding with rotor blades after the opening in September 2005 of Phase 2 of the wind farms. However, the death toll to birds at these two wind farms seems unusual. Last year the National Environmental Research Institute in Rønde, Denmark used radar to track flocks of geese and eider ducks around the Nysted wind farm offshore in the Baltic Sea. It found that the birds flew almost exclusively down the corridors between the 72 turbines; less than one percent flew close enough to risk collision. Many birds avoided the wind farm altogether. The British Royal Society for the Protection of Birds studied the impact on wind farms and concluded, "... evidence suggests that appropriately positioned wind farms do not

pose a significant hazard for birds." The Society notes that climate change poses a much more significant threat to wildlife and therefore supports wind farms and other forms of renewable energy.

People also criticize the noise and vibration produced by the blades, gears, and motors of wind turbines, the flashing lights required on the tall towers for aviation safety, and the shadows the rotating blades cast on the ground. At the same time, many neighbors of wind facilities report no problems and some describe the look of a ridge top with a long row of wind turbines as beautiful. A University of St. Andrews study of two Scottish and one Irish wind farm found support for wind farms was higher among those living near existing sites than among those living near proposed sites. The continual improvements in engineering, the careful selection of sites, and the appropriate use of setbacks from nearby residences can further reduce these problems.

Part 4: Recommendations

Wind power, once confined to ardent environmentalists, is now being taken seriously by the mainstream, and it should be. Though not without its problems, wind power offers amazing attributes. Wind power requires neither fuel nor water, produces no emissions, and offers an endless energy source. Spurred by the high cost of traditional energy, by technological advances that have made it cost efficient, and by government incentives, enormous wind turbines from Vestas Wind Systems of Denmark, Enercion of Germany, Gamesa of Spain, Suzlon of India, from General Electric, and more are going up all over the world. While much of the growth has been in Europe, the U.S. is moving forward, and America's ability to generate electricity from wind has more than tripled in the last three years. The time seems ripe to "carpe ventem," seize the wind.

Information from the Following Resources

American Wind Energy Association
Community Energy Inc.
Department of Defense
Department of Energy
FPL Energy LLC
Federal Aviation Agency
Harrisburg Patriot News
National Renewable Energy Lab
National Wind Technology Center
Pennsylvania Energy Development Authority
Pennsylvania Department of Energy Protection
Pittsburgh Post Gazette
Pittsburgh Tribune Review
Time Magazine
Southwest Wind Power
Wall Street Journal
Wind Powering America

