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Wind Energy: Frequently Asked Questions

1. Is wind energy reliable? Wind is an intermittent source of energy, meaning that wind turbines only produce electricity when the wind is blowing at sufficient speeds. Therefore, a wind farm operator cannot guarantee how much electricity, if any, the facility will generate at a particular time. For this reason, New York State has implemented a number of system and operating practices to accommodate the growth of wind energy, including one of the nation's first centralized wind forecasting systems, which provides power grid operators with an advance estimate of how much wind energy to expect.

No wind forecast can be 100% accurate. However, the electric grid is designed to quickly compensate for fluctuations in both electricity generation and in demand. Grid operators keep "operating reserves" (backup generators) ready in case demand should spike or a generator should go off-line suddenly. In 2010, the New York State Independent System Operator (NYISO), the company that manages the state's electric grid, determined that the grid can take on an additional 8,000 MW of wind-generated electricity by 2018, with no increase in operating reserves, and continue to provide reliable service to customers.[1]

Photo Credit: Invenergy LLC. Wyoming County, NY

2. If more wind turbines are installed, will use of polluting fossil fuels be reduced? Unlike fossil fuel-burning power plants, wind turbines do not cause pollution at the point of electricity generation. When added to the power grid, electricity from wind farms displaces electricity from other types of generators, including fossil fuel-burning power plants. The degree to which fossil fuel-generated electricity is displaced depends on the specific generation mix in use at the locations and times wind energy is available. To the degree that wind displaces fossil-fuel generated electricity on the grid, it reduces the amount of fossil fuel-related pollution emitted.

A study of wind energy impacts in the eastern USA, conducted by the National Renewable Energy Laboratory,[2] concluded that "Wind generation displaces carbon-based fuels, directly reducing carbon dioxide (CO2) emissions. Emissions continue to decline as more wind is added to the supply picture."

3. Will wind power increase or reduce my electricity rates? On the whole, adding wind-generated electricity to the New York grid should reduce the cost of electricity. In March 2009, the NYISO testified that for every 1,000 MW of wind on New York's power grid, wholesale electricity costs are reduced by approximately $300 million.[3]

Hosting a wind farm will neither increase nor decrease electricity rates in the local community, as compared with those of neighboring communities. However, hosting a wind farm can lower area property taxes, create local jobs and boost the local economy, as well as helping to lower electricity costs across the state.

4. Will wind power harm birds and bats? Studies have shown that wind turbines can pose a hazard for birds and bats. Scientists are studying this problem, and their findings are being incorporated into wind turbine design and siting processes, in an attempt to reduce bird and bat mortality.

Early wind turbines were mounted on latticework towers, and used small, fast-spinning blades. The latticework towers were used by some birds as nesting sites, and the fast-spinning blades proved difficult for birds to avoid. By contrast, modern wind turbines use larger, slower-spinning blades and are mounted on monopole towers that do not offer surfaces where birds can

1. New York State Independent System Operator (NYISO), 2010, *Growing Wind: Final Report of the NYISO 2010 Wind Generation Study,* http://www.nyiso.com/public/webdocs/newsroom/press_releases/2010/GROWING_WIND_-_Final_Report_of_the_NYISO_2010_Wind_Generation_Study.pdf
2. National Renewable Energy Laboratory, "Eastern Wind Integration And Transmission Study," 2011. http://www.nrel.gov/wind/systemsintegration/ewits.html
3. NYISO, March 5, 2009, *Testimony of Stephen G. Whitley, President and CEO, New York Independent System Operator, Joint Public Hearing of the NYS Assembly Standing*, Committees on Energy and Corporations, http://www.nyiso.com/public/webdocs/documents/regulatory/legislative_testimony/Whitley_Testimony_Assembly_Hearing_March_5_2009.pdf

nest. In addition, New York law requires that the potential environmental impacts of each proposed wind farm be assessed; during this process, bird migration routes in the area are typically studied to determine the likelihood that turbines might be placed in the way of migrating birds.

According to a 2007 National Research Council report, "there is no evidence that fatalities from existing wind facilities are causing measurable changes in bird populations in the US."[4] In fact, many more bird deaths are attributable to house cats, buildings and cars. According to the US Fish and Wildlife Service, house cats are responsible for an estimated one billion bird fatalities annually in the US, buildings for 100 million to one billion, and automobiles for 60 to 80 million.[5] The National Academy of Sciences estimated in 2006 that wind energy is responsible for less than 0.003% of (3 of every 100,000) bird deaths caused by human and cat activities.

Scientists are just beginning to study why bats are sometimes killed by wind turbines. Some studies now suggest that bat fatalities at wind farms are more numerous than bird fatalities. A recent study by the New York State Department of Environmental Conservation found that over a seven-month period, more than three times as many bats as birds were killed at six wind farms surveyed in New York State.

It appears that a substantial portion of bat fatalities occur during periods of low wind conditions, possibly because bats are less active in very windy conditions; and most seem to occur during the bat migration period from summer to fall.[6] A study done at a Pennsylvania wind farm indicated that 44% to 93% of bat fatalities can be avoided, with almost no reduction in the amount of energy generated, by raising the turbine cut-in speed (only running the turbines when winds are strong) and by reducing the hours of turbine operation at night, during periods of low wind.[7] Such studies are ongoing, and the various mitigation methods proposed are being tested at wind farms in the U.S. and Canada.

Studies of how wind turbines directly affect birds and bats may prove useful in helping improve turbine design and siting to minimize such impacts. But to put these impacts into proper perspective, the wildlife impacts of wind energy should be compared with those of other types of electricity generation, such as coal, oil- and gas-fired power plants, hydroelectric dams, and nuclear plants. A recent NYSERDA study concluded that, considering the entire life cycle of these fuels and their respective electricity generating facilities, wind power poses the lowest collective risk for potential harm to wildlife.[8]

5. Can wind farms provide economic benefits and jobs? Wind farms typically provide economic benefits and jobs to their host communities. Developers pay lease or royalty payments to landowners to site turbines on their property, and pay taxes or payments in lieu of taxes to municipalities and school districts. The Towns of Eagle, Sheldon, and Wethersfield, NY have been able to dramatically reduce town taxes as a result of wind farm payments.[9] Nationwide, wind energy has created more than 85,000 jobs, including construction, maintenance, manufacturing, legal support, and marketing jobs.[10] A 2005 report by the New York State Office of the Comptroller estimated that a 25% annual increase in installed wind capacity in New York would generate 5,462 direct jobs and 6,281 indirect jobs in the state. Of the directly generated jobs, about 3,100 would be manufacturing jobs and 2,000 would be year-long construction jobs, with the remainder in maintenance and operation[11]

6. Is wind power heavily subsidized with taxpayer dollars? Every energy technology is subsidized to some degree. However, the U.S. subsidizes fossil fuels to a much greater degree than renewables. A recent study by the Environmental Law Institute reviewed governmental subsidies from 2002 through 2008 to manufacturers, supply chains, workers, and consumers within various fuel sectors. This study concluded that the majority of tax subsidies, $72 billion, benefited fossil fuels, such as oil and coal, while $29 billion benefited renewable energy; of this $29 billion, $16.8 billion benefited the production of corn-based ethanol,

4. National Research Council, 2007, *Environmental Impact of Wind Energy*, http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=11935
5. US Fish and Wildlife Service, 2002, *Migratory Bird Mortality, Many Human-Caused Threats Affect our Bird Populations*, http://birds.fws.gov/mortality-fact-sheet.pdf,
6. Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, T. H. Henry, G. D. Johnson, J. Kerns, R. R. Kolford, C. P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr., "Patterns of Fatality of Bats at Wind Energy Facilities in North America," *Journal of Wildlife Management,* 72 (2008),: 61–78.
7. Arnett, E. B., M. M. P. Huso, J. P. Hayes, and M. Schirmacher. "Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative," *Bat Conservation International*, 2010. http://www.batsandwind.org/pdf/Curtailment%20Final%20Report%205-15-10%20v2.pdf
8. NYSERDA, 2009, *Comparison of Reported Effects and Risks to Vertebrate Wildlife from Six Electricity Generation Types in the New York/New England Region,* http://www.nyserda.org/publications/Report%2009-02%20Wildlife%20report%20-%20web.pdf
9. Michael Beebe, "Like it or not, wind power is changing the landscape in WNY," *Buffalo News*, October 26, 2008. http://www.buffalonews.com/incoming/article124345.ece
10. American Wind Energy Association (AWEA), 2009, *AWEA Wind Power Value Chain*, http://www.awea.org/pubs/factsheets/value_chain.pdf
11. Hevesi, Alan G., and Kenneth B. Bleiwas, "The Benefits of Renewable Energy for New York State," Office of the Comptroller, Report 12-2005, 2005, http://www.osc.state.ny.us/osdc/renewableenergy.pdf
12. Environmental Law Institute, September 2009, *Estimating US Government Subsidies to Energy Sources 2002-2008*, http://www.elistore.org/Data/products/d19_07.pdf. The referenced study reports subsidies as absolute expenditures, not in terms of dollars per unit of energy produced.

and only $12.2 billion benefited wind, solar, geothermal and other renewables.[12] Thus, on an absolute dollar basis, wind and solar have been the least subsidized energy production activities in the U.S.

Photo Credit: EDP Renewables

However, fossil fuel-powered electricity generators also benefit from a more subtle form of subsidy. When air, water and soil pollution is created by these generators and their fuel suppliers, it results in human health and environmental impacts that are quite costly. These costs take many forms, including increased doctor and hospital visits and the use of pharmaceuticals to treat heart and lung diseases; decreased forest health; decreased lake and river productivity; loss of habitat; damage to built structures from acid rain; loss of soil productivity; and broader impacts from global warming. These impacts are called "externalities" by economists; this means that although the impacts are caused by fossil fuel-burning power plants, much of the cost of addressing these impacts is "external" to those plants. In other words, the costs are borne by society at large.

7. Are there health impacts associated with noise and shadow flicker from wind turbines? Utility scale wind turbines are large, industrial machines and, as such, they produce operational noise. Wind turbine noise can be mechanical (emanating from moving parts in the turbine's gear box) or aerodynamic (the "swish" of the blades through the air, and the "thump" of wind on the tower). Some types of turbines are quieter than others, and the amount of noise perceived by people in proximity to a wind farm will depend a great deal on the topography, ground cover, wind speed and direction, and other variables, including the sensitivity of the listener.

Wind turbine noise has not been shown to have any direct impact on human health. However, it can be annoying to some people. Some individuals living near wind turbines have reported symptoms including sleep disturbance, headaches, dizziness, nausea, anxiety, difficulties concentrating, and tinnitus. In response to these health concerns, in 2009 the American and Canadian Wind Energy Associations (AWEA and CanWEA) established a multidisciplinary scientific advisory panel to conduct a review of the current literature available on the perceived health effects of wind turbines. The panel, which included an international team of medical doctors, audiologists, and acoustical professionals, concluded that "There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct physiological effects," and that "There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences."[13] This finding is reinforced by recent reports from the Ontario Ministry of Health and Long-Term Care[14] and Renewable UK.[15]

There remains much we do not know about the health impacts of sound, and research on this is ongoing. Furthermore, although peer-reviewed scientific studies have not shown direct health impacts from wind turbine sound, the symptoms reported by some individuals may be indirect impacts associated with stress and sleep disturbance.

Shadow flicker occurs when the blades of a turbine rotate during sunny conditions, casting moving shadows on the ground that can result in a strobe-like effect. Like turbine noise, shadow flicker can be annoying, but has not been shown to pose a direct risk to human health. Although 3% of people with epilepsy are photosensitive, generally to frequencies or flashes of light between 5-30Hz, large wind turbine blades cannot rotate this quickly.

Wind turbine noise and shadow flicker can be stressful to some people. However, a 2010 report issued by the Ontario Chief Medical Officer of Health found "no direct causal link between wind turbines and adverse health impacts."[16] The report inventoried all the available peer-reviewed scientific studies on wind energy and its effects on nearby residents, including noise and shadow flicker.

Fortunately, the impact of wind turbine noise and shadow flicker on homes, roads, and populated areas can be mitigated through the use of appropriate setbacks (the distance between wind turbines and nearby houses, roads, and other human structures).

8. Do wind farms impact local property values? Several recent property value studies, including a 2009 study of New York State wind farms by the U.S. Department of Energy, have found no statistically significant correlation between home values and proximity to wind turbines.[17] However, a more recent study, conducted in three upstate New York counties by researchers from Clarkson

13. Colby, W.D., Dobie, R., Leventhall, G., Lipscomb, D., McCunney, R., Seilo, M., & Søndergaard, B. *Wind Turbine Sound and Health Effects: An Expert Panel Review*. December 2009. American Wind Energy Association and Canadian Wind Energy Association.
14. Chief Medical Officer of Ontario, 2010, *The Potential Health Impacts of Wind Turbines*. May 2010. Ontario Ministry of Health and Long-Term Care. http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.aspx
15. Leventhall, G., Lutman, M. & McNally, R. *Independent review of the state of knowledge about the alleged health condition known as Wind Turbine Syndrome (WTS)*. July 2010. RenewableUK Health and Safety Briefing. http://www.bwea.com/pdf/publications/HS_WTS_review.pdf
16. Chief Medical Officer of Health of Ontario, 2010, *The Potential Health Impact of Wind Turbines*, http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf
17. Hoen, Ben., R.Wiser, P. Cappers, M. Thayer, G. Sethi, "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis," *US Department of Energy,* December 2009, http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf

University, found that wind turbines reduced property values in Clinton and Franklin Counties, but not in Lewis County.[18] It is possible that whether and how wind turbine construction impacts property values depends on other variables that are not well understood; it is also possible that because there were very few post-operational property sales to analyze in Clinton and Franklin Counties, but many post-operational property sales in Lewis County, the Clarkson study may have detected a temporary post-announcement, pre-operation decline in property values. Some researchers believe that during the period when a proposed wind farm is being discussed, uncertainty and fear of the unknown are reflected in local property values, but that once the wind farm is built and uncertainty and fear are resolved, property values return to pre-application levels, or higher. One researcher has coined the term wind farm anticipation stigma theory to describe this phenomenon.[19]

Although such studies may eventually show how property values are impacted by wind farms on average, it is important to note that these studies cannot predict whether or in what way a particular property's value might be impacted by the nearby construction of a wind farm.

9. Do wind turbines throw ice long distances, putting the public at risk? Under adverse weather conditions, ice can form on wind turbine blades, and this ice could potentially fall or be thrown off. To address this problem, manufacturers equip wind turbines with automated control systems that sense ice formation on the blades and shut the turbine down. In addition to these automated systems, wind farm operators can manually shut turbines down under icy conditions. Generally, any ice shed from wind turbine blades falls harmlessly to the ground directly under the turbine. While it is possible that ice could, under unusual conditions, be thrown from a turbine blade, generally, setbacks are expected to be more than sufficient to ensure public safety.

10. Will wind power disrupt valuable farmland and open space? Wind turbines are often complementary to farming. Turbine foundations, access roads and electrical equipment occupy only about 5% of the total project footprint,[20] and the majority of the space between turbines can often continue in its traditional use. Wind energy can actually help to preserve farmland, by providing an alternative source of income to farmers who receive lease payments for turbines sited on their land. This can allow farmers to continue farming when the income from crops alone may not be sufficient. However, wind turbines are very tall, and in New York State, they tend to be sited atop ridge lines and high plateaus, where the winds are strongest. Therefore, they are visible from a significant distance, and they can change the visual character of the community. Individual observers may differ as to whether this change in visual character is positive or negative.

11. What is the expected lifespan of a wind turbine, and how is it decommissioned? Wind turbines typically have a 20-30 year lifespan. Responsibilities for decommissioning wind turbines are addressed before the wind farm is built. Typically, the developer will post a bond for the cost of decommissioning; if turbines are decommissioned, the developer will remove the structures and return the land to its previous condition. However, since the wind resource remains, and infrastructure (roads, transmission, etc.) is already in place, most developers prefer to "repower" rather than decommission wind farms. In repowering, old turbines at the end of their lifespan are replaced with new ones in the same locations.

12. Does the public have an opportunity to voice its opinion on wind farm development proposals? All wind projects in New York State of 25 MW or greater capacity must be evaluated by the state siting board. Those under 25 MW in capacity will continue to undergo permitting at the local municipal level, using a process known as the State Environmental Quality Review (SEQR). During both processes, potential environmental impacts are reviewed and there is opportunity for the public to comment prior to the proposed wind farm receiving permits. Local residents will have numerous opportunities to attend hearings, speak with their local representatives, and make their opinions known.

For a more comprehensive set of wind questions and answers, see the NYSERDA Wind Energy Toolkit, online at: http://www.powernaturally.org/programs/wind/Wind%20Energy%20Toolkit.pdf.

18. Heintzelman, Martin and Tuttle, Carrie, *Values in the Wind: A Hedonic Analysis of Wind Power Facilities,* 2011, Clarkson University (unpublished at this writing)
19. Hinman, J. *Wind Farm Proximity and Property Values: A Pooled Hedonic Regression Analysis of Property Values in Central Illinois*. May, 2010. Illinois State University, Department of Economics.
http://renewableenergy.illinoisstate.edu/wind/publications/2010%20Wind%20Farm%20Proximity%20and%20Property%20Values.pdf
20. NYSERDA, *Wind Energy: A Guide for Wind Site Development*, http://www.powernaturally.org/Programs/Wind/WindGuide.pdf

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