8

New York Wind Energy Guide for Local Decision Makers:

Public Safety and Setbacks

NEW YORK STATE OF OPPORTUNITY | NYSERDA

Public health and safety issues associated with wind energy projects are different from other forms of energy generation, since a combustible fuel source, fuel storage, and generation of toxic or hazardous materials are not present. Wind energy projects do share similar electrical infrastructure requirements with conventional power generation facilities, such as medium- to high-voltage power lines and substation equipment. Unique concerns for wind turbines are related to the configuration of the equipment and include blade throws, fire, tower collapse, ice shedding, and vandalism. While most of these are extremely unusual events, public agencies generally address these potential occurrences by establishing reasonable setbacks from residences and public corridors based on the size of the turbine and blades.

Photo credit: istock.com/Onfokus

Public Safety

Blade Failure

A turbine blade can break due to improper design, improper manufacturing, improper installation, wind gusts that exceed the maximum design load of the turbine structure, impact with cranes or towers, or lightning. The distance a blade piece might be thrown from a turbine depends on its mass, shape, speed at the time it breaks from the machine, orientation of the blade at the time of the throw, and the prevailing wind speed.

Although a few instances of blade throws were reported during the early years of the wind industry, these occurrences are now rare, due in large part to better testing, design, and engineering of commercial wind turbines. In February 2016, one of the turbines at the Fenner Wind Farm in Madison County, NY suffered a blade failure, and one of its three blades detached and fell into the field below. No people were hurt and no property was damaged. It is believed that the problem resulted from a bolt failure (Doran, 2016).

Although a few instances of blade throws were reported during the early years of the wind industry, these occurrences are now rare.

Fire

Wind turbines rarely catch fire. Typically, a turbine fire is allowed to burn itself out while staff fire personnel maintain a safety area around the turbine and protect against spot ground fires that could start from sparks or falling material. Power to the section of the project with the turbine fire is disconnected to protect the remaining array turbines, the substation, and the power grid itself. An effective method for extinguishing a turbine fire from the ground does not yet exist, and the events do not last long enough to warrant aerial attempts to extinguish the fire. However, since the public typically does not have access to the private land on which turbines are usually located, the public's well-being should not be at risk. Some fire departments in jurisdictions containing wind farms choose to hold turbine-specific fire training sessions.

Wind turbines rarely catch fire.

Some municipalities require project developers to file plans for the prevention and control of fires in wind turbines. For example, the town of Enfield, NY requires a Fire Protection Plan to be submitted for review during the permit application process. The plans must comply with the county-wide hazard mitigation plan, and be created in consultation with the local fire department (Town of Enfield NY, 2009). In compliance with this local law, the planned Black Oak Wind Farm filed its Fire Prevention and Control Plan in 2013. The plan outlines the appropriate technology used, the maintenance of the turbines, and the training of relevant personnel (Wells, 2013).

Technologies to detect and control turbine fires are also being developed and marketed to limit the life of the fire and amount of equipment damage sustained. In making the decision whether to include these technologies, the project developer must consider the type and components of each turbine, the space available in the nacelle, and economics of such systems (Starr, 2015).

Tower Collapse

Although turbine tower collapses are rare, a few instances of tower collapse have been reported nationwide.

Although turbine tower collapses are rare, a few instances of tower collapse have been reported nationwide. Tower collapse causes have included blade strikes, rotor over-speeding, mechanical brake failure, cyclonic winds, foundation failure, and poor or improper maintenance (torque bolts). In cases where information is available, the majority of the major components (rotor, tower, and nacelle) have fallen to within one to two hub-height distances from the base. As with turbine fires, members of the public do not typically have unsupervised access to the private lands where wind farms are located, and therefore are not at risk. In March 2009, a wind turbine collapsed at a wind farm in Northern New York State; no one was injured in this incident. The manufacturer attributed the collapse to improper wiring during installation, which allowed the turbine to over-speed during high-wind-speed conditions (NYS Public Service Commission, 2010).

Ice Shedding or Throw

Early detection and prevention of ice formation is key to ensuring safety.

Ice can accumulate on the blades, nacelle, and tower during extreme cold weather conditions. Turbines include control systems that will automatically shut down in icing conditions. Control systems can also sense when power production is reduced by ice formation and will subsequently halt turbine operation. As the ice melts, it will fall to the ground in the vicinity of the turbine. Early detection and prevention of ice formation is key to ensuring safety.

During operable wind speeds and when the turbine has not yet been shut down automatically or manually, ice can break off the blades and be thrown from the turbine, instead of dropping straight down. The distance a piece of ice travels depends on a number of variables, including position of the blade when the ice breaks off, blade speed, and location of the ice on the blade.

Blade manufacturers continue to research materials and methods to reduce the possibility of ice accumulation and subsequent throws. Best practices include:

- **Turbine Controls.** Control systems detect icing on the blades resulting in reduced performance, unusual loads, or vibrations. These trigger an automatic stop. The turbine remains off-line until an operator inspects and manually restarts the turbine. If the turbine is not operating, ice from the blades, nacelle, and tower falls to the ground in the immediate vicinity of the machine.
- **Operator Intervention.** Project operators can halt operation of certain turbines or the entire project during icing events to prevent ice throws and equipment damage.
- **Safety Zones and Signage.** Adequate setbacks from inhabited buildings, roads, and power lines significantly reduce the risk of injury or damage in the event of ice throws. Researchers have developed models that predict the distance ice can be thrown from a wind turbine (Renstrom, 2015). Posting signs warning passersby of the risk of falling ice is another prudent measure.

The power grid is also impacted by ice formation, and power to the project may be interrupted by the utility due to repair work or outages. Turbine operations stop immediately when grid power is lost, reducing risk of ice throw.

The people most at risk from falling ice are site personnel; most ice falls from the blades, nacelle, and rotor near the base of the tower. Most project developers have strict rules for personnel and operations during icing events to prevent worker injury and protect the public.

Vandalism

Though not unique to wind turbine installations, the potential for vandalism or trespassing can cause safety concerns. Wind turbines may attract more attention than other structures. Project developers report incidences on their sites ranging from curiosity seekers to bullet holes in blades. Permits may require fencing and postings at project entrances to prevent unauthorized access. Other requirements intended to reduce personal injury and public hazards include locked access to towers and electrical equipment; warning signs, including 24-hour emergency telephone numbers; and fenced storage yards for equipment and spare parts. Fencing requirements will depend on existing land uses, such as grazing. Some communities have established roadside information kiosks to channel curious sightseers out of road traffic and into an area that is a safe distance from the turbines.

Working with Local Emergency Response Teams

Project developers commonly work with local emergency response teams to provide information or training on tower rescues and other wind-specific concerns, and to develop emergency response plans as part of project development. Falls, injuries from heavy or rotating equipment, and injuries from electricity represent examples of the types of events that can occur at a wind energy facility. The height of the nacelle as well as the confined working space can provide additional challenges for medical responders. Federal Occupational Safety and Health Administration (OSHA) regulations, in addition to state worker safety regulations, cover all of the worker safety issues associated with electricity, structural climbing, and other hazards present in a wind farm.

Mitigation of Safety Concerns Through Setbacks

Many concerns associated with safety can be addressed by placing distance between wind turbines and people, property lines, roads, or scenic areas. Although no consensus on appropriate distances or types of setbacks exists, common themes appear in wind energy regulations in New York State and elsewhere.

Most local government requirements include setback specifications for the distance between the wind turbine and structures (residences and other buildings), property lines, and roads. A few agencies have defined setbacks from railroads and overhead transmission lines. The most common way to define a setback distance is in terms of a multiple of the turbine structure height (e.g., 1.5 times the turbine structure height). Other options are to specify a fixed distance or a combination of a fixed distance and a multiple of the turbine height. When specifying the structure height, it is important to define whether the height is the top of the nacelle (also known as hub height) or the highest point reached by the rotor blade (maximum tip height [MTH] or total height).

Wind Energy Ordinances

- Columbia Law School Model Wind Siting Ordinances
- US Department of Energy Catalog of State and Local Wind Energy Ordinances

Examples: Wind turbine setbacks from residences

- Fenner/Stockbridge, NY – 1.5 x MTH
- Martinsburg, NY – 1,500 ft.
- Pawling, NY – the greater of (a) 2 x MTH or (b) 1,000 ft. (Town of Pawling, NY, 2014)
- Somerset, NY – 2 x MTH

Examples: Wind turbine setbacks from property lines

- Fenner/Stockbridge, NY – 1.5 x MTH
- Martinsburg, NY – 300 ft. (rear and side lot lines)
- Eden, NY – Distance greater than MTH (Town of Eden, NY, 2004)
- Somerset, NY – 2 x MTH

For setbacks from structures and residences, some permitting agencies differentiate between houses and buildings on the property leased for the project, and houses and buildings on adjacent parcels. The implication is that a greater distance is appropriate from structures on adjacent parcels, since those properties have less control over the development than the landowner. A waiver of such requirements may be granted if written permission is provided from the neighboring landowner.

Setbacks from property lines may vary for side and rear lot lines but are generally specified in the same way as setbacks from residences. The community may wish to exempt turbines from property-line setbacks if the adjacent property contains a wind turbine from the same project, or the adjacent property is a participant in the project through a land lease and/or wind easement. This is an important consideration particularly in New York State, since turbine layouts and plant infrastructure can result in many parcels of land being utilized for one project.

Setbacks from roads are typically greater for major highways than for local roads. In some cases, scenic setbacks have been required from particular state highways, local roadways, and trails in close proximity to designated wind development areas.

When establishing setback policies, communities will be faced with striking a balance between the zoning and characteristics of the area and the potential economic impacts of the requirements on wind development.

References

Doran, E. (2016, February 11). *113-foot blade falls off windmill that previously toppled in Madison County*. Retrieved August 1, 2016

Oteri, F. (2008). *An Overview of Existing Wind Energy Ordinances.* Golden, Colorado: National Renewable Energy Laboratory. Retrieved August 2, 2016

Starr, S. (2015, September 3). *Making the case for wind-turbine fire detection and suppression systems*. Windpower Engineering & Development. Retrieved August 1, 2016

Town of Enfield NY. (2009). *Wind Energy Facilities Local Law*. Retrieved August 1, 2016

Wells, M. (2013). *Fire Prevention and Control Plan for the Black Oak Wind Farm*. Retrieved August 1, 2016

NYS Public Service Commission (2010). Case 10-E-0149 - *In the Matter of the Investigation of the March 6, 2009 Turbine Failure at a Noble Environmental Power, LLC Windpark. Order Closing Investigation*, Issued and Effective October 18, 2010