

# Public Safety and Setbacks

Understanding key safety considerations associated with wind energy projects



**NYSERDA**

Wind Energy Guidebook for Local Governments  
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# Overview

This section addresses common safety concerns associated with wind energy facilities, recognizing the importance of protecting public safety while promoting responsible clean energy development. The issues covered herein highlight areas of interest to local officials and community members, while offering mitigation strategies to limit conceivable risks to public safety. Topics covered include uncommon but potential hazards, emergency response plans, and risk mitigation through setbacks.

## 1. Public Safety Considerations

Public health and safety issues associated with wind energy projects are different from many other forms of energy generation, as wind facilities do not require combustible fuel sources or fuel storage, and do not generate toxic or hazardous materials. However, wind energy projects do require similar electrical infrastructure compared to conventional power generation facilities, such as medium- to high-voltage power lines and substation equipment.

Many of the unique concerns associated with wind turbines – such as blade throw, tower collapse, or ice shedding – are related to the configuration of the wind energy facility’s equipment. While these events are extremely unusual and rarely occur, public agencies generally address potential occurrences by establishing reasonable setbacks from residences and public corridors, proportional to the size of the turbine and blades. Further, commercial wind turbines are generally certified in accordance with International Electrotechnical Commission Standards (IEC), which help to ensure turbine reliability and public safety.

### 1.1 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 failure, and the prevailing wind speed.

Although a few instances of blade failures 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).

### 1.2 Fire

Wind turbines rarely catch fire. If a fire were to occur, it is best practice to allow the fire to burn itself out while fire personnel maintain a safety area around the turbine and protect against spot ground fires. In addition, 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. As the public typically does not have access to private land on which turbines are usually located, public wellbeing should not be at risk.

Some municipalities require project developers to file plans for the prevention and control of fires in wind turbines. These plans and protocol may be created in consultation with the local fire department and/or relevant county officials. Some fire departments in jurisdictions containing wind farms choose to hold turbine-specific fire training sessions.

### 1.3 Tower Collapse

Although turbine tower collapses are rare, a few instances of tower collapse have been reported nationwide. Known tower collapse causes have included blade strikes, rotor over-speeding, mechanical brake failure, cyclonic winds, foundation failure, and poor or improper maintenance. 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, and vertical collapse of the tower onto itself is typical. 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 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).

### 1.4 Ice Shedding or Throw

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 detect 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. 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. 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.

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 (Renström, 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.

### 1.5 Vandalism

While not unique to wind turbine installations, the potential for vandalism or trespassing can cause safety concerns. 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. 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.

## 2. Working with Local Emergency Response Teams

Project developers commonly work with local emergency response teams to provide information, guidance, 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 are a few examples of the types of events that can occur. 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.

## 3. Mitigating Safety Concerns Through Setbacks

Many safety concerns can be addressed by placing distance, or a setback, between wind turbines and members of the public, 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).

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

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