

Renewable Energy Ordinance Framework – Small Wind

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DVRPC’s Renewable Energy Ordinance Frameworks were developed by DVRPC’s Alternative Energy Ordinance Working Group (AEOWG). The AEOWG brings together leadership from counties and municipalities in the Greater Philadelphia region to support the safe and sound development of small-scale renewable energy systems, including solar photovoltaic, small wind (<100kW), and geothermal. This working group is convened by DVRPC’s Office of Energy and Climate Change Initiatives as a component of its effort to reduce energy consumption and greenhouse gas emissions in the region. This work is in line with DVRPC’s Long-Range Plan, *Connections: The Regional Plan for a Sustainable Future*, which identifies “Build an Energy Efficient Economy” as one of the four key strategies critical to realizing a sustainable future for our region.

These Renewable Energy Ordinance Frameworks are intended to serve as a resource for municipalities as they develop and update ordinances to govern the siting of small-scale renewable energy systems in their community. Municipalities in the DVRPC region are increasingly faced with the task of regulating the installation of small-scale renewable energy systems. As energy costs rise, and state and federal incentives reduce the initial cost of these systems, residents and businesses—some driven by environmental awareness—are becoming increasingly enabled to install renewable energy systems. However, many municipalities in the region do not have in place ordinances to approve, modify, or reject these renewable energy systems. As a result, residents and businesses often face the use-variance process, which must be performed on a case-by-case basis, resulting in considerable time delays, increased project costs, and increased strain on limited municipal resources. Inconsistent and unpredictable land use regulations can create a significant barrier to the installation of renewable energy systems by both residents and businesses, and deter the renewable energy industry from doing business in the region. Further, use variances, if granted, can be construed as spot zoning, creating costly legal challenges and delay.

A handful of municipalities in the region have begun adopting ordinances to proactively regulate the installation of renewable energy systems in an attempt to balance the benefits of renewable energy with the goals expressed in their municipal planning documents. Zoning and other land use regulations play an important role in enabling renewable energy projects that are cost effective and compatible with existing land use.

The purpose of these frameworks is to provide clear, consistent guidance on how to construct renewable energy ordinances that are consistent with state laws; are not overly restrictive or contradictory to the nature of renewable energy systems; and promote safe and sound community development. These frameworks provide a menu of sample ordinance language options, both permissive and restrictive, to allow municipalities to build a customized ordinance that addresses their local issues.

The document is formatted for easy navigation. Text boxes include corresponding guidance that explains the breadth of barriers, benefits, and cautions for municipalities when regulating these types of renewable energy systems.

These frameworks will be updated regularly as municipalities in our region develop ordinances and more information about renewable energy systems becomes available. The language provided in these frameworks is not intended to be adopted wholly. Municipalities should consult their solicitor to understand the implications associated with ordinance adoption and the specific language to be provided in the ordinance.

Introduction: Renewable Energy Ordinance Framework – Small Wind

Legend:

Blue -- Background language for ordinance framework

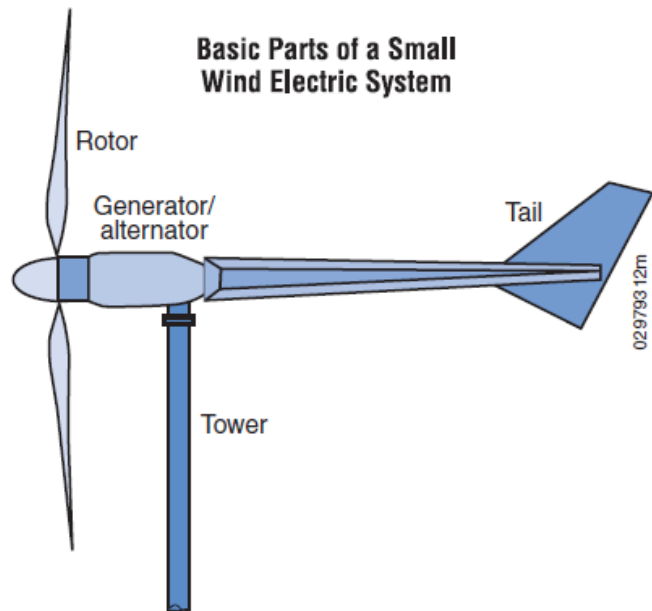
Black – Possible ordinance language

According to the American Wind Energy Association, the number of small wind energy system installations in the U.S. is growing at rates of 14 to 25 percent annually.¹ Though wind as an energy resource is limited in the DVRPC region, several municipalities have been approached by residents seeking to install small wind energy systems on their properties. Municipalities should become familiar with small wind energy technology and the approaches to zoning for this type of land use, in order to appropriately alleviate the burden of costs of installation to prospective owners, as well as alleviating nuisance issues that may arise within the community upon development of this resource.

A small wind energy system is comprised of a turbine, a tower, a foundation, and wiring equipment. Small wind turbines typically carry a nameplate rating of *up to* 100 kW of electricity and are mounted on towers that generally range from 45 to 160 feet high. The “Total System Height” (including the tower and the turbine rotors) may reach up to 180 feet. Small wind energy systems are typically sized to provide supplemental power to residential homes or farms. A typical residential-sized wind energy system ranges in size from five kW to 20kW, depending on the energy demand of the home, while a farm-scale application can reach up to 100kW. Actual energy generation from a wind energy system will fluctuate due to the variable nature of wind, and wind turbine manufacturers can provide site-specific information about the expected annual energy output of a turbine based upon readings of annual average wind speed in the area of installation. A typical household uses roughly 10,000 kWh per year (830 kWh a month), and a 5kW to 15kW turbine could meet a significant portion of this energy demand depending on the wind speeds in the area.²

¹ <http://www.awea.org/smallwind/documents/AWEASmallWindMarketStudy2007.pdf>.

² http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf



Source: http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf

Wind turbines come in a wide range of styles, including horizontal axis or vertical axis. The horizontal-axis wind turbine is most commonly used today.³ Horizontal Axis turbines are characterized by the propeller shape of the turbine and usually have three blades. Several types of towers are available commercially, including free-standing monopole (like a flag pole), and “guyed” towers, which can consist of lattice (like a radio tower) sections or tubing, and supporting guy wires. Guyed towers are the most common tower types for small wind energy systems.

Due to lessons learned about turbulence, durability, productivity, and efficiency, the industry has increased its manufacturing of—and support for—taller towers. The higher the tower, the more power the wind system can produce.⁴ Also, in order to effectively produce power, wind energy systems should be sited in the presence of consistently strong winds, and where wind is least obstructed.⁵ To achieve this, the standard for determining proper tower height is that the lowest extension of the rotor is at least 30 feet higher than any obstacle within a 300-

³ http://www.eere.energy.gov/basics/renewable_energy/wind_turbines.html

⁴ http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf

⁵ DWEA’s Fact Sheets

foot radius of the wind turbine,⁶⁷ while AWEA and DWEA recommend at least 30 feet higher than any obstacle within a 500-foot radius. Turbine height is the most important aspect of meeting this rule, and will often require tower heights of 45 to 160 feet. When an ordinance restricts heights to 30 to 60 feet, the potential output of the turbines may be compromised due to the fact that wind speeds and consistent wind quality increase with elevation, and turbines are more likely to be in the path of an obstruction or hit with turbulent winds at lower elevations. Durability, sound-levels, and maintenance costs can also be negatively affected by tower height restrictions, as lower heights may place the turbine in the path of more turbulent winds.⁸



For more information:

US DOE EERE: Frequently Asked Questions on Small Wind Systems: http://www1.eere.energy.gov/wind/small_wind_system_faqs.html

US DOE EERE: Small Wind Electric Systems: A PA Users Guide: http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf

This framework provides guidance and example language for creating a zoning process that ensures proper siting, installation, and maintenance of a small wind energy system. The language provided can be modified to become a stand-alone ordinance or incorporated into a municipality's existing zoning ordinance. **Note: The language provided in this framework is not intended to be wholly adopted. Please consult with your municipal solicitor.**

⁶ DWEA Briefing Paper: Tower Height <http://www.distributedwind.org/assets/docs/PandZDocs/dwea%20tower%20height.pdf>

U.S. DOE EERE Wind Energy Program http://www1.eere.energy.gov/wind/small_wind_system_faqs.html

⁷ http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf

⁸ DWEA's Fact Sheets

Section 1. Intent/Purpose/Findings

This section offers examples of how to phrase the intent and purpose of the ordinance. The inclusion of intent and purpose language is strongly encouraged in an renewable energy ordinance, as it explains the intent of creating provisions for small wind energy development and clarifies a municipality's rationale for establishing a small wind energy ordinance. It should also address why the regulations are being adopted and outline the goals of the ordinance, and perhaps refer to the correlating act to make the relevance of the ordinance apparent. An intent or purpose section highlights the benefits of small wind energy systems and why they should be protected through the development of this ordinance. This section also serves to establish the rationale for the ordinance in case of a legal challenge.

- It is the purpose of this regulation to promote the safe, effective, and efficient use of small wind energy systems installed to reduce the on-site consumption of utility-supplied electricity. (AWEA, Permitting Small Wind Turbines⁹)

-or-

- The New Jersey Small Wind Model Ordinance offers two simple purpose language statements:
 - (1) Facilitate the permitting of small wind energy systems.
 - (2) Preserve and protect public health and safety without significantly increasing the cost or decreasing the efficiency of a small wind energy system.

⁹<http://archive.awea.org/smallwind/toolbox2/TOOLS/permitting.html>

Section 2. Definitions

Any term used in the text of the ordinance must be defined. This section provides a selection of important terms and their definitions. Several variations have been provided for some terms to allow flexibility for the individual municipality. Definitions may be included in the body of the renewable energy ordinance, if it is stand alone, or may be incorporated into the Definitions section of the zoning ordinance.

Meteorological tower or “met tower:” Means a structure designed to support the gathering of wind energy resource data, and includes the tower, base plate, anchors, guy cables and hardware, anemometers (wind speed indicators), wind direction vanes, booms to hold equipment anemometers and vanes, data logger, instrument wiring, and any telemetry devices that are used to monitor or transmit wind speed and wind flow characteristics over a period of time for either instantaneous wind information or to characterize the wind resource at a given location. (NJ Clean Energy Program, 2007)

Small Wind Energy System: A wind energy system that:

- Is used to generate electricity;
- Has a nameplate capacity of 100 kilowatts or less; and
- Has a total height of 200 feet or less.

A wind energy conversion system: Consists of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 100kW and which is intended primarily to reduce on-site consumption of utility power. (AWEA Permitting Small Wind Energy Turbines)

Wind Energy System: Equipment that converts and then stores or transfers energy from the wind into usable forms of energy. This equipment includes any base, blade, foundation, generator, nacelle, rotor, transformer, vane, wire, inverter, batteries, or other component in the system.

Total Height: The vertical distance from the ground level to the tip of a wind generator blade when the tip is at its highest point.

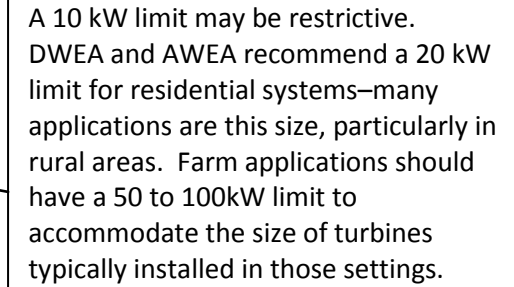
Tower Height: The height above grade of the fixed portion of the tower, excluding the wind turbine itself.

Rotor Diameter: The cross-sectional dimension of the circle swept by the rotating blades.

Residential Wind Energy System: A wind energy conversion system consisting of a wind turbine and associated control or conversion electronics, which has a rated capacity of **not more than 10 kW** and which is intended to primarily reduce on-site consumption of utility power. A system is considered a residential wind energy system only if it supplies electricity primarily for on-site use, except that when a parcel on which the system is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company. (Valley Twp., Mountour County, PA)

Tower: A guyed or freestanding structure, anchors, and foundation that is specifically engineered to support a small wind turbine.

Nameplate Capacity: The maximum rated output of a generator, prime mover, or other electric power production equipment under specific conditions designated by the manufacturer. (Source: EIA, Energy Glossary)



A 10 kW limit may be restrictive. DWEA and AWEA recommend a 20 kW limit for residential systems—many applications are this size, particularly in rural areas. Farm applications should have a 50 to 100kW limit to accommodate the size of turbines typically installed in those settings.

Section 3. Applicability

There are a number of ways that municipalities can review and allow for wind energy projects, and these can greatly impact the feasibility of a project. Simply listing small wind energy systems as an allowed use (**such as an accessory, permitted, conditional use, or special exception**) subject to certain requirements outlined in the ordinance can greatly streamline the process. An ordinance that fails to identify wind energy systems as allowed uses, but which does not prohibit them, can result in wind energy only being permitted by a use variance. This should be avoided, as the use variance process is time consuming and costly for the applicant, and can be construed as “spot zoning.”

A municipality should also decide where it is appropriate for wind energy systems to be placed. This is accomplished by deciding which locations and uses for the wind energy systems are appropriate. The following section will provide language that gives a municipality the options to regulate the use for the wind energy (principal or accessory), the location (which zoning districts), and the level of review required (by right, conditional use, etc.). By combining these factors into appropriate language, a municipality can ensure that wind energy systems are sited appropriately.

- This ordinance applies to Wind Energy Systems to be installed and constructed after the effective date of the ordinance, and all applications for Wind Energy Systems on existing structures or property.
- Wind Energy Systems constructed prior to the effective date of this ordinance shall not be required to meet the requirements of this ordinance.
- Any upgrades, modifications, or changes that materially alter the size or placement of an existing Wind Energy System shall comply with the provisions of this ordinance.

The ordinance language provided applies to wind energy systems that are installed and constructed after the effective date of the ordinance, and all applications for wind energy systems on existing structures or property. Projects that predate the ordinance aren't usually regulated by the ordinance, but language to specify that could be included. However, it is recommended that existing wind energy systems be exempted because it would likely be impractical and costly for such systems to meet new regulations.

This language is somewhat restrictive because it requires systems that predate the ordinance to come into complete compliance if, for example, the system is moved.

There are a variety of ways in which municipalities can review and allow for wind energy facilities, as follows:

- *By right or as an outright permitted use:* Allows wind energy systems to be installed in all districts specified subject to certain conditions, requirements, or restrictions. Examples of the types of conditions, requirements, or restrictions set for wind energy systems can be found in *Section 4. General Regulations* of this framework. This is the most permissive form of review process.
- *As a special exception (PA):* Under the Pennsylvania Municipal Planning Code, a “special exception” is a permitted use if the applicant demonstrates to the Zoning Hearing Board that the use complies with the conditions, requirements, or restrictions set forth in the ordinance. A special exception will require extra commitment from the applicant. For municipalities seeking greater control over small wind energy system development, a special exception may be an appropriate review process. If you decide to include this as the review process in your ordinance, make sure to

specific criteria for ZHB review.

- Another review process is listing small wind energy systems as a *conditional use*, which requires a detailed description of the project and involves a public hearing, as well as review and a decision by the governing body.
- *As an accessory use*: An accessory use is any use considered an integral accessory use to a property that is subordinate to its principal use. An accessory use can be established in two ways: 1) similar to a “by right” or “permitted use,” subject to similar conditions, requirements, or restrictions set forth in the ordinance, or 2) after receiving a “conditional use/special use permit.” The purpose of establishing this use as an accessory use is to ensure that it is never the primary use of the property—that is, it is always an accessory to the primary use. For small wind, the accessory use requirement normally appears in agricultural, commercial, or industrial settings, where energy produced by a turbine is instrumental in accomplishing a main function of the property's use. For example, Valley Township in Montour County, Pennsylvania, sought to establish small scale wind energy systems as an accessory use, but required different methods of permitting depending on the zoning district:
 - A. A Residential Wind Energy System shall be an accessory use permitted by special exception in the R-1 Low Density Residential District.
 - B. A Residential Wind Energy System shall be a permitted accessory use in the A-R Agricultural Rural District.
- *Subject to site plan review*: A site plan review requirement is often a component of the requirement for the applicant to obtain a special use permit, conditional use permit, or variance. This allows the planning board or reviewing body to review the physical characteristics of a site prior to granting a special use permit, conditional use permit, or variance.

Sample Applicability Language

By right with a permit required

- A small wind energy system shall be a permitted use in all zoning districts subject to the following requirements. (from The NJ Office of Clean Energy Model Ord.)

Special Exception

Wind energy facilities shall be permitted by special exception as an accessory use in all zoning districts in the (Municipality). Approval is subject to the appropriate standards in Article (XXXX). (adapted from Franconia Township, Montgomery County)

Conditional Use

- Wind energy systems, off-grid installations, and on-grid installations shall be allowed in any zoning district when approved by the _____ (appropriate governing body) as a Conditional Use. (adapted from Perkiomen Township)

Perkiomen Township further specifies that if a wind energy system receives a conditional use permit, it will be considered an *accessory structure*.

Accessory Use: (Valley Twp., Montour County, PA)

- A Residential Wind Energy System shall be an accessory use permitted by special exception in the R-1 Low Density Residential District.
- A Residential Wind Energy System shall be a permitted accessory use in the A-R Agricultural Rural District.

Valley Township, Montour County, Pennsylvania, sought to establish small-scale wind energy systems as an accessory use, but required different methods of permitting depending on the zoning district.



Section 4. General Regulations

The general regulations are general guidelines or added requirements that must be integrated into the local review process used by your municipality. The standards that follow may be used in addition to existing special use permits and site plan review standards, or they may be used to create a stand-alone set of review standards that substitute for any existing review standards. Approval standards may be imposed upon specific types of wind energy systems, imposed upon specific districts, or be generally applied to all wind energy systems.

Sample General Regulations

Permitting:

The zoning ordinance should clearly define the requirements of obtaining a zoning permit and the terms of the permit, including the documents required at submittal and any additional state or federal requirements.

The New Jersey Clean Energy Program Modal Ordinance defines a more comprehensive list for permit requirements:

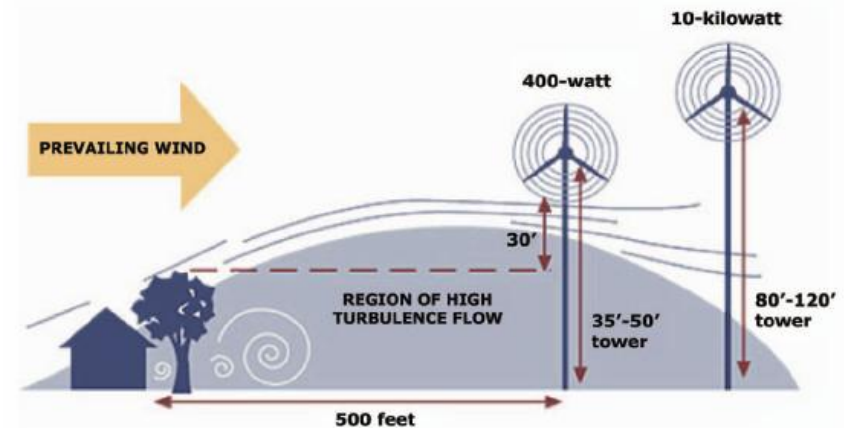
- 1) Permit. A zoning permit shall be required for the installation of a small wind energy system.
- 2) Documents: The zoning permit application shall be accompanied by a plot plan which includes the following:
 - Property lines and physical dimensions of the property;
 - Location, dimensions, and types of existing major structures on the property;
 - Location of the proposed small wind energy system tower;
 - The right-of-way of any public road that is contiguous with the property;
 - Any overhead utility lines; and

- Small wind energy system specifications, including manufacturer and model, rotor diameter, tower height, tower type (freestanding or guyed).
- 3) Fees. The application for a zoning permit for a small wind energy system must be accompanied by the fee required.
 - 4) Expiration. A permit issued pursuant to this ordinance shall expire if:
 - The small wind energy system is not installed and functioning within 24-months from the date the permit is issued; or
 - The small wind energy system is out of service or otherwise unused for a continuous 18-month period.

A requirement such as this should be accompanied with an exception for good faith efforts to repair the system.

Height and Setbacks:

To ensure maximum capacity and lifespan of the system, energy systems should be sited where wind is least obstructed. It is recommended that the bottom of the turbine rotor should clear the highest wind obstacle (rooftop, mature tree, etc.) within a 300-foot radius by at least 30 feet. (while AWEA and DWEA recommend within a 500-foot radius by at least 30 feet).¹⁰ Because wind energy systems need to be tall in order to successfully generate energy from wind, municipalities can alleviate both the concerns of adjacent neighbors, as well as the height needs of the turbine owner, through "set back" and "height" requirements. Height and setback requirements can reference tower height plus the length of one blade (the turbine's "total extended height"), or a specific measurement in feet setback from either the property line, inhabited neighboring structures, utility lines, and/or road right of ways.



A wind turbulence diagram. Source: AWEA: 2008

¹⁰ <http://archive.awea.org/smallwind/pdf/InThePublicInterest.pdf>

Using the property lines, as opposed to an occupied building, as part of the setback formula may help to protect the adjacent property from any future use. Municipalities can also establish specific height requirements for the wind energy systems, which typically range from 60 feet in Valley Township, 72 feet in Haycock, 75 feet in Franconia, and 150 in Perkiomen—though height requirements that are too restrictive may impact the power output of turbines installed under these guidelines. It is up to the municipality to balance the need to restrict height (due to aesthetic or perceived safety concerns of your residents) with the goal of producing power with small wind turbines. Examples of both setback and height requirements are included below.

Setback:

Wind energy system should be located no less than 100 feet (or 1.1 times the height of the device, whichever is greater) from overhead utility lines, and no less than 100 feet (or 1.1 times the height of the device, whichever is greater) from a street line. A device may be located within the front yard, provided that it is located to the side of the dwelling. (Township of Haycock, Bucks County)

- A Wind Turbine shall be installed on a self-supporting tower and shall be set back from any occupied building, property line, or public road, a distance of not less than 1.5 times the height from the surface of the tower foundation to the highest point of the turbine rotor plane. (Valley Twp, Montour County, PA)
- The wind energy system shall be set back a minimum of ninety (90) feet from all property lines, above-ground utility poles, and above-ground utility lines. It shall be set back from all occupied buildings on the lot a minimum of 1.5 times the height of the structure. (Franconia Township, Montgomery County)
- The base of the tower shall be set back from all property lines, public right of ways, and public utility lines a distance equal to 1.1 times the total extended height. (Adapted from DWEA Model Ord.)

A setback requirement of 1.5 the height of the wind energy system is very restrictive. According to DWEA, this level of restriction may be unnecessary, since wind energy systems must meet stringent structural requirements and are no more likely to tumble over than other man-made structures.

Maximum setback distances for wind energy systems should be at least 1.1 times the height of the turbine—though setbacks of the height of the turbine should be sufficient as well. (DWEA)

Height:

Maximum height of the wind energy system structure, including all moving and rotating parts, shall be 72 feet, measured from the undisturbed ground elevation at the base of the device, to the highest point of the arc of the blade, or to the top of the tower, whichever is greater. If a device is attached to an existing structure, then the maximum height of the attached wind energy device shall not exceed 72 feet, including the height of the existing structure. Exceptions to building height, as specified in Section 529, do not apply to wind energy systems. (from Haycock, Bucks Co.)

- A Wind Turbine shall have a maximum height of sixty (60) feet above grade level. (Valley Township, Montour County)
- So long as the total extended height meets sound and set-back requirements, there shall be no specific height limitation, except as imposed by Federal Aviation Administration regulations. (from AWEA Model Ord.)
- Minimum distance between the undisturbed ground at the base of the device and any protruding blade shall be 15 feet, as measured at the lowest point of arc of the blades. (from Haycock, Bucks, Co.)

Minimum lot area: Some municipalities have specified a minimum lot area as additional protection against noise and safety concerns. However, municipalities can choose to allow wind energy systems in only certain districts. For districts where the municipality wishes to allow wind, a combined height and setback requirement should be sufficient to protect against these issues. Examples of language restricting lot size include:

- The lot on which a wind energy facility is located shall be a minimum of three (3) acres in size. (Franconia Township, Montgomery County)
- Minimum lot area: two (2) acres. (Township of Haycock, Bucks County)

This height standard may limit the effectiveness of wind applications. In some situations, 72 feet may not be tall enough. For the most part, height can be limited through the use of setbacks.

A 60-foot height limit is considered especially restrictive by industry standards. (DWEA)

Municipalities that want to be most permissive can forgo establishing a specific height requirement by referencing FAA regulations, which require that structures over 200 feet be lit. According to AWEA, small wind turbines will not likely exceed this height anyway. Currently, the tallest available small wind towers are 160 feet, and the industry does not expect towers to get much taller.

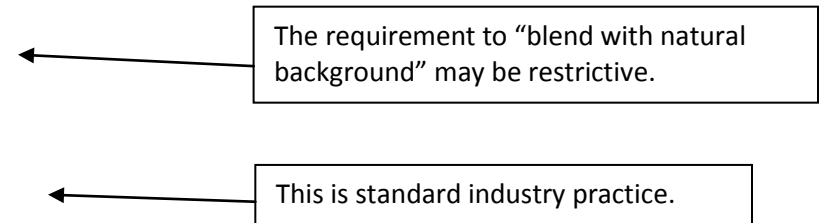
This would not achieve the standard that the lowest extension of the rotor be at least 30 feet higher than any obstacle within a 300-foot radius of the wind turbine (or AWEA and DWEA's "30/500" recommendation).

By requiring a minimum lot size this ordinance greatly restricts wind applications. The use of setbacks is a more permissive regulation than lot size.

AESTHETICS

In addition to noise and safety concerns, aesthetics may be an issue to residents in some communities. Municipalities can alleviate some of the issues associated with aesthetics through restricting the use of advertisements, lighting, or obtrusive colorings on wind energy systems. Some municipalities also place restrictions on the type of tower allowed. Examples of this type of language include:

- Wind Turbine shall be a nonobtrusive color, such as white, off-white, or gray. (Valley Township, Montour County, PA)
- A Wind Turbine shall not be artificially lighted and shall not display advertising, except for reasonable identification of the turbine manufacturer. (Valley Township, Montour County, PA)
- No artificial lighting (unless required by the Federal Aviation Administration), signage, or any forms of advertising shall be utilized or attached to the wind energy system. (Township of Haycock, Bucks County)
- The wind energy system components shall be of a neutral color designed to blend with natural background surrounding the installation. (Franconia Township, Montgomery County)
- The wind generator and the tower shall remain painted or finished in the color or finish that was originally applied by the manufacturer, unless a different color of finish is approved in the zoning approval. (NJ Clean Energy Model Ordinance)



SOUND

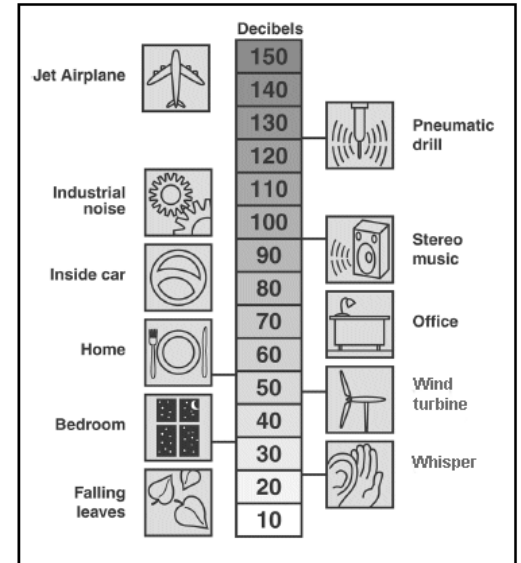
The ambient noise level of many current small wind energy systems measures approximately 52 to 55 decibels, or the equivalent noise levels of a refrigerator.¹¹ These levels can be exceeded during storm events and power outages, though these instances are rare. Municipalities can adopt a noise restriction if they are concerned with protecting neighbors from noise intrusion, however.

- The audible sound from a wind energy system shall not exceed 60 dBA, measured at the property line. (Perkiomen Township, Montgomery County)
- Sound produced by the turbine under normal operating conditions, as measured at the property line, shall not exceed the definition of nuisance noise. Sound levels, however, may be exceeded during short-term events out of anyone’s control, such as utility outages and/or severe storms. (from AWEA Model Ord.)
- Audible sound from a Wind Energy Facility shall not exceed fifty-five (55) dBA, as measured at the exterior of any occupied building on any property adjoining the Wind Energy Facility site. Methods for measuring and reporting acoustic emissions from Wind Turbines and the Wind Energy Facility shall be equal to or exceed the minimum standards for precision described in the AWEA Standard 2.1-1989, titled “Procedures for the Measurement and Reporting of Acoustic Emissions from Wind Turbine Generation Systems Volume I: First Tier.” (Valley Township, Montour County)

FENCING/ATTRACTIVE NUISANCE

Some municipalities have established requirements for a fence around the tower to prohibit climbing. However, according to AWEA, unauthorized climbing of wind energy systems is extremely rare, and further, a fence, which is itself climbable, may pose safety issues of its own. Instead, to deter vandals, AWEA recommends the following:

- Remove climbing foot rungs on the lower 10 or 12 feet of a freestanding tower.



A decibel comparison chart. Source: AWEA

Very permissive language. Most municipalities determine a nuisance level at 55 to 60 dBA. Municipalities should also be sure to include language that gives exceptions for the types of events that may trigger a turbine to exceed its standard noise level, such as utility outages and severe storms (as provided in the AWEA example).

It is not typical for zoning ordinances to require measurement of noise/sound for small wind energy systems. Sound tests are expensive, and it is difficult to identify who is responsible for having a test conducted. Wind turbine manufacturers will provide sound information for their turbines.

¹¹ http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf

- For lattice or guyed towers, fasten sheets of metal or wood to the lower part of the tower to cover all hand and foot-holds.
- Display "Danger-High Voltage" or "Caution-Electrical Shock Hazard" signs to the sides of the tower.

Municipalities in Pennsylvania and New Jersey have addressed the concern for safety in a number of ways:

- Wind Turbines shall not be climbable up to fifteen (15) feet above grade level. (Valley Township, Montour County, PA)
- All ground-mounted electrical and control equipment shall be labeled and secured to prevent unauthorized access.
- The tower shall be designed and installed so as not to provide step bolts, a ladder, or other publicly accessible means of climbing the tower, for a minimum height of eight feet above the ground. (NJ Clean Energy Model Ordinance)

SHADOW FLICKER

Shadow flicker refers to when shadows are cast by a wind energy system's moving blades on a sunny day. According to AWEA, shadow flicker is usually only a concern with large/utility-scale wind energy systems, as the blades of small wind energy systems are narrower and rotate much faster than utility-scale wind energy systems.

- The owner of the wind energy facility shall take all reasonable steps to minimize or eliminate shadow flicker on any regularly occupied adjacent structure. (Perkiomen Twp., Montgomery County)

ROOF MOUNTED or BUILDING INTEGRATED WIND ENERGY SYSTEMS

There are significant industry concerns about the viability of building integrated or roof mounted wind turbines.¹² Due to the turbulent nature of wind surrounding buildings, roof-mounted or Building Integrated Wind Energy Systems have been fraught with issues related to noise intrusion and vibrations (which may pose structural challenges to the building, as well as reduce output). Often, these systems are deemed cost ineffective and produce power far below their rated output. If your municipality wishes to alleviate concerns related to Building Integrated Wind Energy Systems, you may wish to require an added layer of review (e.g., additional engineering analysis) for these applications, or not allow them at all.

- Applications for roof-mounted (or other nontraditionally mounted) turbines must include a wet stamped/sealed/certified structural engineering analysis for the turbine mounting system and for the suitability of the building to which the turbine is to be mounted. (DWEA)

¹² <http://www.buildinggreen.com/auth/article.cfm/2009/4/29/The-Folly-of-Building-Integrated-Wind/?#comments>

ABANDONMENT AND REMOVAL

Local governments should be entitled to recourse in the case that a wind energy system is abandoned and presents a nuisance to the community.

- If a wind energy system is inoperable for twelve (12) consecutive months, the township shall notify the property owner, who shall within three (3) months either restore the system to operating condition or remove it at the owner's expense. (Perkiomen Twp , Montgomery County)

The New Jersey Clean Energy Model Ordinance offers a thorough list of abandonment requirements:

- A small wind energy system that is out of service for a continuous 18-month period will be deemed to have been abandoned.
- The Administrator may issue a Notice of Abandonment to the owner of a small wind energy system that is deemed to have been abandoned. The notice shall be sent return receipt requested.
- The Owner shall have the right to respond to the Notice of Abandonment within 30 days from the Notice's receipt date.
- If the owner provides information that demonstrates that the small wind energy system has not been abandoned, the Administrator shall withdraw the Notice of Abandonment and notify the owner that the Notice has been withdrawn.
- If the Administrator determines that the small wind energy system has been abandoned, the Owner of the small wind energy system shall remove the wind generator from the tower at the Owner's sole expense within six months after the Owner receives the Notice of Abandonment.
- If the owner fails to remove the wind generator from the tower in the time allowed under (5) above, the Administrator may pursue legal action to have the wind generator removed at the Owner's expense.

COMPLIANCE WITH OTHER REGULATIONS

Though not a zoning issue, municipalities should be aware that the following federal and state requirements pertain to wind energy systems:

Federal requirements:

- The Federal Aviation Administration (FAA) requires that structures over 200 feet be lit. Under this regulation, certain requirements exist for wind energy systems located in close proximity (<20,000 feet) to air bases and airports. For more information, see AWEA Permitting Small Wind.

According to AWEA, small wind turbines will not likely exceed this height anyway. This requirement is sometimes referenced in local zoning ordinances for small wind, but it is not likely necessary.

State requirements:

Pennsylvania

- Pennsylvania Uniform Construction Code
 - To the extent applicable, the Wind Energy Facility shall comply with the Pennsylvania Uniform Construction Code; and
 - Act 45 of 1999 as amended, and the regulations adopted by the Department of Labor and Industry.
- *New Jersey:*
- Users of the ordinance for wind energy systems must receive all necessary permits from the New Jersey Department of Environmental Protection (DEP). Compliance with the ordinance does not constitute compliance with DEP rules for those permits, nor does it constitute compliance with the Uniform Construction Code (N.J.A.C. 5:23).

Suggested language that allows the municipality to enforce the most current codes: "All wind energy systems, including towers, shall comply with all applicable local, state, and federal construction and electrical codes." (DWEA)

Examples of permit requirements:

- A wind energy system, including tower, shall comply with all applicable state construction and electrical codes, and the National Electrical Code. Prior to issuance of a building/zoning permit for installation of the device, the applicant must submit to the (Municipality) all documentation required by the Municipal Building Code Official to verify that the design of the device complies with the Pennsylvania Uniform Construction Code (UCC), including, but not limited to, documentation of the structural integrity of the foundation, base, tower, and all appurtenant structures, and electrical design. Design information must be certified by a licensed professional engineer in the Commonwealth of Pennsylvania, and/or an equipment manufacturer. (adapted from Haycock Twp., Bucks County)

Other Requirements

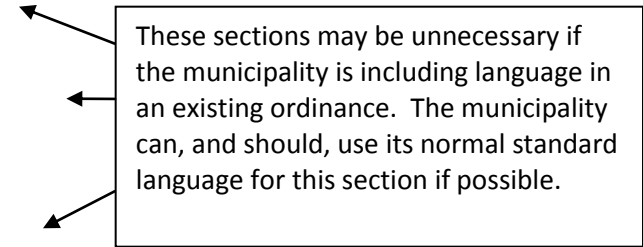
- Third-party certifications ensure industry credibility and consumer protection. The Small Wind Certification Council is a nonprofit organization formed with support from the DOE, AWEA, state energy offices, and turbine manufacturers to certify small wind turbine systems. For more information, visit: <http://www.smallwindcertification.org/>

Section 5. Penalties

We recommend the use of standard language, but the language should be very specific for each municipality.

Section 6. Severability

- If any sentence, clause, section, or other part of this ordinance is, for any reason, found to be unconstitutional, illegal, or invalid, such unconstitutionality, illegality, or invalidity shall not affect or impair any remaining provisions, sentences, clauses, sections, or other parts of this ordinance. It is hereby declared as the intent of (Municipality) that this ordinance would have been adopted had such unconstitutional, illegal, or invalid provision, sentence, clause, section, or part thereof not been included herein.



These sections may be unnecessary if the municipality is including language in an existing ordinance. The municipality can, and should, use its normal standard language for this section if possible.

Section 7. Effective Date

- This ordinance shall become effective 30 days from the date of enactment.

For more information:

- US DOE EERE: Frequently Asked Questions on Small Wind Systems: http://www1.eere.energy.gov/wind/small_wind_system_faqs.html
- US DOE EERE: Small Wind Electric Systems: A PA Users Guide: http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_pa.pdf
- US DOE EERE: Wind Energy Ordinances: http://www.windpoweringamerica.gov/pdfs/policy/2010/wind_energy_ordinances.pdf
- AWEA, Permitting Small Wind Turbines: <http://archive.awea.org/smallwind/toolbox2/TOOLS/permitting.html>
- DWEA Model Wind Energy Ordinance: <http://www.distributedwind.org/assets/docs/PandZDocs/dwea%20model%20zoning%20ordinance%20passed%2001%2007%2012.pdf>

Model Ordinances used in this framework:

- (Valley Twp., Mountour County, PA)
- (NJ Clean Energy Program, 2007)
- (Haycock Twp., Bucks County)
- (Franconia Township, Montgomery County)
- (Perkiomen Twp. , Montgomery County)

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