MEMORANDUM

cityofnovi.org

TO: MEMBERS OF THE PLANNING COMMISSION

FROM: KRISTEN KAPELANSKI, PLANNER

THRU: BARBARA MCBETH, COMMUNITY DEVELOPMENT DEPUTY DIRECTOR

SUBJECT: PROPOSED ORDINANCE REGARDING WIND ENERGY

DATE: JULY 10, 2009

In response to the recent push towards clean energy technology and in an effort to promote "green initiatives" in general, the Community Development Department has proposed a text amendment to address the siting and design of wind turbines to harness wind energy. Following is a brief summary of the standards proposed in the attached ordinance to address issues associated with wind turbines.

Wind turbines come in a variety of sizes designed to accommodate both private use in a residential or business setting and wind energy production via utility grade systems. According to the most recent U.S. Department of Energy National Renewable Energy Laboratory maps, the City of Novi does not have sufficient wind power to accommodate a large-scale utility wind farm. Therefore, the attached ordinance proposes regulations related to wind turbines designed for private use by local residents and businesses.

The proposed ordinance identifies three types of wind turbines: Small Tower-Mounted Wind Energy Turbines (STMWET), Small Structure-Mounted Wind Energy Turbines (SSMWET) and Medium Wind Energy Turbines (MWET). Staff prepared the attached chart summarizing the three types of turbines and the zoning districts where each would be allowed, either as a principal use permitted or a principal use permitted subject to special conditions (a special land use). The draft ordinance language has a number of considerations for siting and design requirements, as well as health and safety issues for all three types of wind turbines.

Small Tower-Mounted Wind Energy Turbines

STMWETs are proposed to be a special land use in all districts, with a height not to exceed 100 feet in non-residential districts and 60 feet in residential districts, unless specific conditions are met. One exception is that these turbines would be a principal use permitted in the OST District (Office Service Technology), I-1 District (Light Industrial) and I-2 District (General Industrial) if the property is located at least 300 feet from residentially zoned property. These wind turbines would be limited to the rear yard with a required setback equal to the height of the tower. Residential properties must be at least 2 acres to be eligible for a STMWET.

Small Structure-Mounted Wind Energy Turbines

SSMWETs are proposed to be a permitted use in all districts with a height not to exceed 15 feet measured from the highest point of the roof with a required setback of 15 feet.

Medium Wind Energy Turbines

MWETs are proposed to be a special land use in the I-1 District (Light Industrial), I-2 District (General Industrial) and the OST District (Office Service Technology). They would be limited to a height of 150 feet with a required setback equal to the total height of the tower. Additional regulations regarding ground clearance, noise, vibration, guy wires, etc. are also provided for in the proposed ordinance. No more than one medium-sized turbine would be allowed for each 2.5 acres of land.

The Implementation Committee met and discussed this matter at the meeting of May 6, 2009. A number of comments were received at the meeting and amendments have been made to the ordinance to address some of those comments. Additional information from the industry has been provided. Draft minutes of that meeting are attached.

This ordinance was modeled after existing wind ordinances from Huron County, Ottawa County, Bloomfield Hills and the State of Michigan's model ordinance. Also attached please find some background information regarding wind turbines. The Planning Commission is asked to hold a public hearing on July 15th, 2009 and forward a recommendation to the City Council regarding this amendment. If any Commissioner has any questions related to this request, do not hesitate to contact Kristen Kapelanski, in the Community Development Department at (248) 347-0586 or kkapelanski@cityofnovi.org.

Summary Chart
of proposed ordinance regulations for
Three types of Wind Energy Turbines

	Residential Zoning Districts	**OST District**	**Light Industrial District**	**General Industrial District**	**Other Non-Residential Zoning Districts**
Structure Mounted (no more than 15 feet above roof)	Principal Permitted Use	Principal Permitted Use	Principal Permitted Use	Principal Permitted Use	Principal Permitted Use
Small Tower Mounted (60-100 feet maximum height in residential, 100 feet maximum height in other districts)	Principal Permitted Use Subject to Special Conditions (must be located in the rear yard, only permitted when lot size is 2 acres or greater)	Principal Permitted Use Subject to Special Conditions unless > 300 feet from residential districts, then it is a Principal Permitted Use	Principal Permitted Use Subject to Special Conditions unless > 300 feet from residential districts, then it is a Principal Permitted Use	Principal Permitted Use Subject to Special Conditions unless > 300 feet from residential districts, then it is a Principal Permitted Use	Principal Permitted Use Subject to Special Conditions
Medium Tower Mounted (150 feet maximum height)	Not permitted	Principal Permitted Use Subject to Special Conditions	Principal Permitted Use Subject to Special Conditions	Principal Permitted Use Subject to Special Conditions	Not permitted

Based on Draft Ordinance language 7/9/09

PROPOSED ORDINANCE AMENDMENTS – STRIKE VERSION

STATE OF MICHIGAN

COUNTY OF OAKLAND

CITY OF NOVI

ORDINANCE NO. 09- 18 – 237

AN ORDINANCE TO AMEND ORDINANCE NO. 97-18, AS AMENDED, THE CITY OF NOVI ZONING ORDINANCE; IN ORDER TO PROVIDE FOR STANDARDS FOR SITING WIND ENERGY TURBINES.

Draft Ordinance 7/9/09

THE CITY OF NOVI ORDAINS:

Part I. That Ordinance No. 97-18, the City of Novi Zoning Ordinance, as amended, hereby amended to read as follows:

Sec. 2508. Uses Not Otherwise Included Within a Specific Use District

1. – 7. [Unchanged]

8. Wind Energy Turbines

a. Intent. The purpose of this Ordinance is to establish guidelines for siting Wind Energy Turbines (WETs). The goals are as follows:

1. To promote the safe, effective and efficient use of a WET in order to reduce the consumption of fossil fuels in producing electricity.
2. Preserve and protect public health, safety, welfare and quality of life by minimizing the potential adverse impacts of a WET.
3. To establish standards and procedures by which the siting, design, engineering, installation, operation and maintenance of a WET shall be governed.

b. Definitions. For purposes of this article, the following items shall be defined as stated:

1. Ambient Sound Level: The amount of background noise at a given location prior to the installation of a WET(s) which may include, but is not limited to, traffic, machinery, lawnmowers, human activity and the interaction of wind with the landscape. The ambient sound level is measured on the dB(A) weighted scale as defined by the American National Standards Institute.

2. Anemometer: Temporary wind speed indicator constructed for the purpose of analyzing the potential for utilizing a wind energy turbine at a given site. This

includes the tower, base plate, anchors, cables and hardware, wind direction vanes, booms to hold equipments, 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.

3. Decommissioning: The process of terminating operation and completely removing a WET(s) and all related buildings, structures, foundations, access roads and equipment.

4. Medium Wind Energy Turbine (MWET): Tower-mounted wind energy system that converts wind energy into electricity through the use of equipment which includes any base, blade, foundation, generator, nacelle, rotor, tower, transformer, vane, wire, inverter, batteries or other components used in this system. The MWET has a nameplate capacity that does not exceed two hundred fifty (250) kilowatts. The total height exceeds one hundred (100) feet and the total capacity exceeds thirty (30) kilowatts. The total height does not exceed one hundred fifty (150) feet.

5. Nacelle: Refers to the encasement which houses all of the generating components, gear box, drive tram and other equipment.

6. Net-metering: Special metering and billing agreement between utility companies and their customers, which facilitates the connection of renewable energy generating systems to the power grid.

7. Operator: Entity responsible for the day-to-day operation and maintenance of a WET.

8. Rotor Diameter: Cross-sectional dimension of the circle swept by the rotating blades of a WET.

9. Shadow Flicker: The moving shadow, created by the sun shining through the rotating blades of a WET. The amount of shadow flicker created by a WET is calculated by a computer model that takes into consideration turbine location, elevation, tree cover, location of all structures, wind activity and sunlight.

10. Small Tower-Mounted Wind Energy Turbine (STMWET): Tower-mounted wind energy system that converts wind energy into electricity through the use of equipment which includes any base, blade, foundation, generator, nacelle, rotor, tower, transformer, vane, wire, inverter, batteries or other components used in this system. The STMWET has a nameplate capacity that does not exceed thirty (30) kilowatts. The total height does not exceed one hundred (100) feet.

11. Small Structure-Mounted Wind Energy Turbine (SSMWET): Converts wind energy into electricity through the use of equipment which includes any base, blade, foundation, generator, nacelle, rotor, tower, transformer, vane, wire, inverter, batteries or other components used in this system. A SSMWET is attached to a structure's roof, walls or other elevated surface. The SSMWET has a nameplate capacity that does not exceed ten (10) kilowatts. The total height does not exceed fifteen (15) feet as measured from the highest point of the roof, excluding chimneys, antennae and other similar protuberances.

12. Total height: The vertical distance measured from the ground level at the base of the tower to the uppermost vertical extension of any blade, or the maximum height reached by any part of the WET.

13. Tower: Freestanding monopole that supports a WET.

14. Wind Energy Turbine (WET): Any structure-mounted, small, medium or large wind energy conversion system that converts wind energy into electricity through the use of a Wind Generator and includes the nacelle, rotor, tower and pad transformer, if any.

c. Applicability. This ordinance applies to all WETs proposed to be constructed after the effective date of this ordinance. All WETs constructed prior to the effective date of this ordinance shall not be required to meet the requirements of this ordinance; however, any physical modification to an existing WET that materially alters the size, type, equipment or location shall require a permit under this ordinance.

d. Small Structure-Mounted Wind Energy Turbine and Small Tower-Mounted Wind Energy Turbine. Notwithstanding other provisions of this section of the ordinance, a Small Structure-Mounted Wind Energy Turbine (SSMWET) shall be considered a permitted use in all zoning districts and shall not be erected, constructed, installed or modified as provided in this ordinance unless administrative approval from the Planning Division and appropriate building permits have been issued to the owner(s) or operator(s). A Small Tower-Mounted Wind Energy Turbine (STMWET) shall be considered a principal permitted use subject to special conditions in all Zoning Districts, except that in the OST (Planned Office Service Technology), I-1 (Light Industrial), and I-2 (General Industrial) districts, a STMWET is a principal permitted use if the property greater than 300 feet from any residential zoning district. A STMWET shall not be erected, constructed, installed or modified as provided in this ordinance unless City Council approval has been granted after a recommendation from the Planning Commission and appropriate building permits have been issued to the owner(s) or operator(s). All SSMWETs and STMWETs are subject to the following minimum requirements:

1. Siting and Design Requirements

(a.) "Upwind" turbines shall be required.

(b.) Visual Appearance

(i) A SSMWET or STMWET, including accessory buildings and related structures shall be a non-reflective, non-obtrusive color (e.g. white, gray, black). The appearance of the turbine, tower and any ancillary facility shall be maintained in working condition and free of rust and corrosion by the owner of the SSMWET or STMWET throughout the life of the SSMWET or STMWET.

(ii) A SSMWET or STMWET shall not be artificially lighted, except to the extent required by the FAA or other applicable authority, or otherwise necessary for the reasonable safety and security thereof.

(iii) A SSMWET or STMWET shall not be used for displaying any advertising (including flags, streamers or decorative items), except for reasonable identification of the turbine manufacture.

(c.) Ground clearance: The lowest extension of any blade or other exposed moving component of the SSMWET or STMWET shall be at least fifteen (15) feet above the ground (at the highest point of the natural grade within thirty (30) feet of the base of the tower) and, in addition, at least fifteen (15) feet above any outdoor surfaces intended for human use, such as balconies or roof gardens, that are located directly below the SSMWET or STMWET.

(d.) Noise: Noise emanating from the operation of a SSMWET(s) shall not exceed, at any time, the lowest ambient sound level that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a residential use parcel or from the property line of parks, schools, hospitals or churches. Noise emanating from the operation of a SSMWET or STMWET shall not exceed, at any time, the lowest ambient noise level plus 5 dBA that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a non-residential use parcel.

(e.) Vibration: Vibrations shall not be produced which are humanly perceptible beyond the property on which a SSMWET or STMWET is located.

(f.) Guy Wires: Guy wires shall not be permitted as part of the SSMWET or STMWET.

(g.) In addition to the Siting and Design Requirements listed previously, the SSMWET shall also be subject to the following:

(i.) Height: The height of the SSMWET shall not exceed 15 feet as measured from the highest point of the roof, excluding chimneys, antennae and other similar protuberances.

(ii.) Setback: The setback of the SSMWET shall be a minimum of fifteen (15) feet from the property line, public right-of-way, public easement or overhead utility lines if mounted directly on a roof or other elevated surface of a structure. If the SSMWET is affixed by extension to the side, roof or other elevated surface, then the setback from the property lines or public right-of-way shall be a minimum of fifteen (15) feet. The setback shall be measured from the furthest outward extension of all moving parts.

(iii.) Location: The SSMWET shall not be affixed to the side of a structure facing a road.

(iv.) Quantity: No more than two (2) SSMWETs shall be installed on any parcel of property.

(v.) Separation: If more than one SSMWET is installed, a distance equal to the height of the highest SSMWET must be maintained between the base of each SSMWET.

(h.) In addition to the Siting and Design Requirements listed previously, the STMWET shall also be subject to the following:

(i.) Height: The total height of a STMWET in any nonresidential district shall not exceed one hundred (100) feet. In any residential district, the total height of a STMWET shall not exceed sixty (60) feet. The total height of the STMWET in any residential district may be increased to a height not to exceed one hundred (100) feet upon submission of an approved wind resources study documenting a 47% increase in the average wind speed at the proposed height over the average wind speed at the established total height limitation of sixty (60) feet. An approved study will require measurements taken at the proposed site of the STMWET spanning a time period of at least one (1) year.

(ii.) Location: The STMWET shall only be located in the rear yard of a property that has an occupied building. In the case of a double-frontage lot, the STMWET may be located in an interior side yard.

(iii.) Occupied Building Setback: The setback from all occupied buildings on the applicant's parcel shall be a minimum of twenty (20) feet measured from the base of the tower.

(iv.) Other Setbacks: The setback shall be equal to the total height of the STMWET as measured from the base of the tower, from the property line, public right-of-way, public easement or overhead utility lines. This setback may be reduced if the applicant provides a registered engineer's certification that the WET is designed to collapse, fall, curl or bend within a distance or zone shorter than the height of the wind turbine.

(v.) Quantity: No more than one (1) STMWET shall be installed on any parcel of property.

(vi.) Electrical System: All electrical controls, control wiring, grounding wires, power lines and system components shall be placed underground within the boundary of each parcel at a depth designed to accommodate the existing land use to the maximum extent practicable. Wires necessary to connect the wind generator to the tower wiring are exempt from this requirement.

(vii.) Lot Size: In any residential district, the STMWET shall only be located on parcels of two acres or larger.

2. Application Requirements. The following information should be submitted with the proposed site plan.

(a.) Documented compliance with the noise requirements set forth in this ordinance. Said documentation shall require, at a minimum, data reflecting ambient sound measurements taken over a two (2) week period, which shall include the location on the property where the measurements were taken. The method of measuring ambient sound levels and the location on the property where the measurements will be taken shall be approved by the City prior to the collection of the data.

(b.) Documented compliance with applicable local, state and national regulations including but not limited to, all applicable safety, construction, environmental, electrical, communications and FAA requirements.

(c.) Proof of applicant's liability insurance.

(d.) Evidence that the utility company has been informed of the customer's intent to install an interconnected, customer-owned generator and that such connection has been approved. Off-grid systems shall be exempt from this requirement.

(e.) The STMWET application shall also include the following: A description of the methods that will be used to perform maintenance on the

STMWET and the procedures for lowering or removing the STMWET in order to conduct maintenance.

3. Safety Requirements

(a.) If the SSMWET or STMWET is connected to a public utility system for net metering purposes, it shall meet the requirements for interconnection and operation as set forth in the public utility's then-current service regulations meeting federal, state and industry standards applicable to wind power generation facilities, and the connection shall be inspected by the appropriate public utility.

(b.) The SSMWET or STMWET shall be equipped with an automatic braking, governing or feathering system to prevent uncontrolled rotation, over-speeding and excessive pressure on the tower structure, rotor blades and other wind energy components unless the manufacturer certifies that a braking system is not necessary.

(c.) A clearly visible warning sign regarding voltage shall be placed at the base of the SSMWET or STMWET. The sign shall contain at least the following:

(i.) Warning high voltage
(ii.) Manufacturer's and owner(s)/operator(s) name(s)
(iii.) Emergency contact numbers (list more than one number)

(d.) The structural integrity of the SSMWET or STMWET shall conform to the design standards of the International Electrical Commission, specifically IEC 61400-1, "Wind Turbine Safety and Design" and or IEC 61400-23 "Blade Structural Testing," or any similar successor standards.

4. Signal Interference

(a.) The SSMWET or STMWET shall not interfere with communication systems such as, but not limited to, radio, telephone, television, satellite or emergency communication systems.

5. Decommissioning

(a.) The SSMWET or STMWET owner(s) or operator(s) shall complete decommissioning within six (6) months after the end of the useful life. Upon request of the owner(s) or assigns of the SSMWET of STMWET, and for a good cause, the City Council may grant a reasonable extension of time. The SSMWET or STMWET will presume to be at the end of its useful life if no electricity is generated for a continuous period of twelve (12) months. All decommissioning expenses are the responsibility of the owner(s) or operator(s).

(b.) If the SSMWET or STMWET owner(s) or operator(s) fails to complete decommissioning within the period prescribed above, the City Council may designate a contractor to complete decommissioning with the expense thereof to be charged to the violator and/or to become a lien against the premises. If the SSMWET or STMWET is not owned by the property owner, a bond must be provided to the City for the cost of decommissioning each SSMWET or STMWET.

(c.) In addition to the decommissioning requirements listed above, the STMWET shall also be subject to the following:

(i.) Decommissioning shall include the removal of each STMWET, buildings, electrical components and any other associated facilities. Any foundation shall be removed to a minimum depth of sixty (60) inches below grade, or to the level of the bedrock if less than sixty (60) inches below grade.

(ii.) The site and any disturbed earth shall be stabilized, graded and cleared of any debris by the owner(s) of the facility or its assigns. If the site is not to be used for agricultural practices following removal, the site shall be seeded to prevent soil erosion.

e. Medium Wind Energy Turbine. A Medium Wind Energy Turbine (MWET) shall be considered a principal permitted use subject to special conditions in the following districts: I-1 (Light Industrial), I-2 (General Industrial) and OST (Office Service Technology). A MWET shall not be erected, constructed, installed or modified as provided in this ordinance unless City Council approval has been granted after a recommendation from the Planning Commission and appropriate building permits have been issued to the owner(s) or operator(s). All MWETs are subject to the following minimum requirements:

1. Siting and Design Requirements

(a.) "Upwind" turbines shall be required.

(b.) The design of a MWET shall conform to all applicable industry standards.

(c.) Visual Appearance

(i) Each MWET, including accessory buildings and related structures shall be mounted on a tubular tower and a non-reflective, non-obtrusive color (e.g. white, gray, black). The appearance of turbines, towers and buildings shall be maintained in working condition and free

of rust and corrosion by the owner of the MWET throughout the life of the MWET.

(ii) Each MWET shall not be artificially lighted, except to the extent required by the FAA or other applicable authority, or otherwise necessary for the reasonable safety and security thereof.

(iii) A MWET shall not be used for displaying any advertising (including flags, streamers or decorative items), except for reasonable identification of the turbine manufacture.

(d.) Vibration: Each MWET shall not produce vibrations humanly perceptible beyond the property on which it is located.

(e.) Shadow Flicker: The MWET owner(s) and/or operator(s) shall conduct an analysis on potential shadow flicker at any occupied building with direct line-of-sight to the MWET. The analysis shall identify the locations of shadow flicker that may be caused by the project and the expected durations of the flicker at these locations from sun-rise to sun-set over the course of a year. The analysis shall identify situations where shadow flicker may affect the occupants of the buildings for more than 30 hours per year and describe measures that shall be taken to eliminate or mitigate the problems. Shadow flicker on a building shall not exceed thirty (30) hours per year.

(f.) Guy Wires: Guy wires shall not be permitted as part of the MWET.

(g.) Electrical System: All electrical controls, control wiring, grounding wires, power lines and all other electrical system components of the MWET shall be placed underground within the boundary of each parcel at a depth designed to accommodate the existing land use to the maximum extent practicable. Wires necessary to connect the wind generator to the tower wiring are exempt from this requirement.

(h.) Location: If an MWET is located on an agricultural, commercial, industrial or public property that has an occupied building it shall only be located in the rear yard. In the case of a double frontage lot, the MWET may be located in an interior side yard. The MWET shall only be located in a General Common Element in a Condominium Development.

(i.) Height: The total height of an MWET shall not exceed one hundred fifty (150) feet.

(j.) Ground Clearance: The lowest extension of any blade or other exposed moving component of a MWET shall be at least fifteen (15) feet above the ground (at the highest point of the grade level within fifty (50) feet of the

base of the tower) and, in addition, at least fifteen (15) feet above any outdoor surfaces intended for human occupancy, such as balconies or roof gardens, that are located directly below the MWET.

(k.) Noise: Noise emanating from the operation of a MWET shall not exceed, at any time, the lowest ambient sound level that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a residential or agricultural use parcel or from the property line of parks, schools, hospitals and churches. Noise emanating from the operation of a MWET(s) shall not exceed, at any time, the lowest ambient noise level plus 5 dBA that is present between the hours of 9:00 p.m. and 9:00 a.m. at any property line of a non-residential or non-agricultural use parcel.

(l.) Quantity: No more than one (1) MWET shall be installed for every two and one-half (2.5) acres of land included in the parcel.

(m.) Setback and Separation:

(i.) Occupied Building Setback: The setback from all occupied buildings on the applicant's parcel shall be a minimum of twenty (20) feet measured from the base of the Tower.

(ii.) Property Line Setbacks: With the exception of the locations of public roads (see below) and parcels with occupied buildings (see above), the internal property line setbacks shall be equal to the total height of the MWET as measured from the base of the tower. This setback may be reduced to a distance agreed upon as part of the special use permit if the applicant provides a registered engineer's certification that the WET is designed to collapse, fall, curl or bend within a distance or zone shorter than the height of the WET.

(iii.) Public Road Setbacks: Each MWET shall be set back from the nearest public road a distance equal to the total height of the MWET, determined at the nearest boundary of the underlying right-of-way for such public road.

(iv.) Communication and Electrical Lines: Each MWET shall be set back from the nearest above-ground public electric power line or telephone line a distance equal to the total height of the MWET, as measured from the base of the tower, determined from the existing power line or telephone line.

(v.) Tower Separation: MWET tower separation shall be based on industry standard and manufacturer recommendations.

2. Safety Requirements

(a.) If the MWET is connected to a public utility system for net metering purposes, it shall meet the requirements for interconnection and operation as set forth in the public utility's then-current service regulations meeting federal, state and industry standards applicable to wind power generation facilities, and the connection shall be inspected by the appropriate public utility.

(b.) The MWET shall be equipped with an automatic braking, governing or feathering system to prevent uncontrolled rotation, over-speeding and excessive pressure on the tower structure, rotor blades and other wind energy components unless the manufacturer certifies that a braking system is not necessary.

(c.) Security measures need to be in place to prevent unauthorized trespass and access. Each MWET shall not be climbable up to fifteen (15) feet above ground surfaces. All access doors to MWETs and electrical equipment shall be locked and/or fenced as appropriate, to prevent entry by non-authorized person(s).

(d.) All spent lubricants, cooling fluids and any other hazardous materials shall be properly and safely removed in a timely manner.

(e.) Each MWET shall have one sign, not to exceed two (2) square feet in area, posted at the base of the tower and on the security fence, if applicable. The sign shall contain at least the following:

(i.) Warning high voltage
(ii.) Manufacturer's and owner(s)/operator(s) name(s)
(iii.) Emergency contact numbers (list more than one number)

(f.) The structural integrity of the MWET shall conform to the design standards of the International Electrical Commission, specifically IEC 61400-1, "Wind Turbine Safety and Design," IEC 61400-22 "Wind Turbine Certification" and or IEC 61400-23 "Blade Structural Testing," or any similar successor standards.

3. Signal Interference

(a.) The MWET shall not interfere with communication systems such as, but not limited to, radio, telephone, television, satellite or emergency communication systems.

4. Decommissioning

(a.) The MWET owner(s) or operator(s) shall complete decommissioning within six (6) months after the end of the useful life. Upon request of the

owner(s) or assigns of the MWET and for a good cause, the City Council may grant a reasonable extension of time. The MWET will presume to be at the end of its useful life if no electricity is generated for a continuous period of twelve (12) months. All decommissioning expenses are the responsibility of the owner(s) or operator(s).

(b.) Decommissioning shall include the removal of each MWET, buildings, electrical components and roads to a depth of sixty (60) inches, as well as any other associated facilities. Any foundation shall be removed to a minimum depth of sixty (60) inches below grade, or to the level of the bedrock if less than sixty (60) inches below grade. Following removal, the location of any remaining wind turbine foundation shall be identified on a map as such and recorded with the deed to the property with the County Register of Deeds.

(c.) All access roads to the MWET shall be removed, cleared and graded by the MWET owner(s), unless the property owner(s) requests in writing, a desire to maintain the access road. The City will not be assumed to take ownership of any access road unless through official action of the City Council.

(d.) The site and any disturbed earth shall be stabilized, graded and cleared of any debris by the owner(s) of the MWET or its assigns. If the site is not to be used for agricultural practices following removal, the site shall be seeded to prevent soil erosion.

(e.) If the MWET owner(s) or operator(s) fails to complete decommissioning within the period described above, the City may designate a contractor to complete the decommissioning with the expense thereof to be charged to the violator and/or to become a lien against the premises. If the MWET is not owned by the property owner, a bond must be provided to the City for the cost of decommissioning each MWET.

5. Application Requirements. The following information should be submitted with the proposed site plan.

(a.) Documented compliance with the noise and shadow flicker requirements set forth in this ordinance. Said documentation shall require, at a minimum, data reflecting ambient sound measurements taken over a two (2) week period, which shall include the location on the property where the measurements were taken. The method of measuring ambient sound levels and the location on the property where the measurements will be taken shall be approved by the City prior to the collection of the data.

(b.) Engineering data concerning construction of the MWET and its base or foundation, which may include, but is not limited to, soil boring data.

(c.) Anticipated construction schedule.

(d.) A copy of the maintenance and operation plan, including anticipated regular and unscheduled maintenance. Additionally, a description of the procedures that will be used for lowering or removing the MWET to conduct maintenance, if applicable.

(e.) Documented compliance with applicable local, state and national regulations including, but not limited to, all applicable safety, construction, environmental, electrical and communications. The MWET shall comply with Federal Aviation Administration (FAA) requirements, Michigan Airport Zoning Act, Michigan Tall Structures Act and any applicable airport overlay zone regulations.

(f.) Proof of applicant's liability insurance.

(g.) Evidence that the utility company has been informed of the customer's intent to install an interconnected, customer-owned generator and that such connection has been approved. Off-grid systems shall be exempt from this requirement.

(h.) A written description of the anticipated life of each MWET; the estimated cost of decommissioning; the method of ensuring that funds will be available for decommissioning and site restoration; and removal and restoration procedures and schedules that will be employed if the MWET(s) become inoperative or non-functional.

(i.) The applicant shall submit a decommissioning plan that will be carried out at the end of the MWET's useful life, and shall describe any agreement with the landowner(s) regarding equipment removal upon termination of the lease.

(j.) The proposed plan shall conform to the requirements of Section 2516 of the Zoning Ordinance: Site Plan Review (All Districts).

6. Certification and Compliance

(a.) The City must be notified of a change in ownership of a MWET or a change in ownership of the property on which the MWET is located.

f. Temporary Uses Related to Wind Energy Turbines. The following is permitted in all zoning districts as a temporary use, in compliance with the provisions contained herein, and the applicable WET regulations.

1. Anemometers

(a.) The construction, installation or modification of an anemometer tower shall require a building permit and shall conform to all applicable local, state and federal safety, construction, environmental, electrical, communications and FAA requirements.

(b.) An anemometer shall be subject to the minimum requirements for height, setback, separation, location, safety requirements and decommissioning that correspond to the size of the WET that is proposed to be constructed on the site.

(c.) An anemometer shall be permitted for no more than thirteen (13) months for a SSMWET, STMWET or MWET.

PART II.

Severability. Should any section, subdivision, clause, or phrase of this Ordinance b e declared by the courts to be invalid, the validity of the Ordinance as a whole, or in part, shall not be affected other than the part invalidated.

PART III.

Savings Clause. The amendment of the Novi Code of Ordinances set forth in this Ordinance does not affect or impair any act done, offense committed, or right accruing, accrued, or acquired or liability, penalty, forfeiture or punishment, pending or incurred prior to the amendment of the Novi Code of Ordinances set forth in this Ordinance.

PART IV.

Repealer. All other Ordinance or parts of Ordinance in conflict herewith are hereby repealed only to the extent necessary to give this Ordinance full force and effect.

PART V.

Effective Date: Publication. Public hearing having been held hereon pursuant to the provisions of Section 103 of Act 110 of the Public Acts of 2006, as amended, the provisions of this Ordinance shall be published within fifteen (15) days of its adoption by publication of a brief notice in a newspaper circulated in the City of Novi stating the date of enactment and effective date, a brief statement as to its regulatory effect and that a complete copy of the Ordinance is available for public purchase, use and inspection at the office of the City Clerk during the hours of 8:00 A.M. to 5:00 P.M., Local Time. The provisions of this Ordinance shall become effective seven (7) days after its publication.

MADE, PASSED, AND ADOPTED BY THE CITY COUNCIL OF THE CITY OF NOVI, OAKLAND COUNTY, MICHIGAN, ON THE ___ DAY OF _____, 2009.

_____
DAVID LANDRY, MAYOR

_____
MARYANNE CORNELIUS, CITY CLERK

Ayes:
Nayes:
Abstentions:
Absent:

NEWS ARTICLE

The Detroit News detnews.com

Monday, July 6, 2009

Wind power gathers speed

More communities look at adopting rules for turbines

Christina Stolarz / The Detroit News

West Bloomfield Township -- Michael Fogel is not a newcomer to the renewable energy initiative. In fact, his West Virginia home has been fitted with the green-friendly gadgets since the 1990s, with more on the way.

But the same cannot be said for his West Bloomfield Township home. Fogel, 67, is hoping township officials will soon implement a wind turbine ordinance so property owners can offset the increasing costs of electricity and heat supplied by fossil fuels.

"It's better late than never," he said. "If everybody would try to do a little bit, we'd contribute to the national energy problem in a great way. It's exciting to harness free energy."

Although Metro Detroit isn't identified by the Wind Energy Resource Zone Board, which was created by a 2008 state law, as a region with the most potential to harvest wind and create energy, a growing number of communities are trying to stay ahead of the "green movement" curve by developing wind turbine ordinances. Port Huron implemented a wind turbine ordinance in August 2007, followed by officials in Taylor and Ray Township, who adopted ordinances last year.

An ordinance will go before the Canton Township Board of Trustees in July; Waterford Township officials have created a rough draft that will likely be ready for a vote by the end of the year, and Howell officials are revising its ordinance regulations. Officials in Commerce, Harrison and West Bloomfield townships are researching wind turbines.

Those property owners in communities that don't yet have a wind turbine ordinance on the books may still be able to get one by seeking a variance from the zoning board of appeals, experts say.

"I think what we're seeing is the beginning of a wave of change," said Chuck Hersey, manager of environmental programs at the Southeast Michigan Council of Governments. "As we're trying to move toward a cleaner economy and a more sustainable environment, these various changes in how we produce and use energy ... make all kinds of sense. It's going to require some revisiting of how (governments) do things."

Hersey said the aim of a wind turbine ordinance, like all ordinances, is to set parameters to protect neighbors and a community's character. While every community will set its own guidelines, most will regulate height, noise frequency and maximum wind speed.

Despite some communities' efforts to adopt such ordinances, many say few residents have taken advantage because the structures are expensive. They start at around $6,000, but costs could come down as new systems come out on the market and advances are made to the technology, said Wayne Beyea, associate director of citizen education with the Michigan State University Land Policy Institute.

"It's an innovation explosion right now," he said.

That's why Port Huron city planners adopted their wind turbine ordinance that allows for structures in any zone with a special approval use permit as long as the property is at least 2 acres. The structures must have an automatic braking system.

They are researching rooftop-mounted wind turbines to determine if those should be included in their ordinance, which allows only for ground-standing towers, said Kimberly Harmer, planning and community development director. Those may be better suited for residential homes instead of the towers, she said.

Only one wind turbine has been installed in Port Huron: St. Clair County Community College installed a 65-foot tower in September, Harmer said. Still, she said city officials are happy to be ahead of the curve since wind turbines are a fairly new concept.

Canton Township resident Jim Demarest hopes the township will adopt an ordinance. The manufacturing representative who sells heat-treating equipment said he would like to purchase one within the next five years.

"Hopefully, in the next five years, GM will have a nice electric vehicle," said Demarest, 37. "I could be charging my batteries when the car is parked here rather than being on the grid. It makes good sense to have wind and solar energy charging my battery."

In Ray Township, officials adopted their ordinance last fall after receiving a lot of inquiries from residents, Supervisor Charles Bohm said. While they stand behind the ordinance -- which allows turbines as a special land use to stand at a maximum height of 150 feet -- the problem lies with the economy.

Bohm said no one has applied to install a wind turbine because they are expensive. The city of Taylor has already seen benefits from its 45-foot-tall, 2.8-kilowatt wind turbine at Heritage Park Petting Farm on Pardee. Not only has it educated children, but it has also cut the electric bill by about 40 percent to 50 percent combined with the solar panels, said Bob Mach, superintendent of building maintenance, vehicle, compost and alternative energy. "Energy costs are so high, everyone is trying to jump on the bandwagon. It's the right thing to do," Mach said.

cstolarz@detnews.com (313) 222-2650

Find this article at:
http://www.detnews.com/article/20090706/LIFESTYLE14/907060320/Wind-power-gathers-speed

☐ Check the box to include the list of links referenced in the article.

IMPLEMENTATION COMMITTEE
DRAFT MEETING MINUTES
MAY 6, 2009 - EXCERPT

EXCERPT FROM DRAFT MINUTES

IMPLEMENTATION COMMITEE
City of Novi Planning Commission
MAY 6, 2009 at 6:00 p.m.
Novi Civic Center – Mayor's Conference Room
45175 W. Ten Mile, Novi, MI 48375
(248) 347-0475

Roll Call
Attending: Victor Cassis, Michael Meyer, Mark Pehrson and Leland Prince
Staff Support: Kristen Kapelanski
Also attending: Barbara McBeth

Discussion Items
Discussion of Possible Wind Energy Ordinance
Discussion of wind energy ordinance proposed by staff regarding regulations for wind turbine location, installation and operation.

Chair Meyer stated the Wind Energy Ordinance is the next item for consideration. Chair Meyer stated that his reading of the materials indicated that there may not be sufficient wind in this part of Michigan and inquired about the person in the news promoting this technology.

Member Cassis said the person is T. Boone Pickens who is spending hundreds of millions of dollars in advertising and lobbying in wind energy and gas technology. Member Cassis said Mr. Pickens has gas wells across Texas.

Deputy Director Community Development Barbara McBeth stated we also have this interest in Novi too, including a company that wanted move to Novi to manufacture wind turbines.

Planner Kapelanski stated that we had a resident call the other day to ask what kind of regulations we have in place for wind turbines.

Planner Kapelanski stated that she would give us a quick overview of the proposed ordinance. Staff is proposing this ordinance because we expect to get more and continued interest for people proposing wind turbines for private residential homes and businesses. As Chair Meyer mentioned, there is not adequate wind currently in Novi for utility-grade wind turbines. The ordinance addresses three types of turbines, with different standards for each type. The small tower-mounted wind energy turbine would be a permitted use in all districts, with a height not to exceed 100 feet, would be required to be in the rear yard with the setback equal to the height of the tower. The small structure-mounted wind energy turbine would be mounted on the roof or side of a business or residence. The structure-mounted turbine could not exceed 15 feet above the roof line, be required to be setback at least 15 feet from all property lines. This is proposed to be a permitted use in all districts.

The medium wind energy turbines would be larger and would probably look like what the commission members have seen in the western US. These turbines would have a height not to exceed 150 feet and would be limited to one turbine for every 2.5 acres. A rear yard location is

required, with a setback equal to the height of the tower and additional setbacks adjacent to occupied buildings. These medium-size turbines would be Special Land Uses in the I-1, I-2 and OST Districts only.

Ms. Kapelanski stated that staff put together this ordinance based on ordinances that have been passed in Ottawa County and Huron County. The State of Michigan Department of Labor of Economic Growth also has a sample ordinance. Staff expects that the Michigan Association of Planning would be coming out with a sample ordinance soon and we may incorporate additional regulations as further review takes place. Staff will seek out wind energy industry representatives to see if there is anything we might be missing in that regard.

Member Pehrson stated that another type of turbine for consideration is a cylindrical, rotating type, the kind that rotates on the axis of the pole. It is probably more relevant for residential uses then the radial/spherical type. The ordinance does propose a measurement standard pursuant to shadow flicker and Member Pehrson would like to see what the plusses and minuses are for that rating. Like an LED light, shadow flicker can trigger epileptic seizure.

Member Pehrson suggested that staff speak with people in the industry. The types of materials used in the tower structure should be regulated, as to the permanency of the paint or the coating on the outside of the metal surface to prevent rust from forming. Member Pehrson's experience is that there is a quality difference in the manufacturing process and suggests adding a paragraph to the ordinance requiring maintenance by the homeowner or property owner.

Member Pehrson stated that, based on the arguments he heard a few years ago regarding location and height of cell towers, this ordinance may also generate controversy. Member Pehrson asked if the ground clearance standard proposed in the ordinance is to the lowest point of the rotational blade itself.

Ms Kapelanski answered, that is the correct standard.

Member Pehrson mentioned a type of turbine with a guard around the blades, similar to an oscillating fan with a cage around it, which can be provided to protect birds. Typically, birds are smart enough to avoid nesting on the turbine, but in this area devoid of wind, Member Pehrson questioned how many people are going to spend $20,000 to $30,000 to put it in. Member Pehrson asked about the number of turbines permitted: In the small turbine category, one is permitted per parcel, but for the larger turbines, does the ordinance allow two per parcel.

Planner Kapelanski stated one medium size turbine is permitted for 2.5 acres. For structure mounted turbines, two would be permitted per building.

Member Pehrson confirmed that for the small tower mounted turbine, one is permitted per parcel.

Member Kapelanski answered, that was correct.

Member Pehrson said he presumed that would be more for residential than the industrial use. Member Pehrson asked if the ordinance would allow turbines to be mounted to a building structure.

Member Kapelanski answered yes, up to a height of 15 feet above the roof line. The Building Division will review for structural concerns.

Member Pehrson asked about the electrical equipment use, and considered adding some standards or size limitations for a control enclosure box, the generator source, or the transmitter than is set to the grid. These units can be large in size. Member Pehrson suggested adding standards for a voltage warning to be placed on all devices. Member Pehrson reviewed the drawings and saw guy wires, and inquired if all structures will not be permitted to use guy wires.

Ms. Kapelanski answered that guy wires would not be permitted.

Member Pehrson said that one of his last comments is on the decommissioning. Member Pehrson would like to see a requirement for the wind generator to be removed much sooner than 12 months after the end of the useful life. A better definition for how and what constitutes useful life is needed. On page 5, sub-paragraph F, the very last sentence, Member Pehrson confirmed that "wires necessary to connect the wind generator to the tower wiring are exempt from this requirement", means the wiring will be placed underground.

Ms. Kapelanski answered that Member Pehrson is correct.

Chair Meyer stated that safety seems to be a key issue.

Member Cassis inquired if we are only proposing wind turbines would be permitted in the I-1 and I-2 districts.

Ms. Kapelanski answered Member Cassis by saying that the I-1 and I-2 districts would allow turbines taller than 100 feet; other districts would allow shorter wind turbines.

Member Cassis said that this discussion was negated at the beginning by saying we do not have wind in Novi. It is really not practical and the person that called should be asked if they every investigated the expense to putting in a wind turbine as to what utility they can get out of it and what saving are they going to get out of it. Member Cassis said we might even suggest solar to the person.

Ms. Kapelanski stated that we have had calls investigating the use of solar panels in Novi. Right now, if someone wants to put up a solar panel, the Building Division will review building permits, but we do not have any zoning ordinance standards.

Member Cassis said that solar is more practical in Novi and more efficient. It is also less costly because it generates more electricity. Mr. Cassis is familiar with solar because he has studied this technology. Solar panels are found throughout Michigan. There are differences in solar technology; one is called thin film, which is not made of thick glass. Two or three companies supply this technology. It is less costly and it transmits electricity more efficiently. It can be installed on the roof of the residence does not cause structural problems.

Member Cassis believes solar is better than wind is because of the resident complaints regarding basketball hoops and cell phone towers. Noise is another thing. Mr. Cassis mentioned how many items we put outside of our homes: air compressors, filters for pools, generators for power and satellite dishes. Member Cassis asked if we should introduce this ordinance for a few people that want a wind turbine, without considering a practical application, cluttering our neighborhoods, and noise considerations.

Ms. Kapelanski said that the research found that the expected noise generated is about 5 decimals above everyday, neighborhood-type noise.

Member Cassis is thinking about maintenance, looks, noise and the fact that it is not really that practical in our area.

Member Pehrson stated that there are always going to be the people that want to be the first to have the technology. New technologies will come along and efficiencies will go up in wind, solar and geo-thermo to eventually be comparable to what is paid per kilowatt. This ordinance will put a framework around the idea, and as we learn more we can tighten up the requirements.

Member Cassis used recycling as an example - it is costly to recycle and uses our resources. Member Cassis said we have to be very careful when we introduce a new ordinance with regard to the practicality of the technologies and the cost.

Ms. Kapelanski said that our main goal in introducing this ordinance is to have standards and regulations in place when someone comes in to put up a wind energy turbine. The ordinance will put a process in place, specify setback and height standards, as well as maintenance standards so staff can assist the public with these expected requests, and so we do not miss something in the process of review.

Chair Meyer said that he thinks the stated intent is just excellent: to promote the safe, effective and efficient use of the wind energy turbine, to preserve and protect public health, safety, welfare and quality of life; and realizing the potential adverse impact of it and establishing standards and procedures by which the design, engineering, installation, operation and maintenance will be governed. Chair Meyer said the intent of the ordinance is clear for anyone curious to know. Chair Meyer asked for clarification regarding the statement "an up-wind turbine should shall be required"; what is a down-wind turbine.

Ms. Kapelanski said she has been researching various types of wind turbines. Most of the ordinances she reviewed recommended an up-wind turbine and she has not yet found out the difference, but will continue her research.

Chair Meyer stated that he had to leave at 7:15 p.m. and wished everyone a good evening.

Deputy Director Community Development, Ms. McBeth stated that some of these ordinance provisions might be open for debate. Perhaps the committee likes the idea of wind turbines in the light industrial, the general industrial and the OST districts, but thinks the residential district standards may allow a structure that is too tall. Ms. McBeth asked Ms. Kapelanski to find out if there could be a lower height limit in residential, but still able to capture the wind. Additional provisions may be added to allow uses permitted subject to Special Land Use approval.

Member Cassis said that he would think I-1 and I-2 would be possibilities that he would consider. But to set a standard, we can always say they are not allowed in residential. For light or heavy industrial, we can make standards. We can always tell the residents that we do not allow wind energy turbines.

Ms. Kapelanski said there would be that option: we could allow wind turbines subject to Special Land Use approval, or we could not allow them in residential districts or other districts.

Member Cassis said maybe the Planning Commission or the City Council will say, yes we want them. But in his view, there are too many things that residents put outside of their homes.

Member Pehrson mentioned that a wind farm was proposed along Martha's Vineyard, out in the sea 75 miles, where you couldn't even see it. People objected to that, and people in Novi may object to 100 foot tall wind turbines in the residential district.

Member Cassis said if we propose this ordinance to the people of Novi, we will have 300-400 people here.

Ms. Kapelanski said those are all considerations in trying to develop a new ordinance.

Ms. McBeth said that Ms. Kapelanski will look into this ordinance some more and consider if it may be appropriate to install a wind turbine if the parcel size is at least an acre, or as a part of a farm, or is located a certain distance to the neighbor.

Member Cassis said that farmers up north to the west have windmills.

Ms. McBeth said that she was thinking about the ITC building and, while they have not proposed it, maybe would want to put a wind turbine on their building. That building is already 100 feet tall and another 15 feet would be permitted under the ordinance standards.

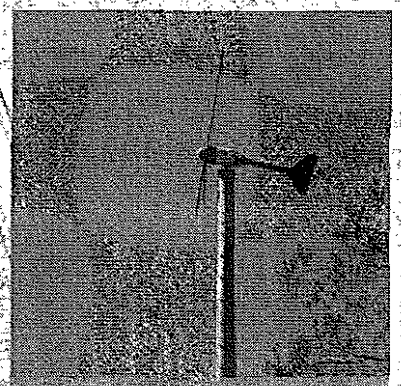
Member Cassis that there are areas that he would go along with.

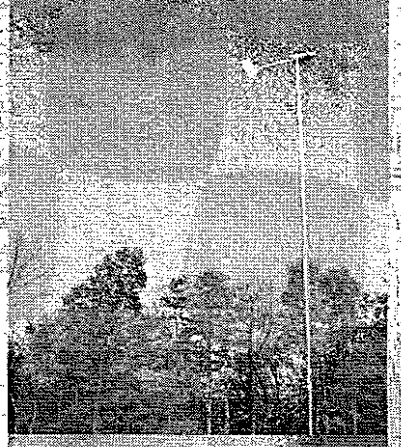
Ms. Kapelanski said that the next regularly scheduled meeting is November 4, 2009 and we will send out a reminder. Planner Mark Spencer is also working on some updates to the residential zoning or use options, and we may schedule an additional meeting of the Implementation Committee before November.

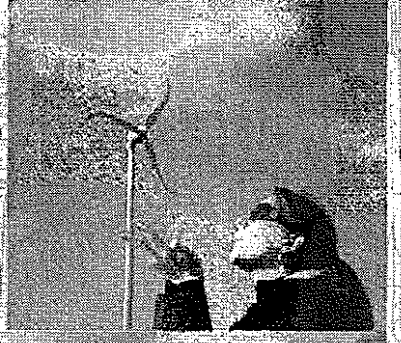
Ms. McBeth asked if the committee found this meeting useful for discussion of text amendments, or is it preferable to present amendments to the Commission as a whole?

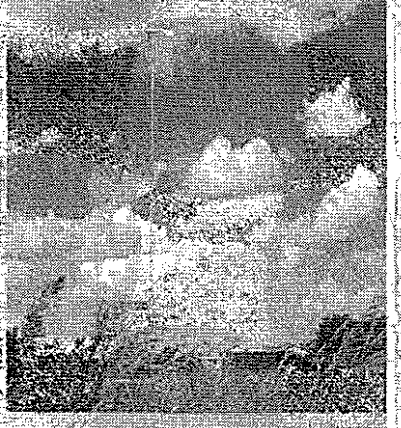
Member Pehrson stated that is was useful to have the discussion in this setting so the committee is able to throw in some ideas. Member Pehrson suggested that another meeting can be scheduled by staff, as needed.

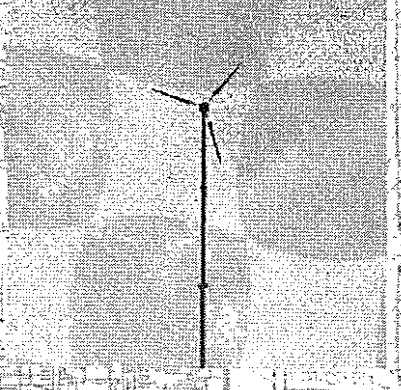
AMERICAN WIND ENERGY ASSOCIATION INFORMATION











In the Public Interest
How and Why to Permit for Small Wind Systems

A Guide for State and Local Governments

American Wind Energy Association
September 2008

"We ought to have a law that allows homeowners and small business people to put up photovoltaic generators and small windmills and any other new sources of widely distributed generation that they can come up with."
- **Al Gore,**
March 19, 2007
CNN Glenn Beck Show

"Bad zoning not only scares away potential customers, but also dealers - the local small businesses that distribute, install, and maintain small wind systems."
- Mike Bergey, Bergey WindPower Co.

"Planners can encourage efficient energy use, diversification of energy supply, and emissions reductions through their influence over the built and natural environments - including both where and how we build, and where and how we preserve open spaces."
- **American Planning Association.**
Planning and Climate Change: Mitigation and Clean Energy Strategies.
www.planning.org/energy/index.htm

In the Public Interest: How and Why to Permit for Small Wind Systems

A Guide for State and Local Governments

The greatest challenges to small-scale renewable energy are not technical, but rather financial, political, and regulatory. Confusing, inconsistent or even absent permitting processes discourage the very people a forward-thinking community would want to enable: those with the motivation and resources to generate their own clean electricity.

Small wind turbines allow homeowners, farmers, small business owners, and public facilities to generate their own clean, safe, and reliable energy for on-site use. Though thousands of towns and counties already do, many have not yet included small wind systems in their zoning codes to allow their use. The reason is often no more than a lack of familiarity with the technology, resulting in overabundant care to avoid setting a controversial precedent. This often renders the permitting process the single most daunting obstacle for would-be consumers and prevents the installation - and associated public benefits - of thousands of small wind systems.

The good news is this is easy to fix. Making the permitting process affordable, streamlined, and accountable is in the best interest of the consumer, environment, and community. This guide explains why, and identifies best practices for local governments to balance the interests of property owners and the community.

Ron Stimmel
September 2008

American Wind Energy Association
rstimmel@awea.org
(202) 383-2546

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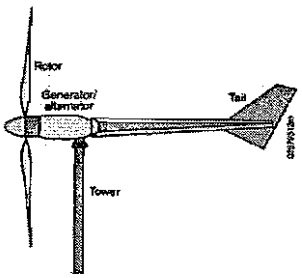
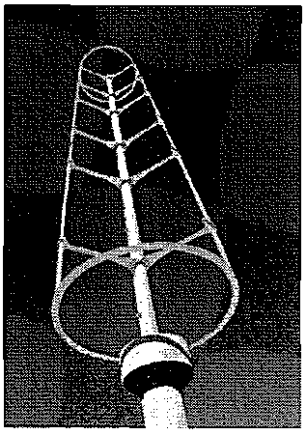


Basic parts of a traditional, Horizontal-Axis Small Wind System



Vertical-Axis Turbine

Skystream 1.8kW turbine aesthetic comparison to lampposts

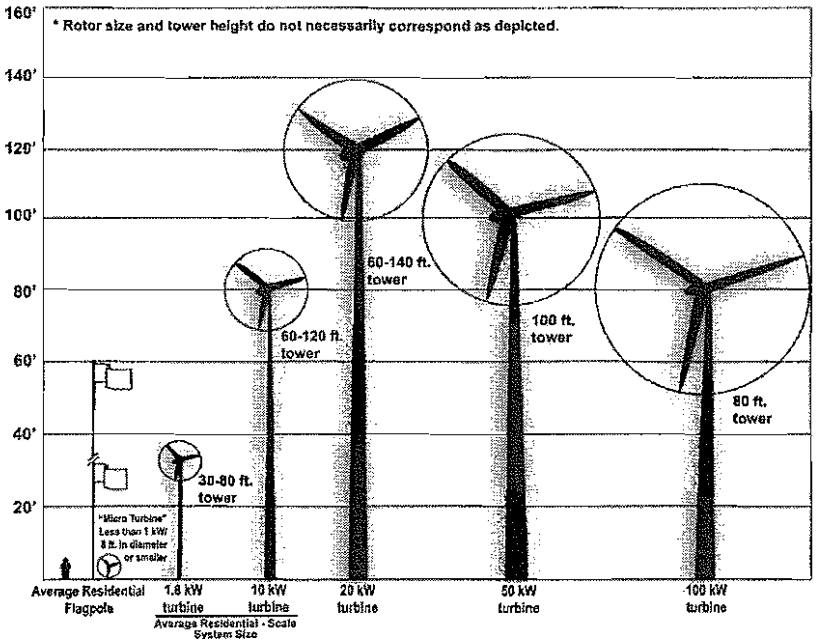
INTRODUCTION

What Are Small Wind Turbines?

A small wind turbine is a device that produces electricity from wind. Moving air causes the turbine to rotate, which generates clean, emissions-free energy that can be used to power a home, farm, school, or small business.[1] Though most small wind turbines look like a miniaturized, "back yard" version of the large, utility-scale, three-bladed turbines, the industry encompasses over 200 different models and they can vary widely in appearance. A small wind turbine is technologically advanced but mechanically simple, with only two or three moving parts. Most feature three blades of 2-15 feet in length, a generator located at the hub, and a tail. The turbine is mounted on a steel tower 35-140 feet high, which is designed as a freestanding monopole (like a street light), a lattice tower (like a radio tower), or a guyed monopole (like a street light with support cables from mid-tower to the ground). (See p. 10 for illustration)

Some models eliminate the traditional propeller-shaped blade design and instead feature a cylinder-like component that revolves similarly to a barbershop pole or corkscrew. Systems of this configuration are known as "vertical axis" turbines because the plane of rotation is perpendicular, or vertical, to the ground.

The technology has advanced considerably in the recent years, making small wind turbines quieter, more reliable, and better able to blend in with surrounding aesthetics. A forthcoming (2009) program to certify small wind turbines to a safety, performance, sound, and reliability standard will further promote high performance and increase consumer confidence.[2]



[1] "Small wind system" encompasses not only the turbine, but the tower, foundation, and wiring equipment often necessary for an installation. "Small wind turbine" and "small wind system" are sometimes used interchangeably.

[2] The Small Wind Certification Council (SWCC) is an independent, third-party program that will, upon its introduction in 2009, certify small wind turbines tested to a performance, safety, and reliability standard. Proposed and enacted incentives for small-turbine consumers at state and federal levels have already begun to account for this impending program by making future certification a requisite for eligibility. Other states, such as California and New York, have incorporated their own criteria for eligibility into their incentive programs in order to grant incentives only to products that meet certain performance and safety conditions.

How Are They Used?

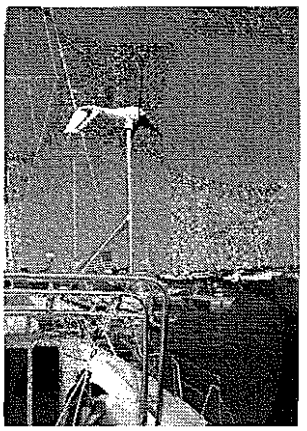
Tens of thousands of homes, farms, small businesses, schools, and other institutions throughout the country use small wind turbines to lower or eliminate their electricity bills. Uses are diverse and quite similar to those of solar photovoltaic panels. The two technologies are in fact natural complements (wind resources are strongest in the winter and spring while solar resources are strongest in the summer) and are often used together in hybrid systems.

Some small wind systems connect to the utility grid while others charge batteries for backup power for remote, stand-alone applications like cabins or even sailboats. Connecting to the electric grid allows a turbine owner to use electricity from the local utility when the wind does not blow, but also allows any surplus electricity - energy produced in excess of consumption, such as when winds are strong and usage is low - to be sent back into the grid and used by a neighbor. But unlike large turbines that power entire cities, small wind systems are used to produce power primarily on-site for a single user.

Common Applications

On- or Off-Grid...

- Single-Family Homes
- Businesses
- Farms
- Institutions
- Schools
- Government Buildings
- Industrial Sites
- Military
- Communications Systems



0.4 kW turbine on a sailboat

What Can Neighbors and the Community Expect?

After installation, which takes about two to 10 days to complete, life with a turbine in the neighborhood is largely uneventful. Visual assimilation of the new turbine is similar to neighbors becoming accustomed to a new building addition, landscaping project, or the removal of a prominent tree. The best way to assess the impact is to visit an actual installation. With approximately 10,000 turbines sold in the U.S. every year, and in all 50 states, they are relatively easy to locate. Contact a manufacturer or local installer to see an installation first-hand. (See www.awea.org/smallwind/smsyslst.html)

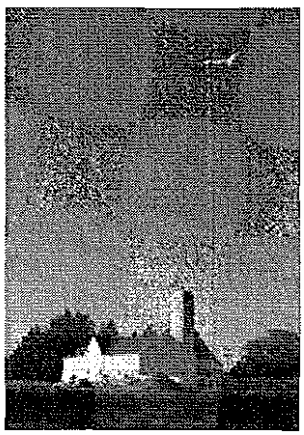
Responsibilities of Turbine Owners

The small wind industry is indeed small, and every installation potentially affects public perception of not only small wind turbines, but of renewable energy as a whole. Each installation is, in essence, an ambassador of the industry. It is in the long-term, self interest of the industry and consumers alike that owners exercise good judgment and courtesy toward their neighbors and community. Doing so often includes informing neighbors, in writing, of a proposed installation and educating them about potential impacts - both real and perceived - of a small wind turbine (see www.awea.org/smallwind/toolbox2/INSTALL/building_permits.html for a sample letter to neighbors).

For fundamental reasons though, topography and the wind itself largely determine precisely where and how high a turbine must be installed. Sometimes there is no way to avoid these physical constraints other than to place or elevate the turbine into a more aesthetically sensitive place on a property. But a turbine owner should make a deliberate effort to take all reasonable measures to minimize impacts on neighboring areas.

"Everybody knows the good things about using renewable energy. I wanted to set an example down here and perhaps encourage others to do the same thing."
- Small-turbine owner Chuck Heide, Somers, WI

"Never before has the general public been so interested in solar and wind energy, nor has the potential for political support ever been so high."
- Ingrid N. Kelley, Chair, Environment, Natural Resources and Energy Division, American Planning Association



Bergey WindPower
10kW turbine

"The way we plan urban areas significantly affects the energy usage of individual building sites. Appropriate site design standards and building codes can encourage energy conservation and the use of renewable energy technologies on site."
- American Planning Association[3]

The "Power" of Good Zoning

Precedent: Commonplace or "Bleeding Edge"?

Understandably, community leaders are sometimes hesitant to enact regulations that appear to be first of their kind. But with tens of thousands of small wind turbines in the U.S., in every state, zoning officials need not fear being on the "bleeding edge" of a new movement. Thousands of townships, counties, and cities have had small wind zoning regulations on the books for decades, setting a substantial precedent for others to follow.

Below is a very small sample of localities with small wind zoning ordinances:
Great Falls, MT
San Bernardino County, CA
Clarke County, VA
Currituck County, NC
Kern County, CA
Long Lake Township, MI
Norwich, VT
Ocean Gate, NJ
Mason City, IA
Wicasset, ME
Rockingham County, VA
Denver, CO
Thetford, VT
Eliot, ME
Henry County, GA
Cape Elizabeth, MA
Rochester, NY
Tippecanoe County, IN
San Francisco, CA
Chicago, IL
Fillmore County, MN
Weber County, UT

Why Zone for Small Wind Systems?

Your family's electric bill has climbed to $400 per month and you expect it go higher. You are worried how global warming will affect your kids. And you don't want to wait around for others to fix these problems. Generating your own, clean power sounds like a great idea, and something you may even be able to afford with the rebate program your state offers for small wind turbines.

So you spend months researching equipment, your neighborhood's wind resource, and ways to pay for a new turbine. All your ducks are finally in line, but when you apply for a building permit, the county office has never heard of small wind systems, or if they have, only of rumors that they are noisy and kill birds. This technology is also nowhere to be found in the zoning code and it is hard for the zoning office to find out information about how to treat this unique structure. Or, since the closest thing the zoning office has dealt with before is large, utility-scale turbines, your 5 kilowatt turbine is treated the same as a 50,000 kilowatt power plant and the permitting requirements and costs are impossibly out of reach.

[3] "Policy Guide on Energy." American Planning Association, April 2004. http://www.planning.org/policyguides/pdf/Energy.pdf See also: "Planning and Climate Change: Mitigation and Clean Energy Strategies." American Planning Association. http://www.planning.org/energy/index.htm. Accessed May 2008.

[4] For a list of states and incentives available for small wind systems, see the Database of State Incentives for Renewables & Efficiency at http://dsireusa.org.

Left without a solution readily at hand, the permit is denied, and you are stuck with high electricity bills and a dependency on conventional fuels. Your community misses the opportunity to increase clean, in-state generation, reduce the pressure on a stressed power grid, and employ local businesses to sell, install, and maintain these systems.

Simply listing small wind systems as an allowed use (such as an accessory, permitted, or conditional use) can avoid this scenario that happens with startling frequency around the country.

Other reasons to permit for small wind systems include:

To Be Prepared. Many states[4] carefully craft incentive programs to help consumers purchase small wind systems only to find that local zoning ordinances stand in the way of the systems' installation. Communities may wish to design zoning policy to anticipate and accommodate small wind installations, especially in states that try to encourage them.

To Retain Autonomy. The states of California, Nevada, Oregon, Wisconsin, Michigan, Vermont, and New Hampshire have been the first to create statewide rules for the permitting of small wind systems. Whether to follow suit or preserve local autonomy, knowing how best to deal with this technology in your community is good long-term strategy.

To Conserve Public Resources. Case-by-case application reviews and hearings cost time and money. Proactively planning for small wind installations can be a rewarding investment.

For the Personal Benefits. Owners of small wind systems enjoy:

- Personal energy independence
- Free electricity after recouping costs
- Relief from high and volatile prices of other forms of electricity
- Reliable electricity
- Ability to support clean energy and fight global warming in a tangible way
- Increased property values

For the Public Benefits. Though the power generated by a small wind system is used only by a single residence or facility, the benefits of wind power extend to the entire community. Community benefits include:

- Reduced pressure on the local electricity grid
- Increased security: can provide back-up power to strategic applications like police stations or hospitals for "hazard mitigation" purposes[5]
- Increased local energy independence
- Increased property values
- Enhanced reliability and power quality of the power grid
- Reduced peak power demands
- Increased in-state electricity generation
- Diversified energy supply portfolio
- Reduced pollutants from traditional forms of energy
- Increased market competition from more consumer choice
- Increased visible indicators of community support for clean energy
- Increased regional economic growth

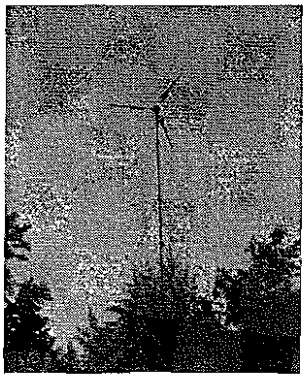
A turbine's productivity is largely in the hands of zoning officials.

"Distributed small wind energy systems... enhance the reliability and power quality of the power grid, reduce peak power demands, increase in-state electricity generation, diversify the sate's energy supply portfolio, and make the electricity supply market more competitive by promoting consumer choice."
- **California Government Code**, Section 65891.13 (a)(2) www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=65001-66000&file=65892.13

Manufacturers ask:
"In which state should I base my operations?"

The answer is:
"States with the best policies."

[5] Sandia National Laboratory has begun development of strategic Energy Surety Microgrids http://www.sandia.gov/news/resources/releases/2006/microgrid.html

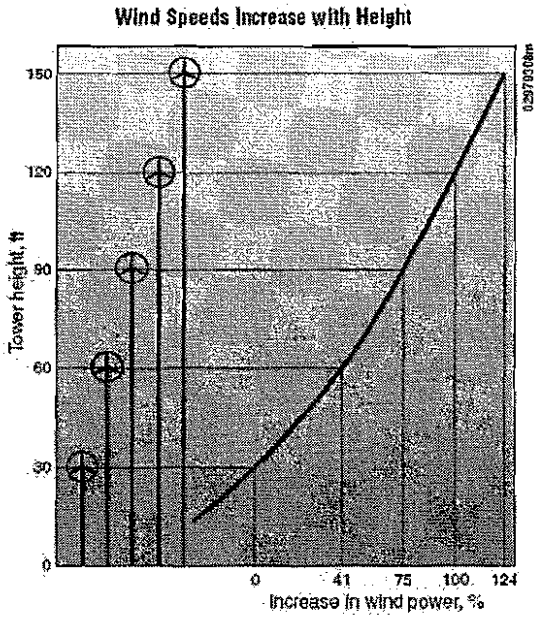


Ventera 10kW turbine

The Importance of Height

Why Do They Need To Be Tall?

A tall tower is the single most important factor in the economic viability of a small wind system. Tall towers enable turbines to access faster and better quality winds, and even small increases in wind speed translate to exponentially more energy the turbine can generate. In other words, a taller tower means far more - and cheaper - energy.

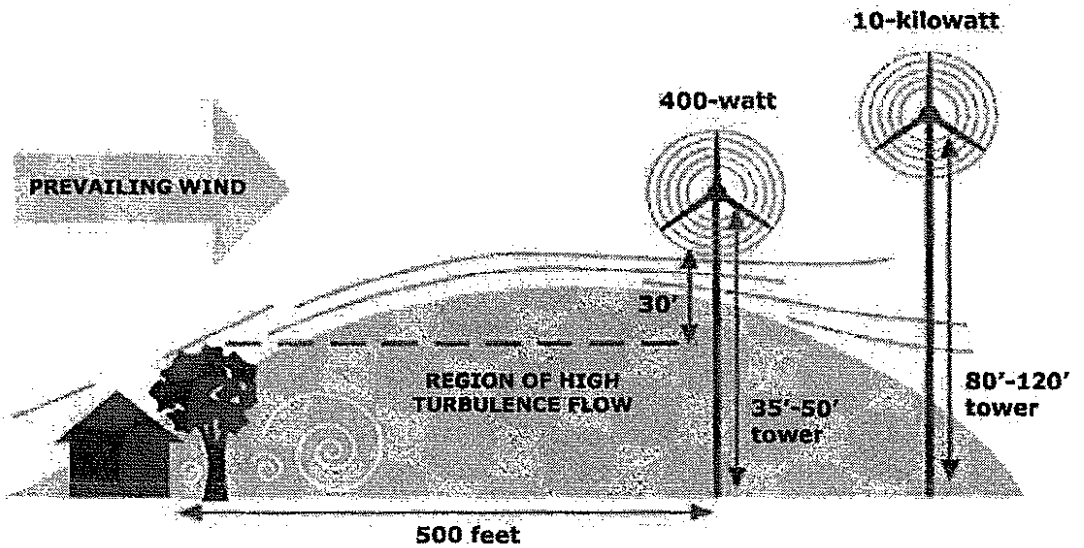


The best sites for turbines are those where the wind is least obstructed, which is often the highest point on a property. The bottom of the turbine rotor should clear the highest wind obstacle (rooftop, mature tree, etc.) within a 500 foot radius by at least 30 feet. Doing so ensures the turbine reaches consistent, fast wind speeds and prolongs the life of the turbine by avoiding stressful air turbulence.

Putting a turbine on too short of a tower is like placing a solar panel in the shade.

Restrictive Zoning Rules Can Undermine State Law

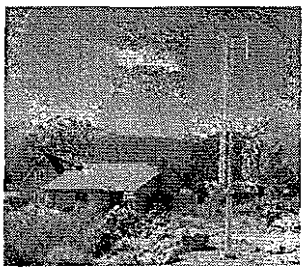
Several states offer financial incentives to promote small wind turbines and clean energy. But zoning height limitations can prevent turbines from generating any meaningful amount of energy, thwarting the intent of the state incentive.



For a 10kW residential-scale turbine

Tower height (feet)	Wind speed (mph)	kWh/year	System cost	Incremental cost from 60'	Incremental energy output from 60'	Incremental energy ÷ incremental cost = ROI*
60	7.3	2,709	$48,665	---	---	---
80	9.3	6,136	$49,841	$1176 or 2.4%	226%	226% ÷ 2.4% = 94 to 1 ROI
100	10.7	9,338	$51,346	$2681 or 5.5%	344%	344% ÷ 5.5% = 63 to 1 ROI

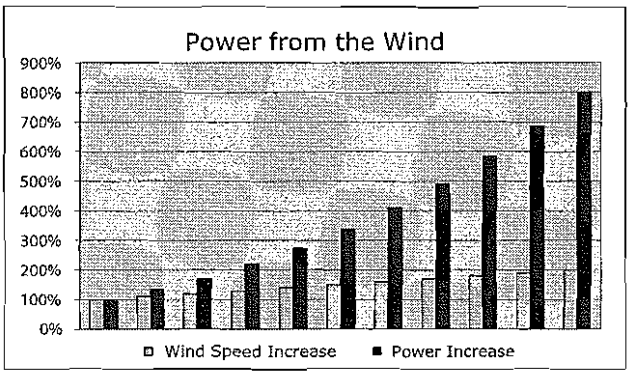
* = Return on Investment Mick Sagrillo, AWEA Windletter, January 2006



Mariah Power Windspire
1kW turbine

Overly conservative zoning height restrictions therefore cost the owner money - and a lot of it. They can also mean more sound, since taller towers raise the generator high above the ground, diluting sound considerably. Sound decreases four-fold with every doubling of distance from the turbine (including distance above the ground) so taller towers are better for their owners as well as neighbors. (See also "Sound" p. 11.)

For zoning officials, the importance of strong winds also means that tower height cannot be compromised as a gesture to neighbors concerned about the visibility of the turbine. "Hiding" a turbine from neighbors using a shorter tower almost always means hiding it from the wind, too.



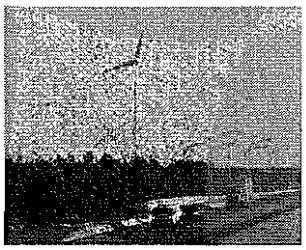
Bergey WindPower
10kW XLS turbine

Nor do two shorter installations make an acceptable substitute for a single, taller one. A tower alone can comprise 50% or more of a system's total cost, so multiple, shorter turbines (on multiple towers) cost the owner far more than a single, taller system. (See also "Multiple Turbines," p. 14.)

It is also important to keep in mind that a turbine's generator size (generating capacity, measured in kilowatts or kW) has little, if anything, to do with its tower height. Sometimes zoning regulations mistakenly limit tower heights based on the size of the turbine's capacity, thinking that a 2kW turbine, for example, always corresponds to a 40 foot tower. This is not the case. Appropriate tower height is matched to a turbine depending on surrounding terrain, trees and buildings, and wind resource. Therefore, tower height restrictions, if any, should only reflect sound and safety concerns rather than be designed to correspond to a system's generating capacity. Most often, in fact, established sound and setback requirements negate the need even to mention height in regulations for small wind systems.

Southwest Windpower "Air" on lamppost

Many existing height limitations still exist based upon the fact that 100 years ago water pressure in firefighters' hoses could not reach higher than 35 feet.



EnergiePGE 35kW turbine

Flagpoles, lamp posts, and utility poles are allowed in front of schools and parking lots among cars and people because they are engineered structures, just like wind turbine towers. They should all receive the same treatment under law.

Issues

The following issues are key components of land use law, as well as public acceptance of small wind systems, and are critical for the successful placement of a turbine:

1. **Setback Distances and Height**
2. **Lot Size**
3. **Aesthetics**
4. **Sound**
5. **Property Values**
6. **Insurance**
7. **Abandonment**
8. **Multiple Turbines**
9. **Urban and Building-Integrated Installations**
10. **Potential of Structural or Electrical Failure**
11. **Soil Studies**

1. Setback Distances and Height:

To balance against the need for tall towers (see p. 6), good practice requires that a turbine in a residential district be "set back" from a property line some given distance. (For commercial or other zones, this distance is often considerably less, even zero, since in these areas affected parties seldom exist immediately outside a property line.) The mandated distance in residential zones should reflect valid concerns for property rights of abutting neighbors, as well as those of the turbine owner.

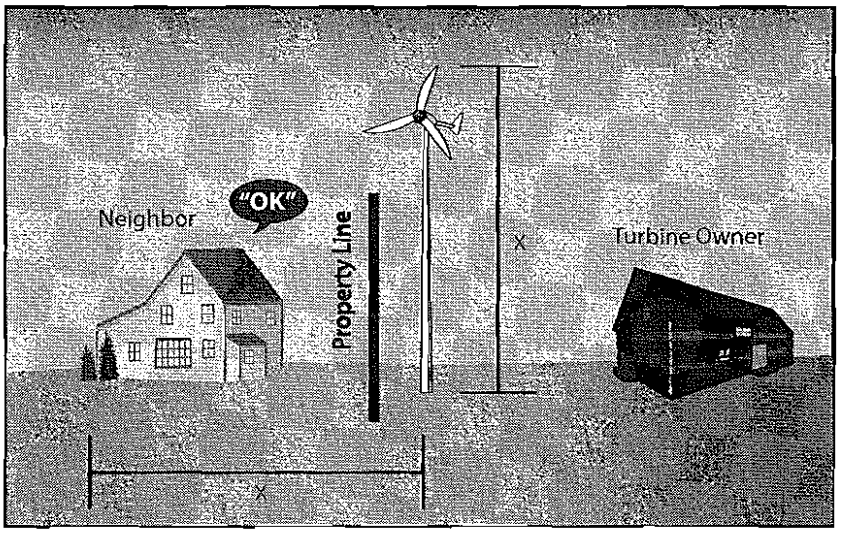
This most commonly translates to the tower height plus the length of one blade (the turbine's "total extended height") from the property line, inhabited neighboring structures, utility lines, and/or road right-of-ways. This distance should suffice so long as the tower is professionally engineered and/or the installer provides engineered plans of the tower, the foundation, and the system does not exceed the definition of nuisance noise as established in the zoning code. (See also "Sound," p. 11.)

Independent structural analyses of a tower and its foundation are readily available from the manufacturer, so requiring additional studies is unnecessary and also prohibitively expensive for a turbine owner. For their own protection and insurance considerations, the manufacturer conducts these studies for reasons of economics, responsibility, and - even if for no other reason - self-preservation. (See "Potential of Structural or Electrical Failure," p. 15.)

However, in residential zones, some argue that a turbine's setback should be no different than that of a house, cellular tower, flag pole, street lights, or any other engineered structure, and that height should not be expressly limited nor specified in zoning regulations. Instead, they argue that in residential zones turbine heights are already self-regulated based on sound level restrictions at the property line.

Also keep in mind that:

- Turbines on the market are engineered to withstand hurricane force winds (110 -130 mph).
- Allowing abutting property owners to submit signed easements may be an alternative form of compliance should roads and utility lines be absent in the immediate vicinity.
- A manufacturer's engineering specifications should be an acceptable means of ensuring safety and practicality.

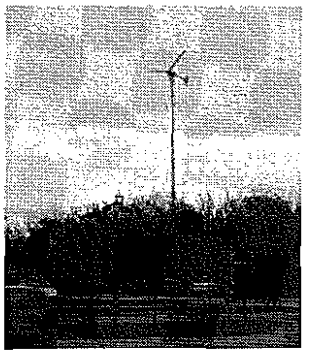


Allowing abutting property owners to submit signed easements may be an alternative form of compliance should roads and utility lines be absent in the immediate vicinity.

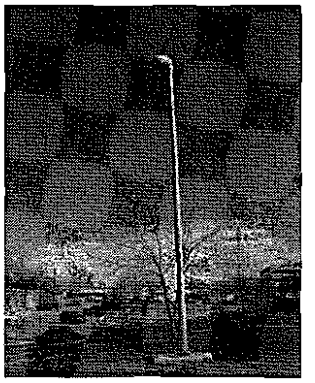
2. Lot Size:

Some zoning rules limit turbines and/or their heights to a corresponding property size. For example, some jurisdictions limit tower height to 80 feet for lots 0.5-1.0 acre and impose no height limit for lots larger than 1.0 acre.

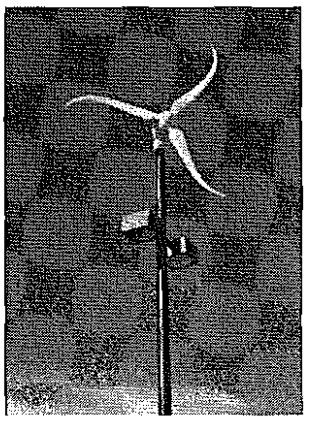
This regulatory approach, however, usually has no meaningful effect simply because sound and setback requirements, which are usually more restrictive, make such a stipulation redundant. Such a requirement may contribute only to additional administrative burdens and unnecessarily limit the use of wind turbines.



Bergey WindPower 1kW turbine

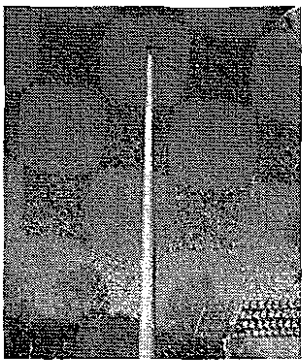


Skystream 1.8kW turbine

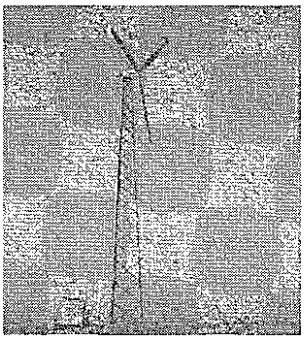


Skystream 1.8kW turbine dual-use on lamppost

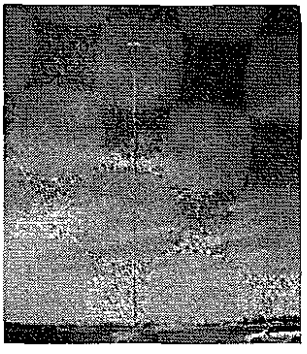
"By placing these windmills where many people can see them, [people] will be able to learn about and experience alternative energy as part of their daily lives."
- Pennsylvania Gov. Edward Rendell



Monopole Tower



Lattice Tower



Guyed Monopole Tower

3. Aesthetics:

To function, wind turbines must be tall and unobstructed, which means that they will likely be visible at some distance (see p. 6). It is also a fact that some people object to their appearance. However, legislating "taste" becomes a difficult task - and an inappropriate one for any authority other than a homeowners' association (and even homeowners' associations may wish to create policies that prohibit aesthetics from entering the debate). Regulating aesthetics requires balancing the perceived or desired character of a community; the public and private benefits of clean, renewable energy; and property rights of all parties.

Advocates say that small wind turbines are icons of the American rural landscape, dating back to the 1920s, and that today they have again emerged as a symbol of independence and a cleaner future. They argue that so long as a turbine is installed safely, particularly on private property, they should be allowed. System owners compare the aesthetics of their turbine to that of a street lamp, utility pole, or flag pole, and like a flag on a flagpole, a turbine only moves or makes a sound when the wind blows (see "Sound," p. 11). Advocates also point to precedent, noting that communities already accept water towers, buildings, billboards, relay towers, cell phone towers, utility poles and lines, grain silos, and radio antennas as part of the landscape.

But the aesthetic impact of wind turbines may be unacceptable in areas with historic significance where aesthetics play an important role in a district's long-established character. Opponents say that their height and movement are a distractive and unpleasant sight and visually intrude on their rights as property owners. Both views are based on emotion, however, not fact. As such, aesthetics are often a very sensitive issue and policymakers should take care to address any concerns fairly.

Small turbines are designed to blend in with their surroundings as much as possible. Studies show that turbines best blend into the sky when painted the factory-default color. Manufacturers avail themselves of expertise to determine how to prevent their turbines from standing out like a sore thumb on the landscape. So requiring owners to "disguise" a turbine or tower by painting it green or other colors to match vegetation would actually make it stand out more and should be avoided.

Some communities regulate appearance by prohibiting the use of commercial markings, messages, or banners on the turbine or tower. Some towns also dictate which tower types are acceptable in order to ensure only the most visually appealing design. This, too, is a subjective assessment, and such decisions are often made without considering the added cost of a "sleeker" tower that performs just as reliably as another design. A monopole tower (like a flag pole) generally has a "tidier" appearance than a lattice tower (like a radio tower) or guyed tower (like a flag pole with wire supports), but they can cost several thousands of dollars more and should not be considered equal economic substitutes. All towers on the market are professionally engineered for safety and reliability, leaving appearance and cost the only significant differences among them.

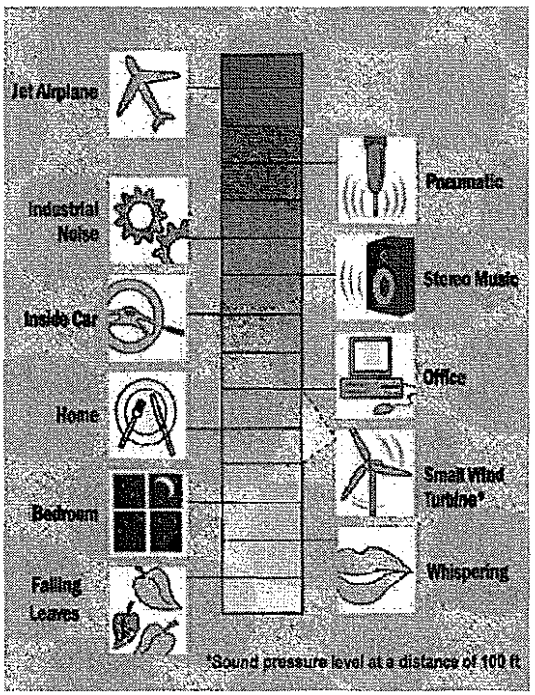
4. Sound:

Modern wind turbines have better insulation, lower rotation speeds, fewer moving parts, no gearboxes, and more efficient blades that make them much quieter than their ancestors. Today's turbines emit sound that is barely discernible from ambient noise, even with a decibel (dB) meter. Sound from traffic, rustling trees, airplanes, and people in fact often sufficiently mask the dull, low, "white noise" sounds a small turbine can make at certain wind speeds. Only during short-term events like severe storms or utility outages do turbines make distinctive sounds, but in these occurrences ambient sound levels increase as well.

To put this into further perspective, the sound made by the lanyard clasp on a flagpole line hitting its pole is far more "tonal" and distinguishable than any sound a small wind turbine makes, and is less easily masked by ambient sounds.[6]

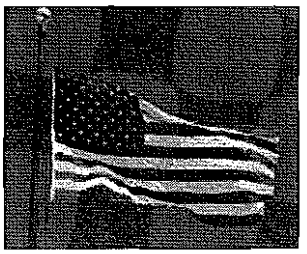
Zoning policy should reflect ambient sound levels as well as occasions where no affected parties are located immediately outside a property boundary. Therefore, except during short-term events like storms and utility outages, a small wind system should be installed and operated such that sound pressure levels do not exceed the definition of "nuisance noise" as established by existing zoning code. or at the nearest dwelling, whichever is greater. Sound levels should always be measured downwind of the turbine to account for the canceling effect of the sound of the wind itself. If ambient sound levels exceed "nuisance" levels on certain occasions, such as during storms, sound level limits of small wind systems should also be given reprieve during these events which are out of everyone's control.

Or, instead of singling out wind turbines in sound regulations, it may be more fair and administratively simple to use default sound/noise regulations that apply universally to other objects and appliances in a community. The small wind section of Wisconsin's (state-wide) zoning ordinance, for example, has no mention of sound because its designers chose to treat small wind turbines equally with other allowed devices/structures.

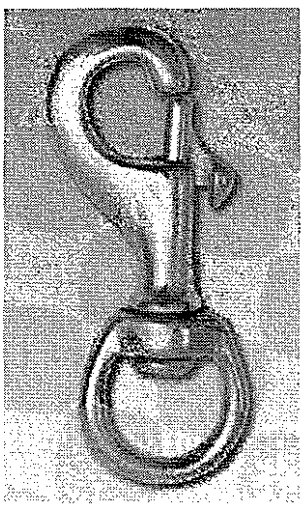


Sound Level Comparison

Modern small wind turbines are typically quieter than most external air conditioners.



A clasp hitting a flagpole is far more distinguishable than any sound a small wind turbine makes



[6] Flag clasp photo credits: Flags Unlimited

Most people's reaction to turbines, even up close, is that they are much quieter than they expected.

"Vermont turbine owner David Blittersdorf reports that the home next to his sold within one day for the full asking price. His new neighbors later told him that his 10kW turbine was a major factor in the quick sale. 'They said they wanted to live in a place where the community cared about the environment. They told me that they, too, wanted to install a small wind turbine someday,' says Blittersdorf."
- Permitting Small Wind Turbines: A Handbook: Learning from the California Experience. California Energy Commission, 2003. www.awea.org/smallwind/documents/permitting.pdf

4. Sound (con't):

Planners and zoning committees should also keep in mind that:

- Sound decreases significantly with distance from the source (including height - another good reason to allow tall towers). Doubling the distance from the turbine decreases the sound level by a factor of four. For example, sound level readings at 25ft. from the turbine hub drop by a factor of 4 at 50ft., and by a factor of 16 at 100ft. Noise intrusion across a property line from a turbine that is set back 100ft. or more is typically very limited.

- Turbine manufacturers are keenly aware of the public demand for quieter machines and have invested in new materials and designs to minimize sound. As a result, today's turbines operate at near-ambient sound levels.

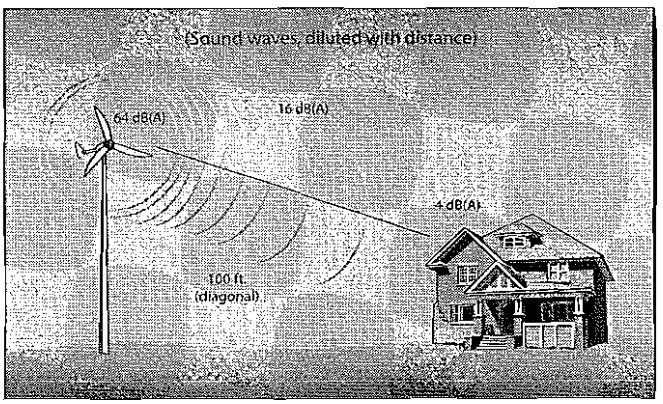
- Only a few events or circumstances can cause a normal operating wind system to become audible, including utility blackouts (or a full battery bank for those models that incorporate batteries). Both situations are temporary, and in many cases (but not all), easily remedied by the owner by manually shutting down the turbine.

- Sound level test data for some turbines is available from the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL).[7]

- Requiring certified noise tests for a residential wind system is unnecessary given the lower sound emissions of today's turbines and that sound data is readily available from manufacturers. Such tests are also beyond the budget of any homeowner.

- "Noise" is a subjective term. Whether a person generally favors wind turbines or not can determine how he or she views a single, seemingly objective sound.

- The single best way to understand the nature of a turbine's sound is to visit an installation site. All turbines are a marginally different so be sure to visit a location with a similar wind resource and the same model turbine as is in question.



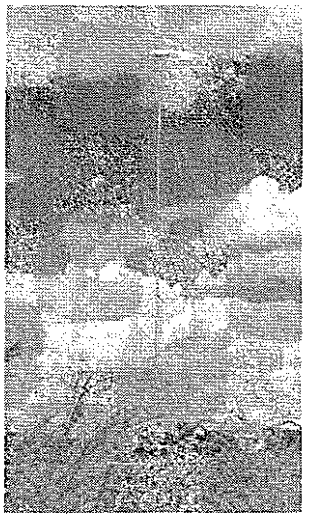
[7] The National Renewable Energy Laboratory (NREL) has tested several residential-sized wind turbines for sound emission levels. NREL engineers noted a "marked progress toward quieter turbines" in recent years and concluded in one case that "the turbine noise could not be separated from the background noise." This is generally true of most of today's residential wind equipment over a great range of operating wind speeds. NREL engineers noted, however, that "the operating condition [of the wind turbine] has a strong influence on the noise characteristics." They found two scenarios where sound actually increased above normal operating conditions: when grid connection was lost (for grid-connected models) and when the batteries were full (for battery-charging models). The solution is simply for the owner to shut off the turbine in these situations to avoid excessive noise. See the NREL report, "Acoustic Tests of Small Wind Turbines," NREL/CP-500-34662, by P. Migliore, J. van Dam, and A. Huskey at http://www.nrel.gov/docs/fy04osti/34662.pdf.

Additional Resources:
Alberts, Daniel J. "Primer for Addressing Wind Turbine Noise". Lawrence Technological University, 2005. http://home.nethere.com/dja1701/technical_writing/papers/AddressingWindTurbineNoise.pdf

5. Property Values:

Evidence[8] indicates that the presence of wind turbines increases neighboring property values. No study has ever concluded that wind turbines - neither large nor small - have had a depressing effect on nearby residential property values.

A recent survey found that most people are interested in or willing to pay more for homes equipped with solar panels or wind turbines.[9]



Windward Engineering
4.25kW turbine

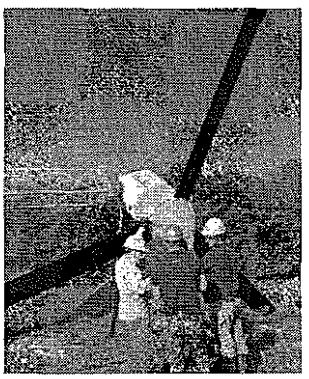
6. Insurance:

The small wind system should simply be added to existing homeowner, farm, or business policies as an "appurtenant" (uninhabited) structure and not require a separate policy. Precautions such as setback requirements for wind turbines are designed specifically to protect that which is beyond one's own property line. Homeowner's insurance policies make no distinction based on how far a turbine is from one's own house, so neither should zoning rules.

7. Abandonment:

Some towns require assurance that any non-functioning turbine will be removed after a period of time to prevent unnecessary clutter in a community. Abandonment due to malfunction has become particularly rare due to today's improved technology, though a community should be entitled to recourse should an abandoned turbine present a nuisance.

Security bonds may be required for large, utility-scale turbines which are located on land leased from a third-party property owner, but these are inappropriate and unduly burdensome for owners of small systems who install turbines on land they own. It is recommended that any small wind turbine owner whose equipment is inoperable for six months be notified by the zoning committee that the owners have six months from the notice date to restore their system to operating condition. If the owner fails, the wind turbine should be removed from the tower for safety reasons. The tower itself would then be managed under the Public Nuisance language of the rest of the existing zoning code.

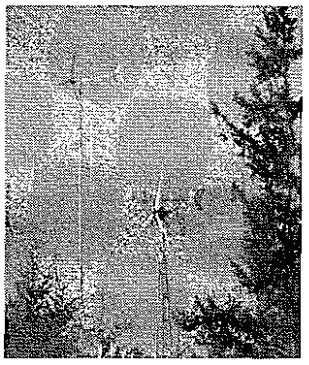


Bergey WindPower
10kW XLS turbine
lowered for
ground maintenance

[8] A May 2003 study by the Renewable Energy Policy Project (REPP) study, *The Effect of Wind Development on Local Property Values,* finds that "...for the great majority of projects the property values actually rose more quickly in the view shed than they did in the comparable community. Moreover, values increased faster in the view shed after the projects came online than they did before." Available at http://www.crest.org/articles/static/1/ binaries/wind_online_final.pdf.

See also: Advice from an Expert: Residential Wind Turbines and Property Value. American Wind Energy Assoc. http://www.awea.org/faq/sagrillo/ms_zoning_property values.html.

[9] "Renewable Energy Study." California Energy Commission, Nov. 2001. http://www.energy.ca.gov/reports/2002-04-03_500-02-016.pdf. p. 28

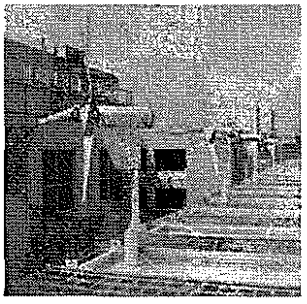


Abundant Renewable Energy ARE 110 2.5kW and ARE 442 10kW turbines

8. Multiple Turbines:

Though rare, some small wind systems come in "arrays" of multiple turbines, each of which is usually very small. However, regulations should treat additional turbines no differently than the first. So long as each turbine, or the resulting aggregate installation, meets the sound, setback, and safety requirements as exist for other structures, there should be no need for further or special considerations.

When determining height limits (if any - see "Setback Distances and Height," p. 8), keep in mind that rarely are multiple units equal economic substitutes for one larger, taller turbine. Therefore to meet restrictive height limitations, multiple small turbines are not an equal substitution. See the payback period table in the "Height" (p. 7) section of this guide for an illustration.



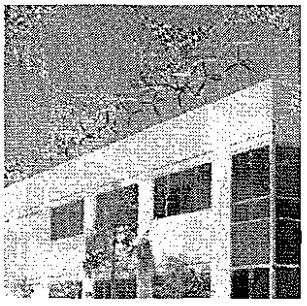
Proven Energy 2.5kW turbine rooftop array

9. Rooftop Turbines and Urban Environments:

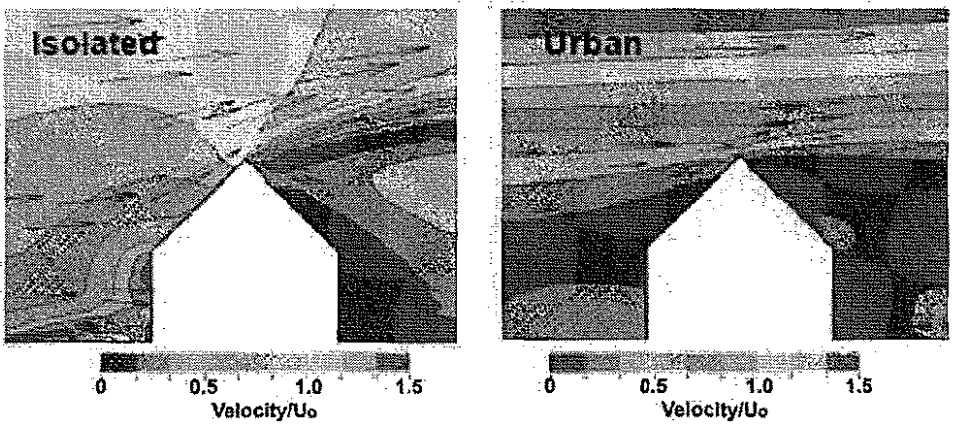
In very rare instances turbines are installed directly onto building rooftops or even designed as part of the building itself (known as "architecturally integrated"). These installations appear mostly in urban or densely-built areas where small property sizes may prevent the use of towers elsewhere on a property. These types of installations currently account for less than 1% of all applications, but interest is increasing rapidly and zoning officials may receive permit applications for urban or rooftop installations.

Siting becomes especially important for turbines in urban settings. Wind patterns behave very differently around buildings and in densely-built areas, so a turbine must be sited very precisely in order to gain access to wind of sufficient quality. Height, for example, becomes increasingly important in order for the turbine to rise above aerodynamic obstacles and turbulence, as depicted in the graphic below.

Regardless of these unusual physical conditions, as long as other sound and setback requirements are met, no additional or unusual standards should be imposed for architecturally-integrated turbines and/or those in dense environments.



AeroVironment rooftop array



Source: Watson, S.J. "Predicting the Yield of Micro-Turbines in the Urban Roof-Top Environment." Centre for Renewable Energy Systems Technology, Loughborough University, U.K. Presentation, March 2008.

10. Potential of Structural or Electrical Failure:

Requiring code compliance and manufacturer drawings should sufficiently balance the public and private needs for an installation to be safe, practical, reliable, and affordable.

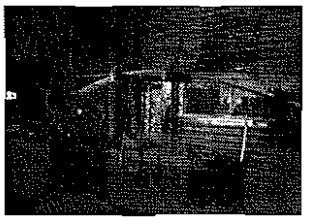
Wind turbines are professionally engineered structures and are designed to withstand decades of near-constant operation (see "Setback Distances and Height" p. 8). They shut down automatically during utility outages in order to protect utility line workers, and will not energize a dead power line. They are also equipped with manual and automatic over-speed protection devices that keep the turbine operating in a controlled range of speeds. Because of these and other factors, mechanical failures are very rare, especially those that would have an impact on surrounding areas.

But as a precaution, just as for any other allowed structure, the applicant should submit to the zoning board a line drawing of the electrical components, as supplied by the manufacturer, in sufficient detail to allow for a determination that the manner of installation conforms to the National Electrical Code. Doing so also serves to demonstrate that the installer and manufacturer are engaged in an evaluation of the suitability of the site.

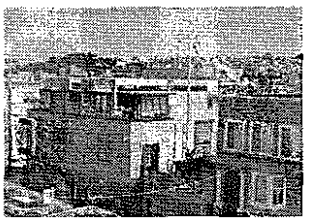
Though rare, some zoning boards require an engineering analysis of a tower and its foundation, but this is a very costly and often redundant measure. Even more rare is the requirement of an engineer's "wet stamp," which is a from-scratch calculation performed by a structural engineer of the tower's integrity. Such a study can cost thousands of dollars and serves only to duplicate work that the manufacturer originally performed as a prerequisite for securing liability insurance.

Proven Energy, Ltd. manufacturing facility in Scotland, UK

"Renewable energy equipment has become more reliable and economical, and installation standards are more professional." **- American Planning Association, 2004.**[10]

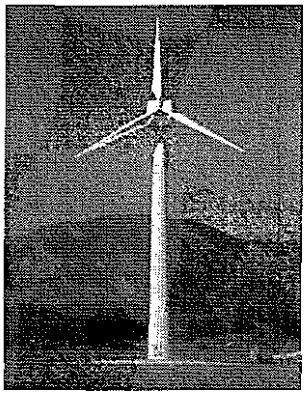


Bergey WindPower blade testing

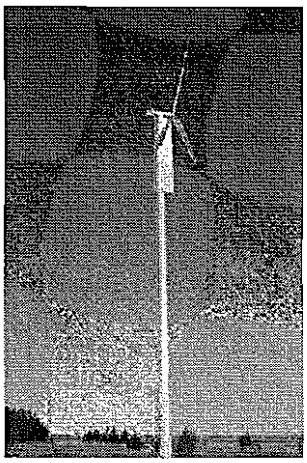


A small wind turbine can in fact be one of the more aesthetically pleasing features in a city. Rooftop heating and ventilation systems, antennas, and other structures found in urban environments usually reduce any aesthetic impacts from small wind turbines in comparison.

[10] "Policy Guide on Energy." American Planning Association, April 2004. http://www.planning.org/policyguides/pdf/Energy.pdf



Northern Power
100kW turbine



Entegrity Wind Systems
50kW turbine
in Quinter, Kansas

11. Soil Studies:

Wind turbine foundations face forces that are not unlike those seen in light-pole or flag-pole foundations, but for the same height, wind turbine towers generally experience higher forces at the very top of the tower. The wind turbine foundation therefore plays an important role in an installation, as does the soil in which it is installed.

As standard practice, manufacturers engineer foundations for "worst-case" scenarios by assessing soil conditions based on U.S. Geological Survey soil maps, core samples, studies from the National Resource Conservation Service, or other resources. For "abnormal" soils consisting of rock, gravel, sand, peat or water-saturated earth/muck, etc., a manufacturer or local professional engineer conducts a tailored, project-specific soil review and often designs a custom foundation for the site. The installer always confirms with the manufacturer or an independent professional engineer that the site's soil conditions meet minimum standards as specified by the tower manufacturer, and that the tower is designed to local engineering standards (which vary by jurisdiction). For decades this has effectively ensured safe, durable installations while maintaining their affordability.

These built-in safeguards make formal site soil analyses unnecessary for residential-scale (20kW or smaller) turbines and avoid the need for special studies and designs that can exceed the cost of the foundation itself. For example, a foundation designed for a "worst case" scenario might require 50% more concrete than that for another, similar structure. Assuming this fortified foundation also costs 50% more, an installation for a residential turbine normally costing, say, $4,000, would increase to $6,000. This is expensive, but a relatively small share of the total cost of the system. However, a foundation 50% more robust (and expensive) for a turbine larger than 20kW, where the foundation might normally cost $30,000, would now cost $45,000 - an increase of $15,000. At this point, a professional engineer's "wet stamp" based off a site-specific geotechnical study is now the best economic option for achieving the same, safe ends.

The best practice would be to require an engineer's wet stamp and a soil analysis for turbines greater than 20kW, but allow "worst-case" foundations (already the industry's standard practice) for turbines any smaller. This would ensure quality, secure, and affordable installations.

Non-Issues/"Red Herrings"

The following are common misconceptions about small wind:

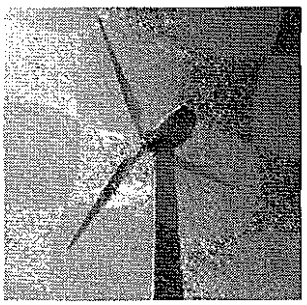
i. **Shadow "Flicker"**
ii. **Fences/Attractive Nuisance**
iii. **Birds**
iv. **"Icing"**
v. **Electrical Signal Interference**
vi. **Lightning Strikes**
vii. **Stray Voltage**

i. Shadow "Flicker":

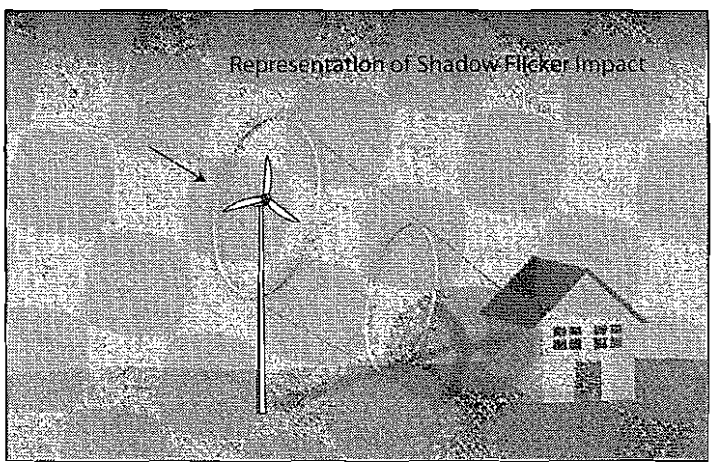
Under very specific circumstances, low sunlight passing through the moving rotor of a turbine can cast visible shadows on the ground or on structures. This issue pertains almost exclusively (and similarly rarely) to large, utility-scale turbines because of their slower-moving blades. Shadows also depend on the time of day, day of year, and latitude of the site's location.[11]

Small turbines are shorter, have narrower blade profiles, and spin much faster than utility-scale turbines so that any shadows become essentially invisible at operating speeds. Turbines of all sizes are designed to start spinning only after a minimum wind speed has been attained, so chances are very slim that a small turbine will spin slowly enough to make shadow flicker a concern.

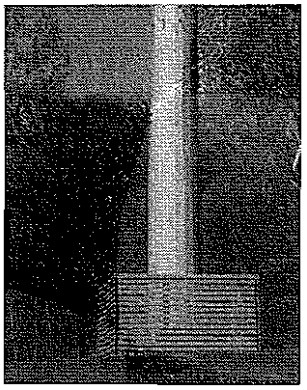
Furthermore, normal setback distances dictated by property lines or sound requirements mitigates, if not entirely eliminates, this potential nuisance, especially at U.S. latitudes.



Northern Power
100kW turbine
in Golden, Colorado



[11] The possibility of shadow flicker affecting a given location can be calculated very precisely. See http://www.windpower.org/en/tour/env/shadow/shadowc.htm for a shadow flicker calculator.



Bergey WindPower
10kW XLS
monopole turbine
with fence in Erie, PA

ii. Fences/Attractive Nuisance:

Some voice concern that a turbine could pose a temptation to unauthorized climbers and should be fenced off to prevent potential climbing-related injuries. However, decades of experience and tens of thousands of installations have shown that unauthorized climbing is exceedingly rare. A fence, which is itself climbable, can impose its own attractive and aesthetic nuisance and in the process do little more than create false, negative impressions about renewable energy.

Furthermore, for a turbine tower to be an "attractive nuisance" to the public, in most cases a potential climber would first have to trespass on private property - a much more prevalent issue and one that should be dealt with separately. Requiring fencing also places a burden on turbine owners unlike any imposed on flagpoles, utility towers, or other common, climbable structures.

Perhaps most detrimental of all, fences prevent access to the turbine in emergencies. Sometimes a turbine must be shut down manually during storms or electrical problems, and emergency shut-off switches are most often located at the base of the turbine tower. Utilities also require that the turbine be readily accessible to workers performing routine or emergency maintenance on power lines.

Instead, to prevent unauthorized climbing:

- Remove climbing foot rungs on the lower 10 or 12 feet of a freestanding tower.
- 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. Of the thousands of freestanding utility high-line towers across the country, few, if any, are policed or fenced, but they all are posted with such signs.

Utilities, tower manufacturers, and the small wind industry have successfully employed these techniques for decades and are more effective deterrents than any fence.

iii. Birds:

The most common - and most exaggerated - misconception about both large and small turbines is that they are disproportionately harmful to bird and bat populations. Even the vastly larger, utility-scale wind farms that are grouped closely in large arrays account for less than 0.003% of all human-caused bird deaths.[12] House cats and glass windows, by comparison, cause 10,000 times more bird deaths than do wind turbines. No study has been performed specifically to address avian effects of small wind turbines, but because of their dispersed nature and small size, it can be inferred that they have an even smaller impact than their larger counterparts.[13]

Environmental impact or avian migration studies should not be required for individual small wind turbine installations. Are environmental impact studies required for every plate glass window or pet license? Small wind turbines in fact offer a net benefit to local and global environments: they emit no air pollutants, require no mining for fuel nor water for cooling, and have land use "footprints" of only a few square feet.

iv. "Icing":

Like trees, street lamps, or other structures, turbines in cold climates can become covered in ice, which falls to the ground as it melts. But just as an airplane's wing must be de-iced in order for it to fly, a turbine's blade must be free of ice in order to rotate at any significant speed. The weight and aerodynamic interference of ice buildup slows the blades' rotation to a near stand-still, making any melting ice fall straight downward rather than being thrown from the blade.

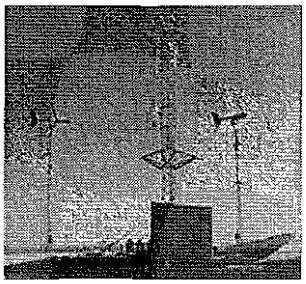
To put this in further perspective, a 1998 study calculated that the risk of personal or property damage from ice falling from a (large) turbine is lower than the risk of being struck by lightning.[14]

[12] "Environmental Impacts of Wind-Energy Projects." National Academy of Sciences, 2007. http://books.nap.edu/catalog.php?record_id=11935

[13] Erickson, et.al, 2002. Summary of Anthropogenic Causes of Bird Mortality

[14] Bossanyi, Morgan, and Siefert. "Assessment Of Safety Risks Arising From Wind Turbine Icing." Finland, April 1998.

Small wind turbines are commonly used to power communications equipment. They will not cause signal interference.



Bergey WindPower
1kW turbine
on telecommunications
station
in Bristol Bay, Alaska

Proven Energy 6kW turbine
powering
telecommunications
equipment

v. Electrical Signal Interference:

Small wind turbine blades are made from materials that are "invisible" to radio frequency transmissions and cannot cause interference problems. In fact, small wind turbines are used by the U.S. Navy to power military communications equipment.[15]

In the past, wind turbine blades were sometimes made of metal which did create unwanted radio or television interference, but the industry has long since abandoned the use of metal blades.

Any structure under 200 feet high - that is to say, any small wind turbine - is also too short to interfere with civilian or military radar. Radar usually does not even scan for objects this close to the ground because common land features at this height, like trees, would normally cause distorted, cluttered, or misleading radar images.

vi. Lightning Strikes:

Wind turbines do not attract lightning, so pose no threat to neighboring properties.

Lightning is essentially the release of pent-up static electricity that moves from a turbulent atmosphere to the ground. Small wind turbines are "grounded," meaning that any static electricity on the tower or generator is dispersed into the ground, preventing a build-up that could invite lightning strikes. As a result, even though small wind turbine towers are made of metal (a conductor of electricity), by virtue of their grounding they are less susceptible to lightning strikes than trees, which cannot shed built-up static electricity. To a lightning bolt, a turbine is therefore no more "appealing" than the ground itself.

However, lightning strikes are still possible, which is why small wind turbines incorporate back-up technologies like surge and lightning arrestors (also known as silicon oxide varistors) and metal oxide varistors, which are also used to protect home computers from electrical surges. Lightning strikes are never completely preventable, but these industry-standard measures offer the best protection available to the owner of the wind system. Good practice in the wind industry includes grounding of all towers and guy wires, which significantly reduces the chance of a lightning strike.

[15] Sagrillo, Mick. "Telecommunication Interference from Home Wind Systems." AWEA Windletter, Volume 22, Issue 4, April 2003.

vii. Stray Voltage:

This unusual phenomenon, primarily affecting farm livestock, is the result of faulty wiring on any number of electrical systems (not just wind turbines) and easily prevented by industry-standard practices. It is also a strictly localized issue that will not affect off-site parties or properties.

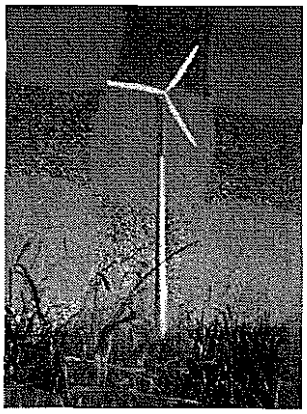
For safety reasons, including to minimize lightning strikes (see above), nearly all types of electrical systems in the U.S. are, at some point in the system, connected to the earth or "grounded." Electric current flowing in the ground dissipates quickly as it moves away from its source (much like sound from a wind turbine). Grounding also allows power systems to detect equipment malfunctions and automatically shut down before harming people or equipment.

If a system is not properly wired, the point(s) at which a system is grounded can develop a small voltage (electrical pressure, essentially) that can push current through the earth and end up contacting unintended objects. Hence the name, "stray" voltage. This phenomenon is rare and primarily affects cattle, whose legs are far enough apart to stand on two points where different voltage levels in the ground exist. The cow may or may not feel this voltage difference, depending on the level and duration of the exposure.

While the design of electrical system makes stray voltage possible, its actual occurrence is the result of poor grounding practices, improper or inadequate wiring, or deteriorated wire insulation. Most small wind turbine inverters - those that are IEEE 1547 or UL1741 compliant - can detect faulty grounding and automatically shut down current flow. Like solar photovoltaic installations that require "ground-fault circuit interrupter" (GFCI) devices to protect consumers from any stray voltage, small wind turbines are also equipped with GFCI measures.

In other words, stray voltage is caused by problems on a particular customer's side of the utility billing meter so is not a problem beyond the electrical system of a particular home or farm. Nor can stray voltage move or be transferred from one property to another, since it is an "on-site" problem stemming from electricity distribution or wiring, not the generation of electricity. The issue therefore does not fall under the jurisdiction of zoning rules, which are designed to protect that which exists outside a property line.

Making It Happen: Best Practices and a Model Ordinance



Entegrity Wind Systems
50kW turbine

Permitted use? Accessory use? Or conditional use?

Anticipating, acknowledging, and understanding small wind turbines not only reduces administrative burdens for zoning boards, but it lowers permitting time and costs to the point where it makes the project within the realm of financial reason for the owner. Streamlining the permitting process is often best achieved by listing small wind turbines as a conditional or accessory use.

A ***Permitted Use permit*** allows a small wind system by default, provided it meets applicable design standards, and is applied commonly to flag poles, church steeples, and grain silos. A permitted use indicates that a justification has been established for the structure's standing eligibility. As such, no public hearings are required and a permit can be obtained quickly. Permitted uses are frequently found in rural areas where potential impacts are minimal.

A ***Special/Conditional Use permit*** allows an installation under certain conditions identified in the statute. This option usually requires a more detailed description of the project from the applicant and often involves a public hearing. A hearing can disadvantage both the zoning board and potential owner, however, since each application must be decided on a case-by-case basis and educational efforts must begin from scratch. Many documented experiences show that this process can cost potential small-turbine owners thousands of dollars and take hundreds of hours to accomplish, if at all.

A ***Site Plan Review*** allows an installation after a physical inspection of the proposed project site and surroundings. This option is usually accompanied by a special/conditional use permit.

An ***Accessory Use*** of land is one that is subordinate, incidental to, and customarily found in connection with the principal use allowed on a lot by the zoning law. A garage, for example, is incidental to the principal use of a lot as a single-family residence and customarily found on a single-family lot. For small wind, this 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. Importantly, allowing small wind as an accessory use avoids the need for special use permits for future applications.

A ***Variance*** is a modification or waiver of certain zoning requirements for a permitted use structure. For a small wind turbine, this usually means making an exception for setback distances or height limits. Variances are issued when prevailing regulations cause an unreasonable "burden" on the property owner and usually require public hearings, making a variance for a small wind turbine very difficult to obtain.

An ***Overlay Zone*** supersedes prevailing zoning rules in certain geographies. A jurisdiction may establish an overlay zone to indicate that a certain area is appropriate for small wind turbines or other renewable energy technologies. This expedites the permitting process, but planners must be careful that this strategy does not overly limit areas outside of zone.

Recommendations

See also AWEA's "Policies to Promote Small Wind Turbines: A Policy Menu for State and Local Governments" 2008. www.awea.org/smallwind

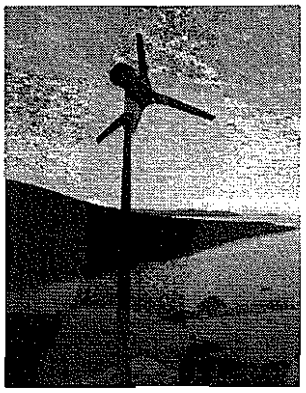
For State and Local Governments

- Create regulations in advance of public inquiries.
- Recognize that small wind systems have very different impacts than large, utility-scale turbines and require completely separate siting considerations. In terms of impact, a residential-scale wind turbine has more in common with a solar photovoltaic panel than it does with a utility-scale wind turbine.
- Treat small turbines as improvements to an individual property, not as commercial or industrial projects.
- Promote consistency among fees, requirements, and procedures across jurisdictions. Doing so reduces complications and inefficiencies for installers, applicants, and governments.
- Experience your own permitting process firsthand: Mayors or governors may want to try to obtain a permit for a turbine for installation at city hall or the governor's mansion.
- Educate permitting staff, zoning officials, and governments about small wind. Share with them this and other publications listed in the "Contributing & Additional Resources" section (p. 28).
- Base code compliance on a common set of standards (IEEE 1547 and UL 1741) that ensure the reliability and safety of a turbine's electrical components, as installed according to the National Electric Code. But also ensure the grid interconnection process formed around these standards is well-founded. See "Freeing the Grid" 2007 report.[16]

Keep in mind the <u>public</u> benefits of small wind:

- Increased property values
- Increased in-state electricity generation
- Reduced pressure on the utility grid
- Increased local energy independence
- Increased security/can provide back-up power to strategic applications like police stations or hospitals for "hazard mitigation" purposes[17]
- Reduced dependence on polluting forms of electricity
- Enhanced reliability and power quality of the electricity grid
- Reduced peak power demands
- Diversified state energy supply portfolio
- Displaced pollutants from traditional forms of energy
- Increased consumer choice
- Increased visible indicators of community support for clean energy
- Increased regional economic growth. Manufacturers ask, "In which state should I base my operations?" The answer is: "States with the best policies."

Education may be the single most important factor in streamlining the permitting process.



Proven Energy 2.5kW turbine

[16] http://www.newenergychoices.org/uploads/FreeingTheGrid2007_report.pdf

[17] Sandia National Laboratory has begun development of strategic Energy Surety Microgrids http://www.sandia.gov/news/resources/releases/2006/microgrid.html

Additional Options

Creating incentives: Beyond removing obstacles and enabling installations to occur on their own, a state or community can create incentives to make small wind turbines a more attractive option for individuals and businesses. These include:

- Reducing, or waiving, permit and development impact fees
- Fast tracking review periods
- Permitting small wind systems by-right in some or all districts to avoid costly and contentious hearings
- Awarding points in performance-based review and green building programs
- Awarding density bonuses for developments that reduce or generate >50% of energy demand on site

Protecting windy areas: A town or state might also anticipate future installations by protecting areas in the community that have exceptionally good wind resources. Local dealers and installers are trained in wind resource assessment and can help locate these areas.

Specifically for Local Governments

Federal preemption of home rule for **cell phone towers** enabled the industry to expand dramatically, which would not have likely occurred without it. Fair zoning for small wind turbines could bring similar economic benefits.

- Implement a stand-alone ordinance specifically to address small wind turbines (see "Appendix," p. 30).
- Expedite processing times by consolidating a jurisdiction's permit review process to as few departments or agencies as possible.
- Encourage permit applicants to notify their neighbors of their proposed installation.
- Educate permit department staff about small wind to ensure safe, fair, expedited, and less costly installations. Demonstration projects offer an excellent educational opportunity. Contact a local dealer to locate a nearby installation.
- Coordinate with neighboring zoning jurisdictions to establish consistent practices, rate schedules, etc. This can be done through Regional Councils of Government or independently, and will save time and money for the town, turbine owner, and installer.
- In the absence of pertinent state legislation, local governments can overrule neighborhood covenants that unnecessarily restrict renewable energy.
- Initiate a Community Energy Plan to assess the renewable energy potential of a locality and devise strategies for meeting energy goals. (This may include implementing a renewable energy overlay zone - see last paragraph.)
- Consider establishing renewable energy overlay zones.[18] This policy would be ideally situated in a local government's Comprehensive Plan (or equivalent) that describes a town's future objectives and strategies.

Without proper care however, a renewable energy overlay zone could inadvertently prevent small wind installations outside the zone where they may be perfectly acceptable. As a precaution, make the zone sufficiently large and create or maintain a provision that allows small turbines (and other renewables) outside of the zone. It may in fact be easier to identify any areas *not* suitable for such installations and make distributed renewables an allowed use elsewhere by default.

Specifically for State Governments

State government action can very effectively streamline the permitting process by standardizing permitting requirements across local jurisdictions. Consider implementing the following:

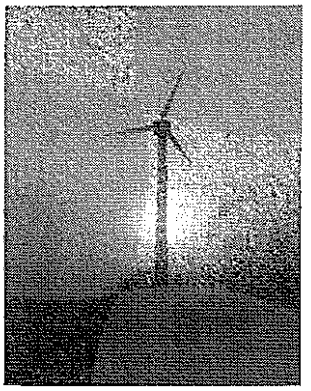
- Establish statewide zoning standards for renewable energy systems. Oregon state law, for example, requires cities and counties to list small wind turbines as an allowed use on any land zoned for agricultural or forest use, pending they meet certain conditions.[19]

- Provide educational opportunities for planners and zoning officials.

- Preempt private covenant restrictions that prohibit or restrict small wind and other distributed renewable energy systems on aesthetic grounds.

- Follow precedent set by over 10 states that prohibit the unreasonable restriction of renewable, distributed energy use within planned communities.[20] These laws are, unfortunately, not often publicly known and so are violated frequently. Therefore accompany any such rules with educational outreach efforts. The Community Associations Institute (CAI) and its chapters, for example, could provide a platform upon which to educate community associations and homeowners about their rights and responsibilities under the law.

- Preempt local zoning jurisdictions. Though likely a politically sensitive measure, the most effective way to enable small wind installations is for a state to preempt "home rule" jurisdiction of local zoning codes to allow the (conditional), statewide installation of small wind turbines under a single umbrella policy. Several precedents demonstrate that doing so helps consumers, communities, and industry. Home rule was preempted on a national scale for cell phone towers (Telecommunications Act of 1996) and was far stronger than what would be needed for small wind systems. This federal preemption succeeded in passing largely because of the perceived national benefit that wireless communications would bring. Advocates argue that the same could surely be said of renewable energy. The states of Wisconsin,[21] Nevada,[22] Vermont,[23] Michigan,[24] Oregon,[19] New Hampshire,[25] and California[26] have all agreed and enacted laws that preempt home rule specifically to prevent undue prohibitions of small wind systems in their states. As a direct consequence, these states enjoy more in-state (non-imported) energy generation and other environmental and economic benefits that small wind offers.



Northern Power 100kW turbine in Kotzebue, AK

[18] Example renewable energy overlay zone: Klickitat County, WA. Klickitat County Planning Department: http://www.klickitatcounty.org/Planning/filesHtml/200408-EOZ-EIS/06-01-map-EOZ.pdf

[19] Northwest Sustainable Energy for Economic Development. Community Wind: An Oregon Guidebook. Report for the Energy Trust of Oregon. (No date given). p. 41-42. http://www.energytrust.org/RR/wind/community/forms_request.html.

[20] These states include Arizona, California, Colorado, Florida, Hawaii, Indiana, Iowa, Massachusetts, Nevada, Utah, and Wisconsin.

[21] 1993. Wisconsin statute 66.0401. Wisconsin's small wind zoning ordinance http://renewwisconsin.org/wind/Toolbox-Zoning/Small%20Wind%20System%20Model%20Ordinance%2012-06.pdf. Available from http://renewwisconsin.org/wind/windtoolbox.html

[22] Nevada State Legislature NRS 278.0208 http://www.leg.state.nv.us/Nrs/NRS-278.html #NRS278Sec0208

[23] Vermont Statute Title 30 Sections 219(a) and 219(b), and 248 amended with bill 209 from 2008 http://www.leg.state.vt.us/statutes/statutes2.htm

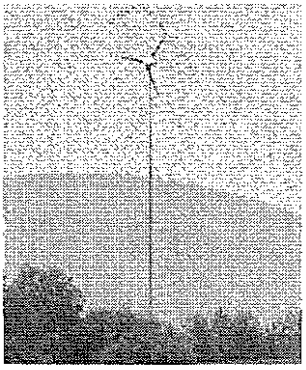
[24] Michigan Siting Guidelines for Wind Energy Systems http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidlines_Draft_5_96872_7.pdf

[25] New Hampshire House Bill 310 http://www.gencourt.state.nh.us/legislation/2008/HB0310.html

[26] California AB 1207 http://info.sen.ca.gov/pub/01-02/bill/asm/ab_1201-1250/ab_1207_bill_20011007_chaptered.html

Vermont's Net-Metering Permitting Process

Vermont's permitting process for net metered (thus, grid-tied) small wind turbines is straightforward and simple: A customer applies for a Certificate of Public Good (CPG), at no cost, from the Vermont Public Service Board (PSB) and distributes the application to adjacent landowners, the town planning committee, and select board, local utility, and several state agencies. Barring any objections within 30 days, the CPG application is generally approved and is exempt from additional state or local zoning regulations. Should there be any public objections, witnesses for each party testify at a public hearing where the PSB makes a final decision.



Windward Engineering Endurance 4.25kW turbine in Arkport, NY

PERMITTING PROCESS: TIME & COST

Even the best zoning ordinances are often thwarted by overly expensive and lengthy requirements for obtaining a permit. We recommend the following:

	Permitted or Accessory Use	Conditional Use
Time	The permit should be granted upon timely review of the application, not exceeding 30 days.	Hearings are usually required to determine whether the installation meets the "conditions" upon which permission is contingent. Any hearings should be held within 30 days of the application date. Promptly thereafter the zoning board should notify the applicant whether or not the permit has been granted and what conditions are necessary to satisfy the permit.
	If an application must be approved by a town or county board after being passed through a planning committee, a reasonable timeframe is 60 days or less.	
Costs	Total permitting costs should be commensurate with any other non-commercial end-use objects or structures, and should reflect the cost of administering the permit and any associated reviews or inspections. Most localities levy fees at a flat rate, but some occasionally use a "valuation method" that calculates the fee as a percentage of the system's cost. However, there is little, if any, correlation between the size of a turbine and the costs and time required for its inspection and review process. Flat fees are therefore more practical and desirable. Furthermore, the valuation method inadvertently discourages larger systems and their associated public benefits. Paradoxically, under this fee structure, the more a turbine owner wants to contribute to the community, the more difficult it becomes to do so. Some localities have implemented a tiered fee structure to distinguish between residential and commercial uses. Still others have waived permitting fees entirely for on-site renewable generators, sending a powerful message of local government support for clean energy and their associated community benefits. Some communities that have waived permitting fees for on-site renewables include Tucson (AZ), San Diego (CA), Fairfax (CA), and the entire state of Vermont.[28]	

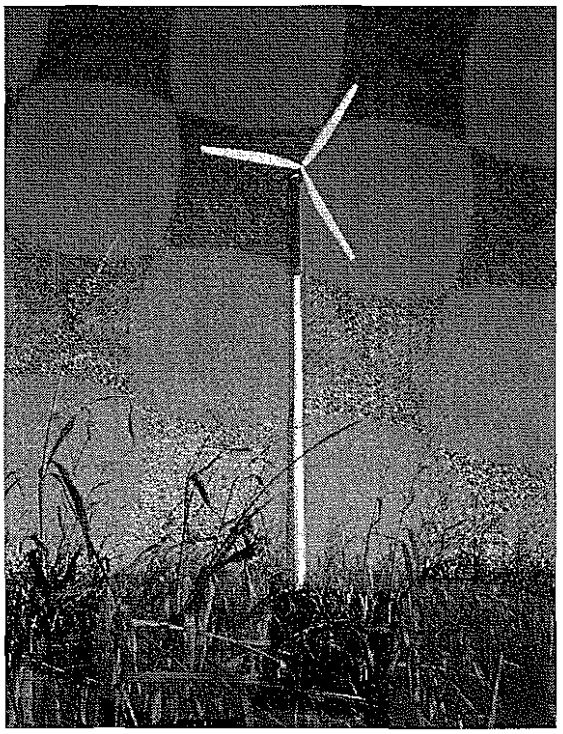
[28] http://lomaprieta.sierraclub.org/global_warming/ pv_permit_study.htm Damian Pitt, "Taking the Red Tape out of Green Power." Network for New Energy Choices, September 2008. In Vermont, permitting is free for all grid-tied renewables statewide under the Certificate of Public Good application process.

Conclusion

Good zoning for small wind is important, achievable, and good public policy.

Planners and zoning officials are in a unique and powerful position to help renewable energy and those who rely on it. Of all the challenges consumers and the industry face to deliver the benefits of clean, on-site power generation, the permitting process can be the most severe. But fortunately, a remedy is available and implementing it can come at a net benefit to the community at large.

By understanding the issues and identifying a variety of potential solutions, renewable energy will be able to play a more vibrant part in American communities.



Entegrity Wind Systems 50kW turbine

Contributing and Additional Resources

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"Wind Energy Siting Handbook" for large turbines. American Wind Energy Association, 2008. http://www.awea.org/sitinghandbook/

"Small-Wind Policy Menu for State and Local Governments." American Wind Energy Association, 2008. www.awea.org/smallwind.

Asmus, Peter; K. Fullerton; S. Peterson; H. Rhoads-Weaver; A. Shutak; and S. Savitt Schwartz. "Permitting Small Wind Turbines: A Handbook - Learning from the California Experience." September 2003. www.awea.org/smallwind/documents/permitting.pdf

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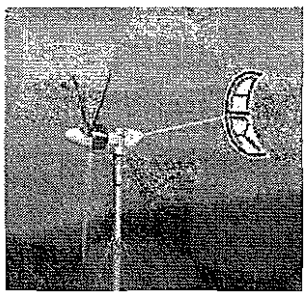
Rogers, et al. "Wind Turbine Acoustic Noise." Renewable Energy Research Laboratory, University of Massachusetts at Amherst. January 2006. http://ceere.org/rerl/publications/whitepapers/Wind_Turbine_Acoustic_Noise_Rev2006.pdf



Abundant Renewable Energy (ARE) 110 2.5kW turbine in Newberg, Oregon

Rhoads-Weaver, Heather; P. Asmus; S. Savitt Schwartz; C. MacIntyre; M. Gluckman; and A. Healey, Canadian Wind Energy Association. "Small Wind Siting and Zoning Study: Development of Siting Guidelines and a Model Zoning By-Law for Small Wind Turbines." April 2006. www.smallwindenergy.ca/downloads/Small_Wind_Siting_Guidelines.pdf

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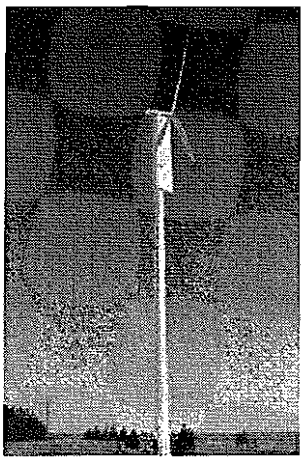
U.S. Department of Energy / National Renewable Energy Laboratory. "Distributed Energy Interconnection Procedures Best Practices for Consideration." March, 2007. http://www1.eere.energy.gov/solar/pdfs/doe_interconnection_best_practices.pdf

www.stray-voltage.com. For in-depth information and a tutorial on stray voltage.

Articles written for the American Wind Energy Association's Windletter by Mick Sagrillo, Sagrillo Light & Power, available at http://www.awea.org/smallwind/sagrillo/index.html and/or RENEW Wisconsin's Small Wind Toolbox at http://renewwisconsin.org/wind/windtoolbox.html:

Abandonment
Aesthetics
Barriers to small wind systems
Code Compliance
Considerations for wind turbine towers
FAA
Fences
Ice shedding
Keeping hearings under control
Net metering and zoning
Payback
Perceptions and local concerns
Property values
Protecting your right
Rules of thumb for tower heights
Setbacks
Shadow flicker and strobing
Siting towers and heights for small wind turbines
Sound
Stray Voltage
Tall tower economics
Tower cost versus power
Tower height versus power
Tower engineering for building permits
Tower heights and zoning hearings
Tower Styles
Towers and Engineering
Trials and tribulations
TV and communications interference
Visibility
Zoning obstacles



Entegrity Wind Systems
50kW turbine
in Quinter, Kansas

A special thanks to Erica Heller of Clarion Associates, Mick Sagrillo of Sagrillo Power & Light, and Jim Green of the National Renewable Energy Laboratory for their expertise and contributions to this document.

APPENDIX: AWEA MODEL SMALL WIND ZONING ORDINANCE

Writing Small Wind into Existing Laws

This model zoning ordinance is used by many localities across the country and aims to strike an equitable balance among the interests of the consumer, industry, and community. It is the product of lessons learned over decades of industry experience and tens of thousands of installations.

AWEA MODEL ZONING ORDINANCE

Use Regulation for Small Wind Energy Conversion Systems

Section 1: Purpose

It is the purpose of this regulation to allow the safe, effective and efficient use of small wind energy systems installed to reduce the on-site consumption of utility supplied electricity.

See p. 4 for a sample of cities, counties, and states that have enacted zoning laws for small wind systems.

Section 2: Findings

The [city or county] finds that wind energy is an abundant, renewable, and nonpolluting energy resource and that its conversion to electricity will reduce our dependence on nonrenewable energy resources and decrease the air and water pollution that results from the use of conventional energy sources. Distributed small wind energy systems will also enhance the reliability and power quality of the power grid, reduce peak power demands, and help diversify the State's energy supply portfolio. Small wind systems also make the electricity supply market more competitive by promoting customer choice.

The State of _____ has enacted a number of laws and programs to encourage the use of small-scale renewable energy systems including rebates, net metering, property tax exemptions, and solar easements. [*As appropriate*] However, many existing zoning ordinances contain restrictions, which while not intended to discourage the installation of small wind turbines, that can substantially increase the time and costs required to obtain necessary construction permits.

Therefore, we find that it is necessary to standardize and streamline the proper issuance of building permits for small wind energy systems so that this clean, renewable energy resource can be utilized in a cost-effective and timely manner.

Section 3: Definitions

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

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

Total Extended Height: The height above grade to a blade tip at its highest point of travel.

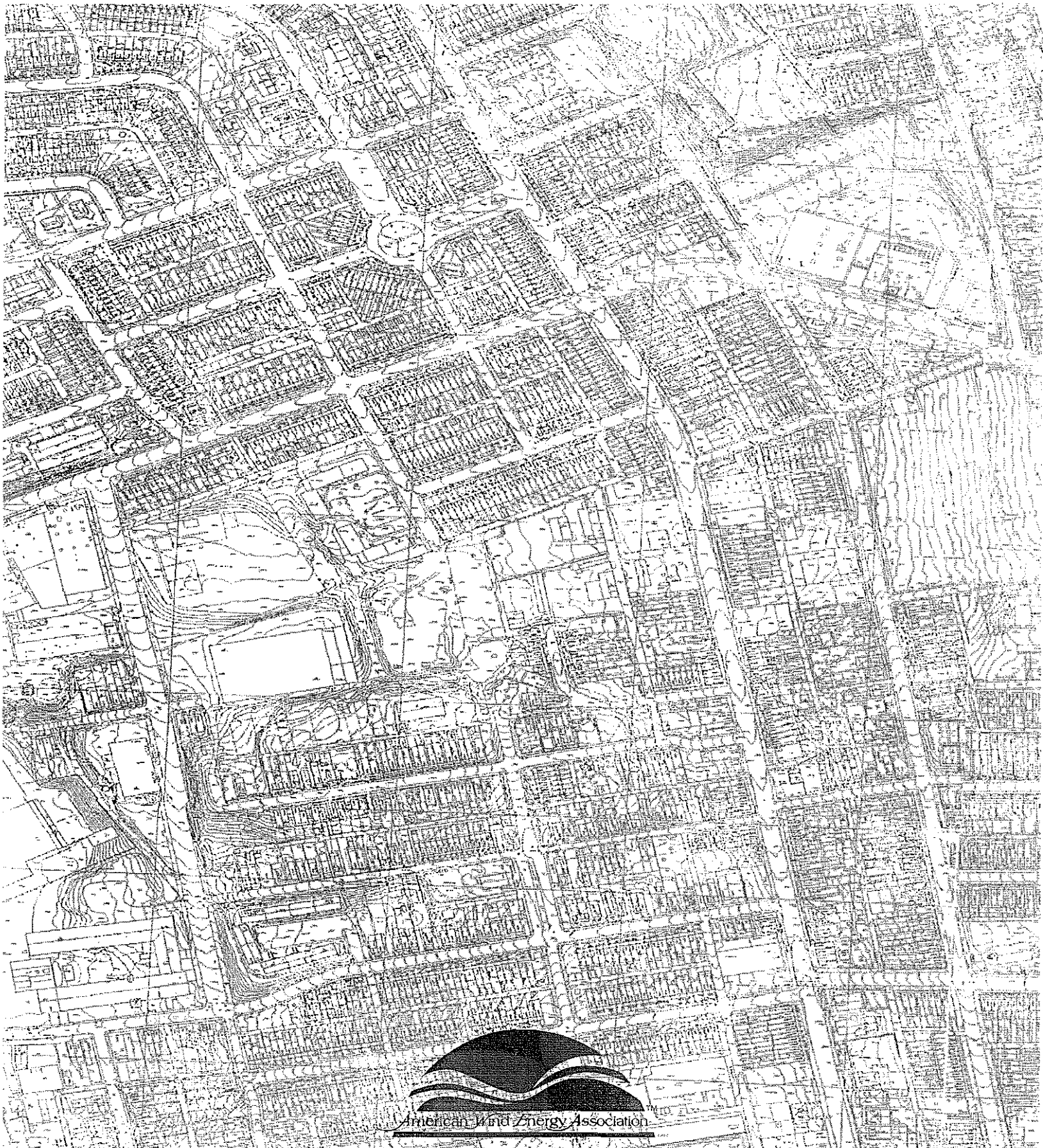
Section 4: Allowed Use

Small wind energy systems shall be allowed as an accessory use in all zoning districts where structures of any sort are allowed; subject to the requirements of Section 5 below. Small wind energy systems not meeting the performance standards of Section 5 may be allowed by conditional use permit.

Section 5: Use Standards for Small Wind Electric Conversion System

5.01	**Setback:** 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 the total extended height. Turbines shall be allowed closer to a property line than its total extended height if the abutting property owner(s) grants written permission and the installation poses no interference with public utility lines or public road and rail right-of-ways.
5.02	**Tower Height:** 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 as stated in 5.07.
5.03	**Sound:** 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 wind storms.
5.04	**Wind Turbine Equipment:** Small wind turbines must have been approved under the state public benefits program or any other small wind certification program recognized by the American Wind Energy Association.
5.05	**Requirement for Engineered Drawings:** Building permit applications for small wind energy systems shall be accompanied by standard drawings of the wind turbine structure and stamped engineered drawings of the tower, base, footings, and/or foundation as provided by the manufacturer. Wet stamps shall not be required.
5.06	**Soil Studies:** For standard soil conditions (not including gravel, sand, or muck), foundations developed by the wind turbine manufacturer shall be acceptable for turbine installations of 20kW or less and will not require project-specific soils studies or an engineer's wet stamp.
5.07	**Compliance with FAA Regulations:** No WEC shall be constructed, altered, or maintained so as to project above any of the imaginary airspace surfaces described in FAR Part 77 of the FAA guidance on airspace protection.
5.08	**Compliance with National Electric Code:** Building permit applications for small wind energy systems shall be accompanied by a line drawing of the electrical components, as supplied by the manufacturer, in sufficient detail to allow for a determination that the manner of installation conforms to the National Electrical Code.
5.09	**Utility Notification:** No small wind energy system shall be installed until evidence has been given that the utility company has been informed of the customer's intent to install an interconnected customer-owned generator. Off-grid systems shall be exempt from this requirement.
5.10	**Insurance:** Additional insurance beyond homeowners' coverage shall not be required.
5.11	**Abandonment:** If a wind turbine is inoperable for six consecutive months the owner shall be notified that they must, within six months of receiving the notice, restore their system to operating condition. If the owner(s) fails to restore their system to operating condition within the six-month time frame, then the owner shall be required, at his expense, to remove the wind turbine from the tower for safety reasons. The tower then would be subject to the Public Nuisance provisions of the zoning code.
5.12	**Signage:** All signs, other than the manufacturer's or installer's identification, appropriate warning signs, or owner identification on a wind generator, tower, building, or other structure associated with a small wind energy system visible from any public road shall be prohibited.
5.13	**Lighting:** No illumination of the turbine or tower shall be allowed unless required by the FAA.
5.14	**Access:** Any climbing foot pegs or rungs below 12 feet of a freestanding tower shall be removed to prevent unauthorized climbing. For lattice or guyed towers, sheets of metal or wood may be fastened to the bottom tower section such that it cannot readily be climbed.

For more information contact Ron Stimmel at rstimmel@awea.org.

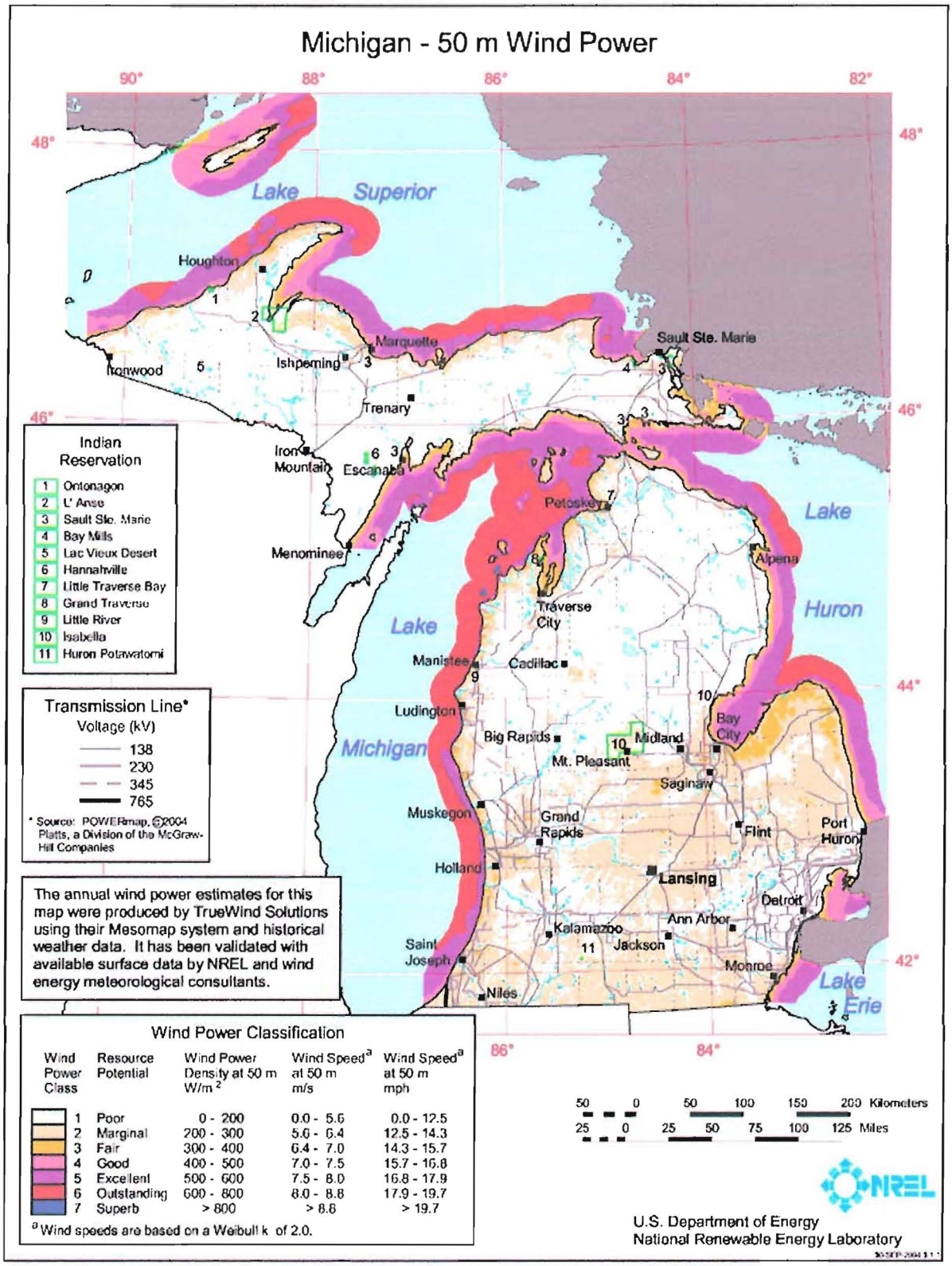


American Wind Energy Association

American Wind Energy Association
11501 M Street, NW • 10th Floor • Washington, D.C. 20005
202-383-2500 (phone) • 202-383-2505 (fax) • www.awea.org

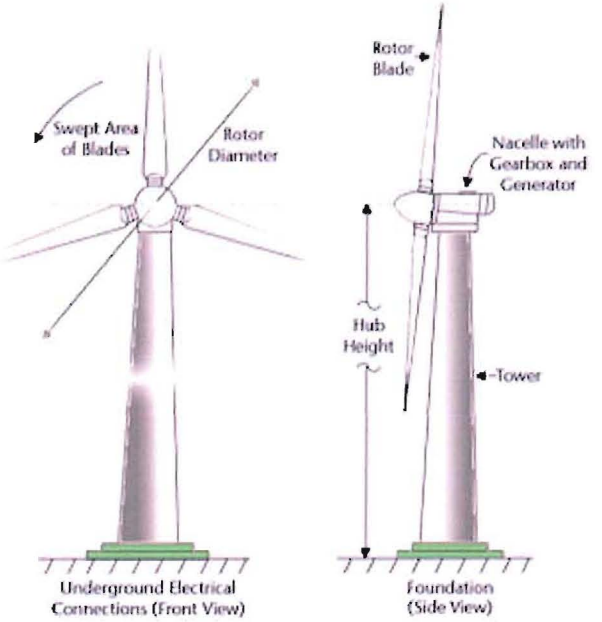
MICHIGAN WIND

RESOURCE MAP


Michigan - 50 m Wind Power
90°
88°
86°
84°
82°
48°
46°
44°
42°
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Houghton
Marquette
Sault Ste. Marie
Ironwood
Ishpeming
Trenary
Iron Mountain
Escanaba
Menominee
Petoskey
Alpena
Traverse City
Manistee
Cadillac
Ludington
Big Rapids
Midland
Bay City
Mt. Pleasant
Saginaw
Muskegon
Grand Rapids
Flint
Port Huron
Holland
Lansing
Detroit
Ann Arbor
Kalamazoo
Jackson
Saint Joseph
Monroe
Niles
Indian Reservation
1 Ontonagon
2 L' Anse
3 Sault Ste. Marie
4 Bay Mills
5 Lac Vieux Desert
6 Hannahville
7 Little Traverse Bay
8 Grand Traverse
9 Little River
10 Isabella
11 Huron Potawatomi
Transmission Line*
Voltage (kV)
138
230
345
765
* Source: POWERmap, ©2004 Platts, a Division of the McGraw-Hill Companies
The annual wind power estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.
Wind Power Classification
Wind Power Class | Resource Potential | Wind Power Density at 50 m W/m² | Wind Speed[a] at 50 m m/s | Wind Speed[a] at 50 m mph
1 Poor 0 - 200 0.0 - 5.6 0.0 - 12.5
2 Marginal 200 - 300 5.6 - 6.4 12.5 - 14.3
3 Fair 300 - 400 6.4 - 7.0 14.3 - 15.7
4 Good 400 - 500 7.0 - 7.5 15.7 - 16.8
5 Excellent 500 - 600 7.5 - 8.0 16.8 - 17.9
6 Outstanding 600 - 800 8.0 - 8.8 17.9 - 19.7
7 Superb > 800 > 8.8 > 19.7
[a] Wind speeds are based on a Weibull k of 2.0.
50 0 50 100 150 200 Kilometers
25 0 25 50 75 100 125 Miles
NREL
U.S. Department of Energy
National Renewable Energy Laboratory

EXAMPLES OF WIND TURBINES

Examples of Wind Turbines



Drawing of the rotor and blades of a wind turbine, courtesy of ESN

ADDITIONAL INFORMATION TO ADDRESS COMMENTS AND QUESTIONS FROM IMPLEMENTATION COMMITTEE

Upwind Turbines

The rotor on an upwind turbine is in the front of the unit, positioned similar to a propeller driven airplane. This is the most common type of small turbines operating in the U.S. To keep it oriented into the wind, a yaw mechanism such as a tail is needed.

Advantage The reduced tower shading. The air will start to bend around the tower before it passes it so there is some loss of power from the interference, just not the degree as in the downwind turbine.

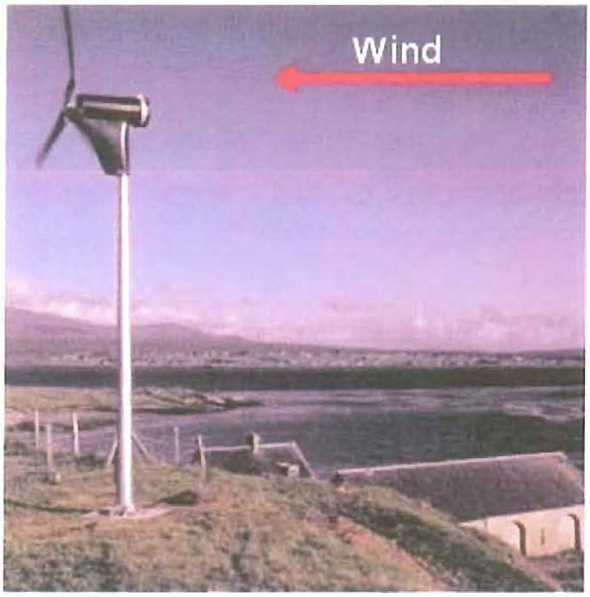
Disadvantage The extended nacelle that is required to position the rotor far enough away from the tower to avoid any problems with a blade strike. The blades themselves must be somewhat stiff to avoid bending back into the tower. This will mean the point where the blade attaches to the rotor hub will be stressed during high, gusty wind conditions.

Downwind Turbines

The downwind turbine has its rotor on the back side of the turbine. The nacelle typically is designed to seek the wind, thus negating the need for a separate yaw mechanism.

PLANNING COMMISSIONERS
PROVIDED TO ASSIST
IN QUESTION REGARDING
"UPWIND" VS. "DOWNWIND"
TURBINES. "UPWIND" ARE
THE MORE COMMON TYPE
OF SMALL TURBINE.

BMS



Advantage

The rotor blades can be flexible since there is no danger of a tower strike. The flexing blade has two advantages.

1. They can be less expensive to make

2. They can relieve stress on the tower during high or gusty wind conditions since the

flexing allows some wind load to be transferred directly to the blades instead of the tower. The Proven has a hinged design that allows the blade to flex back to dissipate energy for speed control.

Disadvantage

The flexible blade advantage can also be a disadvantage as the flexing may fatigue the blades.Tower shadow is problem with a downwind machine since the rotor blade actually passed behind the tower. This can cause turbulence and increased fatigue on the unit.

Summary

The upwind turbine will be the most common in the small scale, renewable energy scene. The two largest manufacturers of turbines, Bergey and Southwest Wind Power, produce upwind machines. The exception is Southwest Wind Power who recently started selling a downwind model, the Skystream, which is aimed at the grid-tie market. The predominant downwind machine is the Proven brand. Produced in Scotland.

For residential size turbines there is no clear winner between the upwind and downwind design. You can't really say that one turbine will last longer or produce more power just because it's an upwind or downwind turbine. Although this is an important factor to consider, it's not the end all be all.

ADDITIONAL INFORMATION REGARDING WIND TURBINES.

AWEA AMERICAN WIND ENERGY ASSOCIATION

FAQ for Small Wind Systems

FOR MORE INFORMATION, PLEASE CONTACT:

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Small Wind Advocate

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202-383-2546

For a complete list of AWEA member equipment providers see: www.awea.org/smallwind/smsyslst.html

General Information about Small Wind Systems

Small Wind Turbines are electric generators that use the energy of the wind to produce clean, emissions-free power for individual homes, farms, and small businesses. With this simple and increasingly popular technology, individuals can generate their own power and cut their energy bills while helping to protect the environment. Unlike utility-scale turbines, small turbines can be suitable for use on properties as small as one acre of land in most areas of the country.

What size turbine is needed to power an entire home? On average, a typical American home would require a small turbine with a 5-kilowatt (kW) generating capacity to meet all its electricity needs. A machine of this size has a diameter of approximately 18 feet. The exact size needed to power a home, however, can range from 2 kW to 10 kW (12-25 ft. diameter) based on a home's energy use, average wind speeds, and the turbine's height above ground (which affects its productivity).

How tall are they? The average height of a small wind turbine (of any capacity) is about 80ft. (about twice the height of a neighborhood telephone pole), with a range of 30-140 ft. Generator size and tower height are not generally related; a 5-kW turbine could be on a tower anywhere from 30-140 ft. in height, for example.

What is the average payback period? The length of the payback period depends on the turbine, the quality of wind at the installation site, prevailing electricity rates, and available financing and incentives. Depending on these and other factors, the time it takes to fully recover the cost of a small wind turbine can take anywhere from 6 to 30 years.

How much do they cost? The purchase and installation of a system large enough to power an entire home costs, on average, $30,000, but the price can range from $10,000 to $70,000 depending on system size, height, and installation expenses. The purchase and installation of very small (<1 kW) off-grid turbines generally cost $4,000 to $9,000, and a 100-kW turbine can cost $350,000. The federal government and many states have rebate or tax credit programs in place to encourage investment in small wind (see http://dsireusa.org).

What happens when the wind does not blow? For grid-connected systems, the user will not notice a difference when the wind is not blowing. The utility provides electricity when the wind does not blow, and any extra electricity the turbine generates is sent back to the utility system to be used by a neighbor. Off-grid turbines store power in batteries for on-demand use and are often complemented by solar electric panels to provide more consistent generation.

Do I need to take wind measurements? Taking detailed measurements to gauge your wind resource is usually unnecessary. Individual installers/dealers or manufacturers can determine whether your property is suitable for a system by inspecting the surrounding area.

Continued...

AWEA AMERICAN WIND ENERGY ASSOCIATION

FAQ for Small Wind Systems

Are they noisy? A turbine operating at full capacity is about as loud as a refrigerator. Modern models are increasingly quiet and any sound emitted is often masked by the sound of the wind itself.

How much land is required? Will my town let me install a turbine? Land requirements vary from place to place. Zoning codes sometimes impose a minimum requirement on lot size or on the distance a turbine may be placed from a property line, and may vary depending on the height of the proposed turbine. Also, it is essential to have a site with unobstructed access to winds, which most often requires higher towers, larger land lots, and non-urban locations. Currently, less than 1% of all small wind turbines are used in urban applications partly due to zoning restrictions, but mostly because wind quality is much poorer in densely built environments. Contact your turbine factory dealer or see AWEA's small-wind permitting guide at www.awea.org/smallwind to for help navigating the permitting process.

How does the rated capacity of a small wind system compare to its actual performance? Rated capacity indicates the rate of energy production at a given wind speed, so the answer depends on wind speed - and the turbine. A more accurate indicator of energy production, however, is blade length. A 5-kW turbine (average residential size, 18ft. rotor diameter) produces around 10,000 kWh per year in 12-mph average winds, which is about 100% of what an average U.S. home requires. At the larger end of the spectrum, a 100-kW turbine (60ft. diameter) in these conditions will generate around 250,000 kWh per year.

Are batteries or other storage needed? For very small systems, yes, but not for residential-scale turbines or larger. There are two types of systems: those connected to the electricity grid ("on-grid") and those used off-grid for battery charging or backup power. Most systems sold today are off-grid, but demand is rising for on-grid systems which essentially use the grid as a "battery": when the wind blows, the owner uses electricity from the turbine; when winds are low and consumption is high, the owner uses electricity from the grid. A small wind turbine is more commonly used in conjunction with solar photovoltaic technology than it is with a battery storage system.

How are small wind systems maintained? Routine inspections are performed once every few years of a turbine's 20+-year lifespan. A professional installer or trained technician (usually the manufacturer or dealer that sold the turbine) maintains the turbine and tower through physical inspections, though some turbines can be monitored remotely from a home computer.

How can I advocate for good policies? AWEA, our members, and our allies actively engage state and federal lawmakers to promote good policies for small wind, such as tax credits, streamlined zoning and permitting, net metering, and standardized grid interconnection rules. Grassroots activism is a key component of our efforts. To join, visit the following links:
www.awea.org/legislative/grassroots_activities.html
www.awea.org/smallwind/toolbox2/drawer_2_promotion.html

Where can I go for more information? The American Wind Energy Association has a toolbox of information on its Web site for people interested in installing a small wind system at www.awea.org/smallwind. On this site, you can find advice from an expert, some state-specific information about buying and installing a small wind turbine, success stories, technical information, and much more.

Also see "Wind Turbine Buyer's Guide" by Mick Sagrillo and Ian Woofenden in *Home Power* magazine (June/July 2007) www.homepower.com/files/featured/TurbineBuyersGuide.pdf.

Photos courtesy of Bergey Windpower and Michael Mercurio, Beach Haven, NJ

AWEA AMERICAN WIND ENERGY ASSOCIATION

Wind Turbines and Health

The American Lung Association's agenda for the new administration, Protect the Air We Breathe: An Agenda for Clean Air, states

"Climate, energy and clean air are inexorably linked. Solutions that lead to cleaner air must be included in any approach to cleaner, more efficient energy use and reductions in global warming." [1]

Wind energy is one such solution - a clean energy source that can provide communities with decreased greenhouse gas emissions, along with air quality improvements and corresponding human health benefits.

FOR MORE INFORMATION, PLEASE CONTACT:

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Manager of Siting Policy

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20% Wind Energy and Climate Change
As America and the world grapple with the immense problem of climate change, one energy source stands out as an abundant, affordable and readily available supply option: wind power. The U.S. Department of Energy's 20% Wind Energy by 2030 Technical Report (www.20percentwind.org) finds that wind power can supply 20 percent of America's electricity by 2030 and reduce projected emissions of carbon dioxide (CO2), the leading greenhouse gas, by 25 percent. Additionally, each megawatt-hour of wind generation can prevent the loss of up to 600 gallons of water from fossil fuel power plant cooling.[2]

The wind industry takes health concerns seriously
Any concern that wind turbines may impact someone negatively should be explored. However, we are not aware of any scientifically peer-reviewed information demonstrating a link between wind turbines and negative health effects. Thousands of people around the world live near wind turbines without ill consequences.

Wind energy can help improve air quality
Air quality has a direct impact on human health. Particulate matter in the air, often as a result of power plant emissions, has been shown to affect cardiovascular and respiratory health. Unhealthy levels of particle pollution can even cause otherwise healthy people to get sick. More than 25 percent of the people in the United States live in counties with unhealthy levels of short-term particle pollution.[3] The generation of electricity from the wind does not result in any air emissions. By offsetting more polluting forms of energy generation, wind energy can actually improve air quality and our health.

Wind energy can help reduce global warming pollutants
In 2007, wind energy generation prevented the emission of nearly 28 million tons of carbon dioxide – a greenhouse gas that contributes to climate change. Human health can be adversely affected by rising global temperatures. Fewer frost events and longer warm seasons could result in stronger and more widespread allergens and fungal spores, as well as an increase in the spread of exotic diseases. Health experts also raise concerns of an increased incidence of heat waves and resulting deaths.[4] Wind energy produces less than two percent of the emissions from coal combustion per megawatt-hour, even when the manufacturing process of wind turbines is accounted for, giving it one of the lowest greenhouse gas lifecycle emissions levels of any power technology.

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Wind Turbines and Health

Wind plants are generally quiet:
Wind plants are very quiet compared to other types of industrial facilities, such as manufacturing plants. But wind plants typically are located in rural or low-density residential areas, where turbine noise may be more obvious because background noise is lower than in urban areas. On the other hand, the turbine noise may often be masked by the noise of the wind itself - especially since turbines are located where the wind speed is higher than average and because they operate only when the wind is blowing.

The source of wind turbine sounds
The sounds emitted from wind turbines can be mechanical, from internal equipment such as the gearbox or yaw drive, or aerodynamic, from air moving past the rotor blades. Current turbine designs effectively reduce mechanical sound through sound proofing; therefore, the aerodynamic sound, often described as a "whooshing" sound, is what can normally be heard.

There is no reliable evidence that low-frequency sound from wind turbines is a problem
Low-frequency sound is generally defined as frequencies between 10 Hz (Hertz, oscillations per second) and 100 Hz. This type of sound has many sources, such as machinery, transportation or the ocean, and is generally always present as an element of background noise. Infrasound is considered to be frequencies below 20 Hz and can be perceived at frequencies as low as 2 Hz. According to a peer-reviewed article in Canadian Acoustics, "there is no reliable evidence that infrasound at levels below its hearing threshold has an adverse effect on the body" (p.30) and "infrasound from wind turbines is below the audible threshold and of no consequence" (p.34).[5] Also, low-frequency sound weakens rapidly with distance. The aerodynamic "whooshing" sound described above is not low-frequency sound or infrasound.

Shadow flicker occurrence is easily calculated
Shadow flicker occurs when the blades of a turbine pass in front of the sun to create a recurring shadow on an object. Computer models in wind development software can determine the days and times during the year that specific buildings in close proximity to turbines may experience shadow flicker. Mitigation measures can be taken based on this knowledge and may include setbacks or vegetative buffers. Issues with shadow flicker are less common in the United States than in Europe due to the lower latitudes and the higher sun angles in the United States.

Shadow flicker is not harmful to persons with epilepsy
The allegation is sometimes made that shadow flicker from wind turbines can cause epileptic seizures. This is not true—shadow flicker from wind turbines occurs much more slowly than the light "strobing" associated with seizures. The strobe rates necessary to cause seizures in people with photosensitive epilepsy are 3 to 5 flashes per second[6] and large wind turbine blades cannot rotate this quickly.

Sources:

[1] American Lung Association. (2009). An Agenda for Clean Air: Protect the Air We Breathe http://www.lungusa.org/atf/cf/%7B7a8d42c2-fcca-4604-8ade-7f5d5e762256%7D/PROTECT_THE_AIR_WE_BREATHE.PDF
[2] Department of Energy. (2008). 20% Wind Energy by 2030 www.20percentwind.org
[3] American Lung Association. (2008). State of the Air: 2008. http://www.stateoftheair.org/2008/health-risks/
[4] U.S. News and World Report. (2008). 10 Ways Global Warming Could Hurt Your Health. http://health.usnews.com/articles/health/2008/09/15/10-ways-global-warming-could-hurt-your-health.html
[5] Leventhall, G. (2006). Infrasound from wind turbines – Fact, fiction or deception. Canadian Acoustics, 34(2), p.29-36.
[6] Epilepsy Foundation. (n.d.). Photosensitivity and Epilepsy. http://www.epilepsyfoundation.org/about/photosensitivity/

Plans available for viewing at the
Community Development Department.