

## INTRODUCTION

The growth in the number of wind energy conversion systems (WECS) in Minnesota over the last 15 years is a remarkable measurement of sustainability. Wind energy has no harmful emissions, reduces greenhouse gases, captures local resources for economic gain, and is frequently cost-competitive with other forms of electric generation. But WECS have impacts on other land uses that are found in areas of wind resources, including residential homes, some agriculture, natural resources, and on the character of the community. As the market for wind energy increases and the cost drops, increasing numbers of local governments find themselves trying to address proposed WECS without the proper policies or zoning tools in place.

Although most of Minnesota's wind energy resource is in rural areas, even urban areas are having to address these issues. Increasing numbers of urban residents and businesses are looking for opportunities to improve sustainability and energy independence. The land use conflicts between WECS and other uses are even greater in the suburban and urban environment. Cities must draw a clear line as to where wind energy systems are appropriate and where the nuisances and conflicts outweigh the benefits of wind energy.

### Understand Your Goals

The first step in creating a wind energy ordinance is to identify the community's goal to be achieved by the regulation. Some communities want to encourage renewable energy generation. Other communities are primarily concerned with mitigating conflicts between wind energy systems and other land uses. The first goal leads to the question of where should the community give priority to wind energy. This in turn requires the community to understand where there might be a meaningful wind energy resource; trees, buildings, and topography all have a substantial effect on the viability of the local wind resource. The second goal leads to the question of whether wind energy is appropriate for the community, and how extensively to restrict it. Communities can choose to prohibit WECS, except for those installations that in the regulatory province of the State. Prohibiting WECS in locations where the wind resource is poor or nonexistent can actually have a positive effect on developing local energy opportunities, by directing land owners to focus on energy efficiency, solar energy or other resources more suitable for their site.

### Large WECS, Small WECS

In order to address the issues associated with WECS, local governments must understand that WECS come in many different sizes and designs, with dramatically different impacts on and benefits to the community. The first distinction communities need to make in addressing WECS in their development regulations is between systems that are primarily designed as electric power generators for utility systems or wholesale power markets, and those systems that are designed primarily to provide power to a single resi-

### *Model Wind Energy Ordinance*

*This ordinance is based primarily on the model ordinance for county governments created in 2005 by the Clean Energy Resource Teams and the Minnesota Project. The ordinance was created to help counties address the evolving dilemmas associated with utility-scale wind development (large turbines typically with over one megawatt (1 MW) of capacity). The accompanying guide to the CERTS model ordinance may be found at: [www.mncounties3.org/macpza/OrdinanceLinks/wind%20ord1.pdf](http://www.mncounties3.org/macpza/OrdinanceLinks/wind%20ord1.pdf)*

*This model also adopts standards for large turbines set by the Minnesota Public Utilities Commission in its 2008 order, Docket E,G-999/M-07-1 102.*

*Additional sources include:*

- *In the Public Interest: How and Why to Permit for Small Wind Systems - A Guide for State and Local Governments, September 2008*
- *Permitting Small Wind Turbines: A Handbook, California Energy Commission, AWEA, September 2003*
- *Small Wind Electric Systems: A Minnesota Consumers' Guide, U.S. DOE, 2007*
- *Small Wind Energy Guide: Kandiyohi County, Minnesota, August 2007*
- *City of Minneapolis Wind Energy Ordinance*
- *City of Mankato WECS Ordinance*
- *City of Pipestone WECS Ordinance*
- *City of St. Louis Park WECS Ordinance*

### **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.*

*Source: 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*

dence or business. The former use utility-scale turbines with a capacity measured in megawatts, rise hundreds of feet into the air, and are typically (but not always), part of a wind farm system with other similar turbines. The latter are, by contrast, quite small in terms of generating capacity, height, and frequency in the landscape. Small wind systems are sometimes further divided into two categories of very small systems and larger systems. Where these divisions are made is highly dependent upon the character of the community, the type of local government, and the magnitude of the wind resource.

### **Elements of a WECS Ordinance**

Counties, cities, and townships are enabled to regulate land use under Minnesota Statutes 394 and 462 for the purpose of: “promoting the health, safety, morals, and general welfare of the community.” How wind energy land use issues affect each type of community will significantly change the structure and focus of the WECS ordinance. Some common elements to consider in all communities are noted below.

#### **A. Distinguish between Types of Wind Energy Applications**

As noted earlier in the introduction, the community will likely need to distinguish between the different sizes of wind energy systems relative to the typical lot size, density, natural resources, and wind resource. Two or three categories of WECS may need to be identified in the ordinance: large scale (commercial), smaller scale (non-commercial), very small (micro).

#### **B. Define Necessary Permits**

Some WECS can be listed as permitted uses, but others should be considered conditional uses, and some applications should be prohibited. Large-scale WECS should always be conditional, in order to ensure that the specific design of the system minimizes nuisances and allow for public comment. Non-commercial WECS in rural areas should probably be permitted uses. Conditional use permits may be justified for non-commercial systems where housing density is greater than a rural setting. WECS on lots smaller than one acre become problematic, although in certain circumstances half-acre lots can accommodate micro-WECS. Genuine urban density areas (either in existence or planned) should not include WECS as a permitted or conditional use, barring a change in technology that allows for decreased visual, safety, and noise impacts.

If the community chooses to utilize a wind-energy overlay district, a greater degree of flexibility should be built into the development process. Large-scale projects should probably still be conditional, but fewer conditions will allow the district to serve as an encouragement for sustainable development of local wind resources.

**C. Identify Wind Resource Standards**

Communities should identify where optimal wind resources are located, or identify the conditions that define legitimate wind resources. Installing WECS in areas with minimal wind resources is bad for both the landowner and the community. The Minnesota Department of Commerce has wind resource maps for the entire state at a 500 meter resolution. Alternatives to the statewide maps include site-specific certification by a certified wind energy assessor or installer, or performance criteria that identify the turbine will be above trees and buildings for a minimum radius distance.

**D. Establish Setbacks**

Communities need to identify setbacks that protect surrounding land uses and community character but still allow the community's wind resource to be developed. Examples of land uses that could dictate setbacks include:

1. Residential homes, distinguishing between homes of people who are financially participating in the project and those who are not.
2. Property lines and road rights-of-way
3. Designated conservation or wildlife areas, wetlands, scenic river bluffs,

**E. Establish Safety Standards**

Communities need to identify safety standards that protect without effectively prohibiting the WECS. Requiring engineering certification on very small systems may have the same effect as prohibiting WECS. Residential areas may need some consideration of a tower as an attractive nuisance, and reasonable fall zones should always be considered.

**F. Establish Design Standards**

Design standards need to be matched to the type of WECS. Commercial systems should always have tubular towers. Treatment of power lines, color, lighting, signage, and substation should be specified. Non-commercial systems, depending on the allowed height and the surrounding land uses, may also have specific design considerations that must be followed. All WECS other than the very small category should have a decommissioning plan and provisions.

**G. Establish Other Applicable Standards**

Noise standards are particularly important for non-commercial systems in non-agricultural areas for the satisfaction of surrounding land owners and protection of the WECS owner from unwarranted complaints. Minnesota state law is based on a standard of 50 decibels at the nearest house). Electric code compliance and FAA regulations may also need to be addressed. Cities and rural areas near may need to address visual impacts

**H. Minimize Infrastructure Impacts**

Commercial systems need to address the risk to roads for both initial transportation of components and on-going maintenance of the WECS. Any system (commercial or non-commercial) that includes excavations for creating a foundation needs to protect drainage systems. Telecommunications infrastructure can be affected if care is not taken. Green infrastructure can also be affected, including habitat systems and natural viewsheds that define community character.

***Adapting the Model Standards***

*The initial sections of this model ordinance was written primarily for county or township governments, and targeted for situations typical for rural agricultural areas of Minnesota. Many standards will need to be adapted for communities that are less rural or that have lower quality or more sporadic wind resources due to forested lands or topography. Most cities can disregard virtually all of the commercial WECS provisions except for the possibility of isolated utility-scale turbines on very large parcels that are unlikely to be subdivided or redeveloped (industrial or institutional areas). Local units of government will need to assess their own community standards and may choose alternative thresholds than shown here.*

***Interpretation, Conflict and Separability***

*The community may wish to examine the Interpretation, Conflict and Separability language in its other ordinances and utilize consistent language.*

**I. Wind Energy Conversion System Ordinance**

- A. **Purpose** - This ordinance is established to regulate the installation and operation of Wind Energy Conversion Systems (WECS) within Model Community not otherwise subject to siting and oversight by the State of Minnesota under the Minnesota Power Plant Siting Act (MS 116C.51-116C.697. ), encourage local wind energy development in priority wind energy areas, and meet Model Community’s Comprehensive Plan goals, including the following:
  - 1. Goal - Encourage the sustainable use of local economic resources.
  - 2. Goal - Encourage development that helps meet Model Community’s and the State of Minnesota’s climate protection goals.
  - 3. Goal - Minimize conflicts between desirable land uses that may need to coexist in the same area.
  
- B. **Interpretation, Conflict and Separability**
  - 1. **Interpretation** - In interpreting these regulations and their application, the provisions of these regulations shall be held to be the minimum requirements for the protection of public health, safety and general welfare. These regulations shall be constructed to broadly promote the purposes for which they are adopted.
  - 2. **Conflict** - These regulations are not intended to interfere with, abrogate or annul any other ordinance, rule or regulation, statute or other provision of law except as provided in these regulations. No other provision of these regulations that impose restrictions different from any other ordinance, rule or regulation, statute or provision of law, the provision that is more restrictive or imposes higher standards shall control.
  - 3. **Separability** - If any part or provision of these regulations or the application of these regulations to any developer or circumstances is a judged invalid by any competent jurisdiction, the judgment shall be confined in its operation to the part, provision or application directly involved in the controversy in which the judgment shall be rendered and shall not affect or impair the validity of the remainder of these regulations or the application of them to other developers or circumstances.
  
- C. **Enforcement, Violations, Remedies and Penalties** - Enforcement of the Wind Energy Conversion System Ordinance shall be done in accordance with process and procedures established in Section \_\_\_\_ of the Model Community Zoning Ordinance.

## D. Definitions

**Aggregated Project** - Aggregated projects are those which are developed and operated in a coordinated fashion, but which have multiple entities separately owning one or more of the individual WECS within the larger project. Associated infrastructure such as power lines and transformers that service the facility may be owned by a separate entity but are also included in the aggregated project.

**Blade Arc** - The arc created by the edge of the rotor blade that is farthest from the nacelle.

**Commercial WECS** - A WECS of equal to or greater than 100 kW in total name plate generating capacity.

**Non-Commercial WECS** - A WECS less than 100 kW in total name plate generating capacity.

**Fall Zone** - The area, defined as the furthest distance from the tower base, in which a guyed tower will collapse in the event of a structural failure. This area is less than the total height of the structure.

**Feeder Line** - Any power line that carries electrical power from one or more wind turbines or individual transformers associated with an individual wind turbine to the point of interconnection with the electric power grid, in the case of interconnection with the high voltage transmission systems the point of interconnection shall be the substation serving the WECS.

**Meteorological Tower** - For the purposes of this Wind Energy Conversation System Ordinance, meteorological towers are those tower which are erected primarily to measure wind speed and directions plus other data relevant to siting WECS. Meteorological towers do not include towers and equipment used by airports, the Minnesota Department of Transportation, or other similar applications to monitor weather conditions.

**Micro-WECS** - Micro-WECS are WECS of two (2) kW nameplate generating capacity or less mounted on a tower of 70 feet or less.

**Property Line** - The boundary line of the area over which the entity applying for WECS permit has legal control for the purposes of installation of a WECS. This control may be attained through fee title ownership, easement, or other appropriate contractual relationship between the project developer and landowner.

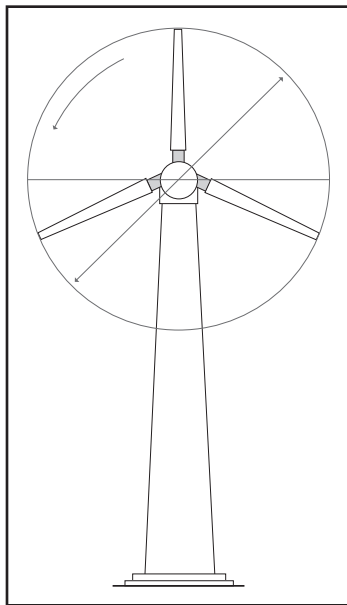
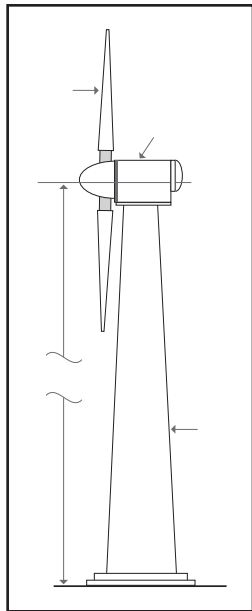
**Public Conservation Lands** - Land owned in fee title by State or Federal agencies and managed specifically for conservation purposes, including but not limited to State Wildlife Management Areas, State Parks, State Scientific and Natural Areas, federal Wildlife Refuges and Waterfowl Production

### *Commercial, Non-Commercial*

*Different communities will set different thresholds to distinguish between commercial and non-commercial wind energy systems. Under existing Minnesota law renewable energy projects with a electric generating capacity of less than 40 kW qualify for "net metering," in which electric generation in excess of on-site demand is purchased by the electric utility at the retail rate. While the net metering threshold seems reasonable, the standard is actually somewhat artificial. The land use and nuisance characteristics of a 40 kW system and a 100 kW system are quite similar, especially in rural communities. Federal and state laws have established relatively favorable procedures and rates for interconnecting renewable generators of under 100 kW capacity. Some communities may find that turbines of up to 100 kW are fully consistent with other land uses and reasonably quality for a less rigorous (non-commercial) set of standards and review procedures.*

### *Micro-WECS*

*This model ordinance recognizes a separate category for very small WECS that has a lower threshold for land use approval. The example here uses a capacity threshold of two kW, quite small for a generator, on a 60-foot tower, the minimum height for meaningful production. Urban communities may consider regulation for shorter towers and building mounted systems (see Minneapolis reference at the end of the ordinance) but these systems are unproven and are little more than curiosities; technology does not currently exist to generate meaningful energy in turbulent and low speed urban wind.*



Areas. For the purposes of this section public conservation lands will also include lands owned in fee title by non-profit conservation organizations. Public conservation lands do not include private lands upon which conservation easements have been sold to public resource management agencies or non-profit conservation organizations.

**Rotor Diameter** - The diameter of the circle described by the moving rotor blades.

**Substations** - Any electrical facility designed to convert electricity produced by wind turbines to a voltage greater than (35,000 KV) for interconnection with high voltage transmission lines shall be located outside of the road right of way.

**Total Height** - The highest point, above ground level, reached by a rotor tip or any other part of the WECS.

**Transmission Line** - Those electrical power lines that carry voltages of at least 69,000 volts (69 KV) and are primarily used to carry electric energy over medium to long distances rather than directly interconnecting and supplying electric energy to retail customers.

**Tower** - Towers include vertical structures that support the electrical generator, rotor blades, or meteorological equipment.

**Tower Height** - The total height of the WECS exclusive of the rotor blades.

**WECS - Wind Energy Conversion System** - An electrical generating facility comprised of one or more wind turbines and accessory facilities, including but not limited to: power lines, transformers, and substations that operate by converting the kinetic energy of wind into electrical energy. The energy maybe used on-site or distributed into the electrical grid.

**Wind Turbine** - A wind turbine is any piece of electrical generating equipment that converts the kinetic energy of blowing wind into electrical energy through the use of airfoils or similar devices to capture the wind.

- E. **Procedures for Permits** - Zoning, Land Use, and Conditional Use permits and Variances shall be applied for and reviewed under the procedures established in this Ordinance, except where noted below.
1. The application for all WECS shall include the following information:
    - a. The names of project applicant
    - b. The name of the project owner

- c. The legal description and address of the project
  - d. A description of the project including: number, type, name plate generating capacity, tower height, rotor diameter, and total height of all wind turbines and means of interconnecting with the electrical grid.
  - e. Location of property lines, wind turbines, electrical wires, interconnection points with the electrical grid, and all related accessory structures, including distances and drawn to scale.
  - f. Location and height of all buildings, structures, above ground utilities and trees located within five hundred (500) feet of each proposed non-commercial WECS and within three rotor diameters of each commercial WECS.
  - g. For commercial WECS, identification of the primary and secondary wind axis.
  - g. An elevation drawing accurately depicting the proposed WECS and its relationship to structures on the subject site and adjacent lots.
  - h. Engineer's certification of tower structure and foundation. Manufacturer certification and specification sheets may, at the discretion of Model Community, be used in place of engineering study for non-commercial WECS.
  - i. Documentation of land ownership or legal control of the property.
  - j. Non-commercial WECS shall submit a copy of the interconnection agreement with the utility or documentation that an interconnection agreement is not necessary.
  - k. Non-commercial WECS that are not connected to the electric grid shall identify location of battery or other storage device.
2. The application for commercial WECS shall also include:
- a. The latitude and longitude of individual wind turbines.
  - b. A USGS topographical map, or map with similar data, of the property and surrounding area, including any other WECS within 10 rotor diameters of the proposed WECS.
  - c. Location of lakes, wetlands, parks, federal or state habitat areas, other protected natural areas, and County Biological Survey sites within 1,320 feet of the proposed WECS.
  - d. An acoustical analysis documenting the sound level within 1000 feet of the turbine
  - e. FAA Permit Application
  - f. Location of all known communications towers within 2 miles of the proposed WECS
  - g. Decommissioning Plan

***Objects Within 500 Feet***

*Identifying structures and trees within 500 feet of the proposed WECS helps the community document that the WECS is being installed in an area with legitimate wind resources. Turbines generally must be 20-40 feet above trees and buildings within 500 feet to operate as designed.*

**Aggregated Projects**

Large electric generating facilities are regulated by the State rather than by local governments. Aggregated projects having a combined capacity equal to or greater than the threshold for State oversight as set forth in MS Statute 216F.01 through 216F.09 (currently 5 MW for wind energy projects, except as noted below) shall be regulated by the State of Minnesota. Commercial wind developments (wind farms) are, however, sometimes broken into phases, or separated by ownership but not by geography. In 2007, the Statute setting regulatory thresholds was changed to allow counties the option of regulating wind energy projects of up to 25 MW (216.F.08), if they follow the process defined in Statute.

**Alternatives to Zoning District Regulation**

An alternative to setting commercial WECS standards for each zoning district is to establish a Wind Energy Development Overlay District. The community can pro actively identify where the conditions are good and bad for large scale wind development based on community priorities such as viewsbed protection, natural resource areas, or ultimate build-out for rural residential or urban development. The community would map an overlay with a separate set of WECS standards. The overlay concept could also be applied to small (non-commercial) WECS in some circumstances.

h. Identification of nearby WECS and description of potential impacts on wind resources on adjacent properties.

- F. **Procedure for Aggregated Projects** - Aggregated projects may jointly submit a single application and be reviewed under a single proceeding, including notices, hearings, reviews and approvals. Permits will be issued and recorded separately. Joint applications will be assessed fees as one project.
- G. **District Regulations** - WECS will be permitted, conditionally permitted or not permitted based on the generating capacity and land use district as established in the table below:

District	Non-Commercial*	Commercial	Meteorological Tower*
Agriculture (A-1, A-2, A-3)	Permitted	Conditionally Permitted	Permitted
Rural Residential	Conditionally permitted	Not permitted	Not Permitted
Rural Town Site	Not permitted	Not permitted	Not Permitted
General Business District	Not permitted	Not Permitted	Not permitted
Highway Commercial	Conditionally permitted	Not Permitted	Permitted
Light Industry	Permitted	Conditionally Permitted	Permitted
Heavy Industry	Permitted	Conditionally Permitted	Permitted
Shoreland	[may depend upon the lake and the specific district]	Not permitted	Not permitted
Urban Expansion Overlay District	Conditionally permitted	Not permitted	Not permitted
Conservation / Special Protection	[depends on the district purpose, the protected resource and the impacts of a turbine on that resource]		
Shoreland	Conditionally permitted	Not permitted	Not permitted
Wild and Scenic River	Conditionally permitted	Not permitted	Not permitted

\* Non-Commercial WECS and Meteorological towers shall require a conditional use permit if over \_\_\_\_\_ feet in height in accordance with the Model Community Zoning Ordinance.



	Wind Turbine – Non- Commercial	Wind Turbine - Commercial WECS	Meteorological Towers
Property Lines	1.1 times the total height in Agricultural or Industrial Land Use Districts only, or the distance of the fall zone, as certified by a professional engineer + 10 feet.	5 rotor diameters along the primary wind axis, 3 rotor diameters along the secondary wind axis (rotor diameters are between 250-400 feet)	The fall zone, as certified by a professional engineer, + 10 feet or 1.1 times the total height.
Residential Dwellings, participating*		750 feet	The fall zone, as certified by a professional engineer, + 10 feet or 1.1 times the total height.
Residential Dwelling, non-participating		1,000 feet	The fall zone, as certified by a professional engineer, + 10 feet or 1.1 times the total height.
Road Rights-of-Way**	The distance of the fall zone as certified by a professional engineer + 10 feet or 1 times the total height.	1 times the height, may be reduced for minimum maintenance roads or a road with Average Daily Traffic count of less than 10.	The fall zone, as certified by a professional engineer, + 10 feet or 1 times the total height.
Other Rights-of-Way (Railroads, power lines, etc)	The lesser of 1 times the total height or the distance of the fall zone, as certified by a professional engineer + 10 feet.	To be considered by the planning commission	The fall zone, as certified by a professional engineer, + 10 feet or 1 times the total height.
Public conservation lands	NA	600 feet	600 feet
Wetlands, USFW Types III, IV and V	NA	600 feet	600 feet
Other Structures		To be considered	
Other Existing WECS	NA	Several factors to be considered in order to minimize or eliminate impact on existing WECS includes: the relative size of the existing and proposed WECS, the alignment of the WECS relative to the predominant winds, topography, the extent of wake interference impacts on existing WECS, and other considerations. Waived for internal setbacks in multiple turbine projects including aggregated projects.	
_____ River Bluff	500	[1,000 / 1,320 ]	

\* The setback for dwellings shall be reciprocal in that no dwelling shall be constructed within 750 feet of a commercial wind turbine.

\*\* The setback shall be measured from future rights-of-way if a planned changed or expanded right-of-way is known.

**H. Setbacks, Wind Turbines and Meteorological Towers**

- 1. Setbacks** - All towers shall adhere to the setbacks established in the above table.
- 2. Substations and Accessory Facilities** - Minimum setback standards for substations and feeder lines shall be consistent with the standards established in the Model Community General Development Standards for Essential Services.

**Meteorological Towers**  
*The community may have an existing tower ordinance in place, and may choose to regulate meteorological towers under that ordinance.*

***River Bluff Setback (previous page)***

*The intent of the setback from river bluffs is to minimize the impact on the scenic qualities of major rivers valleys such as the Mississippi, St. Croix and Minnesota. Care should be taken to avoid excessive setbacks, particularly from bluffs overlooking smaller tributaries to the major river. Wabasha County Minnesota has adopted 1/4 mile setbacks (1,325 feet) from bluffs overlooking tributaries as well as the Mississippi River. This effectively creates a broad corridor where WECS are prohibited. Areas with complex terrain are better suited to use the overlay concept rather than District-based setbacks.*

***Substations and Accessory Facilities (previous page)***

*Many zoning ordinances address “essential services” which includes electric power lines and substations. Most substations are sited adjacent to the road ROWs. This conserves farm land and reduces costs for such facilities, but creates concerns for road authorities including sight lines, snow drifting, and financial liabilities during road re-construction. Substations associated with WECS should be regulated in a manner consistent with essential service regulations. However, if not regulated under a separate standard, the WECS ordinance should establish specific setbacks for substations and lines.*

***Established Wind Resource***

*These are alternative ways the community can ensure that WECS are meeting the community’s renewable energy, climate protection, or energy independence goals.*

**I. Requirements and Standards**

**1. Safety Design Standards**

- a. **Engineering Certification** - For all WECS, applicant must provide engineering certification of turbine, foundation, and tower design is within accepted professional standards, given local soil and climate conditions. For non-commercial and micro-WECS, certification can be demonstrated by the manufacturer’s engineer or another qualified engineer.
- b. **Rotor Safety.** Each non-commercial WECS shall be equipped with both a manual and automatic braking device capable of stopping the WECS operation in high winds (40 mph or greater).
- c. **Warnings**
  - i. For all commercial WECS, a sign or signs shall be posted on the tower, transformer and substation warning of high voltage. Signs with emergency contact information shall also be posted on the turbine or at another suitable point.
  - ii. For all guyed towers, visible and reflective objects, such as plastic sleeves, reflectors or tape, shall be placed on the guy wire anchor points and along the outer and innermost guy wires up to a height of 8 feet above the ground. Model Community may require that visible fencing be installed around anchor points of guy wires.
  - iii. Consideration shall be given to painted aviation warning on metrological towers of less than 200 feet.
- d. **Energy Storage** - Batteries or other energy storage devices shall be designed consistent with the Minnesota Electric Code and Minnesota Fire Code.

**2. Equipment Design and Performance Standards**

- a. **Established Wind Resource** - All WECS shall only be installed where there is an established wind resource. An established wind resource can be documented in the following ways:
  - i. The planned turbine site has a minimum 11 MPH average wind speed at the designed hub height, as documented on the Minnesota Department of Commerce statewide wind speed maps.
  - ii. The planned turbine has a minimum hub height of eighty (80) feet and the blade arc is 30 feet higher, on a vertical measurement, than all structures and trees within 300 feet of the tower.

- iii. The applicant submits an analysis conducted by a certified wind energy installer or site assessor (North American Board of Certified Energy Professional, NABCEP, or equivalent) that includes estimates of wind speed at turbine height based on measured data, estimated annual production, and compliance with the turbine manufacturer’s design wind speed.
  - iv. The proposed turbine is within the community’s designed wind energy overlay district.
- b. **Total Height, Non-Commercial WECS** - Non-Commercial WECS shall have a total height, including tower and rotor at its highest point, of less than 200 feet in rural and industrial zoning districts, and a maximum height of 125 feet in residential and commercial districts.
- c. **Turbine Certification** - Non-commercial and micro WECS turbines shall be certified or in the process of being certified the Small Wind Certification Council (SWCC) Micro-generation Certification Scheme (MCS), or must be listed by the Interstate Turbine Advisory Council.
- d. **Meteorological Towers Exempt from Zoning District Height Standards** - In those districts where meteorological towers are a permitted use, meteorological towers of less than 200 feet shall be exempt from the Conditional Use requirement for other land uses.
- e. **Tower Configuration**
  - i. All wind turbines that are part of a commercial WECS shall be installed with a tubular, monopole type tower.
  - ii. Meteorological towers may be guyed.
- f. **Color and Finish**
  - i. All wind turbines and towers that are part of a commercial WECS shall be white, grey and another non-obtrusive color. Blades may be black in order to facilitate deicing. Finishes shall be matt or non-reflective.
  - ii. Exceptions may be made for meteorological towers, where concerns exist relative to aerial spray applicators.
- g. **Lighting** - Lighting including lighting intensity and frequency of strobe, shall adhere to but not exceed requirements established by Federal Aviation Administration permits and regulations. Red strobe lights are preferred for nighttime illumination to reduce impacts on migrating birds. Red pulsating incandescent lights should be avoided. Exceptions may be made for

***NABCEP Certification***

*Certification processes for small wind installers and site assessors are currently ramping up, and only a few certified professionals are currently available.*

***Turbine Certification***

*Third-party certification helps ensure that the WECS is actually able to produce electricity to meet the community’s energy or climate protection goals.*

***Third-Party Certifiers***

*Several examples are given of entities that certify turbines. There is currently no single centralized place for certifying turbines.*

***Meteorological Towers Exempt from Zoning District Standards***

*This subsection presumes that land uses with a height greater than 100’ require a conditional use permit (common in county zoning ordinances). Communities should ensure consistency between the Standards section and District Regulations.*

**Essential Services**

*The model ordinance references the Essential Services Ordinance for determining substation and feeder line setbacks (Substations on previous page, Feeder Lines on current page). The intent is not to necessarily define the feeder lines as an essential service. The model ordinance anticipates that there will be projects that run feeder lines to interconnection points that are off site. The ordinance does not intend to provide commercial projects with the same prerogatives as a essential services, but rather to simplify determination of setbacks and placement of substations and feeder lines relative to rights-of-ways.*

**Feeder Lines**

*The requirement to bury all feeder lines may, in some communities, need to include provisions for exceptions.*

**Discontinuation and Decommissioning**

*Provisions for decommissioning the site after productive use has stopped protects the community in a variety of ways. Removal of the tower and accessory structures will limit the potential for blight and safety concerns associated with un-maintained equipment. An alternative to removal is restoration of the site, in which subterranean fixtures/foundations are also removed. Restoration will facilitate the return of the site to agricultural production or other uses.*

*The community should also require that the developer post a decommissioning bond or other financial assurance. The local government should not bear the risk of decommissioning should the wind developer go bankrupt.*

metrological towers, where concerns exist relative to aerial spray applicators.

- h. **Other Signage** - All signage on site shall comply with the Model Community sign ordinance. The manufacturer’s or owner’s company name and /or logo may be placed upon the nacelle, compartment containing the electrical generator, of the WECS.
- i. **Feeder Lines** - All communications and feeder lines, equal to or less than 34.5 kV in capacity, installed as part of a WECS shall be buried where reasonably feasible. Feeder lines installed as part of a WECS shall not be considered an essential service, as described in Model Community’s General Development Standards
- j. **Waste Disposal** - Solid and hazardous wastes, including but not limited to crates, packaging materials, damaged or worn parts, as well as used oils and lubricants, shall be removed from the site promptly and disposed of in accordance with all applicable local, state and federal regulations.

**3. Discontinuation and Decommissioning**

- a. **Abandonment.** A WECS shall be considered abandoned after one (1) year without energy production, unless a plan is developed and submitted to the Model Community Zoning Administrator outlining the steps and schedule for returning the WECS to service. All WECS and accessory facilities shall be removed to [ground level / four feet below ground level] within 80 days of abandonment.
- b. **Decommissioning Plan Required** - Each WECS, other than micro-WECS, shall have a decommissioning plan outlining the anticipated means and cost of removing WECS at the end of their serviceable life or upon abandonment. The cost estimates shall be made by a competent party; such as a Professional Engineer, a contractor capable of decommissioning or a person with suitable expertise or experience with decommissioning. The plan shall also identify the financial resources that will be available to pay for the decommissioning and removal of the WECS and accessory facilities.

**4.. Orderly Development**

Upon issuance of a conditional use permit, all commercial WECS shall notify the Environmental Quality Board Power Plant Siting Act program Staff (or successor State regulator) of the project location and details on the survey form specified by the Environmental Quality Board or successor agency.

**J. Other Applicable Standards**

- 1. **Noise** - All WECS shall comply with Minnesota Rules 7030 governing noise, or shall not exceed

fifty (50) dB(A) when measured from the outside of the nearest residence, business, school, hospital, religious institution, or other inhabited structure. The audible noise from wind energy facilities may periodically exceed allowable noise levels during extreme wind events (winds above 30 mph or greater).

2. **Electrical Codes and Standards** - All WECS and accessory equipment and facilities shall comply with the National Electrical Code and other applicable standards.
3. **Federal Aviation Administration** - All WECS shall comply with FAA standards.

K. **Interference** - The applicant shall minimize or mitigate any interference with electromagnetic communications, such as radio, telephone, microwaves, or television signals cause by any WECS. The applicant shall notify all communication tower operators within \_\_\_ miles of the proposed WECS location upon application to Model Community for permits. No WECS shall be constructed so as to interfere with Model Community or Minnesota Department of Transportation microwave transmissions.

L. **Avoidance and Mitigation of Damages to Public Infrastructure by Commercial WECS**

1. **Roads** - Applicants for commercial WECS shall:
  - a. Identify all county, city or township roads to be used for the purpose of transporting WECS, substation parts, cement, and/or equipment for construction, operation or maintenance of the WECS and or substation and obtain applicable weight and size permits from impacted road authority(ies) prior to construction.
  - b. At the request of the road authority, the applicant shall post bonds or other financial assurance, subject to approval of Model Community, sufficient to restore the road(s) to pre-construction conditions.
2. **Drainage System** - The Applicant shall be responsible for immediate repair of damage to public drainage systems stemming from construction, operation or maintenance of the WECS.
3. **Green Infrastructure** - The Applicant shall meet the Minnesota Department of Natural Resources Guidance for Wind Projects, June, 2009 version or most recent version, for siting wind energy facilities and mitigation of risk to natural resources, including the following standards:
  - a. Provide the following information in the application:
    - i. natural heritage concerns within the project
    - ii. public lands within one mile of the project
    - iii. conservation easements and other officially protected natural areas within a quarter mile

**Interference**

*The radius for notification of all communications tower operators will range from two to five miles, depending on the community.*

**Avoidance and Mitigation of Damages**

*Transporting large wind turbines and components to remote sites sometimes requires using roads that are not rated for the weight of the turbine. Developers should notify local road authorities and mitigate for damage risk prior to transporting the turbine and equipment.*

*Similar provisions should be made for green infrastructure. The USFWS and the Minnesota DNR have adopted guidelines for identifying risks and best management practices for mitigating those risks. If the community uses a wind overlay approach rather than the district-based regulation outlined here, the DNR guidelines can help define the overlay district.*

**Standards for Micro-WECS**

*Communities should also consider standards for very small (micro) WECS. In particular, cities and counties with large-lot residential development (2 - 10 acre lots) are likely to need to address interest in wind energy installations for residential homes. These installations will likely be less than 10kW and be 60 to 100 feet in height. Some urban areas allow small WECS with even smaller towers. At tower heights lower than 60 feet, however, the wind resource becomes turbulent and loses much of its power, and is thus of small value as a energy source.*

**Urban Lots**

*This ordinance includes provisions for wind turbines on urban lots, in this case meaning lots smaller than one acre in size. Unless the tower is kept quite low, installations on lots smaller than one acre cannot meet setback requirements. Lower towers mean that the turbine is a questionable energy resource. Communities should consider not allowing WECS in areas where the turbine will dramatically underperform its rated capacity. Community sustainability is not enhanced by putting up a dramatically underutilized wind turbine.*

of the project

- iv. shoreland areas, wildlife corridors and habitat complexes, and designated scenic views.
- b. Demonstrate how the project integrates the United State Fish and Wildlife Service (USFWS) best management practices for minimizing impacts to wildlife from wind energy projects.

**M. Micro-Turbine Standards**

1. **Urban Lots** - Micro- WECS shall be allowed on lots of less than one acre provided the following conditions are met:
  - a. WECS are a permitted, conditional, or allowed accessory land use in the district,
  - b. The tower shall meet all setback requirements applicable to the lot. In all cases the base of the tower shall be setback from all property lines by a minimum of the height of the tower plus 10 feet.
  - c. The tower height is less than 70 feet.
  - d. The proposed system must be certified to operated at noise levels lower than 50 db at a distance no longer than the distance from the base of the tower to the closest property line.
2. **Suburban Lots** - Micro- WECS shall be allowed on lots between two and five acres provided the following conditions are met:
  - a. WECS are a permitted or conditional land use in the district,
  - b. Provisions of Section I.2.a (Established Wind Resource) are met,
  - c. The setback requirements applicable to the lot are met. In all cases the base of the tower shall be setback from all property lines by a minimum of the height of the tower plus 10 feet. For guyed towers the setback can be reduced if the documented fall zone is less than the tower height, but in no case shall the setback be less than the distance from the base of the tower to the nearest building off the site, plus 10 feet.
  - d. The tower height is less than 101 feet.
  - e. The proposed system must be certified to operated at noise levels lower than 50 db at a distance no longer than the distance from the base of the tower to the closest property line.
3. **Building Mounted Systems** - Building mounted WECS shall be setback from property lines by a distance equal to the tower height, and shall provide engineering documentation that the structure upon which the wind energy conversion system is to be mounted shall have the structural integrity to carry the weight and wind loads of the wind energy conversion system and have minimal vibration impacts on the structure.

**Urban WECS Ordinance, Minneapolis (partial)**

**Conditional uses** - Freestanding wind energy conversion systems may be allowed as a conditional use, subject to the provisions of Chapter 525, Administration and Enforcement, sections 535.740 and 535.750, and the following location and lot size restrictions:

1. Residence and office residence districts - Freestanding wind energy conversion systems in the residence and office residence districts shall only be located on institutional use sites.
2. Downtown area - Freestanding wind energy conversion systems shall be prohibited in the downtown area including all downtown districts and the area bounded by the Mississippi River, I-35W, I-94, I-394, and 3rd Avenue North (extended to the river).
3. Minimum lot area - No freestanding wind energy conversion system shall be established on a zoning lot less than one (1) acre in area. A maximum of one wind energy conversion system per acre of lot area shall be allowed.

Source: City of Minneapolis Zoning Code 535.730

**Urban WECS Ordinance, St. Louis Park (Partial)**

**Design requirements.** All WECS shall meet the following design requirements.

- (1) Monopole tower. All towers shall be of a free standing monopole type that does not utilize guyed wires or any other means to support the tower.
- (2) Roof mounting. Roof mounted WECS are prohibited.
- (3) Minimize visual impact. WECS design and location shall minimize visual impact. . . (more)
- (5) Tower lighting. WECS shall not be artificially lighted, except to the extent required by the FAA or other federal or state law or regulation that preempts local regulations.
- (6) Signs and displays. The use of any portion of a WECS for displaying flags and signs, other than warning or equipment information signs, is prohibited.
- (7) Associated equipment. Ground equipment associated with a WECS shall be housed in a structure. Structures housing equipment shall meet the architectural design standards of the Zoning Ordinance. Control wiring and power-lines shall be wireless or underground.
- (8) Braking system required. All WECS shall have an automatic braking, governing or feathering system to prevent uncontrolled rotation, overspeeding and excessive pressure on the tower structure, rotor blades and turbine components.
- (9) Design height. The applicant shall provide evidence that the proposed height of the WECS does not exceed the height recommended by the manufacturer or distributor of the system.
- (10) Interconnection agreement. The applicant shall provide a copy of the utility notification requirements for interconnection, unless the applicant intends, and so states on the application, that the system will not be connected to the electricity grid.
- (11) Technology standards. WECS must meet the minimum standards of a WECS certification program recognized by the American Wind Energy Association, such as AWEA's Small Wind Turbine Performance and Safety Standard, the Emerging Technologies program of the California Energy Commission, or other 3rd party standards acceptable to the City.

Source: City of St. Louis Park Zoning Code, Section 36-369

**Urban WECS Ordinance, Mahtomedi (Partial)**

**Performance Standards.**

- a. Number of Systems. No more than one (1) wind energy conversion system (WECS) shall be permitted per lot.
- b. Capacity. A wind energy conversion system shall have a nameplate capacity of forty (40) kilowatts or less.
- c. Height. The permitted maximum height of a WECS shall be determined in one of the following two ways. In determining the height of the WECS, the total height of the system shall be measured from the base of the tower to the center of the systems hub (also known as the hub height).
  - (1) A ratio of one foot to one foot (1':1') between the distance of the closest property line to the base of the WECS to the height of the system.
  - (2) A maximum system height of one hundred twenty – five (125) feet. The City Council, at its discretion, may waive the maximum system height requirements provided the City Council finds that the overall height is not feasible for the WECS to function properly in the proposed location based on meteorological data that was taken. . . (More)
- d. Setbacks. WECS shall be set back a distance equal to its height from the following:
  - (1) Any public road right-of-way, unless written permission is granted by the governmental entity with jurisdiction over the road;
  - (2) Any overhead utility lines, unless written permission is granted from the affected utility; and
  - (3) All property lines, unless written permission is granted from the affected property owner or neighbor.
- e. Rotor Size. All WECS rotors shall not have rotor diameters greater than forty – five (45) feet.
- f. Rotor Clearance. Blade arcs created by the WECS shall have a minimum of thirty (30) feet of clearance over any structure or tree within a two hundred (200) foot radius.
- g. Rotor Safety. Each WECS shall be equipped with both a manual and automatic braking device capable of stopping the WECS operation in high winds (40mph or greater).

Source: City of Mahtomedi Zoning Ordinance, Subd. 9.4 A.