Founded in 1852
by Sidney Davy Miller

MILLER CANFIELD

MICHIGAN
ILLINOIS
NEW YORK
OHIO
WASHINGTON, D.C.
CANADA
CHINA
MEXICO
POLAND
QATAR

EMILY C. PALACIOS
TEL (734) 668-7784
FAX (734) 747-7147
E-MAIL palacios@millercanfield.com

Miller, Canfield, Paddock and Stone, P.L.C.
101 North Main, Seventh Floor
Ann Arbor, Michigan 48104
TEL (734) 663-2445
FAX (734) 747-7147
www.millercanfield.com

August 26, 2020

Jonesfield Township Zoning Board of Appeals
217 Eddy Street, P.O. Box 117
Merrill, Michigan 48637

Attention: Chairperson Ruth Coppens

Re: DTE Electric Company Request for Zoning Ordinance Interpretations

Members of the Zoning Board of Appeals:

DTE Electric Company (DTE) is in the process of seeking permits and approvals to construct a 225 MW wind park – known as Meridian Wind Park – in portions of Jonesfield Township, and portions of Porter and Mt. Haley Townships in Midland County. The project consists of 77 wind turbine sites (26 primary sites and 1 alternate site in Jonesfield Township) and related infrastructure such as access roads, underground collection lines, and a collection substation.

DTE has submitted an application for a special land use permit and site plan approval (SLUP Application) for the portion of the project in Jonesfield Township for review by the Planning Commission. In connection with its SLUP Application, DTE is seeking determinations regarding certain zoning matters that fall within the jurisdiction of the Zoning Board of Appeals that are anticipated to come up during a review of the SLUP Application.

DTE therefore submits this request for the Zoning Board of Appeals to decide the following interpretative questions.

I. Interpretation of Section 305 Height Exception Provisions

It has been suggested that Zoning Ordinance Section 305(2)(a) may limit the height of a wind turbine to no more than 175 feet. DTE respectfully submits that subsection (2)(a) does not apply to the wind turbine generator towers (WTG towers) identified in the SLUP Application. Instead, for the reasons discussed below, the Zoning Board of Appeals should find that Section 305(2)(c) and the applicable provisions of Chapter 6 of the Zoning Ordinance govern the height of WTG towers.

Section 305(2)(a) states:[1]

> Special structures such as chimneys, smoke stacks, water towers, and standpipes shall be permitted to a maximum height of one hundred seventy-five (175) feet in the A-1 Zoning District or any Industrial Zoning District.

DTE respectfully submits that this provision does not apply to WTG towers. It only applies to structures that are similar to those listed in subsection (a) and located on land zoned A-1 or Industrial.

WTG towers are not similar to the structures listed in subsection (2)(a). The structures listed in that subsection – chimneys, smoke stacks, and water towers – are structures that are accessory (incidental and subordinate) to a principal use or building such as a dwelling or factory.

Instead, the Zoning Board of Appeals should find that WTG towers fall within the exception provided in Section 305(2)(c). Subsection (2)(c) states:

> Tower structures such as radio or transmitting towers, microwave relay towers, or cellular phone towers are subject to the Special Use Permit requirements specified in Chapter 6.

Wind turbines are more similar to the communication towers listed in subsection (2)(c) than the structures listed in subsection (2)(a). Unlike the structures listed in subsection (2)(a), the tower types listed in subsection (2)(c) are not accessory to a principal building or use. Communication towers are a separate land use that may be co-located on land used for other purposes such as agricultural and business property under most zoning ordinances, including the Jonesfield Township Zoning Ordinance.[2] If these tower types are to serve their intended purpose, the height will depend on engineering considerations that vary based on tower type and location.

The Section 612(k) special land use standards that apply to communication towers implicitly recognize this by not setting a maximum height on such towers. Instead, the ordinance regulates the use through setbacks tied to the height of a tower. Section 612(l) regulates wind turbines in a similar manner.

---

[1] The Jonesfield Township Zoning Ordinance includes two subsections (2)(a). One appears at the bottom of page 3-6 and the other at the top of page 3-7. This request pertains to the subsection (2)(a) as it appears on page 3-7.

[2] We have been unable to find any provision that limits the location of these towers to separate lots or parcels of record.

This approach is consistent with long-standing guidelines for siting and regulating wind energy systems published by the State of Michigan and Michigan State University Extension Service (MSU Extension Service). These guidelines recommended the use of setbacks tied to tower height. In *Michigan Siting Guidelines for Wind Energy Systems*, the State recommended that the distance between a utility-grid wind energy system and the property lines of non-leased properties, including public rights-of-way, be at least the height of a wind turbine tower, including the blade in its vertical position.[3] Likewise, the State's *Sample Zoning for Wind Energy Systems* included a recommendation that municipalities require a setback "distance equal to the height of the tower including the top of the blade in its vertical position from property lines or from the lease unit boundary, whichever is less." [4] In discussing the State guidelines, MSU Extension Service explained: "[t]he DLEG guidelines do not suggest setting a maximum height for wind systems. That is because, at least in part, rapid innovations in technology dictate that individual installation requirements will change. … As discussed in the next session, the guidelines establish a direct relationship between tower heights and property line setbacks to ensure public safety." [5]

Another reason Section 305(2)(a) should not be read as applying to wind turbines is that the scope of subsection (2)(a) is limited to structures in an A-1 or Industrial zoning district. WTG towers, however, are not limited to these zoning districts. They are also allowed in the A-2 zoning district.

Finally, the special land use standards that govern WTG towers anticipate towers in excess of 175 feet in height. Section 612(l), Other Requirements 5, provides that lighting of WTG towers is to be as required by the FAA. FAA regulations, specifically Advisory Circular 70/7460-IL dated 12/04/15, indicate that lighting may be required for any permanent or temporary structures with a height exceeding 200 feet. Thus, the Township's WTG tower lighting requirement itself anticipates towers exceeding 175-foot limit of Section 305(2)(a).

For these reasons, DTE respectfully requests that the Zoning Board of Appeals find that the height limitation of Section 305(2)(a) does not apply to WTG towers and that height of WTG towers, like communication towers, is governed by Section 305(2)(c) and applicable special land use requirements of Chapter 6.

---

[3] Tab 1, State of Michigan, Department of Labor & Economic Growth, *Michigan Siting Guidelines for Wind Energy Systems* (2007) at p. 5.

[4] Tab 2, State of Michigan, Department of Labor & Economic Growth, *Sample Zoning for Wind Energy Systems* (2008) at p. 5.

[5] Tab 3, MSU Extension Service, *Michigan Land Use Guidelines for Siting Wind Energy Systems* (2007) at p. 6.

II. Interpretation of Undefined Terms "Wind Turbine Generators" and "WTG Tower"

"Wind turbine generators" are identified as "Special Uses Subject to Review and Approval as Specified in Chapter 6" in Section 504.1 (General Agriculture Zoning District Regulations) and Section 504.2 (Agricultural and Rural Residential Zoning District Regulations). Section 612(l) includes regulations specific to this land use and uses the term "WTG tower." Because the ordinance does not define the terms "wind turbine generators" or "WTG tower," it is appropriate for the Zoning Board of Appeals to do so.

DTE respectfully submits that the land use "wind turbine generators" refers to a group of "WTG towers" connected together by underground electrical wiring (the collection system) that transmits electricity generated by the WTG towers to a substation (the collection substation) that converts the electricity for transmission to another substation (the transmission substation) where it is converted to a high-voltage for transmission to the transmission grid A WTG tower is the structure comprised of a tower, nacelle and rotor blades that is sometimes referred to as a wind turbine, wind turbine generator, wind energy system, or wind mill.

The interpretation described above is consistent with the plain language of the zoning ordinance, how neighboring townships approach the regulation of utility-scale wind energy production facilities, and how the State of Michigan has recommended that municipalities approach the regulations of these facilities, as shown below.

A. Plain Language of Jonesfield Township Zoning Ordinance

The most important consideration when interpreting a zoning ordinance is the plain language of the text. Here, the zoning ordinance explicitly associates the term "Wind Turbine Generators" with the special land use. The term only appears under the heading "Special Land Use Category" in the table that makes up Section 612. The ordinance uses a different term – "WTG tower" – to describe a component of the special land use.

That the special land use "Wind Turbine Generators" should be construed as a use consisting of more than one WTG tower draws support from the fact that the Township Board, in adopting the zoning regulations, chose to identify this particular land use using the plural term: The inclusion of the letter "s" at the end of the word generator clearly expresses the intent that the special land use include all WTG towers that form part of the whole specific project and reflects an implicit understanding that this land use, though diffuse in area, should be regulated as a single project.

Finally, with respect to the definition of WTG tower, logic and common sense suggest that the abbreviation included in term "WTG tower" stands for "wind turbine generator" and therefore refers collectively to the tower and tower-mounted equipment (nacelle and blades) used to generate electricity from wind energy. DTE submits that the letters "WTG's" enclosed in parentheses below the words "wind turbine generators" is intended to signal the intended

meaning of the abbreviation "WTG." (There the "s" is not used in the plural sense but in possessive sense because it is preceded by an apostrophe, suggesting that WTG is not an abbreviation for the special land use "wind generator turbines, which itself is a plural.)

The interpretations offered here are consistent with the approach taken by adjacent townships, each of which have two definitions, one for the equipment that converts wind energy into electricity, and a second broader definition that includes the turbines that generate the electricity, the substation that serves the use, the wires that connect the generators together, and other accessory structures and buildings.

B. Porter Township and Mt. Haley Zoning Regulations Make a Similar Distinction

Porter Township Ordinance #249 (attached at Tab 4) amended the Porter Township Zoning Ordinance to provide for the siting, construction and operation of commercial Wind Energy Facilities as a special land use in a designated overlay zoning district. The Porter Township ordinance provides the following definitions:

> **Wind Energy Conversion Facility, (WECF) or Wind Energy Facility** - An electricity generating facility *consisting of one or more wind turbines under common ownership or operation control, and includes substations, MET Towers, cables/wires and other buildings accessories to such facility*, whose main purpose is to supply electricity to off-site customers. (Emphasis added.)
>
> …
>
> **Wind Energy System** - A wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid.[6]

The Porter Township Ordinance defines specific land use standards that apply to a "Wind Energy Facility" as a whole. (*See, e.g.*, Ordinance #249, paragraph 3 at p. 5, defining specific land use standards for Wind Energy Facilities, which is the broader definition, and includes wind turbines, substations, MET towers, cables/wires and other building accessories.)

Mount Haley Township also amended its zoning ordinance by adopting a Wind Energy Zoning Ordinance Amendment (attached at Tab 5**)**. Similar to Porter Township, Mt. Haley allows wind energy projects as a special land use in a designated zoning overlay district. The Mount Haley ordinance contains the following definitions relating to this special land use:

[6] Tab 4, Porter Township Ordinance #249 at p. 2-3.

Utility Grid WES	A WES designed, built or operated to provide electricity not principally for use on the site where the WES is located. A Utility Grid WES may be located within the Wind Park by issuance of a special land use permit.
…	
Wind Energy System (WES)	A wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the WES to the grid.[7]

Subsection 4 of the Mt. Haley wind energy zoning ordinance amendment, under the heading Utility Grid Wind Energy Systems (WES), expands the definition of a Utility Grid WES to also include its components connecting the WES included in a project. Per subparagraph (f)(vii), the system includes: "*all new infrastructure above and below ground related to the project, including proposed turbine towers, underground and overhead wiring (including the depth of underground wiring), new drainage facilities (if any), access drives (including width), substations and accessory structures.*"[8]

The regulatory approach taken by these townships is consistent with long-standing recommendations of the State of Michigan and MSU Extension Service.

C. Expert Guidelines Recommend Definitions that Distinguish Wind Energy as a Land Use and the Equipment Used to Convert Wind Energy to Electricity

State guidelines for zoning for wind energy systems suggested the following definitions for purposes of regulating utility-scale wind energy generation land uses:

> **Utility Grid Wind Energy System** means a land used for generating power by use of wind at multiple tower locations in a community and *includes accessory uses such as but not limited to a SCADA tower, electric substation.* A Utility Grid Wind Energy System is designed and built to provide electricity to the electric utility grid.
>
> **Wind Energy System** means a land used for generating power by use of wind; utilizing use of a wind turbine generator and includes the turbine, blades, and

[7] Tab 5, Mt. Haley Wind Energy Zoning Amendment at p. 4.

[8] Tab 5 at p. 6.

> tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid. See also On-Site Wind Energy System and Utility Grid Wind Energy System.[9]

Similar to the ordinances of the adjacent townships, the site plan review process recommended by the DLEG guidelines anticipates a review of the utility grid wind energy system as a whole (under the broader definition) that includes any substations that collect the energy generated and other accessory uses, such as accessory roads and collection wiring systems.

In sum, DTE respectfully submits that, following standard practice, as exemplified by ordinance from adjacent townships and the state sample wind energy zoning guidelines, and in recognition of the fact the term "Wind Turbine Generators" is plural, the Zoning Board of Appeals interpret the special land use category term to mean a planned array of WTG towers together with the collection wiring system running between the WTG towers and connecting to a collection substation, access roads, and other structures or buildings incidental and subordinate to the generation of electricity from wind energy at utility scale.

III. Interpretation of Section 612(1) References to "Property Lines"

It may be suggested that the term "property lines" as used in Section 612(l) refers to the property lines of the parcel of land on which a WTG tower is located. DTE respectfully submits the term should be interpreted as referring to property lines separating the special land use (property included in the project) from neighboring property not included in the project. In the alternative, DTE requests that the Zoning Board of Appeals grant setback variances described below.

DTE respectfully submits that references to "adjacent property lines" and "the property line" in Section 612(l) should be interpreted as referring to the property lines separating property included as part of the special land "Wind Turbine Generators" from neighboring property not included in the project. This interpretation is consistent with the plain language of the zoning ordinance, as well as guidelines published by State and the MSU Extension Service.

Section 612(l) includes several provisions that incorporate the term "property line," that when read collectively, indicate that the referenced property line is one separating a "Wind Turbine Generators" special land use from neighboring property. These provisions include the following:

---

[9] Tab 3, *Sample Zoning for Wind Energy System* (2008) at p. 3. The 2008 sample zoning document expanded the definitions of Utility Grid Wind Energy System and Wind Energy System to clarify the distinction between the individual piece of equipment that converts wind energy into electricity and the large energy production system it is tied into and the distinction between on-site systems and utility-grid systems.

Section 612(l), Minimum Building Setbacks, imposes certain minimum setbacks for WTG towers:

> 1. Each WTG tower must be set back from all *adjacent property lines* and road right-of-way lines a minimum distance equal to the height of the tower, including the top of the blade in its vertical position (emphasis added). [10]

Section 612(l), Other Requirements, limits sound levels of WTG towers: [11]

> 2. Maximum noise level generated by any WTG [tower] shall not exceed 60 decibels, measured at *the property line*, including downwind from the installation. Applicant shall provide certification that noise level is not exceeded, both before and after construction (emphasis added).[12]

Interpreting "property line" as used above as referring to property lines defining the boundaries of the special land use is logical and consistent with other provisions of the Jonesfield Township Zoning Ordinance. First, the land use that is being regulated is Wind Turbine Generators." Regulating the location and performance of improvements relative to the property lines defining that use is consistent with how zoning regulations, including zoning regulations adopted by Jonesfield Township, have been traditionally drafted and applied. It is also consistent with the purposes zoning regulations are intended

---

[10] DTE committed siting all wind turbines no closer than 1.5 times the tip height to a public road and 1.5 times tip height from any project property line. DTE has also committed to placing wind turbines no closer than 1,300 (is this supposed to be 1300 vs 1320?) feet to residential buildings on land outside a project property line and no closer than 1,320 feet to the boundary line of the Village of Merrill. DTE has submitted site plans with its SLUP Application showing compliance with this commitment and DTE's expectation that will be legally bound to comply with these commitments during the life of the project.

[11] The word "tower" appears to have been omitted here. Based on their substance, all of regulations falling under the "Other Requirements" heading appear to be intended for WTG towers, though paragraphs 1 and 5 only use the term "towers," and paragraph 2 and 3 use the term "WTG." DTE requests that the Zoning Board of Appeals find that references to "towers" or "WTG" in this section refer to WTG towers.

[12] DTE has committed to sound levels of no more than 55 dB(A) Leq 1-hour at any project property boundaries, and no more than 45 dBA Leq 1-hour at all residential dwellings located outside project property boundaries. DTE has included a sound modelling study with its SLUP Application that shows predicted sound pressure levels based on conservative, worst-case assumptions, and include a plan for managing actual sound levels through operational controls.

to serve: managing the relationship between adjacent land uses and mitigating land use conflicts between adjacent uses.

Second, this interpretation is consistent with other provisions of the zoning ordinance, including defined terms. The provisions governing the review and approval of special land uses are written as applying to the "subject property." For example, Section 601 provides that an application for a special land use permit may be filed by any person who has an interest in the *property subject to the application.*[13] Section 603 requires notice of a public hearing on a special land use permit application to be sent to the owners and occupant within 300 feet of "the *property subject to the application* for the special land use permit." And, Section 606, General Standards for Approval of Special Land Uses, provides that the standards are to be applied to the "*property subject to the application.*" Thus, for purposes of applying zoning regulations to a special land use, what constitutes the "property" depends on what property is described as being included in the application.[14] Appendix A to the SLUP Application identifies the property that is the subject of the application (copy attached at Tab 9). It is property lines separating those properties identified in Appendix A from neighboring properties not included in the application that mark the parameters for applying the special land use standards of Section 612(l). Those property lines are shown by the blue boundary line on the map attached at Tab 1.

This interpretation additionally fits with the ordinance definition of the term "use," which is defined to mean "the purpose for which land … is arranged, designed or intended, or for which land … is or may be occupied," *see* Section 202(185), a definition that is not limited in any way to a lot or parcel description of record. The broad description of what constitutes "use" of land is consistent with the special land use provisions described above that regulate based on the extent of property (land) included in a special land use permit application. The same is true for the ordinance definition of the term "development," which is defined to mean "any manmade change to improved or unimproved real estate," *see* Section 202(47), another ordinance definition not limited to lot or parcel descriptions of record.

---

[13] The ordinance defines the term "easement" to mean a grant of one or more property rights by a property owner … to another person. *See* Sec. 202(58). Thus, for purposes of administering the zoning ordinance, an "easement holder" – someone holding one or more rights in the property of another – is a proper applicant for a special land use permit and whose land rights should be able to be pooled for purposes of establishing a "subject property" for purposes of special land use review and approval.

[14] The zoning ordinance defines the term "adjacent (lot or parcel)," but does not define the term "adjacent property line." It also does not define the term "property."

Finally, the interpretation offered by DTE is consistent with how the term property line is used in State guidelines for siting wind energy systems and sample zoning regulations, and MSU Extension Service's land use guidelines for wind energy systems. In discussing setbacks between a utility grid wind energy system (the functional equivalent of a Wind Turbine Generators special land use) and property lines of adjacent property, the 2007 State guidelines distinguished "non-leased properties, including public rights of way" from lease property that could "include more than one piece of property," and recommended that the setback requirement be applied to "combined properties."[15] In its discussion of the 2007 State guidelines, MSU Extension described the setback approach as a "direct relationship between tower heights and property line setbacks to ensure public safety," and "a good benchmark to protect neighboring property."[16] The State sample zoning regulations thereafter adopted the term "lease unit boundary" to describe the property line from which setback and zoning requirements should be measured.[17]

For these reasons, DTE respectfully requests that the term "property line," as used in Section 612(1) and as applied to its proposed "wind turbine generators" special land use, be interpreted to mean the property lines separating its proposed project from neighboring land uses as shown on the drawing attached at Tab 1.

IV. Summary of Relief Requested

In conclusion, DTE respectfully requests that the Zoning Board of Appeals make the following findings:

1. That the height exception provided by Section 305(2)(a) does not apply to wind turbines, and that wind turbine heights are governed by Section 305(2)(c) and the applicable requirements of Chapter 6.

2. That the special land use "Wind Turbine Generators" be defined as "a planned array of WTG towers together with the collection wiring system, a collection substation, access roads, and other structures or buildings incidental and subordinate to the generation of electricity from wind energy at utility scale," and that the term WTG tower be defined as "a system comprised of a tower, nacelle, and rotor blades that converts wind energy to electricity."

---

[15] Tab 1, *Michigan Siting Guidelines for Wind Energy System* (2007) at p. 5.

[16] Tab 3, *Michigan Land Use Guidelines for Siting Wind Energy Systems* (2007) at p. 6 & 7.

[17] Tab 4, *Sample Zoning for Wind Energy System* (2008) at p. 5.

3. That the term "property line" as used in Section 612(1) refers to the property line separating land that is the subject of a "Wind Turbine Generators" special land use application from neighboring property.

Thank you for your consideration of these requests.

Very truly yours,

Miller, Canfield, Paddock and Stone, P.L.C.

Emily C. Palacios

Attachments:
Tab 1 – DLEG Michigan Siting Guidelines for Wind Energy Systems 2007
Tab 2 – DLEG Sample Zoning for Wind Energy Systems 2008
Tab 3 – MSU Extension, Michigan Land Use Guidelines for Wind Energy Systems 2007
Tab 4 – Porter Township Wind Energy Zoning Ordinance Amendment
Tab 5 – Mt. Haley Township Wind Energy Zoning Ordinance Amendment

1

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

3/5/07

Michigan Siting Guidelines for Wind Energy Systems

INTRODUCTION

These guidelines have been developed by the Energy Office, Michigan Dept. of Labor and Economic Growth to assist local governments to develop siting requirements for wind energy systems. These guidelines are not intended to apply in urban areas that already have height, noise, setback and other requirements that can be applied to wind energy systems. These guidelines have been developed with the intention of striking an appropriate balance between the need for clean, renewable energy resources and the necessity to protect the public health, safety, and welfare. The guidelines represent recommended zoning language for local governments to use if they amend their zoning ordinance to address wind energy systems. The Energy Office, DLEG has no authority to issue regulations related to siting wind energy systems.

Electricity generation is responsible for 36% of carbon dioxide pollution, 64% of sulfur dioxide pollution, 26% of nitrogen oxide pollution, and 34% of mercury pollution in the U.S. Electricity generation from clean, renewable energy resources will reduce air pollution, increase the fuel diversity of our electric system, save natural resources, and provide a hedge against increases in the price of fossil fuels used for electric generation.

Different requirements are recommended for On Site Use (generally small) and Utility Grid (generally large) wind energy systems. On Site Use wind energy systems are sized to primarily serve the needs of a home, farm, or small business. Usually there is a single turbine – in contrast to a large, utility-scale wind farm that may include dozens or even hundreds of turbines. Utility Grid wind energy systems are sized to provide power to wholesale or retail customers using the electric utility transmission and distribution grid to transport and deliver the wind generated electricity. On Site Use wind energy systems can have towers up to 40 meters and Utility Grid wind energy systems can have towers up to 90 meters.

The guidelines have been developed with input from members of the Michigan Wind Working Group. The members of the Michigan Wind Working Group have not endorsed these guidelines. Professor Robert Fletcher, Ph.D. and Daniel Alberts, graduate student from Lawrence Technological University helped in the development of these guidelines by providing briefings on technical issues related to siting. Mr. Alberts also helped by conducting a modified Delphi study related to wind energy siting issues. For the Delphi study final report see:
http://www.ltu.edu/engineering/mechanical/delphi_wind.asp .

Comments or questions are welcome and should be directed to John Sarver, Energy Office at 517-241-6280 or jhsarve@michigan.gov.

RECOMMENDED LANGUAGE FOR LOCAL ZONING ORDINANCES

A. Definitions
   1. Ambient: Ambient is defined as the sound pressure level exceeded 90% of the time or L_{90}.
   2. ANSI: American National Standards Institute.
   3. dB(A): The sound pressure level in decibels. Refers to the "a" weighted scale defined by ANSI. A method for weighting the frequency spectrum to mimic the human ear.
   4. Decibel: The unit of measure used to express the magnitude of sound pressure and sound intensity.
   5. IEC: International Electrotechnical Commission. The IEC is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies.
   6. ISO: International Organization for Standardization. ISO is a network of the national standards institutes of 156 countries.
   7. On Site Use Wind Energy Systems: An On Site Use wind energy system is intended to primarily serve the needs of the consumer.
   8. Rotor: An element of a wind energy system that acts as a multi-bladed airfoil assembly, thereby extracting through rotation, kinetic energy directly from the wind.
   9. SCADA Tower: A freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system.
   10. Shadow Flicker: Alternating changes in light intensity caused by the moving blade of a wind energy system casting shadows on the ground and stationary objects, such as a window at a dwelling.
   11. Sound Pressure: Average rate at which sound energy is transmitted through a unit area in a specified direction. The pressure of the sound measured at a receiver.
   12. Sound Pressure Level: The sound pressure mapped to a logarithmic scale and reported in decibels (dB).
   13. Utility Grid Wind Energy Systems: A Utility Grid wind energy system is designed and built to provide electricity to the electric utility grid.
   14. Wind Energy System: A wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid.
   15. Wind Site Assessment: An assessment to determine the wind speeds at a specific site and the feasibility of using that site for construction of a wind energy system.

B. On Site Use Wind Energy Systems: An On Site Use wind energy system is intended to primarily serve the needs of the consumer. An On Site Use wind energy system with a tower higher than 20 meters shall be considered a Special Land Use. On Site Use wind energy systems with no towers or towers 20 meters or less shall be a Permitted Use in all zoning classifications where structures of any sort are allowed subject to the following requirements. Anemometer towers more than 20 meters in height used to conduct a wind site assessment for possible installation of an On Site Use wind energy system shall also be a Special Land Use.

Prior to the installation of an On Site Use wind energy system with a tower higher than 20 meters, an application for a Special Land Use permit shall be filed with the local government that will include 1) applicant identification, 2) a site plan, 3) documentation that sound pressure level, construction code, tower, interconnection (if applicable), and safety requirements have been met, and 4) proof of the applicant's public liability insurance.

Prior to the installation of an anemometer tower more than 20 meters in height, an application for a Special Land Use permit shall be filed with the local government that will include 1) applicant identification, 2) a site plan, 3) a copy of that portion of the applicant's lease with the land owner granting authority to install the Met tower and requiring the applicant to remove all equipment and restore the site after completion of the wind site assessment and 4) proof of the applicant's public liability insurance.

Commentary: Another way to differentiate between On Site Use and Utility Grid wind energy systems is size of the generators. Early drafts of the siting guidelines made a distinction between a small wind energy system which has a rated capacity of not more than 300 kW and a large wind energy system greater than 300 kW. It was decided that use rather than size was a better way to classify wind energy systems for siting purposes.

1. Property Set-back: The distance between an On Site Use wind energy system and the owner's property lines shall be at least 1 ½ times the height of the wind energy system tower including the top of the blade in its vertical position. The distance between an anemometer tower and the owner's property lines shall be at least 1 ½ times the height of the tower. No part of the wind energy system structure, including guy wire anchors, may extend closer than ten feet to the owner's property lines.

   Commentary: The property set-back requirement is designed to protect neighbors in the unlikely event of a tower failure.

2. Sound Pressure Level: On Site Use wind energy systems shall not exceed 55 dB(A) at the property line closest to the wind energy system. This sound pressure level may be exceeded during short-term events such as utility outages and/or severe wind storms. If the ambient sound pressure level exceeds 55 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

   Commentary: Normal conversation is in the range of 50-65 dB(A). There is more commentary under the Utility Grid section of this document.

3. Construction Codes, Towers, & Interconnection Standards: On Site Use wind energy systems including towers shall comply with all applicable state construction and electrical codes and local building permit requirements. On Site Use wind energy systems including towers shall comply with Federal Aviation Administration requirements, the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 et seq.), the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 et seq.), and local jurisdiction airport overlay zone regulations. An interconnected On Site Use wind energy system shall comply with Michigan Public Service Commission

and Federal Energy Regulatory Commission standards. Off-grid systems are exempt from this requirement.

4. Safety: An On Site Use wind energy system shall have automatic braking, governing, or a feathering system to prevent uncontrolled rotation or over speeding. All wind towers shall have lightning protection. If a tower is supported by guy wires, the wires shall be clearly visible to a height of at least six feet above the guy wire anchors. The minimum vertical blade tip clearance from grade shall be 20 feet for a wind energy system employing a horizontal axis rotor.

   Commentary: Safety issues are addressed by reference to state construction and electrical codes and federal and state requirements related to towers. Safety issues are also addressed by provisions related to property set-backs, lowest point of blade, wind energy system controls, lightning protection, guy wire visibility, and interconnection standards.

C. Wind Site Assessment for Utility Grid Wind Energy Systems: Prior to construction of a Utility Grid wind energy system, a wind site assessment is conducted to determine the wind speeds and the feasibility of using the site. Installation of anemometer towers also known as meterological or "Met" towers shall be considered a Special Land Use. Prior to the installation of the tower, an application for a Special Land Use permit shall be filed with the local government that will include 1) applicant identification, 2) a site plan, 3) a copy of that portion of the applicant's lease with the land owner granting authority to install the Met tower and requiring the applicant to remove all equipment and restore the site after completion of the wind site assessment, and 4) proof of the applicant's public liability insurance. The distance from the center of a Met tower and the property lines between the leased property and the non-leased property shall be at least the height of the Met tower. Leased property can include more than one piece of property and the requirement shall apply to the combined properties.

D. Utility Grid Wind Energy Systems: A Utility Grid wind energy system is designed and built to provide electricity to the electric utility grid. Utility Grid wind energy systems shall be considered a Special Land Use. Prior to the installation of a Utility Grid wind energy system, an application for a Special Land Use permit shall be filed with the local government and shall include the following:

   Commentary: Utility Grid wind energy systems may be treated as Special Land Uses under local zoning ordinances. Zoning Boards may also decide to enter into a "Development Agreement" with a wind energy company that also incorporates suitable conditions or may develop a "Wind Overlay Zone" as an addition to or amendment of their existing zoning ordinances. For example, Huron County has developed a Wind Energy Conversion Facility Overlay Zoning Ordinance.

   1. Applicant Identification: Applicant name, address, and contact information.
   2. Project Description: A general description of the proposed project including a legal description of the property or properties on which the project would be located and an anticipated construction schedule.
   3. Site Plan: The site plan shall include maps showing the physical features and land uses of the project area, both before and after construction of the proposed project.

The site plan shall include 1) the project area boundaries, 2) the location, height, and dimensions of all existing and proposed structures and fencing, 3) the location, grades, and dimensions of all temporary and permanent on-site and access roads from the nearest county or state maintained road, 4) existing topography, 5) water bodies, waterways, wetlands, and drainage channels, and 6) all new infrastructure above ground related to the project.

4. Insurance: Proof of the applicant's public liability insurance.
5. Consent Documents: Copies of any written waivers from neighboring property owners.
6. Sound Pressure Level: Copy of the modeling and analysis report.
7. Certifications: Certification that applicant has complied or will comply with all applicable state and federal laws and regulations. Copies of all such permits and approvals that have been obtained or applied for at time of the application.
8. Visual Impact: Visual simulations of how the completed project will look from four viewable angles.
9. Environmental Impact: Copy of the Environmental Impact analysis.
10. Avian and Wildlife Impact: Copy of the Avian and Wildlife Impact analysis.
11. Shadow Flicker: Copy of the Shadow Flicker analysis.
12. Manufacturers' Material Safety Data Sheet(s): Documentation shall include the type and quantity of all materials used in the operation of all equipment including, but not limited to, all lubricants and coolants.
13. Decommissioning: Copy of the decommissioning plan.
14. Complaint Resolution: Description of the complaint resolution process.

An applicant shall remit an application fee in the amount specified in the fee schedule adopted by the local government. This schedule shall be based on the cost of the application review and may be adjusted from time to time.

The Utility Grid wind energy system project shall meet the following standards and requirements:

1. Overlay Zone: If the site of the proposed project is subject to an overlay zone, the proposed project shall meet or exceed the applicable standards in the overlay zone.

2. Property Set-Back: The distance between a Utility Grid wind energy system and the property lines of adjacent non-leased properties including public rights of way shall be at least the height of the wind energy system tower including the top of the blade in its vertical position. Where property is leased on both sides of a public right of way, a wind energy system may be placed no closer than one rotor radius from the closest edge of the right of way. Leased property can include more than one piece of property and the requirement shall apply to the combined properties.

   SCADA (supervisory control and data acquisition) or meteorological (Met) towers shall also comply with the property set-back requirement. The set-back shall be at least the height of the SCADA or Met tower. An Operations and Maintenance Office building, a sub-station, or ancillary equipment shall comply with any property set-back requirement that may be applicable to that type of building or equipment. Overhead transmission lines and power poles shall comply with the set-back requirements applicable to public utilities.

Commentary: The property set-back requirement is designed to protect neighbors in the unlikely event of a tower failure.

3. Sound Pressure Level: The sound pressure level generated by a Utility Grid wind energy system shall not exceed 55 dB(A) measured at the property lines between leased and non-leased property. This sound pressure level shall not be exceeded for more than 3 minutes in any hour of the day. If the ambient sound pressure level exceeds 55 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

   As part of the application and prior to installation, the applicant shall provide modeling and analysis that will confirm that the Utility Grid wind energy system will not exceed the maximum permitted sound pressure levels. Modeling and analysis shall conform to IEC 61400 and ISO 9613. After installation of the Utility Grid wind energy system, sound pressure level measurements shall be done by a third party, qualified professional according to the procedures in the most current version of ANSI S12.18. All sound pressure levels shall be measured with a sound meter that meets or exceeds the most current version of ANSI S1.4 specifications for a Type II sound meter. Documentation of the sound pressure level measurements shall be provided to the local government within 60 days of the commercial operation of the project.

   Commentary: Noise issues are complex and many communities do not have any detailed noise standards. Normal conversation is in the range of 50-65 dB(A). Noise standards may consider the potential for bodily injury, long term health effects, interference with speech and other activities, and sleep disturbance. EPA and World Health Organization documents indicate that 55 dB(A) is too low to produce hearing loss or long-term health effects.[1&2] Related to speech interference, would 55 dB(A) interfere with speech at the property line? EPA has estimated that the distance between persons would have to be 4 meters before there would be any interference.[1] Related to sleep disturbance, the World Health Organization notes that "80-90% of the reported cases of sleep disturbance in noisy environments are for reasons other than noise originating outdoors" and "habituation to night-time noise events occurs."[2] EPA has noted that the typical sound level reduction of buildings in cold climates is 17 dB (windows opened) and 27 dB (windows closed) so 55 dB would be reduced to at least 28-38 dB indoors.[1]

   References
   1. EPA, 1974. Protective Noise Levels: Condensed Version of EPA Levels Document.
   2. World Health Organization, 1999. Guidelines for Community Noise.

   The guidelines recommend basic standards for sound pressure levels. The standards can be more detailed and sophisticated. Separate standards can be developed for infranoise and low-frequency sound pressure levels. Separate standards can be developed for residential and non-residential areas. Sound pressure levels characterized as tonal can have lower limits. For example, the Huron County ordinance reduces their standard by 5 dB(A) in the event audible noise from the wind energy system contains a steady pure tone. Local governments who desire a more refined standard may want to consider developing a noise ordinance that would cover all generators of sound pressure levels in a fair and consistent manner.

4. Construction Codes, Towers, and Interconnection Standards: Utility Grid wind energy systems including towers shall comply with all applicable state construction and electrical codes and local building permit requirements. Utility Grid wind energy systems including towers shall comply with Federal Aviation Administration requirements, the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 et seq.), the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 et seq.), and local jurisdiction airport overlay zone regulations. The minimum FAA lighting standards shall not be exceeded. All tower lighting required by the FAA shall be shielded to the extent possible to reduce glare and visibility from the ground. The tower shaft shall not be illuminated unless required by the FAA. Utility Grid wind energy systems shall comply with applicable utility, Michigan Public Service Commission, and Federal Energy Regulatory Commission interconnection standards.

5. Safety: All Utility Grid wind energy systems shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present. All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the wind energy system. A sign shall be posted near the tower or Operations and Maintenance Office building that will contain emergency contact information. Signage placed at the road access shall be used to warn visitors about the potential danger of falling ice. The minimum vertical blade tip clearance from grade shall be 20 feet for a wind energy system employing a horizontal axis rotor.

   Commentary: Safety issues are addressed by reference to state construction and electrical codes and federal and state requirements related to towers. Safety issues are also addressed by provisions related to property set-backs, lowest point of blade, interconnection standards, falling ice, access doors, and handling of materials.

6. Visual Impact: Utility Grid wind energy system projects shall use tubular towers and all Utility Grid wind energy systems in a project shall be finished in a single, non-reflective matte finished color. A project shall be constructed using wind energy systems of similar design, size, operation, and appearance throughout the project. No lettering, company insignia, advertising, or graphics shall be on any part of the tower, hub, or blades. Nacelles may have lettering that exhibits the manufacturer's and/or owner's identification. The applicant shall avoid state or federal scenic areas and significant visual resources listed in the local unit of government's comprehensive plan.

   Commentary: Visual impact issues are difficult to address. Individuals seem to either like or dislike the look of wind energy systems. The guidelines try to address visual impact issues by providing some design standards and by restricting commercial advertising.

7. Environmental Impact: The applicant shall have a third party, qualified professional conduct an analysis to identify and assess any potential impacts on the natural environment including, but not limited to wetlands and other fragile ecosystems, historical and cultural sites, and antiquities. The applicant shall take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the

analysis. The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

The applicant shall comply with applicable parts of the Michigan Natural Resources and Environmental Protection Act (Act 451 of 1994, MCL 324.101 et seq.) including but not limited to Part 31 Water Resources Protection (MCL 324.3101 et seq.), Part 91 Soil Erosion and Sedimentation Control (MCL 324.9101 et seq.) , Part 301 Inland Lakes and Streams (MCL 324.30101 et seq.), Part 303 Wetlands (MCL 324.30301 et seq.), Part 323 Shoreland Protection and Management (MCL 324.32301 et seq.), Part 325 Great Lakes Submerged Lands (MCL 324.32501 et seq.), and Part 353 Sand Dunes Protection and Management (MCL 324.35301 et seq.). The applicant shall be responsible for making repairs to any public roads damaged by the construction of the Utility Grid wind energy system.

Commentary: Environmental issues are complex. The guidelines identify areas that should be addressed in an environmental impact analysis but do not specify how the analysis should be conducted. Site specific issues should determine which issues are emphasized and studied in depth in the analysis. There are a number of state and federal laws that may apply depending on the site.

8. Avian and Wildlife Impact: The applicant shall have a third party, qualified professional conduct an analysis to identify and assess any potential impacts on wildlife and endangered species. The applicant shall take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis. The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

   Sites requiring special scrutiny include wildlife refuges, other areas where birds are highly concentrated, bat hibernacula, wooded ridge tops that attract wildlife, sites that are frequented by federally and/or state listed endangered species of birds and bats, significant bird migration pathways, and areas that have landscape features known to attract large numbers of raptors.

   At a minimum, the analysis shall include a thorough review of existing information regarding species and potential habitats in the vicinity of the project area.. Where appropriate, surveys for bats, raptors, and general avian use should be conducted. The analysis shall include the potential effects on species listed under the federal Endangered Species Act and Michigan's Endangered Species Protection Law.

   The analysis shall indicate whether a post construction wildlife mortality study will be conducted and, if not, the reasons why such a study does not need to be conducted. Power lines should be placed underground, when feasible, to prevent avian collisions and electrocutions. All above-ground lines, transformers, or conductors should comply with the Avian Power Line Interaction Committee (APLIC, http://www.aplic.org/) published standards to prevent avian mortality.

   Commentary: These guidelines identify areas that should be addressed in an avian and wildlife impact analysis but do not specify how the analysis should be conducted. Site

specific issues should determine which issues are emphasized and studied in depth in the analysis. To assist applicants to minimize, eliminate, or mitigate potential adverse impacts, the U.S. Fish and Wildlife Service has developed Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines which can be found at http://www.fws.gov/habitatconservation/wind.pdf. If the local government desires more structure to the analysis requirements, the Potential Impact Index developed by the U.S. Fish and Wildlife Service provides a framework for evaluating a project's impact on wildlife

Applicants must comply with applicable sections of the federal Endangered Species Act and Michigan's Endangered Species Protection Law. The applicant should be aware that taking of these species is prohibited by State and/or Federal law unless the proper permits or exemptions are acquired. Early coordination with state and federal agencies is recommended. The applicant or the applicant's impact analyst should contact the U.S. Fish and Wildlife Service's East Lansing Field Office regarding federally-listed species and the Michigan Dept. of Natural Resources for state-listed species.

9. Electromagnetic Interference: No Utility Grid wind energy system shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antennae for radio, television, or wireless phone or other personal communication systems would produce electromagnetic interference with signal transmission or reception unless the applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the wind energy system. No Utility Grid wind energy system shall be installed in any location within the line of sight of an existing microwave communications link where operation of the wind energy system is likely to produce electromagnetic interference in the link's operation unless the interference is insignificant.

10. Shadow Flicker: The applicant shall conduct an analysis on potential shadow flicker at occupied structures. 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 problem areas where shadow flicker may affect the occupants of the structures and describe measures that shall be taken to eliminate or mitigate the problems.

11. Decommissioning: The applicant shall submit a decommissioning plan. The plan shall include: 1) the anticipated life of the project, 2) the estimated decommissioning costs net of salvage value in current dollars, 3) the method of ensuring that funds will be available for decommissioning and restoration, and 4) the anticipated manner in which the project will be decommissioned and the site restored.

12. Complaint Resolution: The applicant shall develop a process to resolve complaints from nearby residents concerning the construction or operation of the project. The process may use an independent mediator or arbitrator and shall include a time limit for acting on a complaint. The process shall not preclude the local government from acting on a complaint. During construction the applicant shall maintain and make available to nearby residents a telephone number where a project representative can be reached during normal business hours.

2

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

Sample Zoning for Wind Energy Systems

April 16, 2008

Introduction

These guidelines have been developed by the Energy Office, Michigan Dept. of Labor and Economic Growth (DLEG) to assist local governments to develop siting requirements for wind energy systems. This material is not intended to apply in urban areas. These guidelines have been developed with the intention of striking an appropriate balance between the need for clean, renewable energy resources and the necessity to protect the public health, safety, and welfare. The guidelines represent recommended zoning language for local governments to use if they amend their zoning ordinance to address wind energy systems. The Energy Office, DLEG has no authority to issue regulations related to siting wind energy systems.

Electricity generation is responsible for 36% of carbon dioxide pollution, 64% of sulfur dioxide pollution, 26% of nitrogen oxide pollution, and 34% of mercury pollution in the United States. Electricity generation from clean, renewable energy resources will reduce air pollution, increase the fuel diversity of our electric system, save natural resources, and provide a hedge against increases in the price of fossil fuels used for electric generation.

Different requirements are recommended for On-site Use (generally small) and Utility Grid (generally large) wind energy systems. On-site Use wind energy systems are sized to primarily serve the needs of a home, farm, or small business. Usually there is a single turbine – in contrast to a large, utility-scale wind farm that may include dozens or even hundreds of turbines. Utility Grid wind energy systems are sized to provide power to wholesale or retail customers using the electric utility transmission and distribution grid to transport and deliver the wind generated electricity. On-site Use wind energy systems can have towers up to 40 meters and Utility Grid wind energy systems can have towers up to 90 meters.

The guidelines have been developed with input from members of the Michigan Wind Working Group. The members of the Michigan Wind Working Group have not endorsed these guidelines. Professor Robert Fletcher, Ph.D. and Daniel Alberts, graduate student from Lawrence Technological University helped in the development of these guidelines by providing briefings on technical issues related to siting. Mr. Alberts also helped by conducting a modified Delphi study related to wind energy siting issues. For the Delphi study final report see:
http://www.ltu.edu/engineering/mechanical/delphi_wind.asp .

The guidelines were placed in typical sample zoning ordinance language by Kurt H. Schindler, Regional Land Use Educator with Michigan State University Extension.

Comments or questions are welcome and should be directed to John Sarver, Energy Office at 517-241-6280 or sarverj@michigan.gov.

Sample Zoning Amendments for Wind Energy Systems

The following is offered as sample zoning amendment language. It is intended as a starting point for a community to use when considering this issue.

- **If zoning exists:** If this is being done in a city, village, township, or county with its own existing zoning, then these provisions must be adopted pursuant to the Michigan Zoning Enabling Act.[1] A step-by-step checklist of procedures to amend the zoning ordinance is available from Michigan State University Extension's *Land Use Series*: "Checklist # 4: For Adoption of a Zoning Ordinance Amendment (including some PUDs) in Michigan" is available from www.msue.msu.edu/lu.
- **Township with county zoning:** If this is being done in a township that relies on county zoning, then the township must work with the county planning commission so these provisions are placed in the county's zoning ordinance pursuant to the Michigan Zoning Enabling Act.[2]
- **Zoning does not exist:** If this is being done in a township, village or city where zoning does not exist, then it is not possible to adopt these regulations concerning wind energy systems without first adopting zoning.

There are many different ways for a zoning ordinance to deal with the issues outlined here. The sample provided here is just one. It is written with the following assumptions:

1. The municipality already has site plan review in its zoning ordinance.
2. The section numbering system follows the standard system of codification presented in Michigan State University Extension's *Land Use Series:* "Organization and Codification of a Zoning Ordinance", available from www.msue.msu.edu/lu.
3. The municipality's attorney will review any proposed amendments before they are adopted.

Following are the sample zoning amendments with commentary.

Definitions

Add the following definitions to Section 503 (the section of the zoning ordinance for definitions of words).

> ANEMOMETER TOWER means a freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system which is an accessory land use to a UTILITY GRID WIND ENERGY SYSTEM.
>
> AMBIENT means the sound pressure level exceeded 90% of the time or L_{90}.
>
> ANSI means the American National Standards Institute.

[1] P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3101 *et seq.*)

[2] P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3101 *et seq.*). A step-by-step checklist of procedures to amend the zoning ordinance is available from Michigan State University Extension's *Land Use Series*: "Checklist # 4: For Adoption of a Zoning Ordinance Amendment (including some PUDs) in Michigan" is available from www.msue.msu.edu/lu.

dB(A) means the sound pressure level in decibels. It refers to the "a" weighted scale defined by ANSI. A method for weighting the frequency spectrum to mimic the human ear.

DECIBEL means the unit of measure used to express the magnitude of sound pressure and sound intensity.

IEC means the International Electrotechnical Commission.

ISO means the International Organization for Standardization.

LEASE UNIT BOUNDARY means boundary around property leased for purposes of a Wind Energy System, including adjacent parcels to the parcel on which the Wind Energy System tower or equipment is located. For purposes of setback, the Lease Unit Boundary shall not cross road right-of-ways.

The IEC is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies.

ISO is a network of the national standards institutes of 156 countries.

ON SITE WIND ENERGY SYSTEM means a land use for generating electric power from wind and is an accessory use that is intended to primarily serve the needs of the consumer at that site.

ROTOR means an element of a wind energy system that acts as a multi-bladed airfoil assembly, thereby extracting through rotation, kinetic energy directly from the wind.

SHADOW FLICKER means alternating changes in light intensity caused by the moving blade of a wind energy system casting shadows on the ground and stationary objects, such as but not limited to a window at a dwelling.

SOUND PRESSURE means an average rate at which sound energy is transmitted through a unit area in a specified direction. The pressure of the sound measured at a receiver.

SOUND PRESSURE LEVEL means the sound pressure mapped to a logarithmic scale and reported in decibels (dB).

UTILITY GRID WIND ENERGY SYSTEM means a land use for generating power by use of wind at multiple tower locations in a community and includes accessory uses such as but not limited to a SCADA TOWER, electric substation. A UTILITY GRID WIND ENERGY SYSTEM is designed and built to provide electricity to the electric utility grid.

WIND ENERGY SYSTEM means a land use for generating power by use of wind; utilizing use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid. See also ON-SITE WIND ENERGY SYSTEM and UTILITY GRID WIND ENERGY SYSTEM.

WIND SITE ASSESSMENT means an assessment to determine the wind speeds at a specific site and the feasibility of using that site for construction of a wind energy system.

General Provisions

Add to Article 10 subpart 107 (a part of the general provisions of the zoning ordinance dealing with structures and accessory structures) the following provisions for small wind energy systems with short towers as a use by right. That means a special use permit is not required.

1074. On-site Use Wind Energy Systems and Anemometer Tower.

An On-site Use wind energy system is an accessory use which shall meet the following standards:

A. Designed to primarily serve the needs of a home, farm, or small business.

B. Shall have a tower height of 20 meters or less.

C. Property Set-back: The distance between an On-site Use wind energy system and the owner's property lines shall be equal to the height of the wind energy system tower including the top of the blade in its vertical position. The distance between an anemometer tower and the owner's property lines shall be equal to the height of the tower. No part of the wind energy system structure, including guy wire anchors, may extend closer than ten feet to the owner's property lines, or the distance of the required setback in the respective zoning district, whichever results in the greater setback.

D. Sound Pressure Level: On-site Use wind energy systems shall not exceed 55 dB(A) at the property line closest to the wind energy system. This sound pressure level may be exceeded during short-term events such as utility outages and/or severe wind storms. If the ambient sound pressure level exceeds 55 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

Commentary: Another way to differentiate between On-Site Use and Utility Grid wind energy systems is size of the generators. Early drafts of this sample language made a distinction between a small wind energy system which has a rated capacity of not more than 300 kW and a large wind energy system greater than 300 kW. It was decided that use rather than size was a better way to classify wind energy systems for siting purposes.

Commentary: The property set-back requirement is designed to protect neighbors in the unlikely event of a tower failure. A setback equal to the tower's height should be adequate, but some communities require 1½ times the tower height as the setback.

Commentary: Normal conversation is in the range of 50-65 dB(A). There is more commentary under the Utility Grid section of this document.

E. Construction Codes, Towers, & Interconnection Standards: On-site Use wind energy systems including towers shall comply with all applicable state construction and electrical codes and local building permit requirements. On-site Use wind energy systems including towers shall comply with Federal Aviation Administration requirements, the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 *et seq*.), the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 *et seq*.), and local jurisdiction airport overlay zone regulations. An interconnected On-site Use wind energy system shall comply with Michigan Public Service Commission and Federal Energy Regulatory Commission standards. Off-grid systems are exempt from this requirement.

F. Safety: An On-site Use wind energy system shall have automatic braking, governing, or a feathering system to prevent uncontrolled rotation or over speeding. All wind towers shall have lightning protection. If a tower is supported by guy wires, the wires shall be clearly visible to a height of at least six feet above the guy wire anchors. The minimum vertical blade tip clearance from

Commentary: Safety issues are addressed by reference to state construction and electrical codes and federal and state requirements related to towers. Safety issues are also addressed by provisions related to property set-backs, lowest point of blade, wind energy system controls, lightning protection, guy wire visibility, and interconnection standards.

grade shall be 20 feet for a wind energy system employing a horizontal axis rotor.

Special Use Standards

Add a section to Article 16 (the part of the zoning ordinance for specific special use permit standards).

1609. Utility Grid Wind Energy System, On-site Use Wind Energy System over 20 meters high, and Anemometer Towers over 20 meters high.

An Utility Grid Wind Energy System, On-site Use Wind Energy System over 20 meters high, and Anemometer Towers over 20 meters high shall meet the following standards in addition to the general special use standards (section 8608 of this ordinance):

A. Property Set-Back:

1. Anemometer Tower setback shall be the greater distance of the following:
   a. The setback from property lines of the respective zoning district;
   b. The setback from the road right-of-way; and
   c. A distance equal to the height of the tower from property lines or from the lease unit boundary, which ever is less.
2. Utility Grid and On-site Use Wind Energy System setback shall be greater distance the following:
   a. The setback from property lines of the respective zoning district;
   b. The setback from the road right-of-way; and
   c. A distance equal to the height of the tower including the top of the blade in its vertical position from property lines or from the lease unit boundary, which ever is less.
3. An Operations and Maintenance Office building, a sub-station, or ancillary equipment shall comply with any property set-back requirement of the respective zoning district. Overhead transmission lines and power poles shall comply with the set-back and placement requirements applicable to public utilities.

Background: Prior to construction of a Utility Grid wind energy system, a wind site assessment is conducted to determine the wind speeds and the feasibility of using the site. Installation of anemometer towers is considered a Special Land Use in this sample.

Commentary: Utility Grid wind energy systems may be treated as Special Land Uses under local zoning ordinances. Local governments may also decide to enter into a "Development Agreement" with a wind energy company that also incorporates suitable conditions or may develop a "Wind Overlay Zone" as an addition to or amendment of their existing zoning ordinances. For example, Huron County has developed a Wind Energy Conversion Facility Overlay Zoning Ordinance.

Commentary: The property set-back requirement is designed to protect neighbors in the unlikely event of a tower failure. A setback equal to the tower's height should be adequate, but some communities require 1½ times the tower height as the setback.

B. Sound Pressure Level: The sound pressure level shall not exceed 55 dB(A) measured at the property lines or the lease unit boundary, whichever is farther from the source of the noise. This sound pressure level shall not be exceeded for more than three minutes in any hour of the day. If the ambient sound pressure level exceeds 55 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

Commentary: Safety issues are addressed by reference to state construction and electrical codes and federal and state requirements related to towers. Safety issues are also addressed by provisions related to property set-backs, lowest point of blade, interconnection standards, falling ice, access doors, and handling of materials.

C. Safety: Shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present. All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the wind energy system. A sign shall be posted near the tower or Operations and Maintenance Office building that will contain emergency contact information. Signage placed at the road access shall be used to warn visitors about the potential danger of falling ice. The minimum vertical blade tip clearance from grade shall be 20 feet for a wind energy system employing a horizontal axis rotor.

D. Post-Construction Permits: Construction Codes, Towers, and Interconnection Standards: Shall comply with all applicable state construction and electrical codes and local building permit requirements.

E. Pre-Application Permits:
   1. Utility Infrastructure: Shall comply with Federal Aviation Administration (FAA) requirements, the Michigan Airport Zoning Act (Public Act 23

Commentary: Noise issues are complex and many communities do not have any detailed noise standards. Normal conversation is in the range of 50-65 dB(A). Noise standards may consider the potential for bodily injury, long term health effects, interference with speech and other activities, and sleep disturbance. EPA and World Health Organization documents indicate that 55 dB(A) is too low to produce hearing loss or long-term health effects.[1&2] Related to speech interference, would 55 dB(A) interfere with speech at the property line? EPA has estimated that the distance between persons would have to be 4 meters before there would be any interference.[1] Related to sleep disturbance, the World Health Organization notes that "80-90% of the reported cases of sleep disturbance in noisy environments are for reasons other than noise originating outdoors" and "habituation to night-time noise events occurs."[2] EPA has noted that the typical sound level reduction of buildings in cold climates is 17 dB (windows opened) and 27 dB (windows closed) so 55 dB outdoors would be reduced to no more than 28-38 dB indoors.[1]

References:

1. EPA, 1974. Protective Noise Levels: Condensed Version of EPA Levels Document.
2. World Health Organization, 1999. Guidelines for Community Noise.

The guidelines recommend basic standards for sound pressure levels. The standards can be more detailed and sophisticated. Separate standards can be developed for infranoise and low-frequency sound pressure levels. Separate standards can be developed for residential and non-residential areas. Sound pressure levels characterized as tonal can have lower limits. For example, the Huron County ordinance reduces their standard by 5 dB(A) in the event audible noise from the wind energy system contains a steady pure tone. Local governments who desire a more refined standard may want to consider developing a noise ordinance that would cover all generators of sound pressure levels not just wind systems in a fair and consistent manner.

of 1950 as amended, M.C.L. 259.431 *et seq*.), the Michigan Tall Structures Act (Public Act 259 of 1959 as amended, M.C.L. 259.481 *et seq*.), and local jurisdiction airport overlay zone regulations. The minimum FAA lighting standards shall not be exceeded. All tower lighting required by the FAA shall be shielded to the extent possible to reduce glare and visibility from the ground. The tower shaft shall not be illuminated unless required by the FAA. Utility Grid wind energy systems shall comply with applicable utility, Michigan Public Service Commission, and Federal Energy Regulatory Commission interconnection standards.

2. Environment:
   a. The site plan and other documents and drawings shall show mitigation measures to minimize potential impacts on the natural environment including, but not limited to wetlands and other fragile ecosystems, historical and cultural sites, and antiquities, as identified in the Environmental Analysis.
   b. Comply with applicable parts of the Michigan Natural Resources and Environmental Protection Act (Act 451 of 1994, M.C.L. 324.101 *et seq*.) (including but not limited to:
      i. Part 31 Water Resources Protection (M.C.L. 324.3101 *et seq*.),
      ii. Part 91 Soil Erosion and Sedimentation Control (M.C.L. 324.9101 *et seq*.) ,
      iii. Part 301 Inland Lakes and Streams (M.C.L. 324.30101 *et seq*.),
      iv. Part 303 Wetlands (M.C.L. 324.30301 *et seq*.),
      v. Part 323 Shoreland Protection and Management (M.C.L. 324.32301 *et seq*.),
      vi. Part 325 Great Lakes Submerged Lands (M.C.L. 324.32501 *et seq*.), and
      vii. Part 353 Sand Dunes Protection and Management (M.C.L. 324.35301 *et seq*.))
      as shown by having obtained each respective permit with requirements and limitations of those permits reflected on the site plan.

> Commentary: Environmental issues are complex. These guidelines identify areas that should be addressed in an Environmental Impact Analysis, but do not specify how the analysis should be conducted. Site specific issues should determine which issues are emphasized and studied in-depth in the analysis. There are a number of state and federal laws that may apply depending on the site.

F. Performance Security: Performance Security, pursuant to section 8611 of this Ordinance,shall be provided for the applicant making repairs to public roads damaged by the construction of the wind energy system.

G. Utilities: Power lines should be placed underground, when feasible, to prevent avian collisions and electrocutions. All above-ground lines, transformers, or conductors should comply with the Avian Power Line Interaction Committee (APLIC, http://www.aplic.org/) published standards to prevent avian mortality.

H. The following standards apply only to Utility Grid Wind Energy Systems:
   1. Visual Impact: Utility Grid wind energy system projects shall use tubular towers and all Utility Grid wind energy systems in a project shall be finished in a single, non-reflective matte finished color. A project shall be constructed using wind energy systems of similar design, size, operation, and appearance throughout the project. No lettering, company insignia, advertising, or graphics shall be on any part of the tower, hub, or blades. Nacelles may have lettering that exhibits the manufacturer's and/or owner's identification. The applicant shall avoid state or federal scenic areas and significant visual resources listed in the local unit of government's Plan.
   2. Avian and Wildlife Impact: Site plan and other documents and drawings shall show mitigation measures to minimize potential impacts on avian and wildlife, as identified in the Avian and Wildlife Impact analysis.
   3. Shadow Flicker: Site plan and other documents and drawings shall show mitigation measures to minimize potential impacts from shadow flicker, as identified in the Shadow Flicker Impact Analysis.
   4. Decommissioning: A planning

Commentary: These guidelines identify areas that should be addressed in an Avian and Wildlife Impact Analysis but do not specify how the analysis should be conducted. Site specific issues should determine which issues are emphasized and studied in-depth in the analysis. To assist applicants to minimize, eliminate, or mitigate potential adverse impacts, the U.S. Fish and Wildlife Service has developed Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines which can be found at http://www.fws.gov/habitatconservation/wind.pdf. If the local government desires more structure to the analysis requirements, the Potential Impact Index developed by the U.S. Fish and Wildlife Service provides a framework for evaluating a project's impact on wildlife.

Applicants must comply with applicable sections of the federal Endangered Species Act and Michigan's Endangered Species Protection Law. The applicant should be aware that taking of these species is prohibited by State and/or Federal law unless the proper permits or exemptions are acquired. Early coordination with state and federal agencies is recommended. The applicant or the applicant's impact analyst should contact the U.S. Fish and Wildlife Service's East Lansing Field Office regarding federally-listed species and the Michigan Dept. of Natural Resources for state-listed species.

Commentary: Visual impact issues are difficult to address. Individuals seem to either like or dislike the look of wind energy systems. These guidelines try to address visual impact issues by providing some design standards and by restricting commercial advertising.

commission approved decommissioning plan indicating 1) the anticipated life of the project, 2) the estimated decommissioning costs net of salvage value in current dollars, 3) the method of ensuring that funds will be available for decommissioning and restoration, and 4) the anticipated manner in which the project will be decommissioned and the site restored.

5. Complaint Resolution: A planning commission approved process to resolve complaints from nearby residents concerning the construction or operation of the project
6. Electromagnetic Interference: No Utility Grid wind energy system shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antennae for radio, television, or wireless phone or other personal communication systems would produce electromagnetic interference with signal transmission or reception unless the applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the wind energy system. No Utility Grid wind energy system shall be installed in any location within the line of sight of an existing microwave communications link where operation of the wind energy system is likely to produce electromagnetic interference in the link's operation unless the interference is insignificant.

Zoning Districts

Add, where appropriate, to each land use district's list of possible special land uses the following:

1. Anemometer Tower over 20 meters high.
2. Utility Grid Wind Energy System.
3. On-site Use Wind Energy System over 20 meters high.

Site Plan Review

Add a section to Article 94 (the part of the zoning ordinance covering what is included in a site plan) to include additional items which should be shown on a site plan, and included in supporting documents for wind energy systems.

9407. Site Plans for Anemometer Tower, Utility Grid Wind Energy System, and On-site Use Wind Energy System.

In addition to the requirements for a site plan found in sections 9404, 9405, and 9406 of this Ordinance, site plans and supporting documents for Anemometer Tower, Utility Grid Wind Energy System, and On-site Use Wind Energy Systems which are over 20 meters high shall include

Comment: As indicated earlier, this sample is written with the assumption the requirement for site plans is already a requirement in the zoning ordinance. Further, that the site plan and/or permit application already requires basic information such as applicant identification; parcel identification including boundaries; scale; north point, natural features, location of structures and drives (existing and proposed); neighboring drives, buildings, etc.; topography; existing and proposed utilities; open spaces, landscaping, buffering features; soils data; and so on.

Also it is assumed the zoning ordinance requires all other applicable permits to be obtained prior to submission of the site plan, or at least the site plan prepared as will be required by other permitting agencies (when concurrent permitting will take place).

Finally it is assumed the ordinance already provides for an application fee and a site plan review fee in an amount specified in a published fee schedule adopted by the legislative body of the local unit of government. As with all fees, the amount must be set to cover anticipated actual cost of the application review.

the following additional information:

A. Documentation that sound pressure level, construction code, tower, interconnection (if applicable), and safety requirements have been reviewed and the submitted site plan is prepared to show compliance with these issues.
B. Proof of the applicant's public liability insurance for the project.
C. A copy of that portion of all the applicant's lease(s) with the land owner(s) granting authority to install the the Anemometer Tower and/or Utility Grid Wind Energy System; legal description of the property(ies), Lease Unit(s); and the site plan shows the boundaries of the leases as well as the boundaries of the Lease Unit Boundary.
D. The phases, or parts of construction, with a construction schedule.
E. The project area boundaries.
F. The location, height, and dimensions of all existing and proposed structures and fencing.
G. The location, grades, and dimensions of all temporary and permanent on-site and access roads from the nearest county or state maintained road.
H. All new infrastructure above ground related to the project.
I. A copy of Manufacturers' Material Safety Data Sheet(s) which shall include the type and quantity of all materials used in the operation of all equipment including, but not limited to, all lubricants and coolants.
J. For Utility Grid Wind Energy Systems only:
    1. A copy of a noise modeling and analysis report and the site plan shall show locations of equipment identified as a source of noise which is placed, based on the analysis, so that the wind energy system will not exceed the maximum permitted sound pressure levels. The noise modeling and analysis shall conform to IEC 61400 and ISO 9613. After installation of the Utility Grid wind energy system, sound pressure level measurements shall be done by a third party, qualified professional according to the procedures in the most current version of ANSI S12.18. All sound pressure levels shall be measured with a sound meter that meets or exceeds the most current version of ANSI S1.4 specifications for a Type II sound meter. Documentation of the sound pressure level measurements shall be provided to the local government within 60 days of the commercial operation of the project.
    2. A visual impact simulation showing the completed site as proposed on the submitted site plan. The visual impact simulation shall be from four viewable angles.
    3. A copy of an Environment Analysis by a third party qualified professional to identify and assess any potential impacts on the natural environment including, but not limited to wetlands and other fragile ecosystems, historical and cultural sites, and antiquities. The applicant shall take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis, and shall show those measures on the site plan. The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.
    4. A copy of an Avian and Wildlife Impact Analysis by a third party qualified professional to identify and assess any potential impacts on wildlife and endangered species. The applicant shall take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis, and shall show those measures on the site plan. The applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

        (Sites requiring special scrutiny include wildlife refuges, other areas where birds are highly concentrated, bat hibernacula, wooded ridge tops that attract wildlife, sites that are frequented by federally and/or state listed endangered species of birds and bats, significant bird migration pathways, and areas that have landscape features known to attract large numbers of raptor.)

        (At a minimum, the analysis shall include a thorough review of existing information regarding species and potential habitats in the vicinity of the project area.. Where appropriate, surveys for bats, raptors, and general avian use should be conducted. The analysis shall include the potential effects on species listed under the federal

Endangered Species Act and Michigan's Endangered Species Protection Law.)

(The analysis shall indicate whether a post construction wildlife mortality study will be conducted and, if not, the reasons why such a study does not need to be conducted.)

5. A copy of a shadow flicker analysis at occupied structures to 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 site plan shall identify problem areas where shadow flicker may affect the occupants of the structures and show measures that shall be taken to eliminate or mitigate the problems.
6. A second site plan, which includes all the information found in sections 9404, 9405, and 9406 of this Ordinance, and shows the restoration plan for the site after completion of the project which includes the following supporting documentation:
   a. The anticipated life of the project.
   b. The estimated decommissioning costs net of salvage value in current dollars.
   c. The method of ensuring that funds will be available for decommissioning and restoration.
   d. The anticipated manner in which the project will be decommissioned and the site restored.
7. A description of the complaint resolution process developed by the applicant to resolve complaints from nearby residents concerning the construction or operation of the project. The process may use an independent mediator or arbitrator and shall include a time limit for acting on a complaint. The process shall not preclude the local government from acting on a complaint. During construction the applicant shall maintain and make available to nearby residents a telephone number where a project representative can be reached during normal business hours.

[April 16, 2008; C:\Documents and Settings\Kurt Schindler\My Documents\wp\Zoning\WindEnergy\WindEnergySampleZoning.wpd]

3

Extension Bulletin WO-1053 • Revised • October 2007

Michigan Land Use Guidelines for Siting Wind Energy Systems

Michael Klepinger, Extension Specialist
Michigan State University

MICHIGAN STATE UNIVERSITY EXTENSION

LAND POLICY INSTITUTE

Michigan Land Use Guidelines for Siting Wind Energy Systems

As public interest in renewable energy increases, planning and zoning for wind power are beginning to come of age in Michigan. Publication of new wind potential maps in 2004 helped fuel an increase in landowner interest in wind energy across the state (USDOE, 2004). Wind power companies are prospecting for new sites among landowners, and when landowners inquire at their local government offices about local permits, they often discover the rules are unclear. Very few Michigan jurisdictions have wind system siting laws on their books.

Although only three commercial-scale turbines were operating in the state at the end of 2006, an additional 52 turbines were reportedly under construction or proposed during the year (Sarver, 2006; AWEA, 2006). Some neighbors of these wind development projects are voicing concerns to township, city and county officials. The most common concerns are about tower heights, tower setbacks, wildlife impacts, blade shadow flicker and noise. These topics, and related scientific studies, are addressed in this bulletin.

Communities that proactively plan for wind turbines and carefully develop regulations for their installation will avoid a measure of uncertainty and the unfortunate public discord that sometimes comes along with new land use proposals. (Recall, for example, the spate of cell tower controversies during the 1980s and 1990s.) All local officials are advised to consider adopting planning policies and regulations before an energy facility siting application is received.

Guidelines for siting wind energy systems were released in December 2005 by the Michigan Energy Office in the Department of Labor and Economic Growth (DLEG). The DLEG guidelines are titled "Michigan Siting Guidelines for Wind Energy Systems," and they are now available online. The new guidelines are meant to help local officials strike a balance between the need for clean, renewable energy resources and a local government's responsibility to protect the public health, safety and welfare. They present background commentary and suggested zoning language for local governments.

This bulletin describes the most important provisions of the new guidelines and how they suggest handling the most common concerns of neighbors. It looks at the science behind the guidelines and provides a glossary and references for further reading. It concludes with a short list of Michigan communities that have adopted local planning and zoning laws about wind system siting.

Growing supply and demand for renewable energy

According to the U.S. Department of Energy, the Federal Energy Regulatory Commission and other authorities, the cost of the fossil fuels most commonly used to generate electricity continues to rise. The average end-user price of electricity in the United States was 8 cents per kilowatt hour (kWh) in 2005 (EIA, 2006a).

Since the early 1980s, the price of wind-generated electricity has dropped more than tenfold—from about 40 cents per kWh in 1980 to about 4 cents to 6 cents in 2005 (Aabakken, 2005). The Federal Energy Information Administration assumes in its most recent forecast that current (wholesale-level equivalent) costs from coal and natural gas generation range from 4 cents to 5 cents per kWh, which suggests that recent wind power prices can be competitive with the most common electricity fuels (EIA, 2006b). If the United States were to impose so-called carbon taxes on fossil fuel-based facilities, as is done in other countries, wind-generated electricity would become relatively cheaper (Duke, 2006).

Now that wind power is competitively priced, it offers real advantages over conventional sources because it generates energy without using fossil fuel. Wind energy production is immune from fuel price spikes caused by natural disasters and by political instability. Wind provides a hedge against rising energy costs.

A study released in 2006 by the Rand Corporation states, "Wind is the fastest growing form of renewable energy in the United States and the only source of

renewable energy that is currently cost-competitive in multiple markets with conventional electricity sources." In 2005, wind industry capacity in the United States expanded by about one-third (Rand, 2006; EIA, 2006b).

According to industry sources, 2,454 megawatts (MW) of new generating capacity was installed in 2006, an investment of approximately $4 billion. (One megawatt of wind power produces enough electricity to serve 250 to 300 homes on average each day.) These new wind farms boosted cumulative U.S. installed wind energy capacity by 27% in 2006 to 11,603 MW (AWEA, 2007).

Benefits of renewable energy

Renewable energy is part of the current conversation around Michigan. Proponents note that electricity generated by wind energy systems will reduce air pollution and help slow global climate change. It will increase the fuel diversity and security of our electric system, reduce the impacts of coal mining, and relieve pressure to extract oil and gas from fragile environments. It will provide a hedge against increases in the price of fossil fuels while reducing the need to build new central power plants. And industrial or agricultural activity can continue in and around wind tower sites. Many people see renewable energy, particularly wind energy, as a substantial part of Michigan's diversified energy supply in the future.

Fossil fuel-based electricity generation is responsible for 36% of carbon dioxide pollution, 64% of sulfur dioxide pollution and 26% of nitrogen oxide pollution in the United States (EIA, 2005). Coal-burning power plants are the largest human-caused source of mercury emissions to the air, accounting for over 40 percent of all domestic human-caused mercury emissions (USEPA, 2006). Although most of Michigan's electricity supply is currently derived from burning coal in plants built in previous decades, there are now viable alternatives.

Wind energy is also the fastest growing source of electricity in the world. Approximately 1,650 new wind turbines were installed in the United States during 2005. Although leasing arrangements vary widely, the American Wind Energy Association estimate for income to a landowner from a single utility-scale turbine (1.5 MW) is about $3,000 a year. Many landowners (particularly farmers) are currently considering lease offers from wind development companies.

Despite the many attractions of wind energy, proposals to install new wind generation towers and facilities can stir up controversy in community planning and zoning meetings (as local officials know is true with any type of proposed development).

Proponents and opponents: a special note about scientific facts and issue advocacy.

It is sometimes difficult to know whom to believe in a land use controversy. Proponents and opponents alike can be very convincing — and sometimes they misuse scientific data.

Sometimes an issue revolves around personal opinion or personal taste and aesthetics; sometimes there isn't one "right" answer. Most local officials are not trained scientists, but they are nevertheless asked to decide wind power siting issues grounded in scientific studies.

Proponents might say:

1. Wind turbines are visually interesting.
2. Wind turbines are quiet.
3. Wind power does not pollute.
4. Wind power increases national security.
5. Wind turbines leave a small footprint.
6. Wind power can supplement other sources.
7. Wind power is never going to rise in cost.

Opponents might say:

1. Wind turbines spoil the scenery.
2. Wind turbines are noisy.
3. Wind turbines kill a lot of birds.
4. Wind cannot totally replace other sources.
5. Wind turbine blades are dangerous.
6. Wind power is intermittent.
7. Wind power costs more than coal.

Local officials can expect some or all of these difficult data interpretation issues to arise, and it is a very challenging job. Despite these challenges, a thoughtful review of the science, engineering and field experience behind wind energy is required of local land use officials who want to take a fair and objective look at the issues.

Publications and Web sites of proponent organizations and opponent groups often refer to scientific research. Unfortunately, references are sometimes taken out of context, and they are sometimes misused. The sidebar at right is a recent example of how one scientific paper was used. Opponents and proponents both erred (in their favor) when making a case for a decision on the size of a property line setback. Neighbors raised the possibility of ice throw.

In this example, the proponent claims the Morgan study says the probability of being hit by ice throw is just as low as the probability of being hit by lightning. But anyone who takes the time to read Morgan's study can see the inaccuracy of the proponent's claim. Morgan does not say this.

Also in this example, the opponent claims that industry guidelines (not just one scientist) recommend a very high risk protection level — setbacks should be large enough so that the chance of being hit by ice remains as low as the probability of being hit by lightning. Morgan does not say this, either.

Reading Morgan's scientific paper and the scientific papers he cites makes it clear that there are no guidelines agreed upon by the industry. How can these advocates make such claims? It is fair to say that neither the opponent's nor the proponent's use of Morgan's statement is based on an objective reading of the statement.

From this example, we can see why planners and local officials must carefully investigate any controversy. Independent third-party information is required. Officials must ask: What do we know to be true and what further research is needed on the issue at hand? The Michigan Siting Guidelines for Wind Energy Systems provide a good foundation for local decision makers. The guidelines were written with deliberation and substantial input from a group of Michigan stakeholders and experts in the field.

Original wording of the statement in a scientific article:

"The level of risk which is acceptable should be determined. This is subject to case-specific factors such as ease of access, however a suitable level may be10^{-6} strikes/m^2/year which is the typical probability of lightning strike in the UK" (Morgan, 1998, citing MacQueen).

Reference as used by opponent:

"The wind industry's authoritative ice throw guidelines recommend an ice throw risk of 10^{-6} – or one strike per million square meters per year. At this risk level, a minimum ice throw safety setback for …an 82 meter rotor diameter wind turbine in heavy icing conditions…is 656 meters (2,152 feet)" (citing Morgan, 1998).

Reference as used by proponent:

"The paper concludes that the risk of anything or anyone being hit by ice from a wind turbine is '10^{-6} strikes/m^2/year, which is the typical probability of being hit by a lightning strike in the UK'" (citing Morgan, 1998)

How the original statement by Morgan is used in this MSUE publication:

The author is stating that an acceptable risk level has not yet been determined and *he merely offers a level that may be suitable*. And though that is somewhat interesting, it does not make the case for either side of the setback issue. (It also happens that Morgan's article referenced a 1983 study concerning rotor blade fragmentation, not setbacks or the physics of ice throw.)

What the Michigan guidelines have to offer

As a starting point, the guidelines suggest that local governments should adopt different requirements for systems constructed for on-site use and for larger systems built to supply the utility grid. They suggest that communities place personal systems in one class and utility-scale systems in another class of land use.

The guidelines suggest placing large projects, referred to as "Utility Grid" systems, into a special land use permit process of site plan review. They recommend that utility-scale site plan requirements should include a map of:

- The project area boundaries.
- The location, height and dimensions of all existing and proposed structures and fencing.
- The location, grades, dimensions of all temporary and permanent roads.
- Existing topography.
- Water bodies and wetlands.
- All new aboveground infrastructure related to the project.

Furthermore, there are utility grid system provisions for liability insurance, regulatory compliance, preconstruction environmental studies, visual impact simulations and a shadow flicker analysis. These are recommended in addition to addressing setbacks and sound levels for smaller, so called, "On Site Use" wind systems (described below). A decommissioning plan and a complaint resolution plan are also suggested for larger utility grid proposals. For large systems, the guidelines refer the reader to the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 et seq.) and the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 et seq.).

Small Systems: Two Key Concerns

Small "On Site Use" wind systems are defined in the DLEG guidelines as systems "intended to primarily serve the needs of the consumer" on whose property they are constructed. There are two primary concerns for on-site systems in the guidelines: setbacks and sound.

First, the recommended setback between a consumer's wind energy system and property lines is to be a minimum of 1½ times the height of the wind tower. Height should be measured from the base of the tower to the top of one of the blades in a vertical position. And secondly, the guidelines suggest that, to handle noise issues, small wind energy systems should be metered and proven not to exceed 55 decibels on the "A" scale (dB[A]) at the property line. (However, if the ambient sound pressure level exceeds 55 dB[A], the guideline standard is the ambient level dB[A] plus 5 dB[A]. Local officials should use caution here. See "Noise levels" on page 9).

A few more on-site small system safety concerns are addressed in the Michigan guidelines. To protect passers-by, it is recommended that the minimum vertical blade tip clearance from ground level should be 20 feet (for a wind energy system employing a horizontal axis rotor — vertical axis generators are currently quite rare). In addition, the guidelines suggest lightning protection and an automatic braking or governing requirement to prevent uncontrolled rotation or overspeeding. And if a tower is supported by guy wires, the wires should be clearly visible to a height of at least 6 feet above the ground.

The guidelines recommend that on-site use wind energy systems should be classified as a "permitted use" if the tower proposed is 20 meters tall or less. As such, a small system would be allowed as a use by right within any zoning district selected by local officials. Towers more than 20 meters in height, however, whether they are declared to be for personal use or are to provide utility-scale power, should be classified as "special use" structures. So, the height of a system determines the amount of information the applicant must provide. Smaller "permitted use" system approvals require less information than larger "special use" system approvals.

If a personal-use tower is to be permitted, a list of application provisions is suggested in the guidelines. These include applicant identification; a site plan; documentation that sound pressure levels, construction codes, tower integrity, interconnection (if applicable) and safety requirements have been met; and proof of the applicant's public liability insurance.

Neighbor concerns with utility-scale systems: issues for local officials

A number of issues are at hand when large-scale wind systems or wind farms are proposed. The following sections provide a description of how the guidelines address stakeholder concerns about siting larger utility-scale wind systems and what the available scientific evidence says about the issues.

Tower height

The DLEG guidelines do not suggest setting a maximum height for wind systems. This is because, at least in part, rapid innovations in technology dictate that individual installation requirements will change (Sarver, 2006). But the guidelines do suggest that it is prudent for local government officials to consider the proposed height and then classify the development accordingly.

Regulating the height of structures is nothing new in Michigan communities. Michigan law specifically allows regulation of building heights. It follows, therefore, that wind generator towers, which are "built structures," should be subjected to the same legal treatment as any other building.

Building heights are in some cases regulated because of the size of local fire and emergency equipment (public safety). In others, heights are limited because of aesthetic or cultural concerns (public welfare). Washington, D.C., for example, restricts building heights to "the width of the street plus 20 feet" (which, incidentally, preserves the record local height of the Washington Monument). In Madison, Wisconsin, city law limits the height of buildings within 1 mile of the Wisconsin State Capitol (Madison General Ordinances, 2002). Michigan communities are given quite a bit of discretion when regulating structure heights, so long as there is a valid public safety purpose or public welfare purpose.

As discussed in the next section, the guidelines establish a direct relationship between tower heights and property line setbacks to ensure public safety.

Setbacks

Property line setbacks for primary structures such as a house or a store and for accessory structures such as a residential garage or storage shed are often provided for in local zoning codes and regulations. And though setback provisions are sometimes enforced to preserve airspace or views for the welfare of the public, the genesis of setback regulation lies in public safety. This is in large part due to the Great Fire of London in 1666 and subsequent experience here in the United States. Access between buildings in crowded urban areas is particularly important to fire suppression. Setbacks are important for a number of reasons.

When applied to a wind power development, property line setbacks address two potential issues of public safety: equipment failure and ice throw or ice shedding.

There are no recorded injuries to passers-by or neighbors from wind energy systems (Sipe, 2005). As many as 25 people have been killed while installing or servicing wind turbines. The literature indicates that only one non-industry person has ever been killed by a wind power installation — a parachutist (Sipe, 2006). Wind tower or turbine structural failures rarely occur, but in fact they have occurred. It is prudent, therefore, to require a horizontal setback at least equal to the vertical height of the system in case of a tower collapse. With this simple provision in place, damage to neighboring property could be avoided in the event of a tower collapse.

Cold-weather icing of generator blades and turbine components is a possibility in Michigan, as it is in parts of Europe, where reliable independent studies have been done on the dangers of falling ice. Insurance industry sources indicate that no liability or injury claims have been incurred because of icing in either Europe or the United States (Fox, 2004).

Why do the guidelines recommend a setback based on system height?

It is true that, with any type of tower or building, large pieces of ice can dislodge and fall to the ground. This is called ice shedding or ice sloughing. Wind energy systems do not present any new or unusual risk from ice sloughing when they are standing still — the force of gravity is in control. Shedding can occur on a calm, sunny day. Setback provisions to protect from ice sloughing could be the same for wind systems as those used for other structures.

Some scientists (Seifert et al., 2003) recommend a simple formula to protect the public during the few days each year that heavy icing occurs:

setback = hub height + blade diameter x 150%

Spinning rotor blades do present a certain amount of risk of ice throw because of the centrifugal force of the rapidly spinning blades. Proponents suggest the risk is negligible — very thin ice sheets and small ice particles have never hurt anyone.

Opponents, on the other hand, have suggested that all risk must be considered. It has been suggested that perhaps protection from ice throw should be based on the statistical risk of being struck by lightning (Morgan, 1998).

Why not just use a scientifically calculated, model-based setback distance?

Modeling ice throw will take us only so far. Though we really cannot make progress in today's world without projections and models, neither will models provide all the answers. Because there are so many variables involved, all models include fundamental assumptions about what will occur. And no matter how carefully a model is crafted, the assumptions in a model will not satisfy all opponents or proponents.

So, ultimately, local officials have to decide for themselves. How large is too large? It is true in system modeling that the larger the horizontal setback requirement, the safer. What distance is really needed to protect neighbors from ice throw?

Fortunately, experience shows that property damage or personal injury from ice throw is very limited. It is a matter of basic physics that ice buildup significantly and negatively affects the aerodynamics of windfoils. Ice-laden blades do not spin very fast, if they spin at all. The range of ice throw (distance from the tower) is determined largely by blade speed.

Scientific models and practical experience both tell us that the greatest risks from ice or any other falling material are within one blade diameter of the tower base (MacQueen, 1983; Fox, 2004). Local officials can rely on the laws of physics — small particles and thin sheets of ice are more likely than large, heavy chunks to be thrown from rapidly spinning blades. Off-site risks appear to be quite low. There are no recorded injuries to passersby or neighbors from wind energy systems.

Clearly, ice fall is not the only perceived safety issue with wind energy systems. Towers have collapsed, and large pieces of blades have fallen to the ground. There have been turbine fires. Small components — for example, nuts and bolts — have fallen to earth. But, as with ice danger, there is no record of anyone being hurt off-site because of system component failure. Evidence of damage to off-site property could be called negligible.

So, local officials are advised to require property line setbacks for turbine towers, and a horizontal distance of 1 to 1½ times the system height is recommended in the new DLEG guidelines as a good benchmark to protect neighboring property.

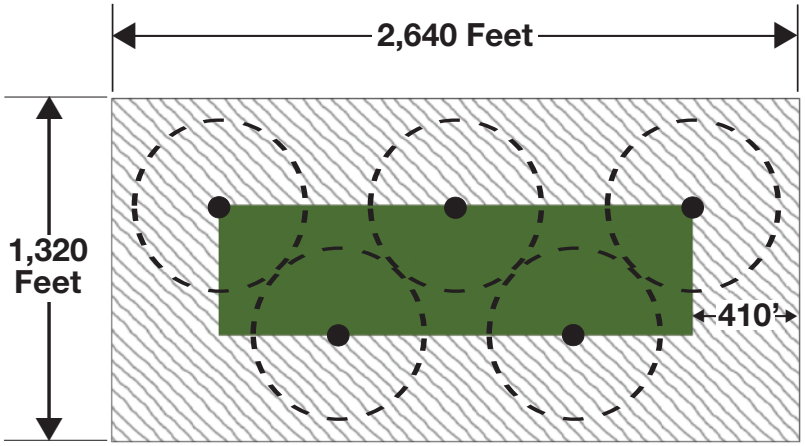
Setbacks affect the developer's bottom line

When local officials decide how large the setback must be, they are also determining the total number of wind generators a landowner can install. This affects the economic viability of developing wind power projects on each site and in the community as a whole.

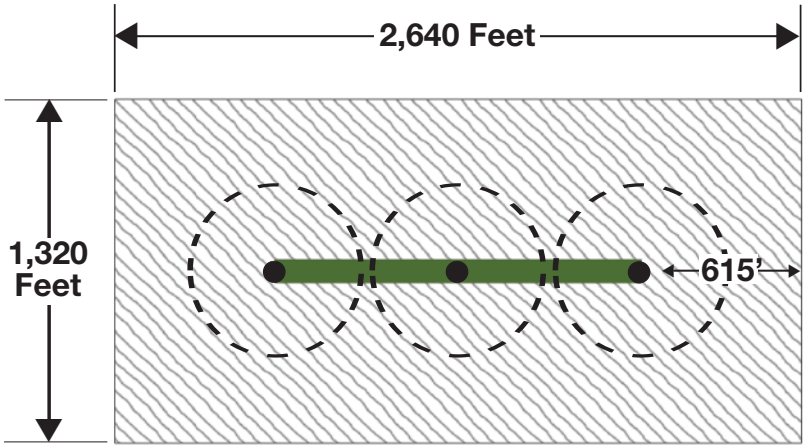
In addition to legal setback requirements, wind developers must calculate how closely turbines can be located to one another within the setback area. This spacing is necessary because of the turbulence or "wake" each turbine creates. Wind developers often base their calculation of turbine spacing on the size of the rotor diameter, in part. Depending on prevailing winds and land features, a distance of three, five or even 10 rotor diameters between turbines might be required to maximize the efficiency of the installation.

For example, a required setback from property lines "equal to the system height" on the illustrated rectangular 80 acre parcel allows the installation of as many as five turbines. A larger setback — in the second example it is "equal to 1.5 times system height" — allows three turbines. An even larger setback — the third example illustrates a setback requirement "equal to 2 times system height" — excludes placement of any turbines on the rectangular 80 acres.

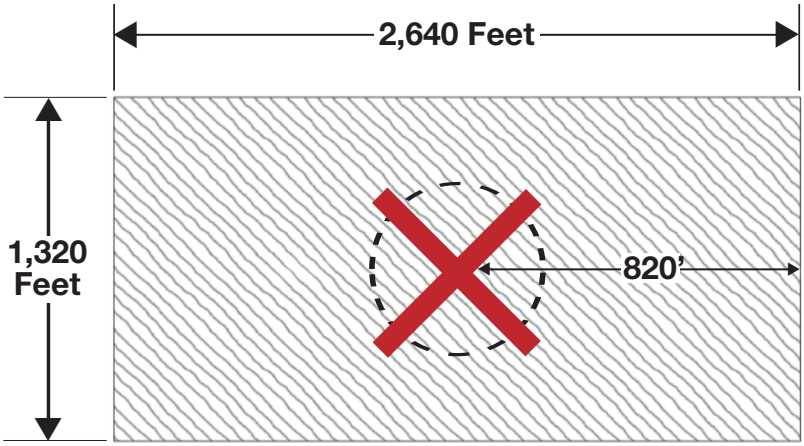
There are more issues than safety, profitability and economic development to consider when local officials decide on a setback requirement. Setbacks affect the character of a community because they affect the overall aesthetic experience of residents and visitors to the area. All setback provisions should be based in the community plan. The setback distance to neighboring property also affects the potential for noise pollution and light strobing or shadow flicker that neighbors will experience.



Five turbines on 80 acres with setback of 410 feet.



Three turbines on 80 acres with setback of 615 feet.



No turbines on 80 acres with setback of 820 feet.

* These setback illustrations assume minimal tower spacing of three rotor diameters or 690 feet and system height of 410 feet on a rectangular 80-acre parcel. The same assumptions on a square 160-acre parcel would allow installations of 11, nine and five turbines, respectively.

Noise levels

At higher wind speeds, the ambient sound of rushing wind tends to mask turbine sounds. Wind machines have three sources of sound: the turbine blades passing through the air, the spinning generator and the moving gears. Regardless of the source, local government is responsible for setting local rules about excessive sound or noise. The authors of the new guidelines considered many aspects of wind system sounds and then presented their recommendations, based on potential long-term health effects, potential interference with speech and other activities, and potential sleep disturbance. These issues are sometimes raised by neighbors during wind system permitting and siting. Unfortunately, very few scientific studies (related to wind power systems) address these effects.

Field studies are needed to investigate the impact of wind turbines on people living in their vicinity (Pedersen and Waye, 2004; van den Berg, 2004). This is a new and active area of research. Scientists held the first International Conference on Wind Turbine Noise in Berlin in 2005, and a second international wind turbine noise conference will be held in France in 2007, organized by the Institute of Noise Control Engineering.

Local decision makers currently find themselves in an awkward position — without a scientific basis for their judgments about noise effects. And because noise is generally defined subjectively as "unwanted sound," scientific studies might never be conclusive. Noise is a subjective judgment — some people enjoy the hum of a turbine. And what is music to some is just noise to others.

Noise issues are complex; many communities have never adopted detailed noise standards. Very few communities have purchased sound level meters to measure noise objectively, and most people do not routinely judge sound in terms of decibels. (One of the best places to learn about sound pressures and decibels is the Australian University of New South Wales Web site, currently at **http://www.phys.unsw.edu.au/~jw/dB.html**.) Although the newest turbines are relatively quiet, all wind turbines emit low frequency, midrange and high frequency sound that can be perceived for some distance.

Sound engineering consultant fees of several hundred or even a few thousand dollars have been incurred in attempts to quantify off-site noise in land use controversies with sound level meters. The cost of access to expertise is sometimes a significant barrier to objective judgment.

Communities that do have a noise ordinance usually take a relatively ineffective approach similar to this:

Section 2. Prohibited Noises

A. General Regulation

It shall be unlawful for any person to make, continue or cause to be made or continued any loud, unreasonable, unnecessary or unusual noise or any noise which either annoys, disturbs, injures or endangers the comfort, repose, health, peace or safety of any other person, resident or property owner within the Township.

B. Specific Prohibitions

The following activities and noises are prohibited if they produce clearly audible sound beyond the property line of the property on which they are conducted.
[…more…]

Note that this poor example ordinance uses the subjective standard of "clearly audible" sound. Subjective standards have failed in Michigan courts. The Michigan Wind Siting Guidelines suggest a different approach--using a measurable objective standard rather than a subjective standard. (All local ordinance provisions should be reviewed by a member of the Michigan Bar Association.)

Although acoustic scientists have adopted a standard that provides a uniform methodology to ensure consistency and accuracy in the measurement and analysis of sound, there are no generally agreed upon standards for how to apply the measurements when regulating wind system noise in a community.

There are no directly applicable federal or state laws. The U.S. Department of Labor Occupational Safety and Health Administration (OSHA) has issued regulations

Most indoor conversation is in the range of 55 to 60 decibels (dB[A]).

COMMON SOUND LEVELS

	Sound pressure level dB(A)
Threshold of hearing	0
Broadcast studio or rustling leaves	10
Quiet house interior or rural evening	20
Quiet office interior or ticking watch	30
Quiet rural area or theater interior	40
Quiet suburban area	50
Office interior or ordinary conversation	60
Vacuum cleaner ten feet away	70
Passing car ten feet away	80
Passing bus or truck ten feet away	90
Passing subway train ten feet away	100
Night club with band playing	110
Threshold of pain	120

Source: State of Maine TAB #4 Noise, 2000.

for protection of workers in the workplace, but it has no authority to regulate noise off-site. Congress passed the Noise Control Act of 1972 and the Quiet Communities Act of 1978, and although these laws remain in effect today, they are essentially unfunded.

The U.S. Environmental Protection Agency issued an advisory document in 1974 that is still used by state and local governments that have the responsibility to regulate most neighborhood noise (USEPA, 1974). The advisory is also used by sound engineering consultants who advise local government officials. It identifies a 24-hour exposure level of 70 dB(A) as the level of environmental noise that will prevent any measurable hearing loss over a lifetime. Levels of 55 dB(A) outdoors and 45 dB(A) indoors are identified by the EPA as "preventing activity interference and annoyance." These levels of noise are considered appropriate to permit spoken conversation and other activities such as sleeping, working and recreation (USEPA, 1974).

The EPA levels are not single-event or peak levels. Instead, they represent averages of acoustic energy over periods of time, such as 8 hours or days or years. For example, occasional higher noise levels would be consistent with a 24-hour exposure average of 70 dB(A), so long as a sufficient amount of relative quiet prevails for the remaining period of time (USEPA, 1974).

Acceptable noise levels for various areas are identified by the EPA according to the use of the area. Levels of 45 dB(A) are associated with indoor residential areas, hospitals and schools; a level of 55 dB(A) is identified in the advisory for certain outdoor areas (USEPA, 1974).

In contrast to the EPA advisory on neighborhood noise, the new Michigan wind energy guidelines do not suggest different dB(A) levels for various places (hospitals, schools, etc.) or land use zones. Rather, they suggest that, in most cases, a decibel level of 55 dB(A) measured at the property line should not be exceeded for more than 3 minutes in any hour of the day. Recognizing that some installations will be proposed in areas that already have higher sound levels, they also recommend that, if the ambient sound pressure level exceeds 55 dB(A), the standard should be set as ambient dB(A) plus 5 dB(A).

And finally, as part of the large-scale wind system application process, the applicant is to provide modeling and analysis that will show that the utility grid wind energy system will not exceed the maximum permitted sound pressure levels. After installation of the system, sound pressure level measurements must be done by a qualified third party and submitted in a report as proof of compliance.

Shadow flicker

Shadow flicker is a term used to describe what happens when rotating wind turbine blades come between the viewer and the sun, causing an intermittent shadow. For residents close to wind turbines, shadow flicker can occur under certain circumstances (most notably near sunrise and sunset) and can be annoying when trying to read or watch television (AWEA, 2006b). Screening of neighboring property with plants, awnings or structures is the most common treatment for shadow flicker annoyance. Opponents have raised health concerns, particularly mentioning the idea that shadow flicker might trigger epileptic seizures.* However, there are no documented health affects associated with shadow flicker.

The Michigan Siting Guidelines for Wind Energy Systems suggest utility grid systems should have a shadow flicker analysis submitted as part of the special use permit application package. The analysis must "identify the locations of shadow flicker that may be caused by the project and the expected durations of the flicker at these locations from sunrise to sunset over the course of a year." The analysis report should also describe measures that the installer will take to eliminate or mitigate effects.

* *According to the British Epilepsy Foundation, around 5% of people with epilepsy are likely to experience seizures triggered by flickering or flashing light, but the foundation is not aware of flickering from wind turbines triggering a seizure. Most people with photosensitive epilepsy are sensitive to flickering around 16 to 25Hz, although some people may be sensitive to rates as low as 3Hz (British Epilepsy Foundation, 2006). A current model General Electric turbine has a nominal rotor speed of 10 to 20 rpm, which translates to a blade pass frequency of less than 1Hz. A NEG-Micon wind turbine with a 72-meter rotor diameter and a nominal rotor speed of 17.3 rpm translates to a blade pass frequency of 0.87Hz.*

Birds, bats and avian impacts

Virtually all construction on the land is capable of damaging habitat of birds and bats, altering flight patterns and causing mortality. Both the positive and the negative effects of wind power system development should be considered when energy choices are made by power companies, by permitting authorities and by consumers.

Because of the well-documented bird kills caused by some early wind farm installations, concerns are sometimes raised by citizens in local land use meetings about the need to avoid serious avian mortality when siting new windmills. Industry advocates, biologists and bird advocates have said that obsolete, first-generation turbines that were poorly placed have caused an excessive number of avoidable bird deaths. Steps have been taken to minimize avian impacts.

The bird kill problem in the United States surfaced in the late 1980s and early 1990s at Altamont Pass east of San Francisco, where approximately 6,000 turbines were installed on 70 square miles of rolling hills. Within a few years, scientists estimated that several hundred red-tailed hawks and kestrels, and dozens of golden eagles were killed each year by turbine collisions, guy wire strikes and electrocutions (Hoover and Morrison, 2005; Orloff and Flannery,1992). Biologists suggest that proposals for new wind farms that consider bird migration routes, bird abundance and turbine height will help to minimize fatalities (Desholm and Kahlert, 2006; USFWS, 2005).

Recently, bat scientists estimated that more than 2,000 bats were killed during a one-year period at a wind power facility in the mountains of eastern West Virginia (Kerns and Kerlinger, 2004). Bat mortality at wind turbine sites is currently poorly understood (CBWG, 2006). There are no estimates for wind-power-related bat deaths nationwide.

How many birds die each year?

Scientists provide currently reliable estimates of around two bird deaths per turbine per year outside California (NWCC, 2004; Erickson et al., 2001). (California is an exception because the old Altamont Pass turbines have skewed the data over the years. Many of these outdated installations are being decommissioned.) Therefore, with the current number of installed U.S. wind turbines

U.S. Annual Bird Mortality Comparison - Selected Causes

Causes of bird mortality	2005 estimated annual bird mortality range	2020 estimated annual bird mortality
Hunting by house cats	75 million to 100 million	More than 75 million
Collisions — vehicles	10 million to 60 million	More than 10 million
Collisions — buildings and structures	100 million to 500 million	More than 100 million
Wind power developments	20 thousand to 30 thousand	80 thousand to 120 thousand

Note: This chart, which draws on the latest bird mortality studies, assumes the number of wind turbines will rise fourfold between 2005 and 2020 (a possibility but by no means a certainty).

outside of California standing at between 10,000 and 15,000 units, a current estimate of 20,000 to 30,000 annual wind-power-related bird deaths can be made. It is reasonable to expect a quadrupling of wind system installations during the next 15 years. This would yield an estimate of 80,000 to 120,000 annual wind-power-related bird deaths.

To put this into perspective for local decision makers, independent biologists and the National Audubon Society estimate that house cats kill between 75 million and 100 million birds per year in the United States (ABC, 2006; Malakoff, 2004). One of the greatest risks to birds is plate glass. Windows in buildings kill between 100 million and 500 million birds each year (Klem, 1990). Travel by air and car kills between 2 million and 60 million birds each year (USFWS, 2005; Veltri, 2005).

Future land development will contribute to increased bird-windowpane collisions, bird-automobile collisions and house cat hunting — these are concerns of local officials. Fossil fuel extraction and combustion will also contribute in unquantifiable ways to avian mortality, so a choice must be made by local officials. It should be noted, too, that although wildlife welfare is everyone's concern, primary responsibility for wildlife management most clearly lies with federal and state authorities under federal and state law.

The new guidelines suggest that local officials take note of avian mortality risks and require an avian and wildlife impact analysis in an application for a utility-scale installation. The analysis should conform to state and federal wildlife agency recommendations based on local conditions.

Local officials are correct to defer to the federal or state government when pressed by citizens to protect birds and bats from construction of wind systems, but they do not have to be silent about the issue. As with air and water pollution, local ordinances may require applicants simply to show that they have obtained "required permits from state and federal authorities" (e.g., the federal Endangered Species Act and Michigan's Endangered Species Protection Law, P.A. 451 of 1994).

All developments in a community involve trade-offs. Bird safety advocates are correct that wind systems might disrupt habitat and cause mortality. Wind energy advocates note that wind energy provides clean electricity without many of the environmental impacts associated with other energy sources — air pollution, water pollution, mercury emissions and greenhouse gas emissions associated with global climate change. Reducing these environmental impacts by installing renewable energy systems can significantly benefit birds, bats, and many other plant and animal species (NWCC, 2004).

For more information

The Michigan Siting Guidelines for Wind Energy Systems provide local land use leaders with a menu of provisions to select from and offer useful background and guidance to answer some of the questions local officials will undoubtedly hear from neighbors of proposed wind power developments. Contact your county MSU Extension office for more information on land use and wind energy, or find more information online at www.michigan.gov/documents/Wind_and_Solar_Siting_Guidlines_Draft_5_96872_7.pdf.

Michigan's main planning enabling acts are the Township Planning Act (P.A. 168 of 1959), the County Planning Act (P.A. 282 of 1945) and the Municipal Planning Act (P.A. 285 of 1931). Michigan's main zoning enabling acts, adopted in 1921 and 1943, were recently consolidated into a single act (P.A. 110 of 2006) called the Michigan Zoning Enabling Act (M.C.L. 125.3101 et seq.) (MZEA, 2006).

The following states have adopted laws related to wind energy planning, zoning or siting. (The State of Michigan does not have specific enabling legislation for wind facility siting.)

State	Primary Reference
California Government Code	Section 65892.13
Minnesota Statues of 2006	Chapters 216f and 500.30
Montana Code Annotated	Section 70-17-303
N. Carolina General Statues	Section 113A-206(3)(b)
Oregon Revised Statutes	Chapter 469.300
Wisconsin State Statutes	Section 66.0401

References

Aabakken, J. 2005. Power Technologies Energy Data Book (3rd ed.). NREL/TP-620-37930. Golden, Colo.: National Renewable Energy Laboratory. Online at http://purl.access.gpo.gov/GPO/LPS65772.

ABC. 2006. American Bird Conservancy Factsheet: Cats Indoors! Campaign. Online at http://www.abcbirds.org/cats/downloads.htm.

AWEA. 2007. American Wind Energy Association January News. Online at http://www.awea.org/news/.

AWEA. 2006a. American Wind Energy Association December News. Online at http://www.awea.org/news/.

AWEA. 2006b. Wind power myths vs. facts. Factsheet. Online at http://www.ifnotwind.org/pdf/Myths%20&%20Facts.pdf.

British Epilepsy Foundation. 2006. Photosensitive epilepsy – other possible triggers. Living with epilepsy information series. Online at http://www.epilepsy.org.uk/info/photo_other.html.

CBWG. 2006. Guidelines for assessing and minimizing impacts to bats at wind energy development sites in California. California Bat Working Group. Online at http://www.wbwg.org/Papers/CBWG%20wind%20energy%20guidelines.pdf.

Desholm, M., and Kahlert, J. 2006. Avian collision risk at offshore wind farms. Journal of Ornithology 147(Suppl. 5): 156.

Duke. 2006. Taxing carbon to finance tax reform. Issue brief. Duke Energy and World Resources Institute. Online at http://pdf.wri.org/taxing_carbon_full.pdf.

EIA. 2006a. Energy Information Administration Factsheet: Average Retail Price of Electricity to Ultimate Customers by End-Use Sector. Online at http://www.eia.doe.gov/cneaf/electricity/epa/epat7p4.html.

EIA. 2006b. Energy Information Administration Annual Energy Outlook 2006 with Projections to 2030. Online at http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2006).pdf.

EIA. 2005. Energy Information Administration Annual Energy Outlook 2005: Market Trends—Electricity Supply and Demand. Online at http://www.eia.doe.gov/oiaf/archive/aeo05/electricity.html.

EMD International. 2006. WindPro modeling software for turbine siting. Product description. Online at http://www.emd.dk/WindPRO/Introduction/.

Erickson, W., et al. 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons of other sources of avian collision mortality. Report to the National Wind Coordinating Committee, Washington, D.C.

Fox, B. 2004. Letter to M. Rubin, November 16, 2004. Energy Insurance Brokers. Online at http://www.powernaturally.org/Programs/Wind/toolkit/icethrowinscopy.pdf.

Hoover, S., and M. Morrison. 2005. Behavior of red-tailed hawks in a wind turbine development. Journal of Wildlife Management, Volume 69, Issue 1 (January 2005), pp.150-159.

Kerns, J., and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia. Annual Report for 2003. Mountaineer Wind Energy Center, W.V.

Klem, D., Jr. 1990. Collisions between birds and windows: mortality and prevention. Journal of Field Ornithology, Volume 61, Number 1 (Winter 1990), pp.120-128.

Klem D., Jr. 2006. Glass: A Deadly Conservation Issue for Birds. Bird Observer. Vol. 34, No. 2. Online at http://www.birdscreen.com/PDF/Bird-Observer2006.pdf.

MacQueen, J.F., et al. 1983. Ice Throw. IEE Proceedings, Vol. 130, Pt. A, No. 9, pp. 574-586.

Madison General Ordinances. 2002. Madison Zoning Code, Sec. 28.04(14).

Malakoff, D. 2004. Clear & Present Danger. Audubon Society Alert Factsheet. Online at http://audubonmagazine.org/features0403/alert.html.

Michigan Siting Guidelines for Wind Energy Systems. 2005. Michigan Department of Labor and Economic Growth Energy Office. Online at http://www.michigan.gov/cis/0,1607,7-154-25676_25774---,00.html.

Morgan, C., E. Bossanyi, and H. Siefert. 1998. Assessment of safety risks arising from wind turbine icing. Paper presented at BOREAS 4, April 1998, Pyha, Finland. Online at http://virtual.vtt.fi/virtual/arcticwind/boreasiv/assessment_of_safety.pdf.

NREL. 1987. Wind Energy Resource Atlas of the United States. Washington D.C.: National Renewable Energy Laboratory, U.S. Department of Energy.

NWCC. 2004. National Wind Coordinating Committee Factsheet: Wind turbine interactions with birds and bats. Online at http://www.nationalwind.org/publications/wildlife/wildlife_factsheet.pdf.

NWCC. 2002. Permitting of Wind Energy Facilities. Washington, D.C.: National Wind Coordinating Committee.

Orloff, S., and A. Flannery. 1992. Wind Turbine Effects on Avian Activity, Habitat Use, Mortality in Altamont Pass and Solano County wind resource areas, 1989-1991. Final report. Sacramento: California Energy Commission.

Pedersen, E., and K. Waye. 2004. Perception and annoyance due to wind turbine noise: a dose-response relationship. Journal of the Acoustical Society of America, 116(6) (December 2004), pp. 3460-3470.

Rand Corporation. 2006. Impacts on U.S. Energy Expenditures of Increasing Renewable Energy Use. Santa Monica, California: Rand Corporation.

Sarver, J. 2006. Personal communication. John D. Sarver, Energy Office supervisor, Michigan Department of Labor and Economic Growth. December 2006.

Seifert, H., A. Westerhellweg, J. Kröning. 2003. Risk analysis of ice throw from wind turbines. Paper presented at BOREAS 6, April 2003, Pyhä, Finland. Online at http://web1.msue.msu.edu/cdnr/icethrowseifertb.pdf.

Sipe, P. 2006. An Archive of Articles on Wind Energy, Electricity Feed Laws, & Other Topics. Online at http://www.wind-works.org/articles/index.html.

Sipe, P. 2005. Wind Energy — The Breath of Life or the Kiss of Death: Contemporary Wind Mortality Rates. Online at http://www.wind-works.org/articles/BreathLife.html.

USDOE. 2006. Wind Energy Guide for County Commissioners. Online at http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wpa/county_commissioners.pdf.

USDOE. 2004. Michigan Wind Energy Resource Maps. Online at http://www.michigan.gov/cis/0,1607,7-154-25676_25774-101765--,00.html.

USEPA. 2006. Frequently Asked Questions About Mercury. Factsheet. Online at www.epa.gov/mercury/about.htm.

USEPA. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Online at http://www.epa.gov/history/topics/noise/01.htm.

USFWS. 2005. International Migratory Bird Day Factsheet: Clear the Way for Birds! IMBD Explores Bird Collisions. U.S. Fish and Wildlife Service. Online at http://www.fws.gov/birds/documents/Collisions.pdf.

van den Berg, G. 2004. Effects of the wind profile at night on wind turbine sound. Journal of Sound and Vibration, Volume 277, Issues 4-5 (November 2004), pp. 955-970.

Veltri, C.J., and D. Klem. 2005. Comparison of fatal bird injuries from collisions with towers and windows. Journal of Field Ornithology, Vol. 76, No. 2, pp.127-133.

Reference materials, not cited

Barios, L., and A. Rodríguez. 2004. Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines. Journal of Applied Ecology, 41 (1), 72-81.

Burkett, E. 2003. A Mighty Wind. The New York Times Magazine. June 15, 2003, pp. 48-51.

Cascade Township. 2003. Cascade Charter Township, Kent County, Michigan, Noise Ordinance. Ordinance No. 1 of 2003.

EWEA. 2003. Wind Force 12: A Blueprint to Achieve 12% of the World=s Electricity from Wind Power by 2020. European Wind Energy Association. Online at http://www.ewea.org/index.php?id=30.

Hoffert, M., et al. 2002. Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet. Science, Nov. 1, 2002:981-987.

Prete, L. 2002. Transmission Pricing Issues for Electricity Generation from Renewable Resources. Online at http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/transprice_art.pdf.

TrueWind Solutions, L.L.C. 2003. The New England Wind Map. Online at http://truewind.teamcamelot.com/ne/.

U.S. Department of Energy. 2006. Wind Energy Guide for County Commissioners. Online at http://www.nrel.gov/docs/fy07osti/40403.pdf.

Wind Powering America. 2006. About Wind Powering America. Online at http://www.eere.energy.gov/windpoweringamerica/wind_powering_america.html.

Catalog of Michigan Communities with Wind System

Planning/Zoning Code Language

Jurisdiction/Provisions	Noise	Setback	Studies Required Before and/or Afte r	Max. Height	Blade Clearance
Banks Township	60 dB(A)	1 x height	Report of soil present on site. Hazard prevention plan.	400'	15'
Antrim Co.					
Billings Township	No adverse impact as determined by Planning Commission.	500' / 1,000'	Documentation regarding wind speed, direction & steadiness. Security and fire plan. Impact assessment.	No adverse impact as determined by Planning Commission	None
Gladwin Co.					
Caseville Township	55 dB(A)	1.5 x height	Site plan. Documentation of sound pressure level and safety requirements being met.	150'	20'
Huron Co.					
Claybanks Township	55 dB(A)	800' 1.75, 1.5 x height	Site plan. Sound impact study.	None	60'
Oceana Co.					
Crystal Township	55 dB(A)	Height plus 200 feet	Environmental impact study, noise emission study and written maintinence plan.	400'	20'
Oceana Co.					
Elmwood Township	60 dB(A)	100'	Site plan.	250'	20'
Leelanau Co.					
Emmet County	60 dB(A)	1 x height	Site plan. Certification of noise standard.	400'	20'

Jurisdiction/Provisions	Noise	Setback	Studies Required Before and/or After	Max. Height	Blade Clearance
Eveline Township	50 dB(A)	2,600' / 500'	1 year wind resource study. Report of soils present & description of foundation.	230' / 300'	20'
Charlevoix Co.					
Filer Township	55 dB(A)	1 x height	Site plan. Visual impact analysis. Fire protection plan. Construction plan.	Established in the special use permit.	20'
Manistee Co.					
Golden Township	55 dB(A)	1.5 x height	Site plan. Sound pressure level report.	Comply with MI Tall Structures Act & local requirement	50'
Oceana Co.					
Grant Township	55 dB(A)	800 ft or 2 x height. Discretionary in case of wind farm	Wind site assessment for feasibility.	Discretionary	60 ft.
Newaygo Co.					
Hamlin Township	40 dB(A)	2 x height	Year's data of sufficient wind. Avian study.	None	None
Mason Co.					
Huron County	50 dB (A) or ambient level + 5 dB(A)	1.5 x hub height, 2 x hub height	Site plan. Avian study. Sound levels. Bi-annual inspection. Decomissioning plan with bond.	275'	75'
Lake Township	60 dB(A)	1 x height	Site plan.	75'	None
Benzie Co.					
Lodi Township	55 dB(A)	1.5 x height	Site plan. Avian study. Annual inspections. Decommissioning plan.	Subject to provisions of special uses	None
Washtenaw Co.					

Jurisdiction/Provisions	Noise	Setback	Studies Required Before and/or After	Max. Height	Blade Clearance
Mackinaw City	60 dB(A)	.5 x height	Site plan.	400'	20'
Cheboygan Co.					
Marion Township	50 dB(A)	1.5 x height	Annual wind resources and soil report. Hazard prevention plan. Annual wind production report by month.	400'	20'
Charlevoix Co.					
Mason County	45 dB(A)	2 x height	Site plan. DNR avian data. Wind Rose Chart. Sound chart. Yearly maintenance inspection.	None	30'
Minden Township	55 dB(A) or ambient level plus 5 dB(A)	2 x hub / 1,000	Site plan. Avian analysis. Sound study at "potentially affected existing" buildings	Conditional	50'
Sanilac Co.					
Oliver Township	55 dB(A)	1.5 x height	Site plan. Sound level documentation.	150'	20'
Huron Co.					
Otsego County	Governed by ambient baseline noise study	1,250' / 180' or 1.5 x height	Site plan. Wind resource study. Avian study. Noise analysis. Cost estimate for removal of WTG.	300' / 400'	50'
Suttons Bay Township	60 dB(A)	50' + height	Site plan, visual analysis. Periodic physical inspections.	230'	20'
Oceana Co.					
Whiteriver Township	45 dB(A)	2 x height	Site plan. Environmental study. Financial impact study.	400'	20'
Muskegon Co.					

Glossary*

Airfoil—The shape of the blade cross-section, which for most modern horizontal-axis wind turbines is designed to enhance lift and improve turbine performance.

Ampere-hour—A unit for the quantity of electricity obtained by integrating current flow in amperes over the time in hours for its flow; used as a measure of battery capacity.

Anemometer—A device to measure wind speed.

Average wind speed—The mean wind speed over a specified period of time.

Blade—The aerodynamic surface that catches the wind.

Brake—Various systems used to stop the rotor from turning.

Cut-in wind speed—The wind speed at which a wind turbine begins to generate electricity.

Cut-out wind speed—The wind speed at which a wind turbine ceases to generate electricity.

Furling—A passive protection for the turbine in which the rotor folds either up or around the tail vane.

GWh—Gigawatt-hour, a measure of energy equal to the use of 1,000 megawatt-hours.

Grid—The utility distribution system — the network that connects electricity generators to electricity users.

Inverter—A device that converts direct current (DC) to alternating current (AC).

kW—Kilowatt, a measure of power for electrical current (1,000 watts).

kWh—Kilowatt-hour, a measure of energy equal to the use of one kilowatt in one hour.

MW—Megawatt, a measure of power (1 million watts).

Nacelle—The body of a propeller-type wind turbine, containing the gearbox, generator, blade hub and other parts.

Power coefficient—The ratio of the power extracted by a wind turbine to the power available in the wind stream.

Power curve—A chart showing a wind turbine's power output across a range of wind speeds.

PURPA—Public Utility Regulatory Policies Act (1978), 16 U.S.C. § 2601.18 CFR §292, which refers to small generator utility connection rules.

Rated output capacity—The output power of a wind machine operating at the rated wind speed.

Rated wind speed—The lowest wind speed at which the rated output power of a wind turbine is produced.

Rotor—The rotating part of a wind turbine — either the blades and blade assembly, or the rotating portion of a generator.

Rotor diameter—The diameter of the circle swept by the rotor.

Rotor speed—The revolutions per minute of the wind turbine rotor.

Start-up wind speed—The wind speed at which a wind turbine rotor will begin to spin. (See cut-in wind speed.)

Swept area—The area swept by the turbine rotor; $A = \pi R^2$, where R is the radius of the rotor.

Tip speed ratio—The speed at the tip of the rotor blade as it moves through the air divided by the wind velocity. This is typically a design requirement for the turbine.

Turbulence—Changes in wind speed and direction, frequently caused by obstacles.

Wind farm—A group of wind turbines, often owned and maintained by one company. Also known as a wind power plant.

Yaw—The movement of the tower top turbine that allows the turbine to stay into the wind.

** Adapted from the National Renewable Energy Laboratory Glossary of Terms, 2006.*

4

Porter Township Ordinance #249

AN ORDINANCE TO AMEND THE ZONING ORDINANCE OF THE TOWNSHIP OF PORTER TO PROVIDE FOR THE SITING, CONSTRUCTION AND OPERATIN OF COMMERCIAL WIND ENERGY FACILITIES AS A SPECIAL USE

The Township of Porter ordains:

1. The zoning ordinance is hereby amended by the addition of the following definitions:

WIND ENERGY FACILITY SPECIAL USE DEFINITIONS

Alternative Energy – Renewable energy sources, such as wind, flowing water, solar energy and biomass, which create less environmental damage and pollution than fossil fuels, and offer an alternative to nonrenewable resources.

Ambient – Ambient is defined as the sound pressure level exceeded 90% of the time or L90.

ANSI – American National Standards Institute.

Legislative Body– The **Township Board,** of the **Township of Porter.**

db(A) – The sound pressure level in decibels. Refers to the "a" weighted scale defined by ANSI. A method for weighting the frequency spectrum to mimic the human ear.

Decibel – The unit of measure used to express the magnitude of sound pressure and sound intensity.

FAA – The Federal Aviation Administration.

Hub Height – When referring to a Wind Energy System, the distance measured from ground level to the center of the turbine hub.

Hub height is defined as the height from the Ground Level (GL) at which the hub of the windmill or the hub of the propeller blades of the wind energy generator is situated.

IEC – International Electro Technical Commission. The IEC is the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies.

ISO – International Organization for Standardization. ISO is a network of the national standards institutes of 156 countries.

Met Tower – A meteorological tower used for the measurement of wind speed.

Michigan Tall Structure Act (M.C.L. 259.481 and following) – Governs the height of structures in proximity to airport related uses and is included as a standard in the Article by reference.

Habitable Structure – Any structure usable for living or business purposes, which includes but is not limited to working, sleeping, eating, cooking, recreation, office, office storage, or any combination thereof. An area used only for storage incidental to a residential use, is not included in this definition.

Non-Participating Parcel – Any parcel of property in the Township not within the Wind Energy Overlay District.

On Site Use Wind Energy Systems – This system is intended to primarily serve the needs of the consumer, and is considered an accessory building.

Planning Commission – The Township **of Porter** Planning Commission.

Rotor – An element of a wind energy system that acts as a multi-bladed airfoil assembly, thereby extracting through rotation, kinetic energy directly from the wind.

SCADA Tower – A freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system.

Shadow Flicker – Alternating changes in light intensity caused by the moving blade of a wind energy system casting shadows on the ground and stationary objects, such as a window in a dwelling.

Sound Pressure – Average rate at which sound energy is transmitted through a unit area in a specified direction. The pressure of the sound measured at a receiver.

Sound Pressure Level – The sound pressure mapped to a logarithmic scale and reported in decibels (dB).

Tip Height – When referring to a Wind Energy System, the distance measured from ground level to the furthest vertical extension of the rotor.

Utility Grid Wind Energy Systems – This system is designed and built to provide electricity to the electric utility grid.

Wind Energy Conversion Facility, (WECF) or Wind Energy Facility – An electricity generating facility consisting of one or more wind turbines under common ownership or operation control, and includes substations, MET Towers, cables/wires and other buildings accessory to such facility, whose main purpose is to supply electricity to off-site customers.

Wind Energy Facility Site Permit – A permit issued upon compliance with the standards enunciated in this Section

Wind Energy Overlay District – Districts created by the legislative body upon receiving a recommendation from the Planning Commission, by identifying specific areas within the County best situated for development of wind energy facilities. This District will be defined by the **Township of Porter** Wind Energy Overlay District Map, as approved by the Planning Commission.

Wind Energy Overlay District Map – This will be a Map showing the areas that are considered to be acceptable siting locations for Wind Energy Facilities. This overlay Map will be created and approved by the Planning Commission. This Map will also include exclusionary zones that are considered to be unsuitable for location of these facilities.

Wind Energy System – A wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the wind energy system to the grid.

Wind Site Assessment – An assessment to determine the wind speeds at a specific site and the feasibility of using that site for construction of a wind energy system.

Site plan review is amended by the addition of the following:

SITE PLAN REVIEW

Wind Energy Facility Special Use Site Plan Review Required

1. Wind Energy Conversion Facilities shall not be located, constructed, erected, altered, or used without first obtaining a Wind Energy Facilities Permit pursuant to this Section. The wind Energy Facilities Site Plan must be reviewed and approved by the Planning Commission pursuant to standards contained herein. An applicant proposing a Wind Energy Facility must submit the following site plan materials:

a. Company contact information (telephone numbers and e-mail addresses), including name of company, name of project, key company contacts with titles, EIN (Employer Identification Number)

b. A narrative describing the proposed Wind Energy Facility, including an overview of the project

c. Site plan (GIS shape file overlay, electronic file and paper copy) of the property showing existing and proposed features such as buildings, structures, roads (right of ways), applicable utility easements, county drains, land use, zoning district, ownership of property, location of proposed turbine towers (with required setbacks, exclusion zones and non-participating properties), underground and overhead wiring (including depth underground), access roads (including width), substations and accessory structures

d. Details or drawings shall show features in the design of a typical tower and its base that upon removal of said tower will allow restoration of the soil at the site to a depth of 4 feet.

e. Anticipated construction date and anticipated completion date

f. The lessor must acknowledge the fact in writing that the decommissioning process poses some risk of the concrete bases remaining in place, if the responsible party (lessee) was unable to properly remove the bases as required in this ordinance. This acknowledgement is to be submitted with the application package and can be in the form of the actual lease language that has been signed by the lessor or an "Acknowledgement Letter" that documents this understanding and has been signed by the lessor.

2. *Application Material.* The following shall be included and/or be utilized as standards when preparing, submitting and reviewing an application for a Wind Energy Facility.

a. *Applicant shall show evidence of compliance with applicable statutes and County ordinances including, but not limited to:*

i. *Part 31 Water Resources Protection (M.C.L.324.3101 et seq.),*
ii. *Part 91 Soil Erosion and Sedimentation Control (M.C.L. 324.9101 et seq.), and the corresponding County ordinance.*
iii. *Part 301 Inland Lakes and Streams (M.C.L. 324.30101 et seq.),*
iv. *Part 303 Wetlands (M.C.L. 324.30301 et seq.),*
v. *All other applicable laws and rules in force at the time of Application*

b. *Visual Appearance, Lighting, Power lines.* The applicant shall use measures to reduce the visual impact of wind turbines to the extent possible, utilizing the following:

i. Wind turbines shall be mounted on tubular towers, painted a non-reflective, non-obtrusive color. The appearance of turbines, towers and buildings shall be maintained throughout the life of the wind energy facility (i.e., condition of paint, signs, landscaping, etc).

ii. Wind turbines and meteorological towers 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. Wind turbines shall not be used for displaying any advertising except for reasonable identification of the manufacturer or operator of the Wind Energy Facility.

iv. The electrical collection system shall be placed underground at a depth designed to accommodate the existing agricultural land use to the maximum extent practicable. The collection system may be placed overhead from substations to points of interconnection to the electric grid or in other areas as necessary.

3. Setbacks, Separation and Security. The following setbacks and separation requirements shall apply to all wind turbines within a Wind Energy Facility.

a. Occupied Buildings: Each wind turbine shall be set back from the nearest residence, school, hospital, church or public library, or any other occupied buildings a distance no less than the greater of (a) two (2) times its Hub Height, or (b) one thousand, five hundred (1,500) feet.

b. Shadow flicker minimization: Wind turbines shall be placed such that shadow flicker to any occupied buildings occurs no more than 20 hours per year.

c. Property line setbacks: Except a set forth in this section, wind turbines shall not be subject to a property line setback. Wind turbines and access roads shall be located so as to minimize the disruption to agricultural activity and, therefore, the location of towers and access routes is encouraged along internal property lines. Wind turbines shall not be located within 2 times Hub Height of the property line of a Non-Participating Parcel.

d. Boundaries with non participating parcels: Wind turbines shall not be located within 2 times Hub Height of the property line of a non-participating parcel.

e. Public roads: Each wind turbine shall be set back from the nearest public road a distance no less than 400 feet or 2 times its Hub Height, whichever is greater, determined at the nearest boundary of the underlying right-of-way for such public road.

f. Railroads & "Rails to Trails": Each wind turbine shall be set back from the nearest Railroad or "Rails to Trails" a distance no less than 400 feet or 2 times its Hub Height, whichever is greater, determined at the nearest boundary of the underlying right-of-way for such Railroad & Rails to Trails".

4. Compliance with Wind Energy Site Permit: Following the completion of constructions, the applicant shall certify that all construction is completed pursuant to the Wind Energy Site Permit. (GIS overlay)

5. Wind Turbine/Tower Height: The applicant shall demonstrate compliance with the Michigan Tall Structure Act (MCL 259.481 and following), FAA guidelines, and local airport zoning as part of the approval process.

6. Noise: Wind Energy Facilities shall not exceed 55 db(A) at the habitable structure closest to the wind energy system. This sound pressure level may be exceeded during short-term events such as utility outages and/or severe wind storms. If the ambient sound pressure level exceeds 55 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

7. Minimum Ground Clearance: The blade tip of any Wind turbine shall, at its lowest point, have ground clearance of not less than seventy five (75) feet.

8. Signal Interference: No large scale Wind Energy Facility shall be installed in any location where its proximity with existing fixed broadcast, retransmission, or reception antennas for television, radio, or wireless phone or other personal communication systems would produce electromagnetic interference with signal transmission or reception.

9. Safety

a. All collection system wiring shall comply with all applicable safety and stray voltage standards.

b. Wind turbine towers shall not be climbable on the exterior.

c. All access doors to wind turbine towers and electrical equipment shall be lockable.

d. Appropriate warning signs shall be placed on wind turbine towers, electrical equipment, and Wind Energy Facility entrances.

e. Appropriate signage for emergency contact information shall be located at the wind turbine tower.

10. Transportation: Submit a copy of a proposed transportation plan to be used by construction and delivery vehicles. Approval of appropriate authorities required prior to construction;

11 Special Use Permit. An applicant for a Wind Energy Facility shall remit a fee in the amount specified in the approved schedule adopted by resolution of the legislative body.

This schedule shall be based on the cost to the Township of the review, which may be adjusted from time to time.

3. The zoning ordinance regarding special uses is amended by the addition of the following:

SPECIFIC LAND USE STANDARDS

Wind Energy Facility

1. Wind Energy Facility Special Use Purpose and Intent

The purpose of this Article is to provide a regulatory scheme for the designation of properties suitable for the location, construction and operation of Wind Energy Conversion Facilities (Wind Energy Facilities) within the **Township** in an effort to protect the health, welfare, safety, and quality of life of the general public, and to ensure compatible land uses in the vicinity of the areas affected by wind energy facilities. A Wind Energy Facility Overlay District shall be considered a map amendment, wherein lands so classified shall become pre-qualified for a Wind Energy Facility with construction of such facility approved pursuant to Chapter 14 Wind Energy Facility Site Plan review portion of the Township **of Porter** Zoning Ordinance. It is further recognized that a Wind Energy Facility Overlay District is intended as an agricultural preservation measure. This shall be applicable for all wind turbines.

2. Regulatory Framework

2.1 Zoning

A Wind Energy Facility may be constructed on land that is within a Wind Energy Facility Overlay District on the official zoning map for the, subject to provisions and standards of the Township of Porter Zoning Ordinance, Wind Energy Facility Site Plan Review and other appropriate Approvals.

2.2 Principal or Accessory Use

A Wind Energy Facility and related accessory uses may be considered either principal or accessory uses. A different existing use or an existing structure on the same parcel shall not preclude the installation of a Wind Energy Facility or a part of such facility on such parcel. Wind Energy Facilities that are constructed and installed in accordance with the provisions of this Section shall not be deemed to constitute the expansion of a non-conforming use or structure. Wind Energy Facilities shall be reviewed and approved pursuant to the Zoning Ordinance.

2.3 Overlay District

After designation as a Wind Energy Overlay District, new uses within the "overlay" area shall be limited to those uses identified within the applicable zoning district and Wind Energy Facilities, subject to any additional standards of this Section.

3. APPLICABILITY

The requirements in this ordinance shall apply to all Wind Energy Conversion Facilities, which shall be permitted as a special use in a Wind Energy Facility's Overlay District. Wind Energy Facilities Site Plan Review standards shall be used when reviewing any application for a wind energy facility.

4. CERTIFICATION

Any approval for Wind Energy Facilities shall require the applicant to provide a post-construction certification that the project complies with applicable codes and industry practices. Applicant shall provide as-built GIS shape file, electronic file, and paper site plan.

5. INSPECTIONS

The applicant's maintenance and inspection records shall be generated annually and are subject to audit by the Township. Inspection Reports shall contain current contact information and be updated whenever the contact information changes.

6. DECOMMISSIONING

The applicant shall submit a plan describing the intended disposition of the alternative energy project at the end of its useful life and shall describe any agreement with the landowner regarding equipment removal upon termination of the lease. Within 12 months of any tower or turbine not operating, the applicant/owner must submit a plan to the **Township** concerning the status of the wind power project and steps that shall be taken to either decommission the tower or turbine, or to achieve renewed Commercial Operation. Any tower/turbine left unused or inoperable for over 24 months would be deemed to be disposed of by developer/applicant. The land must be returned to its original state. Concrete bases will be removed four feet below ground level with appropriate drainage and filled with like soil that was removed. The applicant shall post a performance bond or equivalent financial instrument for decommissioning. The bond shall be in favor of the **Township** and may be provided jointly as a single instrument for multiple governmental units within a single wind farm, provided that any such single instrument shall be in an amount of at least $1 million per unit and shall contain a replenishment obligation.

Porter Township Ordinance #249

Separability. If any section, subsection, paragraph, sentence, clause, phrase or portion of this ordinance is, for any reason, held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision and such holding shall not affect the validity of the remaining portions thereof.

Ordinances Repealed. All ordinances and/or parts of ordinances inconsistent with This ordinance are hereby repealed.

Effective Date. This ordinance shall take effect and be in force 15 days from and after its enactment as provided below.

Passed and approved by the Township Board of the Township of Porter, Michigan, in regular session, held Oct. 1, 2014.

We, the undersigned, Supervisor and Clerk of the Township of Porter, Michigan, do hereby certify that the above and foregoing Ordinance, known as Ordinance No. 249 of the Township of Porter, Michigan, was introduced at a regular meeting of the Township Board, held on Oct. 1, 2014.

Dated at Porter Township, Michigan, this 1st day of October, 2014.

Robert M Alexander
Supervisor

Jacqueline Corbat
Clerk

Porter Township Ordinance #249

I, the undersigned, Township Clerk, DO HEREBY CERTIFY that the foregoing and above Ordinance No. 249 of the Township of Porter, Michigan, is a true and compared copy of the original ordinance, now on file in my office, and of the whole thereof; that the same was published within 10 days from its adoption in the Gratiot County Herald, circulated in the Township of Porter, Michigan, on the 1st day of October A.D., 2014, and that the Affidavit of Publication thereof is now on file in my office and is a part of the original records pertaining to the adoption of the aforesaid ordinance.

I FURTHER CERTIFY, that in accordance with the foregoing ordinance shall take effect 15 days after its enactment as aforesaid.

Dated at Porter Township, Michigan, this 1st day of October, 2014.

Ingawinny Corbat

, Township Clerk

5

MT. HALEY TOWNSHIP
MIDLAND COUNTY, MICHIGAN
WIND ENERGY ZONING ORDINANCE AMENDMENT
ORDINANCE NO. _01-11____

At a regular meeting of the Township Board of Mt. Haley Township, Midland County, Michigan, held at the Mt. Haley Township Hall on __November 12_____, 20_18_, at _7:00___ p.m., Township Board Member ___Norm Jardis_____ moved to adopt the following Ordinance, which motion was seconded by Township Board Member _Dick Dougherty_____:

An Ordinance to amend the Mt. Haley Township Zoning Ordinance, Ordinance No. 02-11, as amended, to add a new Section 621, creating a new Wind Park overlay district including sections 21, 22, 23, 24, 28, 27, 26, 25, 33, 34, 35, 36, and the southern half of sections 16, 15, 14, and 13 of Mt. Haley Township; authorizing Wind Energy Systems within the Township; and establishing requirements for Wind Energy Systems within the Zoning Ordinance.

Mt. Haley Township, Midland County, Michigan, ordains:

Section 1. Amendment of Article II, Section 2.2, Definitions: The Mt. Haley Township Zoning Ordinance, Ordinance No. 01-11, as amended, shall be amended to add the following new Section 621:

SECTION 621 WIND ENERGY

Index of Subsections:

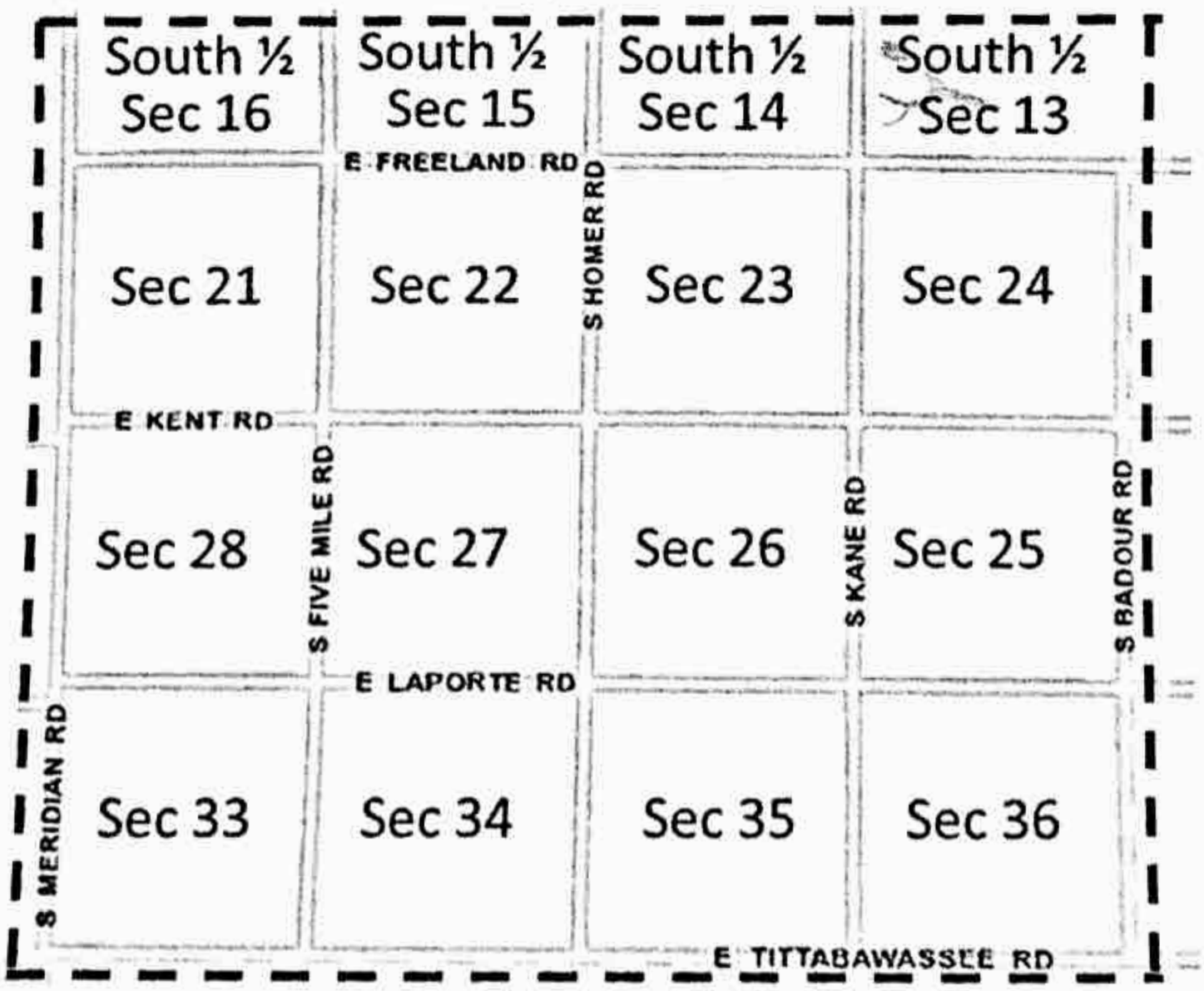
1. STATEMENT OF INTENT; ESTABLISHMENT OF WIND PARK OVERLAY DISTRICT

Due to the passage of PA 342 of 2016, known as the Clean and Renewable Energy and Energy Waste Reduction Act, which requires Michigan electric providers to supply renewable energy sources, Mt. Haley Township felt a need to address wind energy in the Township. Wind energy is a renewable and carbon-free energy resource of the Township, and the conversion of wind energy to electricity may reduce dependence on nonrenewable energy sources and decrease the adverse effects that result from the use of conventional energy sources. However, wind energy facilities may cause significant potential negative effects because of their large size, lighting, shadow flicker, noise, and other factors.

The following regulations have been developed with the intention of obtaining an appropriate balance between the need for clean, renewable energy resources and the need to protect the public health, safety, and welfare of the Mt. Haley Township community. Regulation of the siting, installation, and operation of wind energy facilities is necessary to ensure compatible land uses. The regulations provide for the designation of property suitable for the location, construction, and operation of wind energy facilities in the Township. Refer to section 6.2.2 of the master plan.

A zoning overlay district is hereby established for the location of Utility Grid WES by issuance of a Special Land Use Permit. This overlay district will be referred to hereafter as the Wind Park. The Wind Park includes sections 21, 22, 23, 24, 28, 27, 26, 25, 33, 34, 35, 36, and the southern half of sections 16, 15, 14, and 13.

Sections in Mt. Haley Township; Midland, MI



2. DEFINITIONS

1	ANSI	American National Standards Institute.
2	A-Weighted Sound Level	The sound pressure level in decibels as measured on a sound level meter using the A-weighting network, a method for weighting the frequency spectrum to mimic the human ear. Expressed as dB(A).
3	Background Sound	The all-encompassing sound associated with a given environment without contribution from the source or sources of interest, as defined by ANSI S12.9 Part 3.
4	Continuous Background Sound	Background sound measured during a measurement period, after excluding the contribution of transient background sounds, as defined by ANSI S12.9 Part 3.
5	dB(A)	The sound pressure level in decibels. The "A" weighted scale defined by ANSI.
6	Decibel	ANSI S1.1 definition: Unit of the level of a power or power-like quantity when the base of the logarithm is the tenth rood of ten. Unit symbol, dB. The unit of measure used to express the magnitude of sound pressure, sound intensity, and sound power.
7	Decommission	To remove or retire from active service.
8	Dwelling	A building in which people currently live or may be used to live in. This includes homes that may be currently unoccupied but for sale, for rent, or used as a vacation home.
9	Equivalent A-weighted Continuous Sound Level	The level of a steady sound which, in a stated time period and at a stated location has the same A-weighted sound energy as the time varying sound, denoted as L_{EQ} A, and expressed as dB(A).
10	Frequency	The number of oscillations or cycles per unit of time, expressed as Hertz (Hz)
11	Height of Turbine	The distance from the ground level base of the structure to the highest point on the tip of a fully vertical rotor blade.
12	Hertz	The frequency of sound expressed by cycles per second.
13	Hub Height	The distance from ground level to the center of the turbine hub or horizontal rotor shaft.
14	IEC	International Electrotechnical Commission.
15	Inhabited Structure	Any existing structure usable for living or non-agricultural commercial purposes, which includes but is not limited to working, sleeping, eating, cooking, recreation, office, office storage, or any combination thereof. An area used only for storage incidental to a residential use, including agricultural barns, is not included in this definition. If it is not clear by this definition, the Zoning Administrator shall make a determination of any structure regarding whether or not if it is inhabited.
16	ISO	International Organization for Standardization. ISO is a network of the national standards institutes of 156 countries.
17	MET Tower or Anemometer Tower	A temporary or permanent tower used to measure wind speed and direction.

18	Nacelle	The housing to which the rotors and hub are attached and frequently contains rotor breaks, electronics, and generators.
19	Noise Sensitive Facility	An Inhabited Structure, school, hospital, church, public library, or other area designated by the Planning Commission.
20	Non-Participating	A parcel of land that is not Participating.
21	Octave Band	The frequency interval where the upper frequency is twice the lower frequency.
22	One-Third Octave Band	The frequency interval where the upper frequency is the lower frequency times the cube foot of two.
23	On-Site Use WES	A Wind Energy System (WES) that primarily serves the energy needs of the parcel upon which the WES is located.
24	Participating	A parcel of land that participates by ownership, lease, easement agreement, or other contractual agreement, with a person or entity constructing, operating, or submitting a Special Land Use Permit application for a WES, and including the parcel on which a WES is located.
25	Rotor	An element of a WES that acts as a multi-bladed airfoil assembly extracting kinetic energy directly from the wind through rotation.
26	SCADA Tower	A temporary or permanent freestanding tower containing instrumentation such as anemometers that is designed to provide present moment wind data for use by the supervisory control and data acquisition (SCADA) system.
27	Shadow Flicker	Alternating changes in light intensity caused by a moving blade or rotor of a WES casting shadows on the ground and stationary objects, such as a window at Dwelling.
28	Sound Power	The rate per unit time at which sound energy is radiated, expressed as watts (W).
29	Sound Power Level	Ten times the logarithm to the base 10, of the ratio of a given sound power to the reference sound power of 1 picowatt, expressed as decibels (dB).
30	Sound Pressure Level	Twenty times the logarithm to the base 10, of the ratio of the root-mean-square sound pressure to the reference pressure of twenty micropascels, expressed as decibels (dB). Unless expressed with reference to a specific weighing network (such as dB(A)), the unit dB shall refer to an un-weighted measurement.
31	Utility Grid WES	A WES designed, built or operated to provide electricity not principally for use on the site where the WES is located. A Utility Grid WES may be located within the Wind Park by issuance of a Special Land Use Permit.
32	Wind Energy System (WES)	A wind energy conversion system which converts wind energy into electricity through the use of a wind turbine generator and includes the turbine, blades, and tower as well as related electrical equipment. This does not include wiring to connect the WES to the grid.
33	Wind Site Assessment	An assessment to determine the wind speeds at a specific site and the feasibility of using that site for construction of a WES.

3. *WIND SITE ASSESSMENT FOR WIND ENERGY SYSTEMS (WES)*

a. Prior to construction of a WES, a wind site assessment may be conducted to determine the wind speeds and the feasibility of using the site. SCADA, Anemometer Towers, or MET Towers taller than 65 feet in height used to conduct a wind site assessment for possible installation of a WES shall be permitted as a Special Land Use in the Agricultural, Commercial, and Industrial Zones.
b. Prior to the installation of the SCADA, Anemometer Tower or MET Tower, an application for a Special Land Use Permit shall be filed with the Township that will include:
   i. Applicant identification
   ii. A site plan
   iii. A copy of that portion of the Applicant's lease with the land owner(s) granting authority to install the MET Tower and requiring the Applicant to remove all the equipment and restore the site after completion of the wind site assessment
   iv. Proof of the owner's and operator's liability insurance unless waived under subsection 14.
c. The distance from the center of an Anemometer Tower or MET Tower and the property lines between the leased property and the non-leased property shall be at least 1.0x the height of the Anemometer Tower or MET Tower. Leased property can include more than one parcel of property and the requirement shall apply to the combined properties.
d. No part of the WES structure, including guy wire anchors, may extend closer than ten feet to the owner's property lines.
e. If a tower is supported by guy wires, the wires shall be clearly visible to a height of at least six feet above the guy wire anchors.

4. UTILITY GRID WIND ENERGY SYSTEMS (WES)

A Utility Grid WES is designed and built to provide electricity to the electric utility grid. Utility Grid WES shall be permitted as a Special Land Use in the Agricultural, Commercial, and Industrial Districts within the Wind Park.

a. Procedure: The Planning Commission review of a Special Land Use Permit application for a WES is a two-step process. The first step is the public hearing and decision by the Planning Commission, per the procedures for review in Section 602. The second step, which may occur at a separate meeting for a Utility Grid WES, is the site plan review process by the Planning Commission as described in Section 709. Both of these sections can be found in Ordinance 02-11.
b. A decision on the Special Land Use Permit application by the Planning Commission includes all proposed Utility Grid WES components, underground electrical lines, substation(s), junction boxes, laydown yard(s), concrete batch plant(s), and any operations/maintenance building(s).
c. Application Fee, Township Costs, and Escrow. With its application an Applicant shall pay an application fee as determined by resolution of the Township Board.
d. Township costs in review and retention of professionals. The Applicant shall pay to and reimburse the Township its costs incurred in acquisition of professional, engineering, or other technical advice or review of the application, including without limitation engineering, sound modeling, sound surveys, visual studies, environmental and wildlife studies, electromagnetic studies, and decommissioning analysis. No special land use approval shall be issued or effective until all such fees have been paid. With the application, the Applicant shall make an initial deposit in an amount specified in a schedule established by the Township Board. Thereafter, in its consideration and review of the application, the Planning Commission may require additional deposits from the Applicants.
e. Prior to the installation of a Utility Grid WES, an application for a Special Land Use Permit shall be filed with the Township and shall include the following:
   i. Applicant Identification: Applicant name, address, and contact information.

ii. Project Description: A general description of the proposed project including a legal description of the property or properties on which the project would be located and an anticipated construction schedule.
iii. Site Plan: The site plan shall include maps showing the physical features and land uses of the project area, both before and after construction of the proposed project. The site plan shall include
    1. the project area boundaries
    2. the location, height, and dimensions of all existing and proposed structures and fencing
    3. the location, grades, and dimensions of all temporary and permanent on-site and access roads, including width and surface material, from the nearest county or state maintained road
    4. existing topography
    5. water bodies, waterways, wetlands, and drainage channels
    6. all new above ground infrastructure related to the project.
iv. Proof of the owner's and operator's liability insurance unless waived under subsection 14.
v. Consent Documents: Copies of any written waivers from neighboring property owners; must be signed and notarized by all involved parties.
vi. Sound Pressure Level: Copy of the modeling and analysis report.
vii. Certifications: Certification that Applicant has complied or will comply with all applicable state and federal laws and regulations. Copies of all such permits and approvals that have been obtained or applied for at the time of the application.
viii. Visual Impact: Visual simulations of how the completed project will look form four viewable angles.
ix. Environmental Impact: Copy of the Environmental Impact analysis.
x. Avian and Wildlife Impact: Copy of the Avian and Wildlife Impact analysis.
xi. Shadow Flicker: Copy of the Shadow Flicker analysis; must include at least one calendar year in the analysis.
xii. Safety Data Sheet(s): Documentation shall include the type and quantity of all materials used in the operation of all equipment including, but not limited to, all lubricants and coolants.
xiii. Fire suppression plan
xiv. Maintenance Schedule: Description of operations, including anticipated regular and unscheduled maintenance.
xv. Decommissioning: Copy of the decommissioning plan.
xvi. Complaint Resolution: Description of the complaint resolution process.

f. The detailed site plan for site plan review shall include maps showing the physical features and land uses of the project area, both before and after construction of the proposed project. The site plan shall include:
    i. The project area boundaries, including all lot lines and dimensions.
    ii. Names and parcel identification number of each parcel with the Utility Grid WES.
    iii. The location, height, composition, dimensions of all existing and proposed structures, fencing, utility easements, land use, zoning district, and ownership of property.
    iv. The location, grades, composition, and dimensions of all temporary and permanent on-site and access roads from the nearest county or state maintained road,
    v. Existing topography,
    vi. Water bodies, waterways, wetlands, and drainage channels
    vii. All new infrastructure above and below ground related to the project, including proposed turbine towers, underground and overhead wiring (including the depth of underground wiring), new drainage facilities (if any), access drives (including width), substations and accessory structures
    viii. Lighting plan
    ix. A description of the routes to be used by construction and delivery vehicles and of any road improvements that will be necessary in the Township to accommodate construction vehicles,

equipment or other deliveries, and a bond which guarantees the repair of damage to public roads and other areas caused by construction of the Utility Grid WES

x. Engineering data concerning construction of the tower and its base or foundation, which must be engineered and constructed in such a manner that upon removal of said tower, the soil will be restored to its original condition to a depth of five feet

xi. Anticipated construction schedule

xii. Description of operations, including anticipated regular and unscheduled maintenance

g. All Utility Grid WES shall be constructed and thereafter maintained and operated to the following standards and requirements:

i. Setbacks

The following setback distances shall be maintained and measured from the center of the base of the Utility Grid WES at ground level.

TABLE 4-1. Summary of Setbacks

Stream and/or River	Setbacks set as per wildlife review study and any agency that has authority over streams and rivers
Creek and/or Drains	No portion of Utility Grid WES within 100' of center line
Utility - overhead	1.0x of tallest tip height to right of way
Utility - underground	1.0x of center of nacelle/hub to right of way
Roadways	1.25x of tallest tip to center line of road
An operations and maintenance office building, a substation, or ancillary equipment	Shall comply with any property setback requirement that may be applicable to that type of building or equipment
Overhead transmission lines and power poles that are part of the Utility Grid WES	Shall be on leased land and shall comply with the setback requirements applicable to public utilities
Participating Dwelling	Greater of 2.0x of tallest tip height or 1000'
Participating property line	No minimum setback
Non-Participating Dwelling	Greater of 2.5x of tallest tip height or 1320'
Non-Participating property line	1.1x of tallest tip height

ii. Utility Grid WES are limited to a height approved by FAA above the existing grade.

iii. Underground power lines serving the Utility Grid WES shall be placed a minimum of five feet below grade and ≤2 feet below any drainage tile on the property.

iv. Construction Codes, Towers, and Interconnection Standards:

1. Utility Grid WES, including towers, shall comply with all applicable state construction and electrical codes and local building permit requirements.
2. Utility Grid WES, including towers, shall comply with Federal Aviation Administration requirements, the Michigan Airport Zoning Act (Public Act 23 of 1950, MCL 259.431 et seq.), the Michigan Tall Structures Act (Public Act 259 of 1959, MCL 259.481 et seq.), and local jurisdiction airport overlay zone regulations. Utility Grid WES shall comply with applicable utility, Michigan Public Service Commission, and Federal Energy Regulatory Commission interconnection standards.

h. Upon completion of the construction of the Utility Grid WES, digital "as built" documentation shall be provided to the Township. The "as built" documentation shall include details of above and below grade components of the Utility Grid WES and all accessory facilities.

5. **LIGHTING**
   a. Utility Grid WES towers shall not be illuminated unless required by the FAA.
   b. When illumination is required by the FAA, Utility Grid WES are required to use Aircraft Detection Lighting Systems (ADLS) if approved by all agencies having jurisdiction over such lighting.
   c. All tower lighting required by the FAA shall be shielded to the maximum extent possible to reduce glare and visibility from the ground. Continuous nighttime lighting systems are not allowed.

6. **SAFETY**
   a. All Utility Grid WES shall be designed to prevent unauthorized access to electrical and mechanical components and shall have access doors that are kept securely locked at all times when service personnel are not present.
   b. All spent lubricants and cooling fluids shall be properly and safely removed in a timely manner from the site of the WES.
   c. Spills shall be reported to and cleaned up as per Michigan Department of Environmental Quality and MIOSHA requirements.
   d. A sign shall be posted near any tower and any operations and maintenance building that will contain emergency contact information.
   e. Signage placed at any road access shall be used to warn visitors about the potential danger of falling ice.
   f. The minimum vertical blade tip clearance from grade shall be 50 feet for a WES employing a horizontal axis rotor.
   g. The Applicant shall be responsible for maintenance of the access roads. At the landowner's discretion, the entrance of each access road from the public right of way shall be gated, with wings as appropriate, to discourage trespassers.

7. **VISUAL IMPACT**
   a. Utility Grid WES shall use tubular towers and all Utility Grid WES shall be finished in a single, non-reflective matte finish and neutral color.
   b. Cosmetic appearance shall be maintained to "as installed" or new condition. This includes but is not limited to removal/repair of graffiti and painting of rust within six months of it being reported to owner/operators of Utility Grid WES.
   c. Utility Grid WES with broken, damaged, fallen, or malfunctioning parts shall be repaired to new condition or removed within 9 months of the failure being documented. After that, the damaged Utility Grid WES shall be removed as per the decommissioning process.
   d. A project shall be constructed using Utility Grid WES of similar design, size, operation, and appearance throughout the project.
   e. No lettering, company insignia, advertising, or graphics shall be on any part of the tower, hub, or blades. Nacelles may have lettering that exhibits the manufacturer's and/or owner's identification.
   f. The Applicant shall avoid state or federal scenic areas and significant visual resources listed in the Township's master plan.

8. ***ENVIRONMENTAL IMPACT***
   a. The Applicant shall have a third party, qualified professional conduct an analysis to identify and assess any potential impacts on the natural environment including, but not limited to wetlands and other fragile ecosystems, historical and cultural sites, and antiquities. The Applicant shall take appropriate measures to minimize, eliminate, or mitigate adverse impacts identified in the analysis.
   b. The Applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts. The Applicant shall comply with applicable parts of the Michigan Natural

Resources and Environmental Protection Act (Act 451 of 1994, MCL 324.101, *et seq.*) including but not limited to Part 31 Water Resources Protection (MCL 324.3101, *et seq.*), Part 91 Soil Erosion and Sedimentation Control (MCL 324.9101, *et seq.*), Part 301 Inland Lakes and Streams (MCL 324.30101, *et seq.*), Part 303 Wetlands (MCL 324.30301, *et seq.*), Part 323 Shoreland Protection and Management (MCL 324.32301, *et seq.*), Part 325 Great Lakes Submerged Lands (MCL 324.32501, *et seq.*), and Part 353 Sand Dunes Protection and Management (MCL 324.35301, *et seq.*).

c. The Applicant shall be responsible for making repairs to any public roads damaged by the construction or operation of the Utility Grid WES.

9. AVIAN AND WILDLIFE IMPACT

a. The Applicant shall have a third party, qualified professional conduct an analysis to identify and assess any potential impacts on wildlife and endangered species. The Applicant shall take appropriate measures to minimize, eliminate, or mitigate adverse impacts identified in the analysis. The Applicant shall identify and evaluate the significance of any net effects or concerns that will remain after mitigation efforts.

b. Sites requiring special scrutiny include wildlife refuges, other areas where birds are highly concentrated, bat hibernacula, wooded ridge tops that attract wildlife, sites that are frequented by federally and/or state listed endangered species of birds and bats, significant bird migration pathways, and areas that have landscape features known to attract large numbers of raptors.

c. At a minimum, the analysis shall include a thorough review of existing information regarding species and potential habitats in the vicinity of the project area. Where appropriate, surveys for bats, raptors, and general avian use should be conducted. The analysis shall include the potential effects on species listed under the federal Endangered Species Act and Michigan's Endangered Species Protection Law.

d. The analysis shall indicate whether a post construction wildlife mortality study will be conducted and, if not, the reasons why such a study does not need to be conducted. Power lines should be placed underground, when feasible, to prevent avian collisions and electrocutions. All above-ground lines, transformers, or conductors should comply with the Avian Power Line Interaction Committee (APLIC) published standards to prevent avian mortality.

10. ELECTROMAGNETIC INTERFERENCE

a. No Utility Grid WES shall be installed in any location where its proximity to existing fixed broadcast, retransmission, or reception antenna for radio, television, wireless phone, internet, or other personal communication systems would produce electromagnetic interference with signal transmission or reception unless the Applicant provides a replacement signal to the affected party that will restore reception to at least the level present before operation of the WES.

b. No Utility Grid WES shall be installed in any location within the line of sight of an existing microwave communications link where operation of the WES is likely to produce electromagnetic interference in the link's operation unless the interference is insignificant.

11. SHADOW FLICKER

a. Shadow flicker on Participating Dwellings shall be limited to a maximum of 30 hours per year.

b. Shadow flicker not allowed on or within 100 feet of the nearest wall of Non-Participating Dwelling unless waived by Non-Participating owner(s).

c. Shadow flicker on Participating Parcels will be measured at the nearest external wall or walls.

d. Shadow Flicker Analysis: The Applicant shall conduct an analysis on potential shadow flicker at Dwellings. 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 sunrise to sunset over the course of a year. The analysis shall identify problem areas where shadow flicker may affect the occupants of the Dwelling and describe measures that shall be taken to eliminate the problems. Site plans shall depict a contour around

each proposed Utility Grid WES that represents the predicted 30 hours per year shadow flicker generated by the modeling software used in the report. The analysis shall identify all areas where shadow flicker may affect the occupants of the Dwellings.

e. The shadow flicker analysis shall include a shadow flicker mitigation plan, which describes measures that shall be taken to eliminate shadow flicker that occurs beyond the levels set herein. Mitigation measures may be allowed on Participating Parcels.
f. All Utility Grid WES shall be outfitted with curtailment software.
g. Any shadow flicker complaint shall be addressed by the Applicant and be eliminated based upon the standards herein.
h. If flicker is a nuisance, conflict resolution process shall be employed.

TABLE 11-1. Summary of Allowable Flicker

Participating Dwelling	Limited to a maximum of 30 hours per year
Non-Participating Dwelling	Shadow flicker not allowed on or within 100 feet of the nearest wall of Non-Participating Dwelling unless waived by Non-Participating owner(s).

12. SOUND PRESSURE LEVEL

a. The audible sound from a Utility Grid WES at a Noise Sensitive Facility may not exceed the Equivalent A-weighted Continuous Sound Level (L_{EQ}) limits set forth in Table 12-1, measured in accordance with the methodology described in Subsections 12.e. and 12.f.

TABLE 12-1. Equivalent A-weighted Continuous Sound Level (L_{EQ}) Limits

Zone	Equivalent A-weighted Continuous Sound Level (dB(A) L_{EQ} (1hr))
Participating Parcel; as measured 50' from the Noise Sensitive Facility at the point closest to the Utility Grid WES.	≤ 55
Non-Participating Parcel; as measured 50' from the Noise Sensitive Facility at the point closest to the Utility Grid WES.	≤ 45

b. In the event audible noise from the operation of the Utility Grid WES contains a prominent discrete tone, the limits set forth in Table 12-1 shall be reduced by five dB(A). For a prominent discrete tone to be identified as present the equivalent-continuous sound pressure level in the one-third octave band of interest is required to exceed the arithmetic average of the equivalent-continuous sound frequencies of f500 Hz and above, by eight dB for center frequencies between 160 Hz and 400 Hz, or by 15 dB for center frequencies between 25 and 125 HZ as specified by ANSI S12.9 Part 4, Annex C. This should be done for each 10 minute compliance measuring interval.
c. Any noise level falling between two whole decibels shall be rounded to the nearest whole number.
d. Sound Modeling Study - The Applicant shall provide a predictive sound modeling study of all turbine noise for a Utility Grid WES to verify that ordinance requirements can be met for the Equivalent A-weighted Continuous Sound Level limits in Table 12-1. The sound modeling must follow International Standard, ISO 9613-2 "Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation." The sound modeling study shall use the maximum apparent wind turbine sound power levels

as determined by measurement according to IEC 61400 - Part 11 or as determined by analytical calculations according to the manufacturer, plus 2 dB to each frequency band. The turbine(s) should be modeled as a single point source at the proposed hub height and perceived sound at 6.6 foot +/- 0.7 foot above the ground. Modeling shall include topographical information and assume hard ground (G=0) for all large areas of pavement and water, and mixed ground (G=0.5) for all other land. The sound modeling study shall include a map with all proposed Utility Grid WES locations, all Noise Sensitive Facilities, and all Participating and Non-Participating Parcels. The sound study map shall be overlaid with sound contour lines extending out to the 30-dB(A) sound contour line, at 5 dB(A) intervals from the center of the proposed Utility Grid WES.

e. Post Construction Sound Survey - The Applicant shall complete a post construction sound survey within 12 months of the commencement of the operation of the project. The Applicant shall be able to determine compliance with the Equivalent A-weighted Continuous sound level limits set forth in Subsections 12.a. and 12.b. The measurements and the reporting of the data shall be conducted as described below. The survey shall address noise complaints on file with the Township and Applicant and may require additional measurement locations as deemed necessary by the Planning Commission. Should the sound survey indicate a non-compliant measurement, the owner of the WES will be required to obtain compliance through mitigation or other measures.

i. Methodology
   1. Measurement personnel and instrumentation shall be as required in Subsection 12.g.
   2. A calibration check shall be performed and recorded before and after each measurement period.
   3. The nighttime measurement period shall be two hours minimum and shall be continuously observed by a trained attendant. Sound level data shall be aggregated in 10-minute measurement intervals within the nighttime compliance measurement period (nighttime: 10:00 pm to 7:00 am).
   4. The daytime measurement period shall be two hours minimum and shall be continuously observed by a trained attendant. Sound level data shall be aggregated in 10-minute measurement intervals within the daytime compliance measurement period (daytime: 7:00 am to 10:00 pm).
   5. Compliance will be demonstrated when the Equivalent A-weighted Continuous Sound Level of at least two one hour measurement intervals is less than or equal to the Equivalent A-weighted Continuous sound level limits as set forth in Table 12-1. Representative intervals are defined as:
      a. Periods complying with the general method for routine measurements of ANSI S12.18. Measurement shall be made either downwind as defined in ANSI S12.18, or if the atmospheric conditions are such that the direction of the wind vector is within an angle of ± 45 degrees of the annual prevailing wind direction.
      b. Periods where the concurrent turbine hub-elevation wind speeds are sufficient to generate within 1 dB of the maximum continuous rated sound power from the nearest Utility Grid WES to the measurement location.
      c. Periods where ground level gusts are equal to or less than 5 m/s (11 mph).
   6. The sound level measured in each 10-minute measurement interval above may be corrected for transient background sound and continuous background sound, according to ANSI S12.9 Part 3.

ii. Measurement Locations
   1. The measurement locations shall be chosen by the Applicant's Measurement Personnel and approved by the Planning Commission prior to the Post Construction Sound Survey.
   2. The measurement locations shall be performed at 50' from Noise Sensitive Facilities when possible. Otherwise, 50' for Participating Parcels and at parcel boundary lines for Non-Participating Parcels. The locations shall be in close proximity to one or multiple Utility Grid WES and/or locations which have modeled sound levels closest to limits identified in Table 12-1. A 5:1 ratio (Utility Grid WES to measurement locations) will be used to determine the number of measurement locations, with a

minimum of 8 measurement locations. The measurement locations shall include, but are not limited to, the following:

a. A minimum of four measurements of different Non-Participating Parcels. The measurement location shall be 50 feet from the Noise Sensitive Facility if possible, otherwise at the parcel boundary line nearest the closest Utility Grid WES.
b. A minimum of two measurements of different Participating Parcels. The measurement location shall be at the Noise Sensitive Facility, measured 50 feet from the façade nearest the closest Utility Grid WES.
c. Any measurement location determined necessary by the Applicant's Measurement Personnel and Planning Commission. If both parties agree, a measurement location deemed unnecessary may be omitted from the required locations.

3. The microphone shall be positioned at a height of 5 feet ± 1 foot above the ground, and oriented in accordance with the characteristics of the microphone so that the frequency response is as flat as possible.
4. To the greatest extent possible, measurement locations should be located away from potential contaminating sources of noise such as major highways, industrial facilities and urban areas.
5. To the greatest extent possible, measurement locations shall be at the center of unobstructed areas that are maintained free of vegetation and other structures or material that is greater than two feet in height for a 50-foot radius around the sound monitoring equipment.
6. To the greatest extent possible, measurement locations should be at least 50 feet from any known sound source.
7. Meteorological measurements of the surface wind speed and direction shall be collected using microphones and anemometers at a height of 6.6 foot ± 0.7 foot above the ground, near each noise measurement location. Care should be taken to avoid noise measurement contamination from the anemometer operation.

iii. Reporting of Measurement Data-

Reports shall be submitted to the Planning Commission within 45 days of completion of the post-construction sound survey and shall include, at a minimum, the following:

1. A narrative description of the sound from the Utility Grid WES for the compliance measurement period result.
2. A narrative description of the sound measurements collected.
3. A map showing the Utility Grid WES locations, noise measurement locations, and all Noise Sensitive Facilities.
4. The dates, day of the week, and hours of the day when measurements were made.
5. The wind direction and speed, temperature, precipitation, and sky condition for each 10-minute measurement interval. Meteorological measurements of the wind speed and direction will be reported at both the surface height, and at hub level (to be provided from the closest Utility Grid WES), using the fastest integration time reasonably available.. Both the average and maximum wind speeds for the 10-minute measurement interval shall be reported.
6. The wind energy output for each 10-minute measurement interval for the closest Utility Grid WES.
7. Identification of all measurement equipment by make, model, and serial number.
8. All meteorological, sound, windscreen, and audio instrumentation specifications and calibrations.
9. All A-weighted equivalent sound levels for each 10-minute measurement interval.
10. All 1/3 octave bands between 20Hz and 20kHz linear equivalent sound levels for each 10-minute measurement interval and identification of tonal periods.
11. All attendant's notes and observations.
12. All concurrent time-stamped turbine operational data including the date, time, and duration of any noise reduction operation or other interruptions in operations if present.

13. All periods removed from the data due to temperatures above or below manufacturer specifications, wind speeds above ANSI S12.18 limits.
14. All corrections for transient background and continuous background sound according to ANSI S12.9 Part 3. All methodology shall be included. Data, field notes, and calculations may be provided in electronic form on request of the Planning Commission. Audio recordings may be submitted for identification of intrusive noise events. Audio collection shall occur through the same microphone/sound meter as the measurement data. Audio recordings shall be time stamped (hh:mm:ss), at an adequate quality for identifying events, and in mp3 format.
15. All other information determined necessary by the Planning Commission.

f. As an ongoing condition of any Special Land Use Permit for a Utility Grid WES, the Zoning Enforcement Officer or Township Supervisor may require measurements of the sound from routine operation of the completed Utility Grid WES. Such measurements may be required to determine compliance with this Ordinance and the Special Land Use Permit, to investigate a community complaint for validation the calculated sound levels presented to the Planning Commission in support of the Special Land Use Permit. The measurements and the reporting of the data shall be conducted as described below. Should the measurements indicate a non-compliant measurement, the owner and the operator of the Utility Grid WES shall be required to obtain compliance through mitigation or other measures. Sound testing as a result of a complaint will only be carried out if the location has not been monitored within 5 years and there have been no operation changes to the wind farm that would effect sound emission, and modeled sound levels are within 5 dB of sound level limits.
   i. Methodology- Refer to Subsection 12.g. below.
   ii. Measurement Locations
      1. Measurement locations shall be conducted at the property of the complainant and chosen by the Zoning Enforcement Officer or Supervisor. The measurement locations shall include, but are not limited to, the following representative locations:
         a. For Participating Parcels, a minimum of one measurement location at the Noise Sensitive Facility of the complainant, measured 50 feet from the façade nearest the closest Utility Grid WES.
         b. For Non-Participating Parcels, a minimum of one measurement location at the parcel boundary line of the complainant nearest the closest Utility Grid WES
         c. Any measurement location determined necessary by the Measurement Personnel and approved by the Planning Commission.
      2. The microphone shall be positioned at a height of 5 feet ± 1 foot above the ground, and oriented in accordance with the characteristics of the microphone so that the frequency response is as flat as possible.
      3. To the greatest extent possible, measurement locations should be located away from potential contaminating sources of noise such as major highways, industrial facilities, and urban areas.
      4. To the greatest extent possible, measurement locations shall be at the center of unobstructed areas that are maintained free of vegetation and other structures or material that is greater than two feet in height for a 50-foot radius around the sound monitoring equipment.
      5. To the greatest extent possible, measurement locations should be at least 50 feet from any known sound source.
      6. Meteorological measurements of surface wind speed and direction shall be collected using microphones and anemometers at a height of 6.6 foot ± 0.7 foot above the ground, near each noise measurement location. Care should be taken to avoid noise measurement contamination from the anemometer operation.

7. Reporting of Measurement- Data Measurement Reports shall be submitted to the Planning Commission within 45 days of completion and shall include as indicated above in Subsection 12.e.iii.

iii. Reporting of Measurement- Data Measurement Reports shall be submitted to the Planning Commission within 45 days of completion and shall include as indicated above in e) III

g. General Sound Survey Methodology

i. Measurement Personnel. Measurements shall be supervised by personnel who are independent of the owner or operator of the Utility Grid WES, well qualified by training and experience in measurement and evaluation of environmental sound, Board Certified members of the Institute of Noise Control Engineering (INCE), and approved by the Planning Commission.

ii. Measurement Instrumentation. Measurement devices shall comply with the following requirements:

1. A sound level meter or alternative sound level measurement system used shall meet all of the Type 1 performance requirements of American National Standard Specifications for Sound Level Meters, ANSI S1.4.
2. An integrating sound level meter (or measurement system) shall also meet the Class 1 performance requirements for integrating/averaging in the International Electrotechnical Commission Sound Level Meters, IEC Publication 61672-1.
3. A filter for determining the existence of tonal sounds shall meet all of the Class 1 performance requirements of American National Standard Specification for Octave-Band and Fractional Octave-Band Analog and Digital Filters, ANSI S1.11.
4. An acoustical calibrator shall be used of a type recommended by the manufacturer of the sound level meter and that meets the Type 1 performance requirements of American National Standard Specification for Acoustical Calibrators, ANSI S1.40.
5. A microphone windscreen shall be used of a type that meets or exceeds the recommendations of manufacturer of the sound level meter.
6. The sound level meter shall have been calibrated by a laboratory within 24 months of the measurement, and the microphone's response shall be traceable to the National Bureau of Standards.
7. The sound level meter shall be used with the fast meter response and sampling frequency of one sample per second.
8. Anemometer(s) used for surface wind speeds shall have a minimum manufacturer specified accuracy of ±1 mph providing data in the fastest integration time reasonably available.
9. A wind direction sensor used for surface wind direction shall have a minimum manufacturer specified accuracy of ±3º providing data in five second integrations.
10. Thermometer used for surface temperature shall have a minimum manufacturer specified accuracy of ±2ºC providing data in the fastest integration time reasonably available.
11. A digital recording device shall be used to store the time waveform of the sound pressure levels.

13. *DECOMMISSIONING*

a. Abandonment

i. Any WES that is not used for the production of energy for a period of 12 successive months or longer shall be deemed to be abandoned and shall be promptly dismantled and removed from the property, unless the Applicant receives a written extension of that period from the Planning Commission due to an extended repair schedule for good cause. All above and below ground materials (down to 5 feet below the ground) must be removed. The ground must be restored to its original condition within 12 months of abandonment.

b. Continuing Security and Decommissioning

i. If any WES is approved for construction under this Ordinance, the Applicant shall be required to post continuing security and a continuing escrow deposit prior to commencement of construction which shall remain in effect until the WES has been finally removed, as provided below.

1. Continuing Security: If a Special Land Use Permit is approved pursuant to this section, the Planning Commission shall require a security in the form of a cash deposit, irrevocable letter of credit, or surety bond in a form, amount, time and duration deemed acceptable to the Township, which will be furnished by the Applicant to the Township in order to ensure full compliance with this section and any condition of approval. When determining the amount of such required security, the Township may also require an annual escalator or increase based on the Consumer Price Index (or the equivalent or its successor). Such financial guarantee shall be deposited or filed with the Township Clerk after a Special Land Use Permit has been approved but before construction commences upon a WES. At a minimum, the financial security shall be in an amount determined by the Township to be reasonably sufficient to have each WES fully removed (and all components properly disposed of and the land returned to its original state) should such structure or structures become abandoned, dangerous or obsolete, or not in compliance with this Ordinance or the Special Land Use Permit. Such financial security shall be kept in full force and effect during the entire time while a WES exists or is in place, and such financial security shall be irrevocable and non-cancelable (except by the written consent of both the Township and the then owner of the WES).
2. Continuing Escrow Deposit: A continuing escrow deposit to be held by the Township shall be funded in cash by the Applicant prior to the commencement of construction of any WES and shall be maintained by the WES owner until the WES has been permanently removed. The monetary amount placed by the Applicant in escrow with the Township shall be estimated by the Township to cover all reasonable costs and expenses associated with the continuing enforcement of this Ordinance and the terms of the Special Land Use Permit, which costs can include, but are not limited to, reasonable fees of the Township Attorney, Township Planner and Township Engineer, as well as costs of any consultants, reports or studies which the Township anticipates it may have to perform that are reasonably related to enforcement of this Ordinance and the Special Land Use Permit. If the Township is required to expend any portion of the escrow deposit, or if the existing escrow amount paid by the Applicant proves to be insufficient to cover the Township's enforcement costs, the Township may require that the WES owner place additional monies into escrow with the Township. Alternatively, if lawful, Applicant will pay permit fees equivalent to estimate of all reasonable costs and expenses associated with continuing enforcement of this Ordinance and the terms of the Special Land Use Permit, which costs can include, but are not limited to, reasonable fees of the Township Attorney, Township Planner and Township Engineer, as well as costs for any reports or studies which the Township anticipates it may have done that are reasonably related to enforcement of the Ordinance and the Special Land Use Permit. As for the escrow requirement, the permit fees will also include a replenishment obligation if the permit fees paid by the Applicant prove to be insufficient to cover the Township's enforcement fees, costs and expenses.
3. Continuing Obligations: Failure to keep such financial security and escrow deposit in full force and effect at all times while a WES exists or is in place shall constitute a material and significant violation of a Special Land Use Permit and this Ordinance, and will subject the WES owner to all remedies available to the Township, including possible enforcement action and revocation of the Special Land Use Permit.

c. Decommissioning Plan and Bond

i. This Ordinance requires that the Applicant for a Utility Grid WES Special Land Use Permit submit a decommissioning plan that is to be implemented at the end of the project's useful life. The plan is to

describe the process for disposition of the project, equipment removal agreements with landowners, and financial assurance for the decommissioning process.

ii. Prior to commencing with the decommissioning of one or more Utility Grid WES, a demolition permit shall be obtained from the building inspector. The fee of this permit shall include the Township's cost to hire a professional qualified to interpret the decommissioning plan and capable of determining if and when the decommissioning plan has been carried out.

iii. The following paragraphs describe the project's decommissioning plan per the requirements of this Ordinance. Facility Dismantling, Removal and Site Restoration: Decommissioning includes four primary phases: (1) ground preparation; (2) dismantling of project components; (3) transportation and traffic related to the dismantling; and (4) site reclamation. These are described below.

1. Ground Preparation. The decommissioning of each Utility Grid WES will first require ground preparation to insure that cranes and transport trucks can access the site. Depending on the site-specific land use at each Utility Grid WES site, this may include enlarging the access roads. A crane pad area and disassembly area will also be required on the ground to provide space for crane movement, truck movement, and lowering of Utility Grid WES components. This activity may require grubbing and clearing, as well as upgrading access roads with road material such as gravel. Top soil and natural debris will be salvaged for site reclamation.
2. Dismantling of Project Components. This phase involves dismantling of each Utility Grid WES using similar cranes which are used for assembly. The Utility Grid WES components include the rotor, the nacelle, and the tower which are all disassembled during the process. The sequence of disassembly would be to detach the rotor from the nacelle and lower it to the crane pad area/disassembly area, detach the nacelle from the top tower section, detach the top section from the middle section and then detach the middle section and the bottom section. Components are then separated into categories of reuse, salvage, or disposal. The top section of the concrete foundations used to secure the bottom tower section will be removed to a depth of no less than 5 feet below surrounding grade. The underground cabling will be removed as per the landowner lease agreement. Any overhead cabling and support structures, as well as substation or switching station components, will be disassembled and transported off the site.
3. Transportation and Traffic. The transportation and traffic portion of the decommissioning is key to the process as the mobilization and demobilization of the large cranes and hauling of materials require careful planning and traffic management. The towers will be separated into sections appropriate for transport on the local system. Any roads or crossings built for the project will be left in place for the use of the landowners unless otherwise specified.
4. Site Reclamation. After all material and debris have been removed, the site can be regraded. Salvaged subsoil will be replaced and capped with topsoil and salvaged organic material, such as woody debris, will be added in required areas. Soils at the bases of Utility Grid WES will be resorted to a depth of five (5) feet and to conditions similar to the surrounding ground. Seed mixes and fertilizer will then be applied to the disturbed areas. Landowners will be consulted on specific seed mixes if necessary.

iv. Prior to decommissioning, the input of the landowners will be considered as to the extent of decommissioning that will be undertaken on their land. The future owners or lease holders of the land affected by distribution lines and underground cabling will be consulted prior to decommissioning. The project will be decommissioned in accordance with the decommissioning laws and regulations that will apply at the time of decommissioning.

14. LIABILITY

a. The owner and operator of any WES shall use due care in exercising the rights granted by a special land use permit under this Section 621. The owner and operator shall maintain a liability insurance policy on

all WES within the project on its own behalf and on behalf of the Township as named co-insured, with limits of liability for the entire project of not less than $2,000,000 per occurrence for damages to persons and property (to be adjusted annually to an amount equivalent to 2018 dollars based on the CPI). The Township may, in its discretion, waive the foregoing insurance requirement if the owner and operator enter into an indemnification agreement acceptable to the Township that shall indemnify and hold harmless the Township, its officers, employees, and agents, from any claims, lawsuits, or liability for damages whatsoever arising out of the owner's or operator's operation or maintenance of any WES under the special land use permit.

15. COMPLAINT RESOLUTION

a. The Applicant shall develop a process to resolve complaints from residents concerning the construction or operation of the project. All complaints shall be acknowledged by the current owner of the WES within 10 days of receipt of such complaint. The process may use an independent mediator or arbitrator and shall include a time limit for acting on a complaint. The process shall not preclude the Township from acting on a complaint.
b. The Applicant shall maintain and make available a telephone number where a project representative can be reached during normal business hours.
c. Starting at the time construction begins, the Applicant shall provide a report of all complaints and resolutions to complaints. Reports shall be communicated in writing and in person to the Mt. Haley Township Board at the regularly scheduled board meetings. Frequency of the reports shall be monthly for the first 36 months and quarterly thereafter.

Section 2. Severability: The provisions of this Ordinance are hereby declared to be severable and if any provision, section or part of this Ordinance is declared invalid or unconstitutional by a court of competent jurisdiction, such decision shall only affect the particular provisions, section or part involved in such decision and shall not affect or invalidate the remainder of such Ordinance, which shall continue in full force and effect.

Section 3. Effective Date: This Ordinance shall become effective seven (7) days after its publication following final adoption or as required by law, or as otherwise provided by the Michigan Zoning Enabling Act.

Section 4. Repeal: All Ordinances or parts of Ordinances in conflict herewith are hereby repealed.

YEAS: 5

NAYS: 0

ABSENT/ABSTAIN: 0

ORDINANCE DECLARED ADOPTED.

Richard Keenan

Richard Keenan, Mt. Haley Township Supervisor

CERTIFICATION

I hereby certify that:

1. The above is a true copy of an Ordinance adopted by the Mt. Haley Township Board at a duly scheduled and noticed meeting of that Township Board held on __Nov. 12_____, 20 18__, pursuant to the required statutory procedures.

2. A summary of the above Ordinance was duly published in the _Midland Daily News_____ newspaper, a newspaper that circulates within Mt. Haley Township, on ____Nov 24_____, 20 _18_.

3. Within 1 week after such publication, I recorded the above Ordinance in a book of ordinances kept by me for that purpose, including the date of passage of the Ordinance, the names of the members of the township board voting, and how each member voted.

4. I filed an attested copy of the above Ordinance with the Midland County Clerk on _____, 20__.

ATTESTED:

_____ *Sharron J. Flemming* _____

Sharon Fleming, Mt. Haley Township Clerk