

Local Standards for Wind Power Siting: A Look at Model Ordinances

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Editors' Summary

In almost every state, local regulation plays a significant role in wind power siting. To create an effective and predictable regulatory environment, lawyers and environmental professionals will need to help local governments draft and administer ordinances that address the specific issues involved with electric power generation from wind facilities. These topics include visual impacts, safety requirements, setbacks, wildlife and habitat protection, noise, shadow flicker, electromagnetic interference, decommissioning, and other issues. Lessons derived from model ordinances and state siting requirements can help professionals guide local governments as they exercise authority over these areas.

Local siting regulation is extremely important to the advancement of electric power generation from wind facilities. Installed wind power, now exceeding 40 gigawatts nationally, still represents only 2% of the nation's electric power-generation capacity.¹ An increase in the number of new wind facilities will require attention to the content of local ordinances that, in many states, govern such siting.²

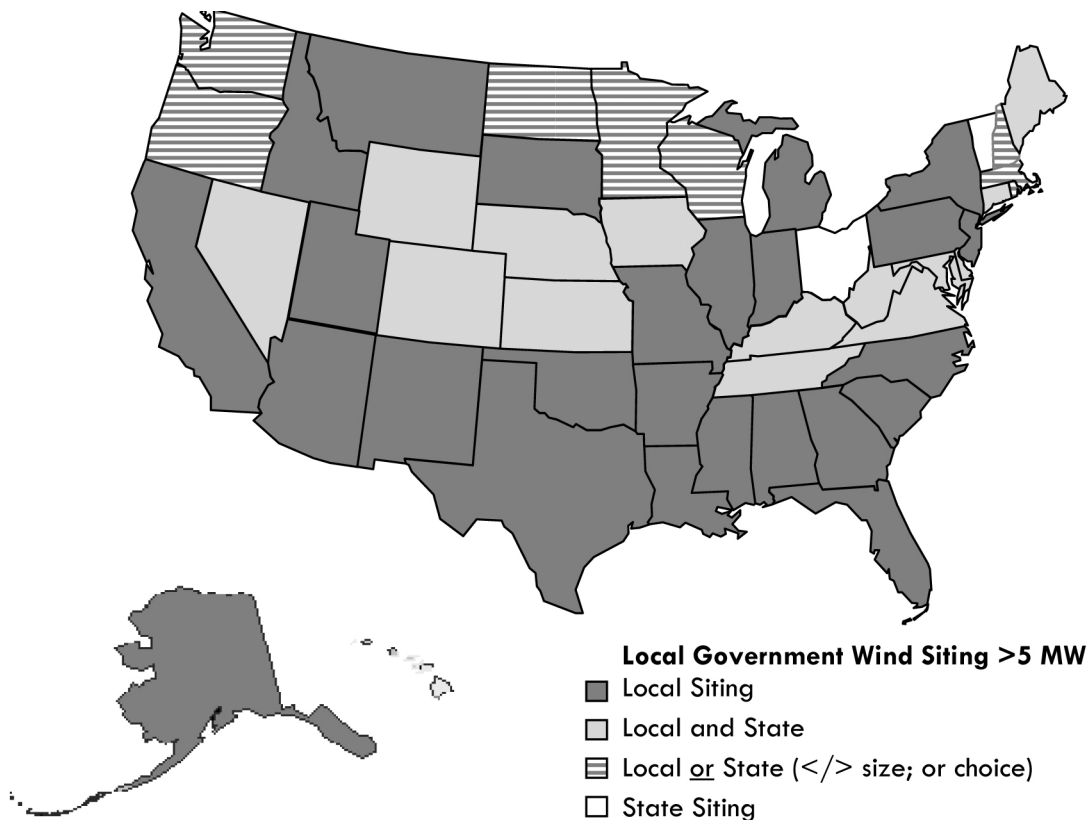
Lawyers and environmental professionals will increasingly be called upon to assist local governments with drafting and administering these ordinances.

Local governments exercise some authority over commercial-scale wind facility siting (> 5-megawatt (MW) capacity) in 48 of the 50 states (see Figure 1). In 34 states, local governments can regulate the siting of most or all commercial-scale wind facilities (or at least those below certain size thresholds) with substantial autonomy. A few additional states authorize local governments to regulate wind facility siting, but make the scope of local regulation subject to limitations defined by state law. In 11 states, the local governments regulate siting of smaller wind commercial-scale wind facilities, and state boards the larger ones—either exclusively or concurrently with local governments. In nearly one-third of the states, siting of most or all commercial-scale wind facilities requires approval by *both* local and state bodies. Only a few states reserve the regulation of siting of all or virtually all commercial-scale wind facilities to state boards and commissions.³ Lawyers and other local ordinance drafters will need to consider addressing at least the following key issues:

- Facility Location
- Visual Impacts

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1. Through 2010, the United States has over 40 gigawatts of installed wind capacity (American Wind Energy Association, *AWEA U.S. Wind Industry Year-End 2010 Market Report* (Jan. 2011)), representing about 2% of electric power-generation capacity, according to the Energy Information Administration, <http://www.eia.doe.gov/cneaf/solar.renewables/page/wind/wind.html>.
2. Patricia E. Salkin & Ashira Pelman Ostrow, "Cooperative Federalism and Wind: A New Framework for Achieving Sustainability," 37 *HOFSTRA L. REV.* 1049, 1065 (2009).
3. Environmental Law Institute, *State Enabling Legislation for Commercial-Scale Wind Power Siting and the Local Government Role* (2011). In Ohio and Vermont, state boards regulate all commercial-scale wind siting, rather than local governments; in Oregon and Washington, state boards *may* regulate such facilities to the exclusion of local governments. All the other states have some role for local government in wind-power siting.

Figure 1: Local Government Authority for Commercial-Scale Wind Siting >5 MW

For the sake of simplicity, Figure 1 does not note all allocations of authority. For example, in New Mexico, there is dual permitting above 300 MW (a very large wind facility); in Kentucky, local governments have exclusive authority below 10 MW.

- Safety Requirements
- Setbacks From Property Lines and Structures
- Wildlife and Habitat Protection
- Noise
- Shadow Flicker
- Electromagnetic Interference
- Decommissioning
- Other

This list of key siting issues is drawn from our review of existing state statutes, regulations, and model ordinances for local governments. If state law is silent on any of these, then local governments will develop their own approaches without guidance from the legislature. Model ordinances have provided some assistance to municipalities under these circumstances (see Table on next page).

In a recent study, the National Renewable Energy Laboratory (NREL) examined the land use requirements of 172 commercial-scale wind facilities constructed in the United

States since 2000.⁴ The NREL found that the land area directly disturbed and occupied by the constructed wind facilities (the direct impact area) ranged from 0.06 hectares/MW (ha/MW) to 2.4 ha/MW, with 80% of the projects directly occupying 0.4 ha/MW or less (with a larger area subject to temporary disturbance during construction). However, the NREL also found that the land area “footprint” of each wind project as a whole (total wind-plant area) ranged from 9 ha/MW to 100 ha/MW; a very few “outlier” projects fell above or below this range. Eighty percent of the evaluated projects used 10-50 ha/MW of generation capacity. This means that local governments regulating commercial-scale wind facility siting will typically be dealing with areas of land larger than 2,500 acres (approximately 4 square miles). This is a very large area indeed, compared with other local planning and zoning decisions and site plan approvals with which they more commonly deal, e.g., for housing developments, commercial centers, and even industrial facilities.

4. Paul Denholm et al., *Land-Use Requirements of Modern Wind Power Plants in the United States*, NREL/TP-6A2-45834 (NREL, Aug. 2009).

Model Ordinances

States can guide local government decisionmaking with model ordinances or other guidance documents. State bodies have written or commissioned model local ordinances for siting commercial-scale wind facilities in:

Maine

<http://www.maine.gov/spo/landuse/docs/ModelWindEnergyFacilityOrdinance.pdf>.

Massachusetts

<http://www.mass.gov/Eoca/docs/doer/renew/model-allow-wind-by-permit.pdf> (allowing wind facilities by special permit) <http://www.mass.gov/Eoeaa/docs/doer/renewables/wind/model-wind-bylaw-0810.pdf> (allowing conditional use of wind facilities).

Michigan

http://www.michigan.gov/documents/dleg/WindEnergySampleZoning_236105_7.pdf.

New York

http://www.powernaturally.org/programs/wind/toolkit/2_windenergymodel.pdf.

Oregon

<http://www.oregon.gov/ENERGY/SITING/docs/ModelEnergyOrdinance.pdf?ga=t>.

Pennsylvania

http://www.pawindenergynow.org/pa/Model_Wind_Ordinance_Final_3_21_06.pdf.

South Dakota

<http://puc.sd.gov/commission/twg/WindEnergyOrdinance.pdf>.

Utah

http://utahcleanenergy.org/files/u1/FINAL_Utah_model_wind_ordinance_2010.pdf.

Wisconsin

<http://www.windaction.org/documents/13190> (draft predating the 2009 revisions to wind facility siting law).

Kansas

The Kansas Energy Council produced a *Wind Energy Siting Handbook* that covers local land use regulation, considerations in wind facility siting, and the ways in which four Kansas county wind ordinances handle those considerations. http://kec.kansas.gov/reports/wind_siting_handbook.pdf.

Independent groups have produced model ordinances in:

Illinois

<http://www.illinoiswind.org/resources/pdf/WindOrdinance.pdf> (Chicago Environmental Law Clinic and Baker & McKenzie).

Minnesota

http://www.cleanenergyresourceteams.org/files/2005_model_wind_ordinance.pdf (Clean Energy Resource Teams, the Minnesota Project, Southwest Regional Development Commission, Minnesota Association of County Planning and Zoning Administrators).

North Carolina

http://www.ncsc.ncsu.edu/wind/wwg/publications/NC_Model_Wind_Ordinance_June_2008_FINAL.pdf (North Carolina Wind Working Group).

I. Facility Location

One key issue is determining where commercial-scale wind facilities may be located. Local governments may specify zoning districts where the use is allowed by right or by special use or conditional use permit. The facility location issue also suggests that a wind power “overlay” district is a suitable way to provide for wind facilities in districts without changing the underlying zoning.

A. Wind Facility Use Districts

Most model ordinances advise local governments to specify the zoning classifications within which large wind facilities are a permitted, conditional, or special use. North Carolina’s model ordinance makes commercial wind facilities subject to special use permitting in all zones.⁵ Minnesota’s model ordinance provides for conditional use permitting of wind facilities in agriculture, light industry, and heavy industry districts.⁶ While not making any particular recommendations, Wisconsin’s draft model ordinance lays out two options for zoning: (1) selecting zoning classifications where wind facilities are allowed; or (2) creating a wind energy overlay district.⁷ Washington’s state law providing for deferential judicial review of wind energy siting decisions in “energy overlay zones” encourages zoning to accommodate wind development.⁸

State legislatures can restrain the ability of local governments to prohibit or zone out wind energy facilities. State statutes may require zoning regulations and land use plans to promote wind energy and prohibit ordinances that bar or unreasonably restrict wind energy.⁹ Legislators should take care to define the types of wind facilities that are covered by such statutory protections. Some local governments have begun to enact ordinances to exclude commercial-scale wind facilities.¹⁰ State legislatures can prohibit such ordinances.¹¹ In general, local governments should provide for how and where wind facilities will be authorized. Ad hoc lawmaking and local moratoria can produce undesirable economic and energy outcomes.

B. Protecting Access to Wind Resources

Colorado’s state enabling legislation on county planning allows county and regional planning commissions to consider “methods for assuring access to appropriate condi-

tions for solar, wind, or other alternative energy sources” when they create master plans.¹² Nebraska law authorizes local governments to protect access to wind energy through their zoning regulations, ordinances, and plans. Further, the Nebraska law includes a nonexhaustive list of measures that may be used to ensure access to wind, including “regulation of height, location, setback, and use of structures, the height and location of vegetation with respect to property boundary lines, the type and location of energy systems or their components, and the use of districts.”¹³

II. Visual Impacts

Visual impacts of wind facilities are often of concern to local governments. This can be an important local issue, and has statewide implications for scenic viewsheds, cultural landscapes, and other significant areas. The following visual impact topics were addressed more than any others.

A. Impacts on Viewshed

Model ordinances sometimes use siting restrictions to protect scenic resources, either by restricting siting within or near officially designated scenic zones, or by requiring setbacks from certain types of resources. The New York model includes both kinds of regulations: ordinances may require that “where wind characteristics permit, wind towers shall be set back from the tops of visually prominent ridgelines to minimize the visual contrast from any public access.”¹⁴ Or they may require that “no individual tower facility shall be installed at any location that would substantially detract from or block the view of the major portion of a recognized scenic vista, as viewed from any public road right-of-way or publicly-accessible parkland or open space within the Town.”¹⁵ To minimize the impact on scenic river valleys, the Minnesota model ordinance recommends setbacks of 500, 1,000, or 1,320 feet from major river bluffs.¹⁶ In a footnote, the drafters emphasize that “care should be taken to avoid excessive setbacks, particularly from bluffs overlooking smaller tributaries.”¹⁷ As discussed above, Maine’s siting process protects impacts on formally catalogued scenic resources. Scenic impacts may also be addressed through informational requirements. For example, Vermont regulations require that petitions to construct wind energy-generation facilities “must include a view-shed anal-

5. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §5 (N.C. Wind Working Group 2008).

6. MODEL WIND ORDINANCE 6 (Clean Energy Resource Teams et al. 2005).

7. WIS. MODEL WIND ORDINANCE FOR TOWNS/COUNTIES §3.2 (Wis. Pub. Serv. Comm. Draft 2007).

8. REV. CODE WASH. §36.70C.130.

9. See NEV. REV. STAT. ANN. §278.02077(a) (requiring local ordinances to accommodate and promote small wind projects). See also definitions for reasonable and unreasonable restrictions, at NEV. REV. STAT. ANN. §278.02077(b)-(c).

10. The Industrial Wind Action Group website compiles news items primarily focused on communities that have acted to inhibit or exclude commercial-scale wind projects, <http://www.windaction.org/news>.

11. E.g., OHIO REV. CODE ANN. §4906.13.

12. COLO. REV. STAT. 30-28-106(3)(a)(IV).

13. NEB. REV. STAT. §66-913.

14. WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.).

15. WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.).

The Michigan sample ordinance takes a similar approach, requiring that “The applicant shall avoid state or federal scenic areas and significant visual resources listed in the local unit of government’s Plan.” SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.H.1 (Mich. Dep’t of Labor & Econ. Growth 2008).

16. MODEL WIND ORDINANCE 8 (Clean Energy Resource Teams et al. 2005).

17. MODEL WIND ORDINANCE 8 n.5 (Clean Energy Resource Teams et al. 2005).

ysis that includes an analysis of aesthetic impacts for a ten-mile radius from the proposed project site.¹⁸

B. Design Characteristics

Most model ordinances address the visual impact of wind energy facilities by setting requirements for various aspects of the turbine design. The most commonly addressed characteristics are color, uniformity, lighting, and advertising.

Most model ordinances include color requirements aimed at making the facilities less conspicuous. For instance, the Michigan Sample Zoning for Wind Energy Systems suggests the requirement that “all Utility Grid wind energy systems in a project shall be finished in a single, non-reflective matte finished color.”¹⁹ The Utah model ordinance provides that “the small wind energy system shall be a neutral color that blends with the environment and complies with [Federal Aviation Administration (FAA)] standards. Gray, beige, and white are recommended.”²⁰ The Pennsylvania model ordinance requires that “wind Turbines shall be a non-obtrusive color such as white, off-white or gray.”²¹

Model ordinances take various measures to ensure that the turbines will have a uniform appearance. The Oregon model ordinance requires “Using turbine towers of uniform design, color and height.”²² The draft South Dakota ordinance stipulates that “All towers shall be singular tubular design, unless approved by the Board.”²³ As noted above, the Michigan model ordinance requires that all turbines be painted a single color.

Limits on lighting also make wind energy facilities less obtrusive. In general, these requirements restrict lighting to whatever is necessary to comply with FAA regulations. Massachusetts’ model ordinances state that “Wind turbines shall be lighted only if required by the Federal Aviation Administration. Lighting of other parts of the wind facility, such as appurtenant structures, shall be limited to that required for safety and operational purposes, and shall be reasonably shielded from abutting properties.”²⁴ Oregon imposes similar lighting restrictions on projects within its exclusive siting authority.

Another common tactic for reducing visual impact is to prohibit any advertising or other signage. There is generally an exception for display of the manufacturer or owner’s name on the turbine. New York’s Wind Energy Model

Ordinance asks local governments to choose between “Brand names or advertising associated with any installation shall not be visible from any public access” or “Wind turbines shall not be used for displaying any advertising except for reasonable identification of the manufacturer or operator of the wind energy facility.”²⁵ The latter is similar to the state requirements imposed by Wyoming²⁶ and Oregon (for developers that opt into Oregon’s state siting process).²⁷

C. Underground Cables

Model ordinances often demand that, when practical, electrical cables must be placed underground. The Pennsylvania model ordinance states that “On-site transmission and power lines between Wind Turbines shall, to the maximum extent practicable, be placed underground.”²⁸ Similarly, the Massachusetts model ordinances require that “Reasonable efforts shall be made to locate utility connections from the wind energy facility underground, depending on appropriate soil conditions, shape, and topography of the site and any requirements of the utility provider. Electrical transformers for utility interconnections may be above ground if required by the utility provider.”²⁹

III Safety Requirements

A. Controlling Access to the Site

The most common safety requirement is control of physical access. The Utah model ordinance requires that “All access doors, climbing apparatuses, or access ways to towers and electrical equipment shall remain locked and inaccessible by the public.”³⁰ Some access provisions also address climb prevention. In Massachusetts, the model ordinance for conditional use permitting requires that “the tower shall be designed and installed so as to not provide step bolts or other climbing means readily accessible to the public for a minimum height of 8 feet above the ground.”³¹

18. VT. CODE R. 5.403(B)(3) (effective Oct. 15, 2006). This requirement does not apply to facilities subject to net metering. VT. CODE R. 5.403(C).

19. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.H.1 (Mich. Dep’t of Labor & Econ. Growth 2008).

20. UTAH MODEL WIND ORDINANCE §4.1.5 (Utah State Energy Program 2010).

21. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §6.E.1 (Pa. Dep’t of Env’tl. Prot. 2006).

22. A MODEL ORDINANCE FOR ENERGY PROJECTS 25 (Or. Dep’t of Energy 2005).

23. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.10.b (S.D. Pub. Util. Comm’n 2008).

24. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.8.2 (Mass. Dep’t of Energy Res. 2008); MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §5.2.1 (Mass. Dep’t of Energy Res. 2008).

25. WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.).

26. WYO. STAT. §18-5-503(a).

27. OR. ADMIN. R. 345-024-0015(1).

28. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §6.E.4 (Pa. Dep’t of Env’tl. Prot. 2006).

29. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.8.5; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §5.2.4.

30. UTAH MODEL WIND ORDINANCE §4.1.8 (Utah State Energy Program 2010).

31. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.9.2. The Pennsylvania model ordinance and the draft Wisconsin model ordinance require that towers are not climbable for at least 15 feet. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §7.G.1 (Pa. Dep’t of Env’tl. Prot. 2006); WIS. MODEL WIND ORDINANCE FOR TOWNS/COUNTIES §5.6.2 (Wis. Pub. Serv. Comm. Draft 2007).

B. Warning Signs

In a typical provision, the Maine model ordinance provides that “A clearly visible warning sign concerning voltage must be placed at the base of all pad-mounted transformers and substations.”³² Michigan requires warnings regarding ice and the posting of emergency contact information.³³ Some model ordinances also require measures to make above-ground wires clearly visible. For instance, the Illinois model ordinance requires that “Visible, reflective, colored objects, such as flags, reflectors, or tape shall be placed on the anchor points of guy wires and along the guy wires up to a height of 15 feet from the ground.”³⁴

C. Design Requirements

Almost every model ordinance imposes safety requirements on the design and dimensions of the turbines. The most common types of provisions require design certifications, blade clearance of a certain distance, and braking systems. Pennsylvania’s model ordinance contains a typical design certification provision, requiring that “The design of the Wind Energy Facility shall conform to applicable industry standards, including those of the American National Standards Institute. The Applicant shall submit certificates of design compliance obtained by the equipment manufacturers from Underwriters Laboratories, Det Norske Veritas, Germanischer Lloyd Wind Energies, or other similar certifying organizations.”³⁵

Model ordinances require clearances of various lengths between the ground and the facilities’ rotating blades. New York’s model ordinance is the strictest, requiring that “The minimum distance between the ground and any part of the rotor blade system shall be thirty (30) feet.”³⁶ South Dakota’s model ordinance requires 25 feet of clearance.³⁷ Model ordinances for Michigan and Oregon both require at least 20 feet.³⁸ Minnesota’s 2005 model ordinance requires just 12 feet of clearance.³⁹

Some model ordinances ensure safety by requiring redundant braking systems that prevent uncontrolled spinning. New York’s model language requires that “All wind turbines shall have an automatic braking, govern-

ing or feathering system to prevent uncontrolled rotation, overspeeding and excessive pressure on the tower structure, rotor blades and turbine components.”⁴⁰ The model ordinance for Pennsylvania requires that facilities “shall be equipped with a redundant braking system. This includes both aerodynamic overspeed controls (including variable pitch, tip, and other similar systems) and mechanical brakes. Mechanical brakes shall be operated in a fail-safe mode. Stall regulation shall not be considered a sufficient braking system for overspeed protection.”⁴¹

D. Emergency Response Plans

Ordinances may require applicants to cooperate with local agencies to develop and implement emergency response plans. For example, the Maine model ordinance states:

The Applicant shall provide a copy of the project summary and site plan to local emergency service providers, including paid or volunteer fire department(s). Upon request, the Applicant shall cooperate with emergency service providers to develop and coordinate implementation of an emergency response plan for a Wind Energy Facility. A Wind Turbine shall be equipped with an appropriate fire suppression system to address fires within the Nacelle portion of the turbine or shall otherwise address the issue of fire safety to the satisfaction of the [municipal reviewing authority].⁴²

IV. Setbacks From Property Lines and Structures

Almost all model ordinances and many state regulations include provisions on setbacks. The key differences among the models stem from the places from which setbacks are measured, the expression of setback distances, and whether waivers are available.

A. Setbacks From Various Points

Setback requirements depend significantly on which objectives the regulators seek to protect. Setbacks are most often measured from property lines, structures, other towers, roads, and sensitive habitats. The most common type of setback requirement prohibits turbines from being built within a specified distance from property lines of adjacent parcels.

In most cases, setback requirements restrict how close turbines may be to property lines. Michigan’s sample ordinance requires a setback from adjacent property at a distance equal to the height of the tower with the blade fully extended.⁴³

32. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.3 (2009).

33. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.C (Mich. Dep’t of Labor & Econ. Growth 2008). “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.”

34. MODEL ORDINANCE REGULATING THE SITING OF WIND ENERGY CONVERSION Sys. IN ILL. §VI.E.2 (Chicago Legal Clinic 2003).

35. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §6.B (Pa. Dep’t of Envtl. Prot. 2006).

36. WIND ENERGY MODEL ORDINANCE OPTIONS 8 (N.Y. State Energy & Research Dev. Auth.).

37. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.9 (S.D. Pub. Util. Comm’n 2008).

38. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1074.F (Mich. Dep’t of Labor & Econ. Growth 2008); A MODEL ORDINANCE FOR ENERGY PROJECTS 26 (Or. Dep’t of Energy 2005).

39. MODEL WIND ORDINANCE 9 (Clean Energy Resource Teams et al. 2005).

40. WIND ENERGY MODEL ORDINANCE OPTIONS 8 (N.Y. State Energy & Research Dev. Auth.).

41. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §7.C (Pa. Dep’t of Envtl. Prot. 2006).

42. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.8 (2009).

43. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.A.2 (Mich. Dep’t of Labor & Econ. Growth 2008) (allowing greater setbacks when required by the zoning district). The ordinance’s commentary notes: “The property set-

(In general, ordinances define tower height as including the highest point of the rotor plane, or “total extended height”). Ohio and Wyoming law—as well as the model ordinances in Pennsylvania, Illinois, and Utah—require a setback equal to 110% of the height of the tower.⁴⁴ South Dakota requires 110% of tower height or 500 feet, whichever is greater.⁴⁵ The Minnesota model suggests choosing a requirement of either 110% or 125% of tower height.⁴⁶ Model ordinances for North Carolina and Oregon suggest property line setbacks of 150% of tower height.⁴⁷

Setbacks from public rights-of-way are also common, and these setbacks are usually equal to the property line setbacks.⁴⁸ However, Minnesota’s model ordinance allows the setback requirement to be reduced for roads with average daily traffic counts of less than 10.⁴⁹ Some model ordinances, including those for Illinois and New York, impose the same setback requirements for distances from property lines, roads, and utility infrastructure.⁵⁰

Most model ordinances do not regulate the distance between turbines in the same project, leaving that determination to the project developer. However, for wind projects under 25 MW, the Minnesota Public Utilities Commission (PUC) requires spacing distances equal to five rotor diameters in the downwind spacing between towers, and three rotor diameters in crosswind spacing, with a narrow exception to accommodate topographic conditions.⁵¹ This requirement is meant to ensure that facilities are “designed and sited in a manner that ensures efficient use of the wind resources, long term energy production, and reliability.”⁵² Ottawa County, Michigan, has developed a model ordinance for its municipalities that requires that “Turbine/tower separation shall be based on industry standards and manufacturer recommendation.”⁵³

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.”

44. WYO. STAT. §18-5-504(a)(ii); OHIO REV. CODE ANN. §4906.20(B)(2); MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §7.B (Pa. Dept of Env’t. Prot. 2006) (noting there may be a more stringent requirement for the zoning classification where the turbine is located); MODEL ORDINANCE REGULATING THE SITING OF WIND ENERGY CONVERSION SYS. IN ILL. §VI.H.3 (Chicago Legal Clinic 2003); UTAH MODEL WIND ORDINANCE §4.1.2 (Utah State Energy Program 2010).
45. S.D. CODIFIED LAWS §43-13-24.
46. MODEL WIND ORDINANCE 7 (Clean Energy Resource Teams et al. 2005).
47. WIND ENERGY MODEL ORDINANCE OPTIONS 9 (N.Y. State Energy & Research Dev. Auth.); MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §7 (N.C. Wind Working Group 2008); A MODEL ORDINANCE FOR ENERGY PROJECTS 27 (Of. Dept of Energy 2005).
48. See, e.g., WYO. STAT. §18-5-504(a)(iii); MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §7 (Pa. Dept of Env’t. Prot. 2006).
49. MODEL WIND ORDINANCE 7 (Clean Energy Resource Teams et al. 2005).
50. MODEL ORDINANCE REGULATING THE SITING OF WIND ENERGY CONVERSION SYS. IN ILL. §VI.H.2 (Chicago Legal Clinic 2003); WIND ENERGY MODEL ORDINANCE OPTIONS 9-10 (N.Y. State Energy & Research Dev. Auth.).
51. Minnesota Public Utilities Commission, *In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less Than 25 Megawatts*, Order Establishing General Wind Permit Standards 8, Docket No. E, G-999/M-07-1102 (Jan. 11, 2008).
52. *Id.* at 5.
53. OTTAWA COUNTY MODEL WIND ENERGY ORDINANCE §6(A)(9)(d)(vi) (Ottawa County Planning Department 2009), http://www.co.ottawa.mi.us/CoGov/Depts/Planning/pdf/Wind_Energy_Ordinance.pdf.

Several model ordinances require setbacks from occupied buildings that are greater than the property line setbacks. These are often more stringent for occupied buildings on nonparticipating property. Ohio prohibits turbines within 750 feet of habitable residential structures.⁵⁴ The South Dakota model ordinance requires that “Distance from currently occupied off-site residences, [non-agricultural] business and public buildings shall be not less than [1,000] feet. Distance from the residence of the landowner on whose property the tower(s) are erected shall be not less than [500] feet or [100%] the system height, whichever is greater.”⁵⁵ The North Carolina model ordinance includes setbacks of 110% and 250% of turbine height from occupied buildings on participating and nonparticipating property, respectively.⁵⁶ The Minnesota model ordinance calls for a setback of 750 feet from neighboring dwellings.⁵⁷ The Pennsylvania model ordinance requires a setback from occupied buildings on nonparticipating property equal to five times the height of the turbine hub.⁵⁸ Wyoming law protects both existing and planned residences by prohibiting the construction of turbines within 550% tower height or 1,000 feet from platted subdivisions, residential buildings, or occupied structures.⁵⁹ Wyoming also prohibits wind-tower siting within one-half mile of any city or town.⁶⁰

A few model ordinances require setbacks from certain habitats or ecosystems. The model ordinance for Minnesota requires 600-foot setbacks from wetlands and public conservation lands managed as grasslands.⁶¹ The New York model ordinance option includes the following language:

Wind turbines shall be set back at least 2,500 feet from Important Bird Areas as identified by New York Audubon and at least 1,500 feet from State-identified wetlands. These distances may be adjusted to be greater or lesser at the discretion of the reviewing body, based on topography, land cover, land uses and other factors that influence the flight patterns of resident birds.⁶²

B. Defining Setbacks

There are numerous ways to define a setback. The most common is to express the setback requirement as a multiple of total tower height, which includes the blades. Relating the setback requirement to tower height assures that a fallen tower of any size will not interfere with neighboring

54. OHIO REV. CODE ANN. §4906.20(B)(2); OHIO ADMIN. CODE §4906-17-08(C)(1)(c)(ii).
55. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.2.a (S.D. Pub. Util. Comm’n 2008).
56. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §7 (N.C. Wind Working Group 2008).
57. MODEL WIND ORDINANCE 7 (Clean Energy Resource Teams et al. 2005).
58. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §7.A.2 (Pa. Dept of Env’t. Prot. 2006).
59. WYO. STAT. §18-5-504(a)(iv)-(v).
60. WYO. STAT. §18-5-504(a)(vi).
61. MODEL WIND ORDINANCE 7 (Clean Energy Resource Teams et al. 2005).
62. WIND ENERGY MODEL ORDINANCE OPTIONS 11-12 (N.Y. State Energy & Research Dev. Auth.).

property uses. Others require setbacks of a certain number of feet. For maximum impact control, these two strategies can be combined. For example, the South Dakota model ordinance imposes a setback for turbines from the participating landowner's residence equal to the greater of 500 feet or 100% of tower height.⁶³ It is also possible to define setback requirements through performance standards. For instance, the Minnesota PUC's regulations for projects under 25 MW require setbacks from homes that are at least 500 feet and sufficient to meet the state's noise requirements.⁶⁴ Maine law requires the primary siting authority to make findings regarding whether setbacks are "adequate to protect public safety" considering "the recommendation of a professional, licensed civil engineer as well as any applicable setback recommended by a manufacturer of the generating facilities."⁶⁵

C. Waiver

Ohio regulations (which govern siting by the state board) provide that "Minimum setbacks may be waived in the event that all owners of property adjacent to the turbine agree to such waiver," and upon a showing of good cause.⁶⁶ About one-half of the statewide model ordinances have provisions for waiver of setback requirements. The Utah model ordinance directs the permitting authority to consider an exception if there is "(a) a signed agreement of consent from abutting property owner(s), and (b) the public right-of-ways and power lines are not impacted by the location."⁶⁷ The North Carolina model ordinance also allows adjacent property owners to waive the setback requirement, but demands that the waiver meet certain conditions; "The written waiver shall notify applicable property owner(s) of the setback required by this Ordinance, describe how the Wind Energy Facility is not in compliance, and state that consent is granted for the Wind Energy Facility to waive the setback as required by this Ordinance."⁶⁸ The Pennsylvania model ordinance allows waivers where "literal enforcement will exact undue hardship because of peculiar conditions pertaining to the land in question and provided that such waiver will not be contrary to the public interest"; in applying this standard, the governing body may consider the opinions of adjacent property owners.⁶⁹ Legisla-

tures may choose specifically to make some of the setbacks, but not others, waivable.⁷⁰

V. Wildlife and Habitat Protection

Numerous state agencies and the U.S. Fish and Wildlife Service (FWS) have developed guidelines for reducing wildlife impacts.⁷¹ These guidance documents provide options for protective measures that may be encouraged through voluntary schemes or enforced through mandatory regulations. The FWS released its Draft Land-Based Wind Energy Guidelines for public review in February 2011. These draft guidelines modified the consensus proposal developed by the U.S. Department of the Interior's Wind Turbine Guidelines Advisory Committee. The Advisory Committee advised use of a "tiered" or sequential approach to wind-facility siting.⁷² The current draft put forward by FWS characterizes these as follows:

Tier 1: Preliminary evaluation or screening of potential sites (landscape-level screening of possible project sites)

Tier 2: Site characterization (broad characterization of one or more potential project sites)

Tier 3: Pre-construction monitoring and assessments (site-specific assessments at the proposed project site)

Tier 4: Post-construction monitoring of effects (to evaluate fatalities and other effects)

Tier 5: Research (to further evaluate direct and indirect effects, and assess how they may be addressed).⁷³

Although some aspects of the draft are controversial, the use of a stepwise approach makes sense for anticipating wildlife impacts. Local governments may prefer to build in such a stepwise consultation approach; at the same time,

63. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.2.a (S.D. Pub. Util. Comm'n 2008).

64. Minnesota Public Utilities Commission, *In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less Than 25 Megawatts*, ORDER ESTABLISHING GENERAL WIND PERMIT STANDARDS 8, Docket No. E, G-999/M-07-1102 (Jan. 11, 2008).

65. ME. REV. STAT. ANN. tit. 35-A, §3455.

66. OHIO ADMIN. CODE §4906-17-08(C)(1)(c)(iii).

67. UTAH MODEL WIND ORDINANCE §4.1.3 (Utah State Energy Program 2010).

68. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §7.1.A (N.C. Wind Working Group 2008).

69. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §8 (Pa. Dep't of Envtl. Prot. 2006).

70. Under the Illinois model ordinance, the permit authority may waive setbacks from roads and property lines, but in no case may the setback from occupied structures be less than 110% of tower height.

71. See, e.g., DRAFT LAND-BASED WIND ENERGY GUIDELINES (U.S. Fish & Wildlife 2011), 76 Fed. Reg. 9590 (Feb. 18, 2011), available at http://www.fws.gov/windenergy/docs/Wind_Energy_Guidelines_2_15_2011FINAL.pdf; INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES (U.S. Fish & Wildlife 2003), available at <http://www.fws.gov/habitatconservation/wind.pdf>; GUIDELINES FOR REDUCING IMPACTS TO WILDLIFE FROM WIND ENERGY DEV. IN AZ. (Ariz. Game & Fish Dep't 2009), available at www.azgfd.gov/hgis/pdfs/WindEnergyGuidelines.pdf; CA. GUIDELINES FOR REDUCING IMPACTS TO BIRDS AND BATS FROM WIND ENERGY DEV. (Ca. Energy Comm. 2007), available at http://www.energy.ca.gov/2007publications/CEC-700-2007-008/CEC-700-2007-008-CMF_MINUS_AP-E.PDF; WIND ENERGY AND WILDLIFE RESOURCE MANAGEMENT IN IOWA: AVOIDING POTENTIAL CONFLICTS (Iowa Dep't of Nat. Res. 2007), available at www.iowadnr.gov/wildlife/diversity/files/wind_wildliferecs.pdf; SITING GUIDELINES FOR WIND POWER PROJECTS IN S.D. (S.D. Dep't of Game, Fish & Parks), available at <http://gfp.sd.gov/wildlife/docs/wind-power-siting-guidelines.pdf>; WIND POWER GUIDELINES (Wash. Dep't of Fish and Wildlife 2009), available at <http://wdfw.wa.gov/publications/pub.php?id=00294>.

72. Wind Turbine Guidelines Advisory Committee, Recommendations to Secretary of the Interior (Mar. 4, 2010), available at http://www.fws.gov/habitatconservation/windpower/Wind_Turbine_Guidelines_Advisory_Committee_Recommendations_Secretary.pdf.

73. DRAFT LAND-BASED WIND ENERGY GUIDELINES (U.S. Fish & Wildlife 2011), 76 Fed. Reg. 9590 (Feb. 18, 2011), available at http://www.fws.gov/windenergy/docs/Wind_Energy_Guidelines_2_15_2011FINAL.pdf.

they may wish to defer explicitly to state wildlife agency expertise, rather than create a duplicative structure.

A. Site Selection

The FWS' previous 2003 Interim Guidance on Avoiding and Minimizing Wildlife Impacts From Wind Turbines specifically recommended avoiding the following types of habitat for wind development: (1) "documented locations of any species of wildlife, fish, or plant protected under the Federal Endangered Species Act"; (2) "known local bird migration pathways or in areas where birds are highly concentrated, unless mortality risk is low" and "known daily movement flyways (e.g., between roosting and feeding areas) and areas with a high incidence of fog, mist, low cloud ceilings, and low visibility"; (3) "near known bat hibernation, breeding, and maternity/nursery colonies, in migration corridors, or in flight paths between colonies and feeding areas"; and (4) "in habitat known to be occupied by prairie grouse or other species that exhibit extreme avoidance of vertical features and/or structural habitat fragmentation."⁷⁴ The 2011 draft guidelines would replace this approach with a series of Questions for Tiers 1 & 2, that should be answered "no" in order to proceed to the next phase; the FWS advises that a "yes" answer should lead to considering either discontinuing the project at the site or identifying means by which the project can be modified to "avoid, minimize, and/or compensate for adverse effects."⁷⁵

Once a project site is selected, the 2003 Interim Guidance still in effect has several recommendations on how to design and operate the facilities. For example, developers should avoid the landscape features known to attract raptors, such as cliffs and prairie dog colonies. Proper configuration of the turbines can also reduce mortality.⁷⁶ Where feasible, tower height should be adjusted to reduce strikes on wildlife, and power lines should be designed to avoid electrocution. Also, where feasible, operators should shut down turbines when birds are highly concentrated onsite.⁷⁷ The needs of particular species at a project site may require tailored regulation. For instance, Virginia directed its Department of Environmental Quality to adopt a permit-by-rule for wind facilities under 100 MW. The Virginia permit-by-rule requires wind facility developers to avoid construction in sea turtle nesting habitat during nesting and hatching season, and places several restrictions on any construction that does take place during those times.⁷⁸

Local regulation will frequently defer to state and federal determinations on wildlife, limiting itself primarily to

ensuring that sufficient information is gathered to address and avoid potential impacts.

B. Survey and Mitigation

State regulations and model ordinances impose informational requirements aimed at minimizing and mitigating wildlife impacts. Under the Virginia permit-by-rule, for example, all applicants must perform desktop studies using maps from the Virginia Fish and Wildlife Information Service, raptor migration surveys, and acoustic bat surveys, the results of which may trigger additional study requirements. A project in a Coastal Avian Protection Zone must include a special analysis of impacts on the species of concern in that particular zone.⁷⁹ A simple model is employed by the Michigan sample ordinance, which requires permit applicants to submit:

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.⁸⁰

In some cases, survey activities must be done in consultation with state or federal wildlife agencies. Developers of commercial-scale wind facilities in Colorado must provide site-specific surveys to the state Division of Wildlife (DOW) and consult with the DOW and the FWS as appropriate.⁸¹ Similarly, the Minnesota PUC order affecting projects under 25 MW includes the following requirement:

The permittee, in consultation with DNR and other interested parties, shall request a DNR Natural Heritage Information Service Database search for the project site, conduct a pre-construction inventory of existing wildlife management areas, scientific and natural areas, recreation areas, native prairies and forests, wetlands, and any other biologically sensitive areas within the site and assess the presence of state- or federally-listed or threatened species. The results of the survey shall be submitted to the permitting authority (PUC or county) and DNR prior to the commencement of construction.⁸²

74. INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES 3-4 (U.S. Fish & Wildlife 2003), available at <http://www.fws.gov/habitatconservation/wind.pdf>. The 2003 Guidance remains in effect until the FWS finalizes a successor document after considering comments on the 2011 draft Guidelines.

75. DRAFT LAND-BASED WIND ENERGY GUIDELINES (U.S. Fish & Wildlife 2011), 25-30.

76. *Id.* at 3.

77. *Id.* at 4.

78. 9 VA. ADMIN. CODE 15-40-60(B)(2).

79. 9 VA. ADMIN. CODE 15-40-40(A).

80. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §9407.J.4 (Mich. Dep't of Labor & Econ. Growth 2008).

81. 4 COLO. CODE REGS. 723-3656(b)-(c).

82. Minnesota Public Utilities Commission, *In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less Than 25 Megawatts*, Order Establishing General Wind Permit Standards 13, Docket No. E, G-999/M-07-1102 (Jan. 11, 2008).

C. Monitoring

According to the FWS, “Post-development mortality studies should be a part of any site development plan in order to determine if or to what extent mortality occurs.” These studies should be designed in coordination with agency biologists, and their extensiveness may depend on the risks involved at a particular site.⁸³ Under the 2011 Draft Guidelines, the FWS would make post-construction studies of mortality and other habitat effects, a key part of Tier 4 review (specifying two to five years).⁸⁴ As discussed above, the Virginia permit-by-rule requires both monitoring and the revision of mitigation plans, based on the proven efficacy of mitigation measures.⁸⁵ The California Energy Commission and the Arizona Game and Fish Department have developed detailed monitoring protocols.⁸⁶

D. Prohibition on Artificial Habitat

Model ordinances for Maine, New York, and Oregon prohibit the creation of artificial bird habitat.⁸⁷ The New York model provides: “Avoid, to the extent practicable, the creation of artificial habitat for raptors or raptor prey, such as (a) electrical equipment boxes on or near the ground that can provide shelter and warmth, (b) horizontal perching opportunities on the towers or related structures or (c) soil where weeds can accumulate.”⁸⁸

VI. Noise

All model ordinances place some limit on noise from commercial-scale wind facilities. Some simply incorporate generally applicable noise standards. For instance, the Oregon model ordinance provides that “The proposed energy project complies with the noise regulations in OAR Chapter 340, Division 35 [Noise Control Regulations]. The applicant must submit a qualified expert’s analysis and written report.”⁸⁹ Where statewide noise regulations apply, any state permitting process will offer a forum for enforcing these standards.⁹⁰

Other model wind ordinances include specific standards, generally comprised of a decibel (dB) limit (which may vary according to the time of day) and the place of measurement. Michigan’s sample ordinance requires that:

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).⁹¹

The Wisconsin Public Service Commission (PSC) allows even stricter noise standards; local ordinances may set a daytime standard of 50 dBA and a nighttime standard of 45 dBA, as measured from the outside of nonparticipating occupied buildings.⁹² Accounting for preexisting noise conditions, the Massachusetts model ordinances prohibit wind facilities from increasing the noise level 10 dBA above the ambient level.⁹³ The Massachusetts models also restrict the production of “pure tones” to less than three dBA.⁹⁴ Ordinances may specify the methodology for measuring sound, as in the Pennsylvania model ordinance’s requirement that measurements conform to certain American Wind Energy Association (AWEA) standards.⁹⁵

Some model ordinances provide for the waiver of noise requirements. Under the North Carolina model ordinance, for instance:

- i. Property owners may waive the noise provisions of this Ordinance by signing a waiver of their rights.
- ii. The written waiver shall notify applicable property owner(s) of the noise limits required by this Ordinance, describe how the Wind Energy Facility is not in compliance, and state that consent is granted for the Wind Energy Facility to waive noise limits as required by this Ordinance.

83. INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES 3 (U.S. Fish & Wildlife 2003), available at <http://www.fws.gov/habitatconservation/wind.pdf>.

84. DRAFT LAND-BASED WIND ENERGY GUIDELINES 46 (U.S. Fish & Wildlife 2011).

85. 9 VA. ADMIN. CODE 15-40-60(A).

86. GUIDELINES FOR REDUCING IMPACTS TO WILDLIFE FROM WIND ENERGY DEV. IN AZ. (Ariz. Game & Fish Dept 2009), available at www.azgfd.gov/hgis/pdfs/WindEnergyGuidelines.pdf; CA. GUIDELINES FOR REDUCING IMPACTS TO BIRDS AND BATS FROM WIND ENERGY DEV. (Ca. Energy Comm. 2007), available at http://www.energy.ca.gov/2007publications/CEC-700-2007-008/CEC-700-2007-008-CMF_MINUS_AP-E.PDF.

87. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.4 (2009); WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.); A MODEL ORDINANCE FOR ENERGY PROJECTS 26 (Or. Dep’t of Energy 2005).

88. WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.).

89. A MODEL ORDINANCE FOR ENERGY PROJECTS 17 (Or. Dep’t of Energy 2005).

90. For example, the Maine Department of Environmental Quality will not issue a permit to wind facilities that will exceed state noise limits. 2 C.M.R.

06 096 375-7 §10(C)(1)(a)(v) (2001).

91. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.B (Mich. Dep’t of Labor & Econ. Growth 2008).

92. WIS. ADMIN. CODE PSC §128.14(3).

93. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.9.4; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §6.3. The Massachusetts models allow local governments to choose whether “violations shall be measured at the property line or at the nearest inhabited residence.”

94. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.9.4; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §6.3.

95. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §11.A (Pa. Dep’t of Envtl. Prot. 2006). “Methods for measuring and reporting acoustic emissions from Wind Turbines and the Wind Energy Facility shall be equal to or exceed the minimum standards for precision described in AWEA Standard 2.1–1989 titled, *Procedures for the Measurement and Reporting of Acoustic Emissions From Wind Turbine Generation Systems Volume I: First Tier.*”

- iii. Any such waiver shall be signed by the applicant and the Non-Participating Landowner(s), and recorded in the Deeds Office where the property is located.⁹⁶

VII. Shadow Flicker

Although large commercial wind turbines tend to have less severe shadow flicker impacts than smaller turbines (whose blades rotate at a higher frequency), state regulations and model ordinances often strive to minimize shadow flicker.⁹⁷ Protective measures are generally focused on occupied buildings on nonparticipating land.

A. Analysis and Impact Minimization

In Ohio's state siting system and some of the model ordinances, shadow flicker is addressed through site-specific analysis and a requirement to minimize any adverse impacts. The Michigan model ordinance applicants to submit

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.⁹⁸

Legislators or ordinance drafters may place specific requirements on the methodology to be used in the analysis, such as the requirement in Maine's model ordinance that "analysis [be] based on . . . modeling software approved by the Department of Environmental Protection."⁹⁹

B. Performance Standards

These analysis requirements may be paired with broad performance standards. For instance, Maine's model ordinance requires that commercial wind facilities "be designed to avoid unreasonable adverse shadow flicker effect at any Occupied building located on a Non-Participating Landowner's property."¹⁰⁰ Or performance standards may be specifically expressed, such as an "hour-per-year standard." Under North Carolina's model ordinance, "Shadow flicker at any Occupied Building on a Non-Participating Land-

owner's property caused by a Large Wind Energy Facility located within 2,500 ft of the Occupied Building shall not exceed thirty (30) hours per year."¹⁰¹

C. Waiver

The model ordinances for North Carolina and Pennsylvania apply the same waiver requirements for noise and shadow flicker standards.

VIII. Electromagnetic Interference

The majority of model ordinances regulate wind facilities' impacts on the many communications technologies that rely on electromagnetic waves—radio, telephone, television, and microwave transmissions. The Oregon model ordinance includes typical language:

Operation of the energy project would not create conditions that unduly reduce or interfere with public or private television, radio, telemetry or other electromagnetic communication signals. If undue reduction or interference occurs, the applicant must restore reception to the level present before operation of the energy project.¹⁰²

Because emergency responders often use microwave communications, those systems often receive special treatment. For instance, Michigan's sample ordinance requires that

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.¹⁰³

The model ordinance for Illinois requires preconstruction coordination with local emergency service providers to assure that projects will not unduly interfere with microwave transmissions.¹⁰⁴

96. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §8.C (N.C. Wind Working Group 2008).

97. As explained in the commentary to the Massachusetts model ordinances, shadow flicker generally occurs only when turbine blades sweep past at a frequency of 2.5-3 times per second. Commercial wind turbines generally do not cause changes in light intensity more frequently than 1.75 times per second.

98. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §9407.J.5 (Mich. Dep't of Labor & Econ. Growth 2008).

99. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §10.2.8 (2009).

100. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.6 (2009).

101. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §8.B (N.C. Wind Working Group 2008).

102. A MODEL ORDINANCE FOR ENERGY PROJECTS 16-17 (Or. Dep't of Energy 2005).

103. SAMPLE ZONING FOR WIND ENERGY SYSTEMS §1609.H.6 (Mich. Dep't of Labor & Econ. Growth 2008).

104. MODEL ORDINANCE REGULATING THE SITING OF WIND ENERGY CONVERSION SYS. IN ILL. §VII.B.1 (Chicago Legal Clinic 2003).

IX. Decommissioning

Almost every model ordinance and many state regulations impose decommissioning obligations on wind facilities. Decommissioning is a complex subject, particularly in the context of local land use regulation that has not traditionally focused on the end-of-life disposition of structures.

A. Requirement to Decommission

Some model ordinances explicitly designate the facility's owner as the party responsible for decommissioning. The South Dakota model ordinance provides that "The owner or operator . . . is responsible for decommissioning that facility and for all costs associated with decommissioning that facility and associated facilities. The decommissioning plan shall clearly identify the responsible party."¹⁰⁵

Regulations should establish a trigger for decommissioning (a point at which the facilities are deemed closed or abandoned) and a time line for decommissioning of such facilities. For instance, the North Carolina model ordinance provides that "The Wind Energy Facility Owner shall have 6 months to complete decommissioning of the Facility if no electricity is generated for a continuous period of 12 months."¹⁰⁶

In the North Carolina, Minnesota, Massachusetts, Maine, South Dakota, and Pennsylvania model ordinances, 12 months of nonuse trigger the decommissioning requirement.¹⁰⁷ The Utah model ordinance, by contrast, considers a project "abandoned when it fails to operate for 24 consecutive months."¹⁰⁸ Some model ordinances provide exceptions for owners who can demonstrate that the nonuse was due to a natural disaster or that there is a plan for returning the facility to operation.¹⁰⁹

There is significant variation in the time allotted for decommissioning, once the decommissioning requirement is triggered. The Pennsylvania model grants 12 months for

the owner to complete the process.¹¹⁰ The model ordinances for Massachusetts allow 150 days for decommissioning after a facility is deemed abandoned.¹¹¹ The Minnesota model allows just 80 days.¹¹² The South Dakota model sets deadlines for both beginning and completing decommissioning; the process must begin within eight months of the end of the facility's useful life and end within 18 months of that time.¹¹³

B. Standards

A decommissioning requirement should also establish standards for restoration of the site. The Pennsylvania model ordinance requires the "removal of Wind Turbines, buildings, cabling, electrical components, roads, and any other associated facilities down to 36 inches below grade. . . . Disturbed earth shall be graded and re-seeded, unless the landowner requests in writing that the access roads or other land surface areas not be restored."¹¹⁴ The Maine and South Dakota model ordinance requirements are similar, except that turbines and associated facilities must be removed to 24 inches below grade in Maine and to 42 inches below grade in South Dakota.¹¹⁵ The Massachusetts ordinances require the removal of solid and hazardous wastes in addition to the removal of the facility structures.¹¹⁶ They also provide for "Stabilization or re-vegetation of the site as necessary to minimize erosion. The permit granting authority may allow the owner to leave landscaping or designated below-grade foundations in order to minimize erosion and disruption to vegetation."¹¹⁷

C. Decommissioning Plan

Model ordinances and state regulators generally require applicants to submit a plan for how the facility's decommissioning will be accomplished and funded. The plan typically includes a cost estimate, which may be the responsibility of a third-party professional.¹¹⁸

105. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.14.a (S.D. Pub. Util. Comm'n 2008).

106. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §10.A (N.C. Wind Working Group 2008).

107. MODEL WIND ORDINANCE FOR WIND ENERGY FACILITIES IN N.C. §10.A (N.C. Wind Working Group 2008); MODEL WIND ORDINANCE 10 (Clean Energy Resource Teams et al. 2005); MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.11.2; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §8.2; ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE Appendix C (2009); MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §14.A (Pa. Dept of Env'tl. Prot. 2006); DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.14.b. (S.D. Pub. Util. Comm'n 2008).

108. UTAH MODEL WIND ORDINANCE §4.2.3 (Utah State Energy Program 2010).

109. The Minnesota model ordinance does not deem a facility in "discontinued use" if "a plan is developed and submitted to the ____ County Zoning Administrator outlining the steps and schedule for returning the [facility] to service." The Utah model ordinance provides a window of 60 days in which the owner may "provide sufficient evidence that the system has not been abandoned." The Maine model ordinance creates an assumption that a facility is abandoned after 12 months of nonuse, but "The Applicant may rebut the presumption by providing evidence, such as a force majeure event that interrupts the generation of electricity."

110. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §14.A (Pa. Dept of Env'tl. Prot. 2006).

111. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.11.1; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §8.1.

112. MODEL WIND ORDINANCE 10 (Clean Energy Resource Teams et al. 2005).

113. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.14.c (S.D. Pub. Util. Comm'n 2008).

114. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §14.B-C (Pa. Dept of Env'tl. Prot. 2006).

115. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE Appendix C (2009); DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.14.d (S.D. Pub. Util. Comm'n 2008).

116. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.11.1(b); MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §8.1(b).

117. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.11.1(c); MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §8.1(c).

118. See, e.g., MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §14.D (Pa. Dept of Env'tl. Prot. 2006).

D. Financial Assurance

The final important element of decommissioning regulations is the financial assurance that the party responsible for decommissioning will be able to complete it. Nebraska requires that wind developers must provide financial assurance in favor of the landowner to ensure decommissioning where the wind farm is on land owned by another landowner.¹¹⁹ Oklahoma state law requires the filing, after the 15th year of operation, of proof of financial assurance sufficient to cover the anticipated costs of decommissioning.¹²⁰ South Dakota law authorizes, but does not require, the PUC to require a “bond, guarantee, insurance, or other requirement” for decommissioning and removal of a wind energy facility. The law provides that the PUC must consider the size, location, and financial condition of the applicant when determining what, if any, financial assurance to require.¹²¹

The Maine model ordinance requires:

Demonstration in the form of a performance bond, surety bond, letter of credit, parental guarantee or other form of financial assurance as may be acceptable to the [Municipal Reviewing Authority] that upon the end of the useful life of the Wind Energy Facility the Applicant will have the necessary financial assurance in place for 100% of the total cost of decommissioning, less salvage value. The Applicant may propose securing the necessary financial assurance in phases, as long as the total required financial assurance is in place a minimum of 5 years prior to the expected end of the useful life of the Wind Energy Facility.¹²²

In an alternative scheme set out by the Pennsylvania model ordinance:

The Facility Owner or Operator shall post and maintain Decommissioning Funds in an amount equal to Net Decommissioning Costs; provided that at no point shall Decommissioning Funds be less than twenty five percent (25%) of Decommissioning Costs. The Decommissioning Funds shall be posted and maintained with a bonding company or Federal or Commonwealth chartered lending institution chosen by the Facility Owner or Operator and participating landowner posting the financial security, provided that the bonding company or lending institution is authorized to conduct such business within the Commonwealth and is approved by the [municipality] . . . Decommissioning Funds may be in the form of a performance bond, surety bond, letter of credit, corporate guarantee or other form of financial assurance as may be acceptable to the [municipality].¹²³

X. Other Requirements

In addition to the main categories of wind-facility siting regulation identified above, several other areas have been the frequent target of regulation. The following nonexhaustive set of issues merit consideration.

A. Incorporation of Other Standards

Most model ordinances explicitly require applicants to comply with other prevailing laws. General language, such as that found in the Utah model ordinance, demonstrates that there is no intention to displace other applicable laws: “Construction and operation of all such proposed large wind energy systems shall be consistent with all applicable local, state, and federal requirements, including all applicable safety, construction, environmental, electrical, communications, and FAA requirements.”¹²⁴

B. Liability Insurance

Some model ordinances require liability insurance coverage. Most often, there is a flexible standard for mandatory coverage. The New York model, for example, requires that:

Prior to issuance of a building permit, the applicant shall provide the town proof of a level of insurance to be determined by the Town Board in consultation with the Town’s insurer, to cover damage or injury that might result from the failure of a tower or towers or any other part or parts of the generation and transmission facility.¹²⁵

An alternate strategy is to impose a specific coverage requirement. The Pennsylvania model ordinance requires that “There shall be maintained a current general liability policy covering bodily injury and property damage with limits of at least \$1 million per occurrence and \$1 million in the aggregate. Certificates shall be made available to the [municipality] upon request.”¹²⁶

C. Good Neighbor Payments

Wisconsin’s PSC rules (suspended by the legislature on March 1, 2011) would have allowed local governments to require wind developers to make payments to nonparticipating neighboring residential owners. “For one turbine located within 0.5 mile of a nonparticipating residence, the initial annual monetary compensation may not exceed \$600” (rising to \$800 for two and to \$1,000 for three or more turbines within the same distance). The provision also had an escalator for the initial amount for agree-

119. NEB. REV. STAT. §76-3001.

120. 2010 OKLA. SESS. LAWS 319 (to be codified at OKLA. STAT. tit. 17, §160.17).

121. S.D. ADMIN. R. 20:10; 22:33.01.

122. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE app. C (2009).

123. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA., §14.E (Pa. Dep’t of Env’tl. Prot. 2006).

124. UTAH MODEL WIND ORDINANCE §4.4 (Utah State Energy Program 2010).

125. WIND ENERGY MODEL ORDINANCE OPTIONS 11 (N.Y. State Energy & Research Dev. Auth.).

See also ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.9 (2009); MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §3.3.

126. MODEL ORDINANCE FOR WIND ENERGY FACILITIES IN PA. §13 (Pa. Dep’t of Env’tl. Prot. 2006).

ments starting in future years.¹²⁷ The rules also would have allowed local governments to require developers to offer financial compensation to nonparticipating farmers within 0.5 miles of a turbine for reductions in productivity based on limitations on their ability to conduct aerial spraying.¹²⁸

D. Impacts on Public Roads

Many model ordinances demand that applicants take measures to avoid impacts on public roads and repair any damage caused by constructing the wind energy facility. Very heavy, large wind turbines and towers transported on rural and secondary roads can produce damage or excessive wear to those roads. For instance, the Maine model ordinance includes the following detailed requirements:

1. The Applicant shall identify all state and local public roads to be used within [name of municipality] to transport equipment and parts for construction, operation or maintenance of a [Type 2 or Type 3] Wind Energy Facility.
2. The Town Engineer, Road Commissioner or a qualified third-party engineer reasonably acceptable to both the [Municipal Reviewing Authority] and the Applicant and paid for by the Applicant . . . shall document road conditions prior to construction. The Town Engineer, Road Commissioner or third-party engineer shall document road conditions again thirty (30) days after construction is complete or as weather permits.
3. The Applicant shall demonstrate, to the satisfaction of the [Municipal Reviewing Authority], that it has financial resources sufficient to comply with subsection 4, below, and the [Municipal Reviewing Authority] may require the Applicant to post a bond or other security in order to ensure such compliance.
4. Any road damage caused by the Applicant or its contractors shall be promptly repaired at the Applicant's expense.¹²⁹

The appropriate provisions for a particular jurisdiction will depend on the state and locally applicable regulations regarding the use of public roads.

E. Minimize New Road Construction

Some model ordinances require applicants to avoid building new roads, when possible, in order to minimize habitat fragmentation, water quality impacts, and other environmental problems. For instance, the Oregon model requires "Using existing roads to provide access to the site, or if new roads are needed, minimizing the amount of land used for

new roads and locating roads to reduce visual impact and other adverse environmental impacts such as erosion."¹³⁰

F. Soil Erosion/Water Quality

Some model ordinances include provisions to protect soil and water quality. Such requirements are likely to apply under state erosion and sediment control laws and under state and federal construction stormwater permits. However, some ordinances specifically address wind facilities' requirements. For instance, the Massachusetts models require that "Clearing of natural vegetation shall be limited to that which is necessary for the construction, operation and maintenance of the wind facility and is otherwise prescribed by applicable laws, regulations, and ordinances."¹³¹ The South Dakota model requires a detailed plan for erosion control.¹³²

G. Maintenance

Some model ordinances include requirements regarding maintenance and repair, primarily to ensure safety and reduce the likelihood of abandonment and disuse. For instance, the Utah model ordinance requires that "The applicant shall maintain the large wind energy system and project in good condition. Maintenance shall include, but not be limited to, painting, structural repairs, and security measures."¹³³ The New York model requires that "Any wind energy system found to be unsafe by the local enforcement officer shall be repaired by the owner to meet federal, state and local safety standards or removed within six months."¹³⁴

130. A MODEL ORDINANCE FOR ENERGY PROJECTS 25 (Or. Dep't of Energy 2005). Similarly, the New York model requires applicants to "Use existing roads to provide access to the facility site, or if new roads are needed, minimize the amount of land used for new roads and locate them so as to minimize adverse environmental impacts." WIND ENERGY MODEL ORDINANCE OPTIONS 9 (N.Y. State Energy & Research Dev. Auth.). The draft South Dakota model ordinance requires that

Construction of turbine access roads shall be minimized. Access roads shall be low profile roads so that farming equipment can cross them and shall be covered with Class 5 gravel or similar material. Access roads shall avoid crossing streams and drainage ways wherever possible. If access roads must be constructed across streams and drainage ways, the access roads shall be designed in a manner so runoff from the upper portions of the watershed can readily flow to the lower portion of the watershed.

DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.1.f.2 (S.D. Pub. Util. Comm'n 2008).

131. MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING CONDITIONAL USE OF WIND ENERGY FACILITIES §3.9.5; MODEL AMENDMENT TO A ZONING ORDINANCE OR BY-LAW: ALLOWING WIND FACILITIES BY SPECIAL PERMIT §6.4.

132. DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES) §6.1.g (S.D. Pub. Util. Comm'n 2008).

133. UTAH MODEL WIND ORDINANCE §4.2.2 (Utah State Energy Program 2010).

134. WIND ENERGY MODEL ORDINANCE OPTIONS 8 (N.Y. State Energy & Research Dev. Auth.).

127. WIS. ADMIN. CODE PSC §128.33(3) (suspended).

128. WIS. ADMIN. CODE PSC §128.33(3m) (suspended).

129. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.2 (2009).

H. Public Inquiries and Complaints

Wisconsin's state PSC rules for local governments provide procedures for receiving public complaints and resolution of issues of non-compliance.¹³⁵ A few model ordinances create procedures for resolving inquiries and complaints from the public. In addition to creating a means of mediating community disputes, these procedures can ease the enforcement burden for public officials. For example, the Maine model ordinance provides that:

The Applicant or its designee shall maintain a phone number and identify a responsible Person for the public to contact with inquiries and complaints throughout the life of the Wind Energy Facility. . . . The Applicant or its designee shall make reasonable efforts to respond to the public's inquiries and complaints and shall provide written copies of all complaints and the company's resolution or response to the Codes Enforcement [Officer] upon request.¹³⁶

XI. Conclusion

Local governments are making their way forward into regulation of a new industrial land use, often planned for large and dispersed sites. Lawyers assisting local governments, citizen groups, and landowners seeking to address wind-facility siting can draw on numerous models in developing suitable approaches. In general, these models offer the following lessons:

- Wind energy should be an authorized land use in various possible use districts and overlay districts (by either by right or permit), and not excluded from entire jurisdictions except on the basis of specific impacts (such as those below) that cannot be addressed in a given jurisdiction except by exclusion.
- Regulations should provide for evaluation of visual impacts on important viewsheds, and should provide for uniform and unobtrusive structures consistent with aircraft safety and other safety requirements.
- Safety requirements should protect the general public and should address access and site engineering.

- Setbacks should be authorized from property lines and structures (particularly inhabited structures on nonparticipating adjacent properties), but these should not be excessive nor more than ordinarily required to meet safety and noise requirements. Setbacks greater than 1.1 maximum turbine height are generally not needed unless they are to address specific considerations relating to impacts on identified residents, public facilities, or resources. Local governments should not impose excessive setbacks in order to exclude wind energy facilities.
- Habitat protection should address avoidance of key habitats, minimization of impacts, and mitigation for unavoidable impacts; it should rely on a step-wise approach of site identification, evaluation, permitting, and monitoring. Local habitat-related requirements should be informed by state and federal expertise and should be structured to supply needed information.
- Noise standards should ordinarily be set using state-wide standards and methods; and electromagnetic interference issues should also be resolved on a technical basis using state or federal requirements where available. Ideally, shadow flicker can be addressed with appropriate site-specific controls such as setbacks from identified occupied structures; regulations can specify site evaluation requirements as well as performance standards.
- Decommissioning of facilities must be provided for, including requirements for triggering of decommissioning requirements and site restoration issues, and financial assurance is often appropriate.
- Local and state governments can address other issues. Among these, regulations concerning the use and maintenance of public and private roads may deserve attention given the particular demands of wind facility construction and maintenance.

135. WIS. ADMIN. CODE PSC §128.40 (suspended).

136. ME. STATE PLANNING OFFICE MODEL WIND ENERGY FACILITY ORDINANCE §14.1 (2009).