

March 6, 2017

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Knowledge
to Life!

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acres is all the Michigan
we will ever have.”*

Former Governor
William G. Milliken

Michigan State University
Extension,
Greening Michigan Institute,
Government and
Public Policy Team

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Sample zoning for Wind Energy Systems

This flyer presents a sample zoning ordinance for utility scale wind energy systems and smaller wind electric generation systems for an individual business or home.

Introduction and History of this Sample Zoning

These guidelines were originally developed in April 2008 by the Energy Office, Michigan Dept. of Labor and Economic Growth (DLEG) (now the MI Energy, Michigan Agency for Energy, <http://www.michigan.gov/energy/>) to assist local governments to develop siting requirements for wind energy systems. The 2008 sample zoning is still DLEG's sample zoning for this topic. The material presented here is not intended to apply in urban areas. It has been developed with the intention of striking an appropriate balance between the need for clean, renewable energy and the necessity to protect the public health, safety, and welfare. The guidelines represent recommended zoning language for local governments to use in rural areas if they amend their zoning ordinance to address wind energy systems. The Michigan Agency for Energy, DLEG, has no authority to issue regulations related to siting wind energy systems.

In 2008 electricity generation was 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 according to the Energy Office, DLEG. 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.

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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 single 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 20 meters and Utility Grid wind energy systems can have towers up to 100 meters or more in height.

The original April 16, 2008 guidelines were developed with input from members of the Michigan Wind Working Group. The members of the Michigan Wind Working Group did not endorse 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's final report see: <http://djal701.tripod.com/WindSitingDelphiInquiry.pdf>.

The guidelines were placed in typical sample zoning ordinance language in April 2008 by Kurt H. Schindler, AICP, Senior Educator, Government and Public Policy with Michigan State University Extension.

In August 2016 Schindler and Neumann updated the sample zoning language to reflect increased scientific research and experience from counties and municipalities that have incorporated some or all of this sample material into their zoning ordinances.

Court and case law

Utility scale wind energy has been very controversial in some communities. Even so, there has been relatively few court rulings from a court of

record (Michigan Appeals Courts, Michigan Supreme Court).

Cautions and Commentary

All of the principals and rules for zoning apply to zoning regulations relating to wind energy systems. Just because a wind energy system is strongly opposed, or strongly supported does not mean that basic due process and other rules do not apply.

They do. These include the following:

Requirements for procedural due process,¹ meaning going through all the notifications, rendering decisions based on standards in the zoning ordinance and competent and material evidence, and more, still have to be done.

Requirements for substantive due process still have to be followed. See sidebar box on page [9](#), [10](#).

The Michigan Zoning Enabling Act require consideration of all legitimate land uses:

A zoning ordinance or zoning decision shall not have the effect of totally prohibiting the establishment of a land use within a local unit of government in the presence of a demonstrated need for that land use within either that local unit of government or the surrounding area within the state, unless a location within the local unit of government does not exist where the use may be appropriately located or the use is unlawful.²

Given the need for reliable, clean energy, as prescribed in the Michigan Clean, Reliable, and Efficient Energy Act of 2008,³ it is unlikely that a

¹U.S. Constitution, Amendment V; Michigan Constitution of 1963, Art. I, §17 .

²Section 207 of P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3207). (This footnote used to cite the following acts, each repealed as of July 1, 2006: Section 27a. of P.A. 183 of 1943, as amended (the County Zoning Act, M.C.L. 125.227a); section 27a of P.A. 184 of 1943, as amended (the Township Zoning Act, M.C.L. 125.297a); and section 12 of P.A. 207 of 1921, as amended (the City and Village Zoning Act, M.C.L. 125.592).)

³MCL 460.1051 *et seq.*

local unit of government could successfully argue in a court of law that there is not a demonstrated need for utility scale or home-use wind energy systems, and therefore such systems may be effectively banned through overly restrictive and unreasonable zoning regulations.

Local zoning must allow the continuation of a nonconforming use⁴ and expansion of a nonconforming use⁵ (an existing building or use of land that lawfully existed prior to zoning or prior to a zoning amendment). However, the ordinance can provide for reasonable terms for restoration, reconstruction, extension, substitution, and acquiring of nonconforming uses that may limit their life span.

Local zoning cannot constitute a taking, which occurs if a regulation requires or permits physical invasion by others onto private property or is so sweeping that it, in effect, takes away all economically viable use of land⁶

Zoning must provide equal protection of all persons affected by the laws.⁷

⁴Section 208 of P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3208). (This footnote used to cite the following acts, each repealed as of July 1, 2006: Section 16 of P.A. 183 of 1943, as amended (the County Zoning Act, M.C.L. 125.216); section 16 of P.A. 184 of 1943, as amended (the Township Zoning Act, M.C.L. 125.286.); and section 3a of P.A. 207 of 1921, as amended (the City and Village Zoning Act, M.C.L. 125.583a.).)

⁵*Century Cellunet of Southern Michigan v. Summit Township et al.*, 250 Mich.App. 543 (2002), Jackson Circuit Court LC No. 99-096108-AA.

⁶Both state and federal constitutions prohibit taking of private property for public use without just compensation – U.S. Constitution, Amendment V, and Michigan Constitution 1963, Article 10 §2. The U.S. Supreme Court has recognized that the government effectively “takes” a person’s property by overburdening that property with regulations. *Pennsylvania Coal Co. v. Mahon*, 260 US 393, 415; 43 S Ct 158; 67 L Ed 2d 322 (1922). As has the Michigan Supreme Court *K & K Construction, Inc. v. Department of Natural Resources*, 456 Mich 570, 576; 575 NW2d 531 (1998). See also *Land Use Series* “Property Taking, Types and Analysis:” http://msue.anr.msu.edu/resources/property_taking_types_and_analysis

⁷U.S. Constitution, Amendment IV.

The zoning ordinance must list possible special uses in specific terms.⁸ It cannot be general or broad categories of land uses.

Most ordinances are written in a permissive way. “A permissive format states the permissive uses under the classification [zoning district], and necessarily implies the exclusion of any other non-listed use.”⁹ So, a zoning ordinance that is silent on wind energy conversion systems actually makes such uses illegal and they are not allowed unless the ordinance is amended to add them to the lists of permitted or special uses, or the zoning board of appeals grants a use variance for the use (and is permitted to do so).

It is not appropriate to write regulations which depend on a neighboring landowner to approve something – such as setbacks, noise limits, or shadow flicker. This can run afoul of the equal protection clauses of both the state and federal constitutions. It can also be argued that the result is arbitrary and capricious. The neighbor might say “yes” to one because they are good friends, and “no” to another because of past rancor. That is not a decision based on standards or treating people equally.

Requirements for “good neighbor payments” cannot be done.¹⁰

One cannot use community dispute resolution in the process of adopting zoning amendments. The local elected body¹¹ cannot delegate away its legislative authority in this way. (However a community dispute resolution process may be a very good idea, and legal, to deal with complaints

⁸*Whitman v. Galien Twp.*, Michigan Court of Appeals (288 Mich. App. 672; 2010 Mich. App. LEXIS 1042, June 10, 2010).

⁹*Independence Twp. v. Skibowski*, 136 Mich App 178 (1984).

¹⁰This does not preclude voluntary payments by developers. But such payments must be voluntary, and not in any way initiated, required, or otherwise coerced by the zoning authority.

¹¹Township Board of Trustees, City Council, Village Council, and County Board of Commissioners.

about issues revolving around the operation of a wind energy system.)

The hierarchy for ordinances relative to zoning within a single jurisdiction is established by statute. (Case law dealing with priorities between local zoning ordinance and state statutes is much more complex than outlined here. See *Land Use Series* “Restrictions on Zoning Authority”¹²) The Michigan Zoning Enabling Act reads:

Except as otherwise provided under this act, an ordinance adopted under this act [a zoning ordinance] shall be controlling in the case of any inconsistencies between the [zoning] ordinance and an ordinance adopted under any other law.

—MCL 125.3210, brackets added

The zoning act also preserves the historical priority of township zoning over county zoning. It reads:

Except as otherwise provided under this act, a township that has enacted a zoning ordinance under this act is not subject to an [zoning] ordinance, rule or regulation adopted by a county under this act.

— MCL 125.3209, brackets added

For purposes of this discussion there are two different types of ordinances: (1) police power ordinance and (2) a zoning ordinance. The two types of ordinances are dealing with entirely different subjects and have different procedures for adoption. If a police power ordinance purports to regulate use of land, then it is a zoning ordinance and will be struck down if not adopted according to the procedures in Michigan Zoning Enabling Act.. And vice versa. If a zoning ordinance tries to regulate the speed of automobiles on public highways, for example, it's not a zoning ordinance and is *ultra vires*¹³ in municipalities that tried to adopt it, even if they do have police power authority.

In a wind energy regulatory jurisdiction

¹²Counties have very limited police power ordinance adoption authority. See http://msue.anr.msu.edu/resources/restrictions_on_zoning_authority

¹³Beyond one's legal power or authority.

dispute an unpublished Michigan Court of Appeals case put forth one simplistic rundown of jurisdiction hierarchy.¹⁴

Townships and counties do not have general jurisdiction within the boundaries of a village or city. Thus, cities and villages are independent and usually only their ordinances apply in the city or village.

Members of the planning commission still have a duty to remove themselves from the deliberations, meetings, and voting on an item if they have a conflict of interest. A conflict of interest could, among other things include:

1. Relationship:
 - A. The member is the applicant
 - B. A member's relative is the applicant (how distant a relative could be defined in the planning commission's bylaws.)
2. Proximity:
 - A. The member is the property owner
 - B. The member's property is adjacent, or within a certain proximity to the land under consideration. Proximity could be established in the planning commission's bylaws.
3. Financial:
 - A. The member (or relative) stands to gain financially by the decision of the planning commission (or zoning board of appeals).

With any of these situations if there is question whether a conflict of interest exists, the Michigan Planning Enabling Act (and Michigan Zoning Enabling Act in regards to appeals boards) require the issue be disclosed and the planning commission

¹⁴*Forest Hill Energy-Fowler Farms, L.L.C. v. Township of Bengal* Michigan Court of Appeals (Unpublished, No. 319134, December 4, 2014). The hierarchy expressed in this court case was:

- County police power ordinances. (Counties have very limited police power ordinance adoption authority. See "County government powers are very limited")
- Municipal (Township, city, and village.) police power ordinances will supersede each of the above ordinances.
- County zoning ordinance will supersede each of the above ordinances.
- Township zoning ordinance will supersede each of the above ordinances.

(or appeals board) vote to determine whether a conflict of interest exists or not. Full recusal of the conflicted member is the general rule in the event of a conflict of interest.

As with any zoning issue, members of the zoning board of appeals should not announce or conclude publically they are for or against a wind energy system or project before the public hearing and all the information has been presented and deliberated, findings of fact have been adopted and reasons in support of the decision formulated, and a motion containing a decision has been made and seconded. Just like any issue, members have the task of remaining neutral so that an application receives its “fair day in court.” When this has not been done disgruntled applicants have applied to circuit court asking the judge to remove the member of the planning commission or appeals board who is displaying bias by announcing his or her favor or opposition to a wind energy project.

There are some attorneys which advise the same duty to be neutral prior to the hearing for members of the planning commission. Other attorneys advise the duty is not as rigorous for members of a planning commission. This is because special use standards invite and encourage differing viewpoints (compared to appeals board variance standards). Thus, it may be a good thing for planning commission members to have differing views on the facts and the evidence, and expressing those views in a hearing or meeting.

It is not appropriate for an appeals board member or planning commission member to say “I’m going to vote against X no matter what because I dislike Xs.” But one should be able to say to an applicant, “I don’t think that your evidence that there is no risk to the community is convincing or meets the standards of the ordinance” even if that clearly implies or is tantamount to saying that the member will vote against X.

Finally, like any land use, whether a permitted or a special use under the local zoning ordinance, a wind energy system application must be granted if the applicant reasonably satisfies the standards and conditions set forth in the zoning ordinance. To protect the public interest and to assure compliance with the ordinance, reasonable

conditions may be imposed as a requirement for approval.¹⁵

Noise issues

Noise issues are complex aspects of wind energy systems which warrant attention. Many communities do not have any detailed noise standards, or they have standards which are not detailed or specific enough.

Regulation of noise tends to focus on volume or sound pressure, expressed as decibels (dB) with various ways of measuring it. But volume is not the only characteristic of noise. It is also characterized by pitch, tone, pulsation, and other features.

There are documented health issues with excessive volume of noise (see the next paragraphs). Thus, the zoning emphasis has tended to be on limiting how loud a land use can be. But that will not satisfy everyone. The other characteristics of noise can be annoying and result in complaints. For example, one can comply with a regulation, not making a noise above the required volume, while running fingernails down a chalk board.

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 – often parallel to the United States Department of Labor Occupational Safety and Health Administration (OSHA) work place safety regulations. The United States Environmental Protection Agency (EPA) and World Health Organization documents indicate that 55 dB(A) is too low to produce hearing loss or long-term health effects.¹⁶ 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 (13.1 feet) before there would be any interference.

Concerning sleep disturbance, the World

¹⁵MCL 125.3504.

¹⁶EPA, 1974. Protective Noise Levels: Condensed Version of EPA Levels Document; and World Health Organization, 1999. Guidelines for Community Noise.

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 nighttime noise events occurs.”¹⁷ 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.¹⁸

The sample zoning in this document uses 40 dB based on the summary of research done by Chief Medical Officer of Health of Ontario, Canada, Report The Potential Health Impact of Wind Turbines (May 2010) (see page 25). (The 2008 sample zoning used 55 dB(A).)

There are State of Oregon policies which assumes a 26 dBA in quiet rural areas and turbine noise cannot exceed 10 dBA. according to Alberta, Canada, wind energy policies¹⁹ (However such a standard in the United States could be challenged as so sweeping that it, in effect, takes away all economically viable use of land –a taking.) Germany basis on three different zones, ranging from 35 to 45 dBA.²⁰ Ontario also bases sound and setback on the size of the system (how many turbines).²¹ New Hampshire went through a lengthy, very extensive, review of wind turbine siting to come up with general standards. they have

45 dBA day, 40 dBA night (8 PM to 8 AM).²²

The wind energy system has to be initially designed and built to meet a given noise standard. After built, control on noise can occur through after construction noise reduction is limited. For example, required operation in a “night mode,” or set back the turbines farther so they can run at full power all the time.

A municipality’s noise standards can be as detailed and sophisticated as it desires. Separate standards can be developed for infranoise and low-frequency sound pressure levels, for example. Separate standards can be developed for residential and non-residential areas. Sound pressure levels characterized as tonal can have lower limits.

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.

Mason County, Michigan may be a good example of a utility grid zoning ordinance relating to noise issues.²³

Not all wind farms are controversial

Development and siting of large wind energy projects, or wind farms, can sometimes be some of the most controversial issues in a community. In other cases, they do not generate much concern at all.

Research suggests a community’s and developer’s ability to provide meaningful education, collaborative discussions, with a strong public participatory process very early in the process lessens friction among parties. “Very early” means prior to wind studies or installation of anemometer

¹⁷World Health Organization, 1999. Guidelines for Community Noise.

¹⁸EPA, 1974. Protective Noise Levels: Condensed Version of EPA Levels Document

¹⁹Haugen, Kathryn M. B.; “Summary of Wind Policies and Recommendations by Country: Companion Summary Chart to “International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences;” Minnesota Department of Commerce: Energy Facility Permitting.

²⁰Haugen, Summary chart and Haugen, Kathryn M. B.; “International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences: Setbacks, Noise, Shadow Flicker, and other Concerns;” Minnesota Department of Commerce: Energy Facility Permitting; October 19, 2011.

²¹Haugen, Summary chart and International Review.

²²Haugen, Summary chart and International Review and New Hampshire Site Evaluation Committee administrative rules site 301.14(f) in http://www.gencourt.state.nh.us/rules/state_agencies/site100-300.html at <http://www.nhsec.nh.gov/rules/>

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<http://www.masoncounty.net/departments/zoning/zoning-ordinance.html>

towers, etc. The research²⁴ was done by Peggy Kirk Hall, J.D., and Assistant Professor and field specialist in agricultural and resource law at The Ohio State University.

The focus of Professor Hall's research was the reasons why a project may be controversial and the factors behind opposition. Then it focuses on things a community can do to further understanding and develop a possible consensus – pro or con – on the wind energy issue.

Hall said it is not accurate and too simplistic to characterize opposition to utility scale wind generation projects as just “NIMBYism” (Not In My Back Yard). There are legitimate concerns which need to be understood and acknowledged, along with an active effort that is needed to mitigate those concerns. In some cases, those concerns cannot be successfully mitigated, and in other cases it may be possible – which may lead to a community issuing local permit approval for a wind farm, or not.

Concern or opposition to a wind farm might be categorized into three areas: (1) anticipated effects, (2) fairness of the development, and (3) values and beliefs, according to research done by David Bidwell (2013).²⁵

The **anticipated effects** of a wind farm can be listed as concerns within these categories: impacts on wildlife & habitat, health and safety, traffic, road use, noise, property values, economic impact on the community and landscape. The last one, landscape, should not be passed over as just aesthetic views. Research includes a “place identity theory” where a person's personal identity is tied to valued landscapes or place. In other words landscape has a symbolic value – so those with a strong bond to their community may view wind farms as a form of

“alien invasion” according to Cass and Walker²⁶ (2009).

Fairness of the development, or process, includes such beliefs and results as: (1) outside interests are profiting or benefitting more than the local community, (2) opposition directed toward the developer and (3) whether procedural fairness, such as unbiased decision making, stakeholders are being treated fairly and other due process issues is being observed by the governing bodies charged with the decision. These concerns come down to the process used and the distribution of the effects. For process, there are two extremes. A community, or local government, may operate in an open and participatory manner, or at the other extreme would be a closed and institutional community, along with everything in-between. Distributional fairness has to do with how residents feel the benefits and burdens are being shared. One may perceive outside interests are getting all the benefits and profits, with little for the local community. This can translate into one's feeling that locals are being treated unfairly. Often, research shows, this leads to opposition directed toward the developer.

Values and beliefs include environmental values where wind energy is seen as a clean, renewable, carbon-free way to generate electricity and yet environmental opposition to wind energy develops locally, known as “green on green” conflicts. One might also characterize it as a local versus global perspective. Bidwell's research suggests:

1. Anticipated effects of a wind farm on the local economy have the single greatest effect on people's support or opposition.
2. The more a person is attached to their place, or neighborhood, the more a person is likely to express caution toward wind energy farm.
3. Fairness of the development, or process used is not a significant predictor of support or opposition toward a wind farm. Fairness of development did have a contributing

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http://ncrcrd.msu.edu/ncrcrd/chronological_archive

²⁵ Bidwell, David; “The role of values in public beliefs and attitudes towards commercial wind energy.” *Energy Policy*; 58 (2013) 189-199, <http://www.sciencedirect.com/science/article/pii/S030142151300164X>

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http://www.academia.edu/5085553/Emotion_and_rationality_The_characterisation_and_evaluation_of_opposition_to_renewable_energy_projects

- relationship with the two previous points.
4. The more a person is considered to have altruistic values toward other humans and community (place identity), the more likely one might express caution toward a wind energy farm.
 5. General environmental beliefs (altruistic values toward ecosystems) by a person tend to result in enthusiasm for wind energy.
 6. Higher education attainment slightly raises the measure that one will be cautious toward a wind energy farm development.
 7. Persons holding traditional values (family, safety for loved ones, honoring elders, showing respect, self-discipline, resistance to temptation) have a strong link to a person with a strong self-identity to place and which is likely to include skepticism of wind farm economic benefits.

Hall's research suggests a significant part of the difference between a very controversial wind development and one that is not controversial is a community's and developer's ability to provide meaningful education and collaborative discussions, with strong public participation very early in the process.

So what can a community do to further understanding and develop a possible consensus – pro or con – on the wind energy issue?

Hall presents the following points for a community which may be addressing a proposed wind energy project. First and foremost, the legally required process is not enough. The public hearing on a submitted application, which is held only after the plan has been largely developed, may be the worst way to engage the public. In Michigan, the public hearing required for a special use permit takes place too late in the process. Likewise the format of the public hearing does not accommodate effective addressing of the factors behind any opposition.²⁷

²⁷ Other Michigan State University Extension articles on public participation:

- The Public Hearing is the worst way to involve the public:
- (continued...)

Hall recommends communities start an education process early –before an application is even submitted. Education should be about:

- (1) wind energy generally,
- (2) the specific wind project including things such as siting issues and
- (3) the identity and history of the project developer.

This education should be done by a trusted third party, not the developer, not the local government, not the local chamber or economic development office, all which may be perceived as on one side of the issue. This may be a role for Michigan State University Extension, a community college, other universities, League of Women Voters or similar organizations.

Education – before the project application or land easement acquisition starts is the time to increase awareness and to educate and inform people.²⁸ Reproducing academic research and studies can be an effective educational tool. Education should not have a goal to convert or persuade members of the community to oppose or support a wind energy project. It needs to be neutral and by a trusted third party. Such efforts can include open houses with experts or a storefront where representatives of the project are accessible. Tours of existing wind farms may also be

²⁷(...continued)

http://msue.anr.msu.edu/news/the_public_hearing_is_the_worst_way_to_involve_the_public

- Before settling for a public hearing, consider the continuum of public involvement:
http://msue.anr.msu.edu/news/before_settling_for_a_public_hearing_consider_the_continuum_of_public_involvement
- Increasing public participation in the planning process:
http://msue.anr.msu.edu/news/increasing_public_participation_in_the_planning_process

²⁸There may be push-back to this approach.

Developers want to get easements as quietly and as quickly as possible. The belief is publicity just raises the price of leases for a developer. However there are examples where education before the project application or land easement acquisition starts has worked, e.g., John Deere in Huron County and other developers in Gratiot County, Michigan.

an effective technique.

There needs to a **participatory process** for addressing issues with all stakeholders. This also means interaction, and conducting one-on-one meetings. Ideally the developer visits a person's farm or home and talks with the resident. Care should be taken to go to all property residents on large and small parcels in the area expected to be affected by the project in some way. The discussion, project planning and problem solving needs to be a collaboration. But the developer must be willing to address individual and stakeholder concerns and be willing to negotiate. The more a developer engages, the less distrust is likely to exist. One does not want the first, or only contact to be with those approaching property owners to get leases signed.

Local government, or a third party, can assemble a **team** whose job it is to identify the various issues for a specific wind energy project. The team should include stakeholders representing the various viewpoints that surface in the community. Activity may include conducting additional studies. That team effort can then lead to development of solutions. This should also happen early in the process. Part of the function of such a team is to engage in "collaborative problem-solving": people involved sharing perspectives, defining issues and interests, exploring different options and evaluating and modifying options to reach an agreement. This team might be a community advisory panel that has direct involvement in the design and siting of the wind energy project. This can be reflected in project revisions (shown in the project application for local government approval). It may also result in recommendations for revisions to the local regulations about wind energy. These teams, when created by any unit of government, are committees subject to the open meeting act and freedom of information act, and are subservient to the board or commission that formed the committee.

Even with these practices in place, the conflict and disagreement in a community may be too intense. In those cases one might consider court sanctioned mediation.

Substantive Due Process Limitations on Regulation

When regulating people's property, one of the major concerns in the United States is that the regulation does not become too restrictive thereby infringing on a person's private property rights, or regulating in areas outside of what is appropriate for government.

Substantive due process has to do with the substance of the regulation, and that the regulation has a logical connection between the government's purpose and the regulation itself, and finally that the regulation is the least amount possible while still achieving the public purpose. Substantive due process is one of our constitutional rights found in the 5th and 14th Amendments, Bill of Rights, of the United States Constitution. The U.S. Supreme Court used substantive due process to give added force to the 4th, 5th and 6th Amendments of the U.S. Constitution.

Substance of the Regulation

Not everything is a legitimate subject for government to regulate. For example, local government regulation that infringes on constitutional liberties would be out-of-bounds for a local ordinance.

Commonly, with zoning ordinances, there are sign regulations. The regulation of signs is permissible provided it is about placement, size, lighting and so on. But if the regulation is based on what the sign says, that conflicts with free speech. Thus, regulation of signs must be content-neutral; we do not regulate what the sign says and we do not treat one sign differently than another based on what the sign says.

So the regulation has to have a rational government purpose, or further a legitimate governmental interest.

Regulation Related to Purpose

The second part of substantive due process is that the regulation relates to the government purpose. In simple terms, that means the local government should be able to explain how the regulation accomplishes its purpose or goal. With zoning, in Michigan, one looks to the master plan to contain the goals, objectives, strategies and actions upon which the zoning ordinance (regulation) is based. Within the master plan there are certain elements, comprising the "zoning plan," which more directly tie regulation in zoning to goals, and objectives in the master plan.

Zoning ordinances include a zoning map dividing the municipality into various zoning districts. The zoning plan elements of the master plan should clearly show how the master plan developed those particular geographic areas – such as text and existing land use maps and analysis, future land use map, projections showing future housing, commercial and industrial needs, natural resource attributes for working lands and so on.

So there needs to be a rational connection between what is trying to be accomplished (legitimate governmental purpose) and the regulation.

Least Regulation

Finally, the rules should be the least amount of regulation possible to achieve the public purpose. If studies and science show a minor regulation will do the job, then that is all that should be required. It would not be appropriate to require additional more regulation.

Master Plan and Research

The documentation of substance of the regulation and how the regulation relates to the public purpose should be reflected in the community's master plan, or supplement to its master plan. So the regulation of wind energy should be based on sound university-based research. It is important to use care when looking for such research. With wind energy there is a higher than normal amount of "studies" which are not quality university-based research, and in some instances there is outright fabrication of research.

Applies to Wind-Energy also

Substantive due process deals with the substance of the government regulation. Government may not overly regulate a wind-energy issue. It has to be a legitimate government purpose, not contrary to protected constitutional rights and other areas established through our history of court cases. If the regulation of a wind-energy land use is about a legitimate governmental purpose the regulation has to logically be related to that government purpose and not off the mark or indirect. The regulation cannot go too far and should be the least regulation possible while still accomplishing the public purpose.

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.²⁹ A step-by-step checklist of procedures to amend a 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 lu.msue.msu.edu.
- **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.³⁰

- **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 apart from the adoption of a complete zoning ordinance establishing rules and creating the public offices and bodies necessary to implement the wind regulations pursuant to the Michigan Zoning Enabling Act.

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 a site plan review process 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 lu.msue.msu.edu.
3. The municipality's attorney will review any proposed amendments before they are adopted.

Following are the sample zoning amendments with commentary.

²⁹P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3101 *et seq.*)

³⁰P.A. 110 of 2006, as amended, (being the Michigan Zoning Enabling Act, M.C.L. 125.3101 *et seq.*).

Definitions

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

AMBIENT MEANS the sound pressure level exceeded 90% of the time or L90.

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. Also includes the same equipment for evaluating wind characteristics in preparation of or evaluation of construction of on Site Wind Energy System and Utility Grid Wind Energy System.

ANSI means the American National Standards Institute.

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

ISO means the International Organization for Standardization.

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.

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.

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.

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 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, agriculture, or small business.
- B. Shall have a tower height of 20 meters (65.6 feet) 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 40 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 40 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 setback 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. Greater setbacks are more likely to result in substantive due process challenges.

Commentary: Normal conversation is in the range of 50-65 dB(A). There is more commentary under the Utility Grid section of this document. See the section on noise on page 5.

Commentary: The 2008 guidelines recommend basic standards for sound pressure levels. The updated sample zoning uses 40 dB based on the summary of research done by Chief Medical Officer of Health of Ontario, Canada, Report The Potential Health Impact of Wind Turbines (May 2010) (see page 25). This 40 dB provision was not in the 2008 Guidelines.

Mason County, Michigan may be a good sample zoning ordinance for purposes of noise issues: <http://www.masoncounty.net/departments/zoning/zoning-ordinance.html> . See also the section on noise on page 5.

- 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.

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.

- 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 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).

16.09 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 (65.6 feet) high, and Anemometer Towers over 20 meters (65.6 feet) high shall meet the following standards in addition to the general special use standards (section ? 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.

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:https://www.co.huron.mi.us/building_zoning.asp.

2. Utility Grid Wind Energy System 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;
 - 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, whichever is less; and
 - d. A distance of 2,500 feet from the property line of any parcel which is not receiving compensation for the Utility Grid Wind Energy System or On-site Use Wind Energy System.

Commentary: The property set-back requirement is designed to protect neighbors in the unlikely event of a tower failure, and ice-throw. A setback equal to the tower's height should be adequate, but some communities require 1½ or 2 or 3 times the tower height as the initial setback. For purposes of noise a setback that is 2½ or 3 times tower height might be the initial setback. Greater setbacks based on tower height are more likely to result in substantive due process challenges.

One should also consider setbacks from major natural gas transmission lines and similar transmission lines (oil, untreated gas, etc.). For example see New Hampshire Site Evaluation Committee administrative rules site 301.14(f) in http://www.gencourt.state.nh.us/rules/state_agencies/site100-300.html at <http://www.nhsec.nh.gov/rules/>.

The 2,500 foot setback is designed to insure a distance back from property owners that are not receiving some form of royalty payment because of proximity. The 2,500 foot distance is based on observed distance flicker has an impact. Other governments have large setbacks such as one kilometer (3,281 feet) with European countries. This provision was not in the 2008 Guidelines.

There may also be thought given allowing flicker if it is within the 2,500 foot setback (on property who's owners receive royalty payment because of proximity). Be careful with this approach as some municipal attorneys would say this cannot be done while others are okay with it.

An option to consider for setbacks is to have a Menu approach with a range of options. An example would be 500 Meters (1,640 feet) to 1,000 meters (3,280 feet). A community may be homogenous and in support of the project (such as all farmers and large land holders) and the developers have worked well with landowners (compensation, inclusiveness). In that case the 1,640 foot, or less, setback may be fine. In other areas where the community is diverse in interests, beliefs, reasons for living in a rural area (resources vs. aesthetics) then the 3,280 foot setback may be more appropriate. Depending on the land use patterns and parcel sizes in the area could also make a difference in local policy. In many parts of Europe 500 meters to 1,000 meters is common. Ontario and other states fall within that range as well.

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.
- B. Sound Pressure Level: The sound pressure level shall not exceed 40 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 40 dB(A), the standard shall be ambient dB(A) plus 5 dB(A).

- 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.

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.

E. Pre-Application Permits:

- 1. Utility Infrastructure: Shall comply with Federal Aviation Administration (FAA) requirements, the Michigan Airport Zoning Act (Public Act 23 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:
 - (1) Part 31 Water Resources Protection (M.C.L. 324.3101 *et seq.*),
 - (2) Part 91 Soil Erosion and Sedimentation Control (M.C.L. 324.9101 *et seq.*),
 - (3) Part 301 Inland Lakes and Streams (M.C.L. 324.30101 *et seq.*),
 - (4) Part 303 Wetlands (M.C.L. 324.30301 *et seq.*),
 - (5) Part 323 Shoreland Protection and Management (M.C.L. 324.32301 *et seq.*),
 - (6) Part 325 Great Lakes Submerged Lands (M.C.L. 324.32501 *et seq.*), and
 - (7) 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 ? 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 approved by the Planning Commission. 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.

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.

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.

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.

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. Utility Grid Wind Energy System shall be:
- a. A minimum of 5,400 feet or 20 times the rotor diameter, whichever is less, from a structure designed for human occupancy; or
 - b. The Utility Grid Wind Energy System or shall be turned off (so the rotor(s) are not moving) during the period of time the structure designed for human occupancy experiences shadow flicker; or

Shadow flicker is a shadow that is cast by the spinning wind turbine blades which causes a strobe effect to be cast on a dwelling window or similar structure.

The distance flicker travels is not well documented. In general the farther away the turbine is from a particular observation point the less the duration of the flicker, the less the intensity of the flicker decreases (is more diffuse and so bothers a smaller percentage of people) and the lower the likelihood it is observed because of various obstructions, such as trees, structures, topography, that block it. Atmospheric conditions play a role in the distance flicker travels. Clear, dry weather (sunny day in winter) is when flicker will be most noticeable for longer distances. Haze, humidity, a few wispy clouds diminishes flicker intensity and length of travel.

Frequently quoted industry standards are that there should not be a shadow flicker for more than 30 minutes a day or 30 hours per year. This is based on a German standard (Haugen, International Review; p. 5). The German standard is an astronomical maximum of 30 hours but an actual eight hours maximum of shadow flicker. The astronomical maximum refers to a formula where the sun is always shining, the wind turbines are operating all of the time, the blades are oriented in the correct direction to make shadow flicker, and there are no obstacles (buildings, vegetation, etc.) between the turbine and the structure on which the shadow is cast. After an astronomical maximum is determined, a factor is applied (depending on the location, available sunny days, etc.) to get to an estimated amount of time for shadow flicker (Haugen, International Review; p. 6.).

Technology has advanced since then. Some would argue now the wind industry has the technology to control shadow flicker that it should be held to a much lower number. In Mason County's experience the technology works very well to minimize or eliminate shadow flicker which is limited by ordinance to 10 hours per year. The State of New Hampshire has adopted eight hours (<http://legislature.vermont.gov/assets/Documents/2016/WorkGroups/House%20Natural%20Resources/Bills/S.230/Written%20Comments/S.230-Penny%20Dube-New%20Hampshire%20Wind%20Siting%20Rules-5-6-2016.pdf>).

Flicker can be observed at great distances (one testimonial mentions it as far as 10,000 feet for example in Mason County) but it is faint and brief. Flicker a mile (5,280 feet) away is visible and more noticeable. Flicker more than one mile is not as likely because a direct line of sight (blocked by trees, structures, topology) is likely. It becomes a public policy decision as to what duration of flicker warrants regulation to control it.

Mason County decided to require modeling for flicker for a distance of 20 times the rotor diameter: 2,000 meters (6,561 feet) for a 50 meter (164 foot) blade. Just because a house is modeled to receive flicker does not mean it will be a nuisance. The flicker may occur on a garage or a part of the house that is rarely occupied. Also a house may be modeled to receive flicker, but may not actually receive it due to obstructions.

Mason County adopted a zero flicker policy because (1) it is easier to enforce "is it happening or not" rather than standards based on minutes per day, (2) less burden on landowner, and (3) the wind industry technology to mitigate flicker (turn off turbines when flicker is likely to occur) works really well. This is not advocated or recommended, just one example.

This updated sample zoning uses 5,400 feet (or 20 times rotor diameter [which is 6,561 feet with 164 foot blades], whichever is less) based on actual experience with Mason County. The 5,400 was the farthest distance Mason County documented flicker was observed. One might use the 5,280 feet (one mile) or 6,561 feet. This provision was not in the 2008 Guidelines. A standard of a maximum of shadow flicker lasting no more than 30 hours per year at any given location is found in some German municipalities.

- c. There is screening (forest, other building(s), topography) which shields the structure designed for human occupancy from a direct line of sight to the rotors causing shadow flicker.
 - 4. Decommissioning: A planning 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.
- I. Shadow Flicker: Site plan and other documents and drawings shall show mitigation measures to minimize potential impacts from shadow flicker. On-site Use Wind Energy System shall be:
 - 1. A minimum of 5,400 feet or 20 times the rotor diameter, whichever is less, from a structure designed for human occupancy which is on a different parcel of land; or
 - 2. The Utility Grid Wind Energy System or shall be turned off (so the rotor(s) are not moving) during the period of time the structure designed for human occupancy on a different parcel of land experiences shadow flicker; or
 - 3. There is screening (forest, other building(s), topography) which shields the structure designed for human occupancy on a different parcel of land from a direct line of sight to the rotors causing shadow flicker.

Commentary: There should also be an administrative sytem for periodic review of the decommissioning plan to make sure the amount of performance guarantee and other aspects of the plan are updated. Maybe do this every 3 to 5 years to make sure the decommissioning funds cover costs 20-30 years down the road when it is decommissioned.

See commentary on shadow flicker in side-bar on page [19](#).

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 (65.6 feet) high.
2. Utility Grid Wind Energy System.
3. On-site Use Wind Energy System over 20 meters (65.6 feet) 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.

9408. 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 ?, ?, and ? [Sections on various site plan content requirements_] 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 (65.6 feet) high shall include 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. (This may include a map of sound level isoline and sound levels at parcel boundaries.)
- 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:

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 and not more.

Some communities have an escrow deposit system to cover costs of more involved special use permit reviews, such as utility scale wind energy systems are likely to involve.

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, ISO 9613, ANSI 512.9 part 2, and ANSI 512.9 part 3. 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 90 days of the commercial operation of the project.

This 90 day provision was not in the 2008 Guidelines. Those guidelines had 60 days.

2. A detailed traffic, road modification plan to accommodate delivery of component of the wind energy system along existing and proposed roads and return of those roads and adjacent lands to their original condition after construction.

This detailed traffic, road modification plan provision was not in the 2008 Guidelines.

3. 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. Include sample of construction materials painted or colored so it is finished in a single, non-reflective matte finished color.
4. 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.
5. 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.)

6. 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.
7. A second site plan, which includes all the information found in sections ?, ?, and ? [Sections on various site plan content requirements_] 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.
8. 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.

A summary of Wind Energy Research and Information.

The Michigan Agency for Energy³¹ has more resources on this topic as well as Michigan Wind Energy Resource Maps, U.S. Department of Energy wind maps on Michigan.³²

The 2008 Sample Zoning for Wind Energy Systems,³³ was prepared in zoning amendment format, following guidelines developed by a wind energy work group, Energy Office for the State of Michigan.

Energizing Michigan, MSU's web page on alternative energy³⁴ (and specifically on wind energy³⁵).

This does not list all research on the topics. To be listed here the research must be peer reviewed, published, university based research, or research using university protocols for research, and summary papers of the same, unless noted otherwise.

- Final Report of the Michigan Wind Energy Resource Zone Board, Oct. 15, 2009³⁶
- "Meeting Michigan's 2015 Renewable Portfolio Standard (RPS): Wind Turbines Required and Projected Land Usage"³⁷ (December 2007) by

Soji Adelaja, Yohannes Hailu, John Warbach, Mike Klepinger, Chuck McKeown, Ben Calnin, and Max Fulkerson

- "International Review of Policies and Recommendations for Wind Turbine Setbacks from Residencies: Setbacks, Noise, Shadow Flicker, and other Concerns;" and "Summary of Wind Policies and Recommendations by Country: Companion Summary Chart to "International Review of Policies and Recommendations for Wind Turbine Setbacks from Residences;" Minnesota Department of Commerce: Energy Facility Permitting; (October 19, 2011) by Kathryn M. B. Haugen.³⁸
- "Projected Impacts of Renewable Portfolio Standards on Wind Industry Development in Michigan"³⁹ (December 2007) by Soji Adelaja and Yohannes Hailu
- "Michigan's Offshore Wind Potential"⁴⁰ (October 2008) by Soji Adelaja, and Charles McKeown.
- 2007 Wind Symposium Videos and Presentations⁴¹

³¹<http://www.michigan.gov/energy/>

³²

http://apps2.eere.energy.gov/wind/windexchange/wind_resource_maps.asp?stateab=mi

³³

http://msue.anr.msu.edu/resources/sample_zoning_for_wind_energy_systems

³⁴

http://msue.anr.msu.edu/program/info/msue_wind_power

³⁵

http://msue.anr.msu.edu/program/msue_wind_power/community_wind

³⁶

http://msue.anr.msu.edu/resources/final_report_of_the_michigan_wind_energy_resource_zone_board

³⁷For a copy of this report contact the Land Policy Institute (LPI): charron@landpolicy.msu.edu.. For other LPI energy related materials see (continued...)

³⁷(...continued)

energy related materials see

http://landpolicy.msu.edu/program/info/renewable_energy_policy_program.

³⁸<http://mn.gov/commerce/energyfacilities/#tabs=3>

³⁹For a copy of this report contact the Land Policy Institute (LPI): charron@landpolicy.msu.edu.. For other LPI energy related materials see

http://landpolicy.msu.edu/program/info/renewable_energy_policy_program.

⁴⁰For a copy of this report contact the Land Policy Institute (LPI): charron@landpolicy.msu.edu.. For other LPI energy related materials see

http://landpolicy.msu.edu/program/info/renewable_energy_policy_program.

⁴¹For a copy of this report contact the Land Policy Institute (LPI): charron@landpolicy.msu.edu.. For other LPI energy related materials see

http://landpolicy.msu.edu/program/info/renewable_energy_policy_program.

- West Michigan Wind Assessment, Grand Valley State University⁴² (And further information: larger picture and systems research.⁴³)
- **Health Issues: Generally** (legal requirement to show)
 - Douglas, Joe P. *et al.*; *Strategic Health Impact Assessment on Wind Energy Development in Oregon*; March 2013; Public Health Division of Oregon Health Authority. https://public.health.oregon.gov/Health/Environments/TrackingAssessment/HealthImpactAssessment/Documents/Wind%20Energy%20HIA/Wind%20HIA_Final.pdf
 - Engel, Albert M.; Legal requirements for human-health based appeals of wind energy projects in Ontario;⁴⁴ *Frontiers in Public Health*; 01 December 2014 | doi: 10.3389/fpubh.2014.00248.
- **Health Issues: Noise**
 - Berger, Robert G.; Payam Ashtiani, Christopher A. Ollson, Melissa Whitfield Aslund; "Health-based audible noise guidelines account for infrasound and low-frequency noise produced by wind turbines";⁴⁵ *Frontiers in Public Health*; published: 24 February 2015 doi: 10.3389/fpubh.2015.00031
 - Chief Medical Officer of Health of Ontario, Canada, Report The Potential Health Impact of Wind Turbines⁴⁶ (May 2010) (A relatively complete overview of noise studies, to date.)

- "Wind Power and Human Health, Flicker, Noise, and Air quality" West Michigan Wind Assessment Issue Brief #2; Grand Valley State University's West Michigan Wind Assessment⁴⁷ (Sea Grant, Michigan⁴⁸)
- Wind Turbine Sound and Health Effects: An Expert Panel Review,⁴⁹ December 2009
- Wind Turbine Noise and Health Study: Summary of Results;⁵⁰ *Environmental and Workplace Health*, Health Canada/Sante Canada; November 6, 2014.
- Article from *Audiology Today* "Wind-turbine Noise, what audiologists should know"⁵¹ by MSU's Jerry Punch and others (July-August 2010) [Not peer reviewed research]
- Recommended Update of *Sample Zoning for Wind Energy Systems*⁵² is a paper prepared by William MacMillan, Electrical Engineer (Ret.), Consumers Energy; Jerry Punch, Professor of Audiology, Department of Communicative Sciences and Disorders, Michigan State University;

⁴²<http://gvsu.edu/wind/>

⁴³<http://www.gvsu.edu/wind/project-documents-3.htm>

⁴⁴<http://journal.frontiersin.org/Journal/10.3389/fpubh.2014.00248/full>

⁴⁵<http://journal.frontiersin.org/article/10.3389/fpubh.2015.00031/abstract>

⁴⁶<http://health.gov.on.ca/en/common/ministry/publications/report>
(continued...)

⁴⁶(...continued)

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⁴⁷<http://www.gvsu.edu/wind/>

⁴⁸<http://www.miseagrant.umich.edu/>

⁴⁹http://msue.anr.msu.edu/resources/wind_turbine_sound_and_health_effects_an_expert_panel_review_or
<http://www.awea.org/Resources/Content.aspx?ItemNumber=4627>

⁵⁰<http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php>

⁵¹<http://www.windturbinesyndrome.com/img/WindTurbineNoise.pdf>

⁵²<http://www.oem.msu.edu/windandhealth.aspx>

and Kenneth Rosenman, Chief, Division of Occupational and Environmental Medicine, Michigan State University. (The report Recommended Update of Sample Zoning for Wind Energy Systems, is a position paper reflecting opinion, and is not university-based peer-reviewed research. The authors were part of the Michigan Wind Working group, health technical workgroup/subcommittee, (a mix of industry, local government, environmental, health specialists). These subcommittees were formed to discuss potential revisions to the state wind energy zoning guidelines. The technical workgroup were disbanded after the state energy office and the Michigan Public Service Commission (MPSC) reviewed activity. Since there was no legislative authorization for the activity, the state departments withdrew their participation in the work group. With no state involvement the state guidelines could not be updated. There will be no report or recommendations from the workgroup. There are a number of recommendations in this report which are not legal under Michigan zoning law, such as but not limited to property owner waiver of setbacks; property owner waiver of noise limits, shadow flicker (or any zoning regulation); requirements for "good neighbor payments"; and use of community dispute resolution in the process of adopting zoning amendments.)

- **Impacts of Wind Energy on property values:**
 - Summary of Property value studies by Dr. Ben Hoen PDF of a PowerPoint.⁵³
 - Summary of a number of property value studies⁵⁴ by Dr. Ben Hoen, U.S. Department of Energy's Lawrence Berkeley National Laboratory.
 - Update (August 2013) Hoen's property value studies: *A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States*⁵⁵ by Ben Hoen and others; Lawrence Berkeley National Laboratory.
 - The Impact of Wind Power Projects on Residential Property Values in the United

⁵³http://msue.anr.msu.edu/resources/the_impact_of_wind_power_projects_on_residential_property_values_in_the_uni

⁵⁴<http://www.escholarship.org/uc/search?creator=Hoen,%20Ben>

⁵⁵<http://www.escholarship.org/uc/item/5gx7k135>

States: A Multi-Site Hedonic Analysis;⁵⁶ Ben Hoen, Ryan Wiser, Peter Cappers, Mark Thayer, and Gautam Sethi; Environmental Energy Technologies Division December 2009

- Various studies from the national board of realtors. Their library has a page devoted to this topic.⁵⁷
- Vyn, Richard J. and Ryan M. McCullough; "The Effects of Wind Turbines on Property Values in Ontario: Does Public Perception Match Empirical Evidence?"⁵⁸ *Canadian Journal of Agricultural Economics/Revue Canadienne D'Agroeconomie*; Vol. 62, Issue 3, pages 365-392, September 2014; on line January 23, 2014.
- A March 19, 2014 webinar transcript⁵⁹ covering some of the arguments on property values research methodology.
- **Impacts on avians (bird, flying animal):**
 - *Turbine Interactions with Wildlife and their Habitats: A Summary of Research Results and Priority Questions*,⁶⁰ summary of research as of January 2014; National Wind Coordinating Collaborative⁶¹
 - U.S. Fish and Wildlife Service⁶² Land-Based Wind Energy Guidelines⁶³

⁵⁶<http://escholarship.org/uc/item/5gx7k135>

⁵⁷<http://www.realtor.org/field-guides/field-guide-to-wind-farms-their-effect-on-property-values>

⁵⁸<http://onlinelibrary.wiley.com/doi/10.1111/cjag.12030/abstract>

⁵⁹

http://apps2.eere.energy.gov/wind/windexchange/pdfs/workshops/2014/webinar_wind_turbine_property_prices.pdf

⁶⁰<http://awwi.org/wp-content/uploads/2014/05/AWWI-Wind-Wildlife-Interactions-Factsheet-05-27-14.pdf>

⁶¹<http://nationalwind.org/research/publications/>

⁶²<http://www.fws.gov/windenergy/>

⁶³https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf

- U.S. Fish and Wildlife Service⁶⁴ *Metrics and Methods Tools For Assessing Impacts to Birds and Bats And Addressing Episodic Mortality Events*,⁶⁵ a world-wide listing of source materials.
- **Why some wind energy projects are controversial, and others are not**
 - Not all proposed large wind energy farms are controversial and there may be reasons why: Part one⁶⁶
 - Strategies to reach consensus on controversial wind energy farms: Part two⁶⁷
 - “Utility Scale Renewable Energy Development – Project Siting & Conflict Resolution” webinar December 5, 2013. PowerPoint.⁶⁸ The webinar was sponsored by the North Central Regional Center for Rural Development⁶⁹ (at this NCRCD archive of training programs⁷⁰). Peggy Kirk Hall, J.D., and Assistant Professor at The Ohio State University.
- A series of fact sheets on **perceptions of the impact of wind energy generation in coastal communities** was just completed by MSU’s Land Policy Institute. The series in in response to the idea that windy, coastal communities will face pressure to develop

wind farms now and for many years to come. The purpose of the fact sheets is to help understand the complex dynamics between communities, policy and the public.

- Community Views⁷¹ - This fact sheet examines how the respondents feel about their community, and potential changes to it, as related to wind energy development.
- Energy Policy Priorities⁷² - This fact sheet summarizes what coastal residents say are their policy priorities, and identifies the types of energy infrastructure and associated policy incentives that policy makers should be examining.
- Regulation Issues⁷³ - This fact sheet explores what survey respondents say about who should regulate wind energy and how confident they feel in various aspects of the planning, zoning and regulatory process.
- Trust and Fairness Issues⁷⁴ - This fact sheet reviews the opinions of the survey respondents in regards to trust, fairness and exploitation in relation to the development of commercial wind energy.
- Impact Perceptions⁷⁵ - This fact sheet addresses the potential impacts of wind development on a community and examines the level of knowledge survey respondents say they have about renewable energy and wind energy development.

⁶⁴<http://www.fws.gov/windenergy/>

⁶⁵https://www.fws.gov/ecological-services/es-library/pdfs/worldwide_wind_guidelines.pdf

⁶⁶http://msue.anr.msu.edu/news/not_all_proposed_large_wind_energy_farms_are_controversial_and_there_may_be

⁶⁷http://msue.anr.msu.edu/news/strategies_to_reach_consensus_on_controversial_wind_energy_farms_part_two

⁶⁸http://expeng.anr.msu.edu/uploads/files/133/Romic_h%20Final.pptx

⁶⁹<http://ncrcrd.msu.edu/>

⁷⁰http://ncrcrd.msu.edu/ncrcrd/chronological_archive

⁷¹http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communities

⁷²http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communities

⁷³http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communities

⁷⁴http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communities

⁷⁵http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communities

- Project Overview⁷⁶ - This fact sheet provides an overview of the project and survey results, plus reviews methods used in the study.
- **Sample zoning regulation and administration.**
 - Sample Zoning for Wind Energy Systems,⁷⁷ April 16, 2008 Energy Office of the Michigan Department of Labor &

Economic Growth (maybe modify this sample zoning to include a 40 dBA sound standard (see above), and a to include a setback from unitized lease boundary which is greater than a property line setback.

- Mason County website⁷⁸ on its wind energy zoning and administration. Good example of noise and flicker ordinance provisions and follow up administration.

⁷⁶http://msue.anr.msu.edu/resources/perceptions_of_the_impact_of_wind_energy_generation_in_coastal_communi4

⁷⁷http://msue.anr.msu.edu/resources/sample_zoning_for_wind_energy_systems

⁷⁸<http://www.masoncounty.net/departments/zoning/la-ke-winds-energy-park.html>