



Understanding Wind Initiative

DRAFT REPORT

Responses to Submitted Questions

Prepared by

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About the Understanding Wind Initiative

The Understanding Wind Energy Initiative is led by a team representing six townships in Manistee and Benzie counties to facilitate community learning and education about wind energy options. The Initiative aims to guide township plans and wind ordinances so that they reflect community goals and scientific research.

The leadership team for the Initiative includes representatives from Arcadia, Onekama, Bear Lake and Pleasanton Townships in Manistee County and Blaine and Joyfield Townships in Benzie County. The Initiative has evolved to encompass three phases, guided by a Macalester College research team:

1. a Wind Energy Symposium held on July 6 involving a representative sample of local citizens;
2. a Wind Energy Community Survey mailed to all property owners in participating townships; and
3. Responses to over 20 pages of questions about wind energy submitted by a large number of residents and other interests.

Macalester College was selected as a lead consultant for the project by the Leadership Team as a result of a recommendation from the Michigan Association of Planning. The Alliance for Economic Success (AES) was the coordinating agency for the Initiative.

Introduction

This report provides responses to questions that were generated at public forums and through written/online submissions in the Spring 2011. Members of the public were invited to attend four forums held in Benzie and Manistee Counties and to submit questions at the forums or through email, fax, or mail. The notice for the forums was sent through the AES email blast, and was also picked up by the local papers. A number of organizations have identified themselves as stakeholders for the project. Many of those organizations sent out notices electronically to their email lists.

All questions were taken straight from the source word for word. In total, close to 100 different participants attended the forums, of which about 1/3 submitted some form of a question. About 60 individuals submitted various numbers of questions by email.

The questions submitted at the forums were recorded by either Cyndy Fuller or Tim Ervin from the AES. The questions were compiled by AES staff and the completed notes and questions were sent to all of the forum participants through email to make sure the questions and ideas were being conveyed correctly and adjusted the questions as the participants saw fit. Of all the questions sent to the participants, only a handful of questions were adjusted. The questions were then thematically categorized by AES staff.

The Macalester College research team received the categorized questions in June 2011. In total there were 468 questions submitted across 38 categories. The questions were coded, with a subset of questions tagged as “comments” rather than questions. The research team had limited time and resources for this project. As a result, general questions about local governance, energy production or energy economics may have been also tagged as “beyond scope of this project”. Any questions about the Gail Wind Project or Duke Energy were coded as “project specific” and have not been addressed because of the stated scope of the Understanding Wind Initiative. Please see the rationale on the following page for other codes.

The research team found extensive published sources and gray literature (unpublished reports and presentations) on wind energy. The research team was able to access this literature to provide basic, and regionally appropriate, responses to a majority of the questions. Whenever possible, a link or citation is provided to the original study. The team also consulted a range of experts to provide additional competent, responsible expertise without any conflict of interest involving companies that are proposing wind energy developments within the project area. Most of these experts responded to single questions and provided pro bono consultation. The Macalester team received the expert replies and inserted them into this report. A few individuals were provided a small stipend for their assistance. The local governance questions were addressed by a research team from the firm Beckett & Raeder and Olson, Bzdok & Howard, P.C. References to particular legal precedents are not included in this report but are available upon request by contacting AES. The final report was approved by the Understanding Wind Initiative Leadership Team.

This report is broken down into the topical categories assigned by AES staff. The research team took great care in preserving the original questions, and they appear at the beginning of each thematic section. The questions are then traceable by following the letter codes and question numbers assigned.

Lastly, there is a great deal of ongoing research about wind energy’s social, environmental and economic impacts. The information provided here is based on available information at the end of August 2011.

Theme Letter Codes

| | |
|--------------------------------------|--|
| A: Sound | U: Height |
| B: Wildlife | V: Viewshed |
| C: Health and Safety | W: Costs of Wind Energy |
| D: Township Governance | X: Social Impacts |
| E: Wind Energy Companies | Y: Oil/Gas Industry |
| F: Setbacks | Z: Michigan Renewable Energy Mandate |
| G: Property Leases | AA: Energy Efficiency |
| H: Environmental Impacts | BB: Property Rights |
| I: Maintenance and Maintenance Costs | CC: Tax Issues |
| J: Tourism | DD: Turbine Location and Placement |
| K: Property Value | EE: Wind Energy Production |
| L: Alternative Forms of Energy | FF: Conflict Resolution |
| M: Decommissioning | GG: Bonds |
| N: Economic Impact | HH: Questions on the Experts |
| O: Job Creation/Impact | II: Construction Issues |
| P: Energy Conservation | JJ: Duke and Gail Wind Specific |
| Q: Energy Grid | KK: Township Financial and Legal Protections |
| R: Zoning | LL: Miscellaneous |
| S: Efficiency | |
| T: Subsidies/Tax Incentives | |

Coding Rationale:

“See response below” —Question has been answered in the “Questions and Responses” section.

“Project specific” —Question relates directly to the Gail Wind Project or Duke Energy. The Initiative is not focused on the Duke Energy project and the research team has had no communication with Duke Energy so is unqualified to answer these types of questions. Similarly, questions about what “will” happen before/after the Gail Wind Project are outside the scope of this project.

“Value judgment” —Question asks the expert or responder to make a moral judgment about wind energy. In addition, questions about what is “fair” or what “should” happen related to wind energy in a township are not answerable by this research team.

“Comment not question” —Question may be phrased in the form of a question but is making a statement that reflects personal opinion. The question may demonstrate considerable research on the topic and present evidence that supports the opinion being presented.

“Needs further clarification” —Question is not phrased in a way that the research team can understand or makes reference to facts that the research team cannot know without knowing the identity of the respondent. For example, questions such as “Will I be able to hear the turbines from my house?”.

“Answer pending” – Question has been referred to an expert and the response is still pending

“See response to question ___” — A similar question has been asked elsewhere

“Beyond scope of this project” —Question is extremely broad in scope and cannot be answered within the context of this project.

Original Questions:

1. Noise issues—will they be addressed? *See responses to questions A4, A5 and A6.*
2. How loud will it be? *See responses to questions A4, A5 and A6.*
3. Will I be able to hear it? *See responses to questions A4, A5 and A6.*
4. Can you describe the sound the turbines make? *See response below.*
5. What does the turbines sound like from approximately 1400 feet away? 1000 feet? 1/2 mile? Is there an accurate recording? *See response below.*
6. What do the turbines sound like when it interacts with a home or building? Are there recordings from inside a house at a specific distance? *See response below.*
7. Describe how the pitch of the turbine blade affects the noise emitted from the turbines? *See response below.*
8. Does ice on the turbine blades affect the sound? *See response below.*
9. Are the people who will live near these windmills aware that there is considerable and constant noise associated with the spinning of the blades? Do they know that huge, heavy chunks of ice fall from the blades in the winter? *Comment not question.*
10. Can you hear turbine sounds from inside a home? *See response to question A6.*
11. People who live near the Mackinaw City wind turbines complain about the noise they make and they cannot sleep. I have stood near them and a couple of blocks away and cannot hear anything except swishing sounds. What sounds do they make that are bothering people? *See response below.*
12. Are noise ordinances that are in place considered for the noise factor these turbines create? What is the decibel they will be running at? *Project specific, but see responses to questions A4, A5 and A6.*
13. Are we allowed to enact a noise ordinance that covers all industry? *See response below.*
14. Can we require that an industrial wind turbine project does not raise our daytime and/or nighttime ambient levels of sound in our ordinance? *See response below.*
15. Should a noise limit in an ordinance set two limits, night time and day time? What are the recommended dB (A) limits to not disturb non-participating residents? *See response below.*
16. Has the State of Michigan recommended ordinance limits on sound pressure levels related to wind turbines? Have any Michigan universities made recommendations? What are those recommendations? *See response below.*
17. Can the community/township regulate noise produced by a turbine be kept at current ambient noise levels at the property line of the lease unit or non-participating lot line? *See responses to questions A13, A14, A15 and A16.*
18. Duke has said they will not exceed 45dB (A) at the outside of a home. The World Health Organization night time sound study provides the relative levels of disturbance of night time sound stating sleep disturbance can be measured at sound levels around 35dB (A). As sound get louder the disturbance gets greater. If people want to sit out and enjoy an evening on the deck during the summer they should not have to be disturbed by sounds from the wind turbines. Should the night time noise standard in an ordinance be not to exceed 30dB (A) at the property line of the participating property owner? This would protect the residents from unnatural sounds and not degrade their quality of life. *Comment not question. The World Health Organization “Night Noise Guidelines for Europe” document can be found at: http://www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf.*
19. Is the sound coming from wind turbine be considered nuisance noise if the sound goes beyond the participating property line and interferes with the sleep and enjoyment of a not participating land owner? *See response to question D13 and V5.*
20. Duke has said they will not exceed 45dB (A) at the outside of a home. Why shouldn't the sound limits be at the property line of the participating property owner rather than at a house of a neighbor (or of a non-participating

resident)? **Comment not question. Township governments are able to create ordinances that require different noise limits outside of homes or at property lines and many townships have created such ordinances.**

21. If there are multiple towers within earshot of homes, is the combined decibel level of these towers less than or greater than decibel levels that are damaging and not merely disturbing. **See response below.**
22. Is there evidence of hearing damage directly caused by proximity to wind turbines? I don't mean correlational evidence – where wind sound is measured and hearing damage is imputed to people living or working in proximity to wind turbines. Same question for infrasound? **See response below.**
23. Vestas, the manufacturer you are considering using, recommends governments supplement relative noise limits with a low absolute maximum limit in the areas of very low background noise (i.e. countryside). Most countryside dB (A) levels are 25-30. Will you be adhering to the manufacturer's recommendations? **Project specific.**
24. Technology on wind turbines, including analysis of sound frequency—do they produce low-frequency sound? **See response below.**
25. Some wind energy companies say that the new upwind generators produce no infrasound (low-frequency sound). There are many acoustical engineers (Rick James) who state there is low-frequency sound from the large (1.8-2.5 MW) upwind generators. Who is correct? If there is no infrasound (low-frequency sound)? Should the township ordinances include a low-frequency sound limit of zero? **See response below.**
26. Is there evidence of technological changes in wind turbine design that can mitigate the sound emitted from the turbines? **See response below.**
27. Are you able to identify any original, follow-up, legitimately scientific research on “wind turbine noise syndrome” other than articles that simply quote Nina Pierpont's work and assume that it is either true or probably true? **See response below.**
28. What test methodologies are used for verifying compliance with sound limits? **See response below.**
29. Why can wind energy be placed anywhere in any zoning district without regard to noise generation and height restrictions? Wind turbines can in fact be regulated. **See response below.**
30. Are there any zoning ordinances anywhere that require there be no more than 40 dB of noise from a proposed project (any project—roads, factories, shopping centers, nightclubs, farms, etc....not just wind), at a property owner's property line? Would, in your opinion, such a requirement be enforceable, or would it amount to exclusionary zoning? **See response below.**
31. What are the current zoning restrictions on sound for other land uses in Benzie and Manistee Counties (i.e. oil & gas, farming, manufacturing, highways, railroads, shipping centers, etc.), and what sound levels can be expected from these uses? **See response below to A15 and A16.**
32. What is turbine whistle? **See response below.**
33. What causes that high pitch whistling? Is this a mechanical problem or just the sound turbines make? **See response to question A32.**
34. Is there a sound difference between different topographies? **See response below.**
35. If wind generators are located on a ridge will the sound (audible and low-frequency) travel further than sound traveling on flat land (fields)? **See response to question A34.**
36. Is the sound from one tower audible from another tower? **See response below.**
37. If sound limits are set too stringently, could they effectively preclude utility-scale wind farm development in Benzie and Manistee Counties? **See response below.**
38. What are the noise level comparisons of windmill construction and producing into the power grid with oil/gas well construction and producing into the grid? **See response below.**
39. What is the noise level of an operating 500 foot windmill compared to an oil/gas compressor facility? **See response to question A38.**

40. In Blaine Township there are areas zoned residential or are predominately residential. What should be the setback from the residential areas so residents are not impacted by noise, both audible and low-frequency? **See response below.**
41. What wind farm design and ambient factors other than setback can minimize the sound level at a receptor? **See response below.**

Questions and Responses:

These questions may have been re-categorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

***For more resources on the affects of wind turbine sound, see response to question C31 ***

A4. Can you describe the sound the turbines make?

Response: The sound from wind turbines comes from two different sources: the mechanical sound of the gears inside the nacelle and the aerodynamic sound of the blades moving through the air. The first type of sound, from the mechanical part of the turbine, is a constant hum that does not vary in strength or pitch. The second type of sound is the periodic “swoosh, swoosh” of the turbine blades spinning in front of the tower of the wind turbine. The sound gets louder as each blade passes in front of the turbine tower.

For more information, refer to:

- Environmental Impacts of Wind Energy Projects section on noise, which gives more detail about the level and type of noise that wind turbines produces:
http://books.nap.edu/openbook.php?record_id=11935&page=157
- Grand Valley State University’s Wind Brief #2, which describes the potential noise and health effects of wind turbines: <http://www.gvsu.edu/wind/project-documents-3.htm>

A5. What does the turbines sound like from approximately 1400 feet away? 1000 feet? 1/2 mile? Is there an accurate recording?

Response: The sound that a wind turbine makes will be about the same regardless of one’s distance away from it, but the loudness of that sound will change. Scientists measure the loudness of sound in decibels (dB) and pitch of the sound in hertz (Hz). For example, the keys on the left side of the piano can be played loudly (high dB) or softly (low dB) but will always be low in pitch (low Hz).

Due to limitations in recording and stereo equipment, the research team was unable to find a verifiable account of a wind turbine recording at specified distances. However, interested readers can find many amateur home recordings on youtube.com and other websites, but the accuracy of distance from turbine and quality of the recording equipment (which may either mask or accentuate wind turbine noise) cannot be verified.

The graphic below shows how the sound of a 2.5 MW turbine decreases as the listener moves farther away from the base of the turbine. The relationship between loudness and distance depicted below is based on the assumption that the terrain is completely flat. Trees, hills, valleys and other topographical features can either block or funnel sound in different ways. Acoustical engineers are able to test and calculate how topography will affect sound created by wind turbines. See response to question A34 for more about sound and topography.

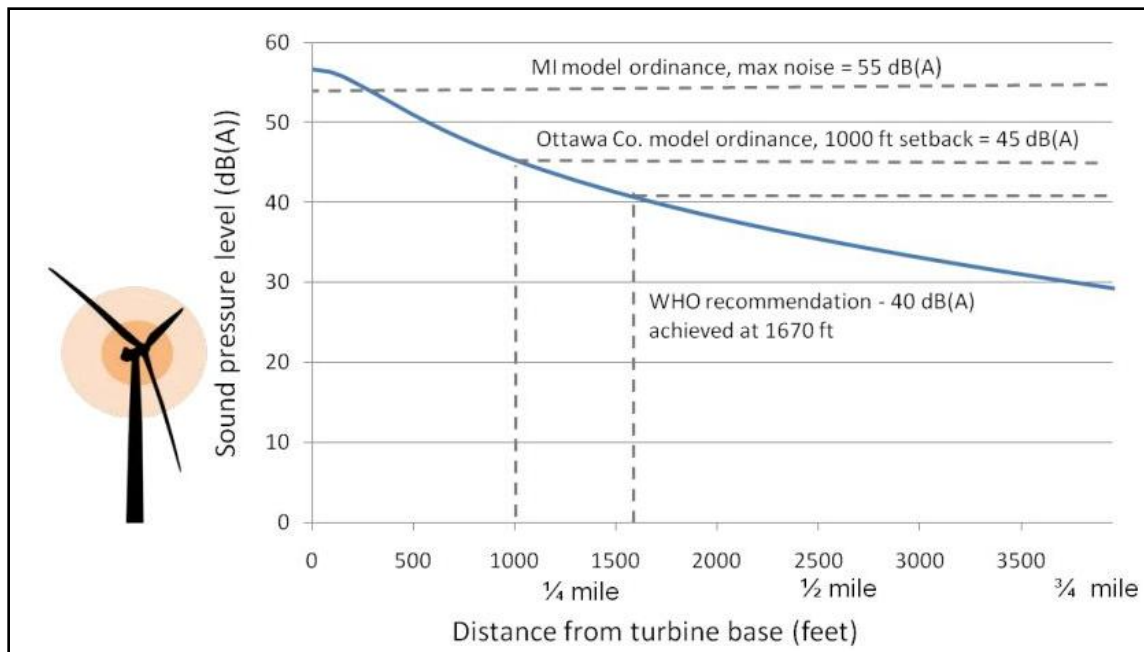


Image credit: Wind Issue Brief #2, West Michigan Wind Assessment, Grand Valley State University.

For more information, go to the University of South Wales' explanation of decibels, online at <http://www.animations.physics.unsw.edu.au/jw/dB.htm>

- A6. What do the turbines sound like when it interacts with a home or building? Are there recordings from inside a house at a specific distance?

Response: The level of noise within a home will vary significantly depending on the proximity of the house to the nearest turbines, the direction of prevailing winds and whether the house is upwind or downwind of the turbine, the architecture of the house, and the topography surrounding the house, including the presence of trees, hills or other structures between the house and turbine. Acoustical engineers are able to model the effects of these factors on the level of noise within a house. Such modeling may be required as part of an environmental impact assessment or requested for from the developer.

- A7. Describe how the pitch of the turbine blade affects the noise emitted from the turbines?

Response: The "pitch" of the turbine blade is its angle relative to the direction of the wind. Modern wind turbines are designed to adjust the pitch of the blades to capture the most wind energy at any given wind speed, "cut-in" or "cut-out" (see questions C21 and C22) at certain wind speeds and sometimes to minimize sound produced by the turbine by slowing down the blades. If a mechanical problem causes the incorrect adjustment of the pitch of the blades, this could create extra turbulence, as well as decrease the turbines efficiency, and cause sound at annoyance levels.

- A8. Does ice on the turbine blades affect the sound?

Response: Ice that forms on wind turbine blades often falls off relatively quickly after the turbine begins to operate (the blades begin to spin), and is unlikely to cause a significant change in the type and level of sound caused by a wind turbine. Blade features that are designed to keep ice from forming on the blades and create additional turbulence could increase the level of noise emitted by a turbine, although these design features are uncommon.

A11. People who live near the Mackinaw City wind turbines complain about the noise they make and they cannot sleep. I have stood near them and a couple of blocks away and cannot hear anything except swishing sounds. What sounds do they make that are bothering people?

Response: Wind turbine noise is a very controversial topic, and researchers are just beginning to investigate potential health impacts. Modern wind turbine designs have greatly reduced the sound produced by wind turbines. Older models produced low-frequency sound and smaller turbines have blades that spin faster so they create more noise.

Some residents who live near wind turbines find the swooshing sound of the blades irritating. Others claim that the low-frequency sound emitted has health implications. Research about wind turbine noise is further complicated by the fact that a substantial majority of people who live near wind turbines are not bothered by it. There may be a subset of individuals who are more sensitive to wind turbines due to pre-existing conditions. As a result, residents can be impacted differently by the same type and size of wind turbines.

Recent research further suggests that people's general opinion about wind energy affects whether or not they find the noise produced by wind turbines annoying (For more information on one Swedish psychological study with a small sample size see: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078467/>).

There is a need for further research to fully understand the basis for complaints about wind turbine noise.

For a summary of existing research on wind turbine noise, see the Acoustic Ecology Institute's "Wind Farm Noise: 2009 in Review": http://www.acousticecology.org/docs/AEI_WindFarmNoise_2009inReview.pdf

A13. Are we allowed to enact a noise ordinance that covers all industry?

Response: In Michigan, a township can enact a noise ordinance that impacts all applications/proposals in that same township. Townships that come together to create a joint master plan may impact developers operating in more than one township. See response to question D1 about ordinance formation.

A14. Can we require that an industrial wind turbine project does not raise our daytime and/or nighttime ambient levels of sound in our ordinance?

Response: Because the State of Michigan has not issued legislation governing the siting of utility scale wind farms, local governments have flexibility in creating wind energy ordinances. Townships and rural municipalities have created ordinances that have different nighttime and daytime noise limits. A wind developer may also obtain noise, light and shadow licker easements from nearby residents and property owners.

The Michigan Public Service Commission's sample wind zoning ordinance uses a sound pressure level not to exceed 55 dB, or ambient noise plus 5 dB, whichever is greater. The 55 dB level is endorsed by the U.S. Environmental Protection Agency and World Health Organization. EPA notes that typical sound level reduction in buildings in cold climates is 17 dB with windows open and 27 dB with windows closed.

A Michigan State University study recently recommended that the State of Michigan update the noise provision to 40 dB during evening hours. The basis for their recommendation can be found at: <http://www.oem.msu.edu/userfiles/file/Resources/WindandHealthReport.pdf>.

Both the MPSC recommendation and the MSU professors' recommendation appear legally defensible.

A15. Should a noise limit in an ordinance set two limits, night time and day time? What are the recommended dB (A) limits to not disturb non-participating residents?

Response: See response to questions A14 and A16.

In Michigan, township boards control local noise restrictions. Many states, counties, towns and townships have created ordinances that have lower nighttime noise limits. The World Health Organization (WHO)

recommends an average yearly nighttime decibel level of 40dB. The WHO report can be found at: http://www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf.

A16. Has the State of Michigan recommended ordinance limits on sound pressure levels related to wind turbines? Have any Michigan universities made recommendations? What are those recommendations?

Response: The State of Michigan issued siting guidelines for wind energy systems in 2005 that recommended that a decibel (dB) level of 55 dB should not be exceeded for more than three minutes of every hour measured at the property line. The Environmental Protection Agency recommends an indoor noise level of 45 dB and has special provisions for specific locations like hospital and schools. To complicate matters, most local governments have vaguely defined noise limits that do not make reference to a decibel level or time limits for noise.

In January 2010 the Michigan Public Service Commission chose to leave all wind turbine noise limiting authority to local governments. Chairman Orjiakor Isiogu stated, "We are recommending that decisions about appropriate setback distances and noise levels continue to be made by local planning and zoning authorities at this time. No evidence was presented to the Commission that suggests a one-size-fits-all approach would work for the entire state."

However, a recent 2011 study by MSU researchers has urged lowering acceptable noise levels to 40 dB, after concluding that there could be potential health risks with the lower frequency noise created by utility scale wind turbines. Ken Rosenman, chief of the division of occupational and environmental medicine at Michigan State University, said in a statement announcing the report that "A level of 55 decibels or higher presents unacceptable health risks. We strongly recommend the state of Michigan consider our recommendations in revising its 2008 guideline on the placement of onshore wind turbines."

For more information about sound limit recommendations, see:

- State of Michigan Siting Guidelines for Wind Energy Systems: http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf
- Michigan Public Service Commission and Department of Energy, Labor and Economic Growth report on noise setbacks: http://www.michigan.gov/documents/mpsc/werzb_rpt_01-2010_309001_7.pdf
- The 2011 MSU report: <http://www.oem.msu.edu/userfiles/file/Resources/WindandHealthReport.pdf>

A21. If there are multiple towers within earshot of homes, is the combined decibel level of these towers less than or greater than decibel levels that are damaging and not merely disturbing?

Response: When two or more turbines can be heard from a house, the combined decibel level (see response A5 for more on decibels) of the two turbines cannot simply be added together. For example, if a person is standing 1000 feet to the left of a turbine creating 40 dB of sound and 1000 feet to the right of another turbine generating 40dB, the person will not hear an 80dB sound. In this case the person would hear 43dB of sound. Multiple wind turbines near a home will impact overall noise levels, but will not be significantly louder than one turbine.

Acoustical engineers are able to model more precisely the effects of multiple turbines on the level of noise within a house. Such modeling may be required through a project's environmental impact assessment or be requested of from developers.

Grand Valley State University's Wind Brief #2 describes the potential noise and health impacts of wind turbines: <http://www.gvsu.edu/wind/project-documents-3.htm>

A22. Is there evidence of hearing damage directly caused by proximity to wind turbines? I don't mean correlational evidence – where wind sound is measured and hearing damage is imputed to people living or working in proximity to wind turbines. Same question for infrasound?

Response: There is no evidence that wind turbines create noise that causes hearing damage. As shown in the image below, even when the listener is standing very close to a wind turbine they will still not be at risk for hearing loss.

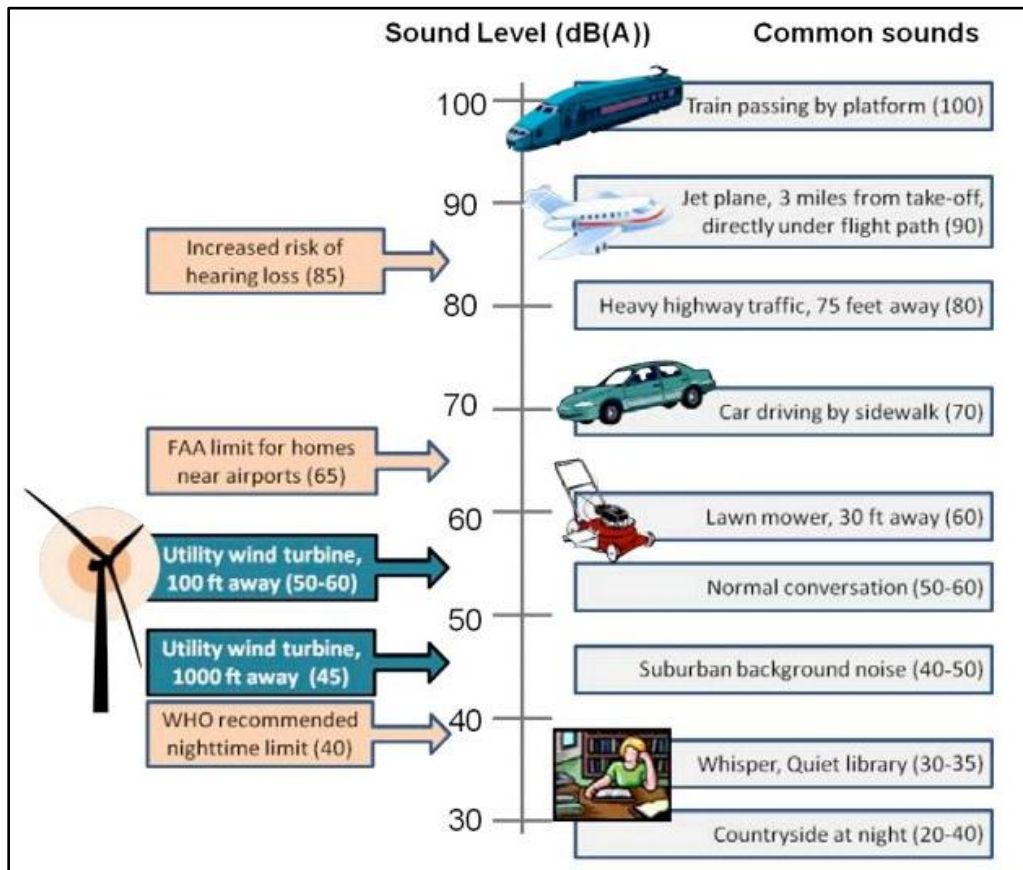


Image credit: Wind Issue Brief #2, West Michigan Wind Assessment, Grand Valley State University.

A24. Technology on wind turbines, including analysis of sound frequency—do they produce low-frequency sound?

Response: The terms “low-frequency” and “infrasound” come up often in discussions about wind turbine noise. These terms refer to the pitch, measured in hertz (see question A5), of the sound created. “Low-frequency” refers to sounds below 100 Hz, and “infrasound” refers to inaudible sound vibrations below 16 to 20 Hz. For comparison, middle C on the piano registers about 260 Hz, the lowest key on the piano registers 28 Hz. Humans can usually sense with other parts of their bodies sound frequencies from 4 Hz to 16 Hz. There is variability between individuals in their ability to perceive low-frequency sound and infrasound, but these are the thresholds for the majority of humans.

Humans typically report annoyance, anxiety and sleep disturbance from low-frequency sound or infrasound when the sound vibrations are very powerful, for example, when the sound pressure is greater than 70 decibels (see question A5 for more on decibels (dB)). There is variability between individuals in their ability to perceive low-frequency sound and infrasound. There is evidence in animal studies that sustained, very powerful infrasound can damage health, but there is no scientific evidence that infrasound at very low sound pressure levels causes psychological or health damage in humans. This does not mean that infrasound can never have negative health impacts on humans in certain cases.

Wind turbines generate both audible sound and infrasound. The audible sound of the “swoosh, swoosh” is a high frequency sound that most people associate with wind turbines. Especially at high wind speeds, low-frequency sound becomes easier to perceive. However, low-frequency infrasound from wind turbines typically does not exceed 50 dB even at close proximity. While the balance of evidence suggests that low-frequency sound from wind turbines does not harm humans, more research needs to be conducted to fully understand the issue.

Also see response below to question A27.

For more information, go to:

- Minnesota Department of Health report of Public Health Effects of Wind Turbines, pg 10,15-18, which gives more information about sound created by wind turbines and its affect on humans: <http://www.energyfacilities.puc.state.mn.us.com/resource.html?id=24519>
- World Health Organization’s “Night Noise Guideline Report,” which suggests a nighttime noise limit of 40 dB: www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf
- Grand Valley State University’s Wind Brief #2, which describes the potential noise and health affects of wind turbines: www.gvsu.edu/wind/project-documents-3.htm

A25. Some wind energy companies say that the new upwind generators produce no infrasound (low-frequency sound). There are many acoustical engineers (Rick James) who state there is low-frequency sound from the large (1.8-2.5 MW) upwind generators. Who is correct? If there is no infrasound (low-frequency sound) should the township ordinances include a low-frequency sound limit of zero?

Response: See response to questions A14, A16 and A24. The peer-reviewed academic literature suggests that the infrasound created by large wind turbines is negligible, but there have been reported cases of infrasound measured across greater-than-expected distances. The acoustical engineering community has not reached a consensus on this issue and more research is currently being undertaken to better understand it. The Acoustic Ecology Institute (AEI) attempts to realistically portray the emerging science behind the noise created by wind farms. For more information about infrasound, see AEI’s 2011 report on Wind Turbine Noise: www.acousticecology.org/wind/winddocs/AEI_WindFarmNoise2011.pdf.

A26. Is there evidence of technological changes in wind turbine design that can mitigate the sound emitted from the turbines?

Response: Yes. Nearly all modern utility turbines have designs that minimize noise. In the past, the wind turbines had downwind rotors and un-insulated nacelles, which resulted in louder noise. Today, all large turbines in the U.S. have upwind rotors, variable pitch (See question A7) and insulation in their nacelles and many can vary their rotational speed. Because the blades of large turbines spin more slowly than smaller turbines, large turbines create less noise than smaller ones. In the US, all wind turbine manufacturers must measure and report turbine sounds following standards set by the International Electrotechnical Commission, which must include sound pressure levels and dominant frequencies, including “turbine whistle” (more on turbine whistle in question A32) for any turbine model. Specific measurements for infrasound are optional. For more information, see: Grand Valley State University’s Wind Brief #2, which describes the potential noise and health impacts of wind turbines: www.gvsu.edu/wind/project-documents-3.htm.

A27. Are you able to identify any original, follow-up, legitimately scientific research on “wind turbine noise syndrome” other than articles that simply quote Nina Pierpont’s work and assume that it is either true or probably true?

Response: The theory behind the Wind Turbine Syndrome is still at an early stage of investigation. The book published by Pierpont describes the first stage, the “case series,” in which the investigator compiles reports of a consistent set of symptoms that may be related to a specific cause. It does not investigate how

common the symptoms are, or even whether they are more common in conjunction with any specific cause. Michael Nissenbaum from Maine is doing one type of next-step research, a “cohort study,” which seeks to identify if the symptoms are more common near turbines than further away. However, it is not clear if Nissenbaum’s study can distinguish whether the symptoms are caused directly by turbine noise, or indirectly by stress, frustration, or sleep disruption experienced by neighbors in response to the noise. It can be argued that indirect and direct effects are equally valid as a concern. It would be easier to mitigate indirect impacts, than any possible direct effects.

Current research is more focused on understanding which qualities of wind turbine sound may trigger more dramatic effects than other noise sources than specifically testing Pierpont’s Wind Turbine Syndrome hypothesis. Some studies do shed light on the underlying acoustics that could be related to the reported symptoms.

One piece of research of note is the work of Alec Salt, who has reported that low-amplitude infrasound may trigger a physiological response in outer ear cells, even if the inner ear cells are not triggered (i.e. people cannot hear it). This research has not confirmed that any possible outer ear cell response is related to the sorts of vestibular effects posited by Pierpont, but it may lead to research that investigates these possible mechanisms. For more information, see the Acoustic Ecology Institute’s “Wind Farm Noise 2011” report, available at: <http://www.scribd.com/doc/58333281/AEI-WindFarmNoise2011>.

A28. What test methodologies are used for verifying compliance with sound limits?

Response: There are many ways to structure a sound monitoring protocol. Sound limit ordinances are often structured to be based off the average noise level, at a specified distance from the wind turbine, over a period of time. Sometimes ordinances include an allotment of time that can violate the sound limit. An example ordinance would have a 40 decibel sound limit with 30 hours above that limit allowed during the course of the year. Acousticians use sound level metering devices to record levels of sound. Methods vary based on how short of time intervals sound levels are averaged over. Sound level could be averaged every ten minutes, or over the entire course of a day or night. Shorter averaging times will better identify the quietest times of day and loudest moments of wind turbine noise.

A29. Why can wind energy be placed anywhere in any zoning district without regard to noise generation and height restrictions?

Response: Wind turbines are regulated. Across the country, townships, municipal, county and state governments place various kinds of restrictions and zoning requirements on the scale and type of wind energy development, as well as the level of sound that is permissible.

A30: Are there any zoning ordinances anywhere that require there be no more than 40 dB of noise from a proposed project (any project—roads, factories, shopping centers, nightclubs, farms, etc....not just wind), at a property owner’s property line? Would, in your opinion, such a requirement be enforceable, or would it amount to exclusionary zoning?

Response: The purpose of a Noise Ordinance is to regulate the amount, duration and source of noise and are generally applied to districts rather than types of projects. Such an ordinance also focuses on time of day, with nighttime noise levels often set lower than daytime noise standards. Regulations addressing activities at a decibel level at or lower than 40 d(B)A at the property line were not readily found. We did find requirements that noise be kept at 40d(B)A or lower in residential areas at nighttime hours.

The City of Belmont, CA has a Noise Ordinance that regulates daytime as well as nighttime noise levels. Nighttime noise levels for Multifamily Residential Structures is kept at 35 d(B)A. See http://www.belmont.gov/SubContent.aspCatId=240002027&C_ID=240003408

The City of Worcester, Massachusetts regulates noise by prohibiting noise that is “plainly audible” from a specified distance from various types of sources. For example, music and sound originating from a commercial establishment prohibits sound that exceeds 10d(B)A above the ambient sound level at the property line. See

<http://www.worcesterma.gov/uploads/5d/4a/5d4a6fbfaf088e5e6089af3cd5d26be5/noise-control.pdf>

Go to <http://www.nonoise.org/lawlib/cities/cities.htm> for one list of communities in the country that have noise ordinances.

It is advisable for a community to analyze their existing ambient noise levels. With that information a baseline ambient d(B)A level for a community can be established. After such a baseline study, a community or township is in a better position to understand additional noise impacts and enact an enforceable and legally supportable ordinance.

The Town of Wilton and the Town of Ridgeville, Wisconsin used the baseline, pre-construction sound limit to set their standard. The noise standard does not allow noise generated by the wind energy system to exceed 5 d(B)A of pre-construction/operational background noise levels and may not exceed 40 d(B)A within 100 feet from any occupied structure.

A32. What is turbine whistle?

Response: Turbine whistle refers to high-pitched noise created by wind turbine blades hitting the air at certain angles. The Minnesota Department of Health report on the Public Health Effects of Wind Turbines states that: “Unexpectedly high aerodynamic noise can also be caused by improper blade angle or improper alignment of the rotor to the wind. These are correctable and are usually adjusted during the turbine break-in period.” That report contains more information about the health and noise affects of wind turbines and can be found at: <http://energyfacilities.puc.state.mn.us/resource.html?id=24519>.

A34. Is there a sound difference between different topographies?

Response: The affect of topography on how sound travels is extremely important and complex. The slope of a hill or ridge can cause sound to increase or decrease more quickly than on a flat plain. Atmospheric phenomenon that alter the movement of air from high elevations to low elevations can also change the way that sound from wind turbines travels.

Research on the affect of topography on wind turbine noise is still evolving. Acoustical engineers are able to model more precisely the effect of local topography on the level of noise created by wind turbines. Such a process may be conducted through a project’s environmental impact assessment. For more information, see Acoustic Ecology Institute’s Wind Turbine Noise Fact Sheet:

www.acousticecology.org/docs/AEI%20Wind%20Turbine%20Noise%20FactSheet.pdf

A36. Is the sound from one tower audible from another tower?

Response: Whether or not the sound of one turbine will be audible from the base of another turbine depends on the distance between the towers, the direction of prevailing winds, and topography of the area. For more information about the sound produced by wind turbines, see questions A5 and A34.

A37. If sound limits are set too stringently, could they effectively preclude utility-scale wind farm development in Benzie and Manistee Counties?

Response: Yes. For example, Emmet County in Michigan has a current wind energy noise ordinance set at 35 decibels and a 400-foot height restriction. Some wind developers have contested that the 35 decibel limit in Emmet County amounts to exclusionary zoning, because it would severely limit what could potentially be built within the zoning boundaries.

A38. What are the noise level comparisons of windmill construction and producing into the power grid with oil/gas well construction and producing into the grid?

Response: Construction noise created by wind turbines is likely similar to other forms of construction. As for operations, oil and gas pump-jacks are relatively quiet during operation, and some natural gas wellheads are basically silent. The loudest oil and gas noise source is coal-bed methane compressor stations, which operate 24/7, but these can be built inside housings that dampen the sound greatly. Wind turbines during operation are louder than a dampened compressor station or any other common oil and gas installation. The wind off the blades of turbines is a bit over 100 decibels at the source, reducing rapidly in the first few hundred feet, and more gradually after that.

A40. In Blaine Township there are areas zoned residential or are predominately residential. What should be the setback from the residential areas so residents are not impacted by noise, both audible and low-frequency?

Response: When creating zoning ordinances related to wind energy projects, distance setbacks are not used to lessen the effects of wind turbine noise. Instead, governments create noise limits. Setbacks are used to reduce any visual annoyance and safety hazard. See questions A15 and A16 for international and state level noise limit recommendations.

A41. What wind farm design and ambient factors other than setback can minimize the sound level at a receptor?

Response: Other than setbacks, the main strategy used to reduce sound level is operational changes. This includes reducing the speed of blade rotation at times when noise is near the local limit, or shutting them down entirely in problematic conditions. Most wind turbine manufacturers are working on new blade design modifications to slightly reduce noise.

Original Questions:

1. Can flight paths of birds and bats be controlled? [See response below.](#)
2. Will migration patterns be studied for birds in the area of Lake Michigan, Bear Lake, Glovers Lake, Mud Lake, Arcadia Lake, Upper and Lower Herring Lakes? Will it be a local Forest Representative or someone from Duke Energy who wouldn't truly know the area? [See response below.](#)
3. Has the Duke project done a formal study of bird migration routes as related to the likely sites of the turbines? Are there design possibilities that would mitigate potential dangers to wildlife? Are flashing lights required at night? [See response below.](#)
4. There are migratory flyways from Platt Lake, to Crystal Lake, Betsie Bay to Upper and Lower Herring Lakes and on down to Bear and Glovers Lake. What should be the setbacks of wind turbines from these lakes with migratory flyways? [Project specific.](#)
5. Can we mandate that no turbines be placed in the areas of migratory bird paths? [See response below.](#)
6. Why do bats get the bends near wind turbines? [See response to question B31.](#)
7. If bats are killed in large numbers and the industrial wind projects are within orchards, what will be the impact on the orchard from the loss of the bat population? [See response below.](#)
8. Bats are extremely susceptible to wind turbines. Studies have shown they do not have to strike the wind turbine since the pressure drop caused by the blades causes the bat's lungs to rupture. What are the mitigation measures that can be used to protect the bat population? [See response below.](#)
9. Is there any real danger to wildlife? What about migrating birds? Do they know that birds have been and will be killed by the spinning blades? Protected species? [See response below.](#)
10. What will the action be if all the experts and all the planning indicate minimal effect on wildlife but it turns out otherwise? [Beyond scope of project.](#)
11. Other than Altamont, could you identify other sites where there has been excessive bird and bat kill? [See response below.](#)
12. What is the impact of wind turbine sound on wildlife living in the industrial wind project area? [See response below.](#)
13. Is there a definitive or exemplar study available regarding the health and wildlife impacts, both positive and negative? [See response below.](#)
14. What is the typical time period that environmental studies cover? One year to cover spring and fall migration—nesting and breeding periods? [See response below.](#)
15. Does environmental impact on wildlife, investigation, birds, etc. last for 1 year. Are there actual fixed studies done? [See responses to questions B13 and B14.](#)
16. The FWS recommends at least a 5-mile setback distance from any active bald eagle's nest. Will the developers apply for a permit to "take" a certain number of bald eagles so they will not be in violation of the Bald and Golden Eagle Protection Act? [See response to question B18.](#)
17. We only have a few bald eagles. What can be done to protect them? [See response below.](#)
18. Will the developers apply for a "take" permit for endangered species of birds and bats so they will not be in violation of the Migratory Bird Treaty Act and the Endangered Species Acts? [See response below.](#)
19. Would the bats and bald eagles in the area potentially be threatened by the wind turbines? [See response to question B9.](#)
20. How do ridge/valley sound and vibration affect fishery, birds, etc. in Blaine Township? [Beyond scope of project; could be answered in site specific proposal/assessments](#)

21. Are there Best Management Practices for avoiding and/or mitigating invasive species proliferation caused by the development? (For example, the development of dirt roads can often spread invasive species from one location to another). **Beyond scope of project; site specific.**
22. Are we allowed to enact ordinances that protect the wildlife habitats currently in our areas? **See response below.**
23. Can the township require or make it mandatory that the applicant follow all US fish and wildlife recommendations? **See response below.**
24. Can the township require the applicant to follow US fish and wildlife wind siting guidelines? **See response to question B23.**
25. Can the township require that the applicant study the impact of wind turbines on bees and their pollination ability, as well as bats? **See responses to questions B2 and B26.**
26. Has the impact of industrial wind farms on beekeeping ever been researched? And what is that impact? Do wind revolving tower blades create a vortex that disorients bees and/or tears their wings? **See response below.**
27. Will the towers be lit in a way that will not attract migrating birds? What other protections will be considered for birds? **See response below.**
28. How many birds die from windmills compared to airplane, automobiles, or window panes? **See response below.**
29. What guidelines are being followed regarding effects on wildlife, in particular avian? Is anyone consulting with the national Audubon organization? Reputable sources/best experts must be consulted when any siting decision is made. While the towers may be sited away from regular migration paths, there could be a problem with lights on those towers especially with many towers. **See response below.**
30. Are proponents and developers aware that the Lake Michigan coast from Benzie to Allegan counties is declared an important bird area by national Audubon? Rafts of 5,000 to 35,000 long-tailed ducks are seen offshore regularly. Wind tower siting in the lake must consider this. **Comment not question.**
31. What ramifications to our ecosystems would there be if many birds and bats are eliminated by large wind turbines? **Beyond scope of this project.**
32. What are the known impacts from turbines, roads, power lines and other associated infrastructure, including but not limited to displacement & avoidance behaviors and direct collision/mortality on the species listed in "Attachment 1?" **Needs further clarification.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

B1. Can flight paths of birds and bats be controlled?

Response: It would be difficult to control the flight paths of birds and bats, but being aware of the spaces where the most migration occurs can help wind developers build in the least obtrusive spots. With more knowledge about flight patterns, wind facilities can be better placed to avoid collision with flying animals. Radar can be used to track the movement of avian wildlife in specific areas, as discussed in a study called "Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document," published by the *Journal of Wildlife Management*. This study can be accessed at http://www.nationalwind.org/assets/publications/Nocturnal_MM_Final-JWM.pdf

B2. Will migration patterns be studied for birds in the area of Lake Michigan, Bear Lake, Glovers Lake, Mud Lake, Arcadia Lake, Upper and Lower Herring Lakes? Will it be a local Forest Representative or someone from Duke Energy who wouldn't truly know the area?

Response: Although the research team cannot comment on whether or not any studies will be carried out for those specific areas, there has been some research done on the effects of wind energy on Great Lake

bird populations. This recent study, entitled “Wind Energy: Great Lakes Regional Guidelines,” comprehensively discusses potential risks to birds and recommends ways to avoid serious impact. This research is available online at <http://conserveonline.org/library/wind-energy-great-lakes-regional-guidelines/view.html>.

According to the Michigan Siting Guidelines for Wind Energy Systems, local ordinances should require wind developers to complete an Avian and Wildlife Impact Assessment with their application for wind farm construction, carried out by a qualified third party. If there are any areas of specific concern, the applicant should “minimize, eliminate, or mitigate adverse impacts identified in the analysis”. This study is available at http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf.

- B3. Has the Duke project done a formal study of bird migration routes as related to the likely sites of the turbines? Are there design possibilities that would mitigate potential dangers to wildlife? Are flashing lights required at night?

Response: The research team is not able to respond to specific questions related to Duke Energy’s project. However, developing research has shown that there are ways to reduce collision rates by altering the design and coloration of turbines. For instance, newer turbine models which have less perching space lessen the number of nesting birds near turbines. Other research suggests that painting visible designs on turbine blades – like stripes or solid colors – have helped reduce the number of fatalities. The National Wind Coordinating Collaborative published a useful report which specifically outlines some of these studies. The “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions” report specifically outlines this work. The report is available online at https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf. Meanwhile, their more detailed Mitigation Toolbox provides summaries of various mitigation studies, accessible online at: http://www.nationalwind.org/assets/publications/Mitigation_Toolbox.pdf.

Flashing lights are required on any structures higher than 199 feet, according to the Federal Aviation Administration, in order to avoid airplane collisions.

- B5. Can we mandate that no turbines be placed in the areas of migratory bird paths?

Response: Migratory birds are differentially impacted by wind turbines. See response below to question B9 for information about which birds are impacted, and mitigation and protection measures.

- B6. Why do bats get the bends near wind turbines?

Response: When a wind turbine spins, a small area of air pressure around the tips of the blades drops slightly, causing a “lift”-like effect, similar to that of an airplane’s wings. Although it is unclear why bats are attracted to wind turbines, as they fly through the low air pressure their lungs expand and fill with liquid – a phenomenon comparable to the bends in divers. The National Geographic reported on this phenomenon in their article “Wind Turbines Give Bats the ‘Bends’ ”. That article is accessible at <http://news.nationalgeographic.com/news/2008/08/080825-bat-bends.html>

More information about bats and wind energy is available at the website of the Bats and Wind Energy Collaborative at <http://www.batsandwind.org/>. This organization was formed in 2003 by Bat Conservation International (BCI), the US Fish and Wildlife Service, the American Wind Energy Association (AWEA), and the National Renewable Energy Laboratory of the US Department of Energy (NREL).

- B8. Bats are extremely susceptible to wind turbines. Studies have shown they do not have to strike the wind turbine since the pressure drop caused by the blades causes the bat’s lungs to rupture. What are the mitigation measures that can be used to protect the bat population?

Response: Although more studies need to be completed in order to more conclusively decide on the best mitigation practices, some past research has shown that wind facility operation hours can be adjusted to weather and other conditions in which bats are most present. For example, it is known that bats are most

active during times of low wind periods, so wind farms could potentially operate less frequently during those times. However, more research must be done into the feasibility of this strategy. See the “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions” at https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf for more detailed information. This report was prepared by the National Wind Coordinating Collaborative (NWCC). The mission of the NWCC Wildlife Workgroup is “to identify, define, discuss, and through collaboration address wind-wildlife and wind-habitat interaction issues by seeking broad stakeholder involvement on scientific and public policy questions”.

In addition, more information about bats and wind energy is available at the website of the Bats and Wind Energy Collaborative at <http://www.batsandwind.org/>. This organization was formed in 2003 by Bat Conservation International (BCI), the US Fish and Wildlife Service, the American Wind Energy Association (AWEA), and the National Renewable Energy Laboratory of the US Department of Energy (NREL). Finally, the “Wind Energy: Great Lakes Regional Guidelines” report lists similar operational guidelines to limit wildlife risks on page 39, available online at <http://conserveonline.org/library/wind-energy-great-lakes-regional-guidelines/view.html>.

B9. Is there any real danger to wildlife? What about migrating birds? Do they know that birds have been and will be killed by the spinning blades? Protected species?

Response: It is widely understood that wind turbines do demonstrate some danger to flying birds and bats, but studies have shown that in relation to other anthropogenic activities, wind farms present a substantially lower risk. In the meantime, much scientific research is currently being done on the most appropriate ways to reduce and mitigate the harmful effects that do exist. For a summary of the issue and a description of the research that is being undertaken, refer to the “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions” report. This report is accessible from https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf, and was prepared by the National Wind Coordinating Collaborative (NWCC). The mission of the NWCC Wildlife Workgroup is “to identify, define, discuss, and through collaboration address wind-wildlife and wind-habitat interaction issues by seeking broad stakeholder involvement on scientific and public policy questions”.

In addition, the “Wind Energy: Great Lakes Regional Guidelines” study provides useful information about the effects of wind development on wildlife, specifically bird and bat populations. It categorizes danger as direct mortality (from flying into the turbine, for instance) and indirect through displacement, fragmentation, and habitat loss. The study acknowledges the potential dangers to wildlife, but it also recommends mitigation measures. This study is available online at <http://conserveonline.org/library/wind-energy-great-lakes-regional-guidelines/view.html>.

B11. Other than Altamont, could you identify other sites where there has been excessive bird and bat kill?

Response: The National Wind Coordinating Collaborative has published several graphs which depict the mortality rates of raptors, all birds, and bats on numerous wind farms across the country. Refer to page 3 of “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions,” at: https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf. This report was prepared by the National Wind Coordinating Collaborative (NWCC). The mission of the NWCC Wildlife Workgroup is “to identify, define, discuss, and through collaboration address wind-wildlife and wind-habitat interaction issues by seeking broad stakeholder involvement on scientific and public policy questions”.

B12. What is the impact of wind turbine sound on wildlife living in the industrial wind project area?

Response: Although the effect of turbine sound on wildlife is not yet fully understood, existing knowledge of animal hearing suggests that some wildlife may be affected by the sound frequencies generated by the

turbines. Some studies show that from far distances, birds are unable to hear the “swooshing” of the turbine, increasing the likelihood of collision. Others link noisy habitats to problems with bird mating, communication, or nesting, but there have been no direct, conclusive studies of the effect of wind facility noise on wildlife. For a brief analysis of some of these studies, refer to the U.S. Fish and Wildlife Service’s report called “The Effects of Noise on Wildlife”. This report can be accessed at <http://www.fws.gov/windenergy/docs/Noise.pdf>.

B13. Is there a definitive or exemplar study available regarding the health and wildlife impacts, both positive and negative?

Response: The *Journal of Wildlife Management* published a study called “Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document”, which assesses the potential impacts of wind farms on bird and bat populations, looks at fatality rates of these species, determines the causes of these deaths, and recommends methods to reduce future mortality. This study can be accessed at http://www.nationalwind.org/assets/publications/Nocturnal_MM_Final-JWM.pdf.

B14. What is the typical time period that environmental studies cover? One year to cover spring and fall migration—nesting and breeding periods?

Response: The time period covered by environmental studies and environmental impact assessments varies from place to place, and depends greatly on what is being researched and the amount of time and space under study. According to the authors of “Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document”, construction surveys, which are conducted by developers to assess the impact of their wind farms, are often carried out in less than a full or active season. However, depending on the given species being studied, one season or one year of data may not provide enough about potential impacts. This document is available at http://www.nationalwind.org/assets/publications/Nocturnal_MM_Final-JWM.pdf.

B17. We only have a few bald eagles. What can be done to protect them?

Response: There have been numerous recommendations proposed for ways to reduce raptor collision rates with wind turbines, many of which are being employed on new and developing wind farms. Pre-construction evaluation of proposed wind farms can help predict and avoid much of the potential for harm; considerations like location, structure, and design can all have a significant affect. For instance, it appears that siting turbines out of raptor habitats, building wind farms in areas of low prey density, painting the blades of the turbine with a distinct pattern, or using newer and larger models can all reduce the danger to raptors. For more information on potential mitigation strategies, see the “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions” report. This report is accessible at https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf, and was prepared by the National Wind Coordinating Collaborative (NWCC). The mission of the NWCC Wildlife Workgroup is “to identify, define, discuss, and through collaboration address wind-wildlife and wind-habitat interaction issues by seeking broad stakeholder involvement on scientific and public policy questions”.

Additionally, the US Fish and Wildlife Service has a “Draft Eagle Conservation Plan Guidance” currently available for public comment. The report has developed a method to calculate compensatory mitigation for the loss of golden eagles caused by wind power. See section F of the report, which is available at http://www.fws.gov/windenergy/docs/ECP_draft_guidance_2_10_final_clean_omb.pdf.

B18. Will the developers apply for a “take” permit for endangered species of birds and bats so they will not be in violation of the Migratory Bird Treaty Act and the Endangered Species Acts?

Response: While the decision to apply for a “take” permit is ultimately up to the wind energy developers, the U.S. Fish and Wildlife Service (USFWS) does allow for non-federal activities which have the potential to

affect endangered species to apply for such a permit. This allows those groups to carry out their projects without technically violating the terms of the Endangered Species Act. The USFWS published the “Habitat Conservation Plan” under Section 10 (a)(1)(B) of the Endangered Species Act, where one may find more information about such permits and the circumstances under which one may be granted. That document is available at http://library.fws.gov/Pubs9/hcp_section10.pdf.

B22. Are we allowed to enact ordinances that protect the wildlife habitats currently in our areas?

Response: Yes, subject to the limitations discussed generally in Question D1. For an example, see the model wind energy zoning ordinance discussed in Question D4, which requires that wind turbines be designed to mitigate the impacts on avian and wildlife. In particular, with regard to wildlife, Townships should take care to avoid regulating in areas pre-empted by state or federal law.

B23. Can the township require or make it mandatory that the applicant follow all US fish and wildlife recommendations?

Response: The guidelines published by the USFWS are voluntary, and more specific requirements and regulations are mandated at a local level on a state-by-state basis. These recommendations are “intended to assist Service staff in providing technical assistance to the wind energy industry to avoid or minimize impacts to wildlife and their habitats” (as described in the introductory Memorandum of the “Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines” – available at <http://www.fws.gov/habitatconservation/wind.pdf>).

B 26. Has the impact of industrial wind farms on beekeeping ever been researched? And what is that impact? Do wind revolving tower blades create a vortex that disorients bees and/or tears their wings?

Response: We have not located any scientific studies on the topic but the subject has been discussed on amateur beekeeping listservs and blogs. For example see the discussion thread about location of hives and how high bees fly at <http://www.beesource.com/forums/showthread.php?217516-Wind-Farms-Turbines-and-Bees>

B27. Will the towers be lit in a way that will not attract migrating birds? What other protections will be considered for birds?

Response: Studies have shown that tower lights do not increase bird mortality rates. The lights are required by the Federal Aviation Administration for structures above 199 feet to avoid airplane collision with tall structures. The red strobe-like flashing poses no apparent danger to birds or bats. The “Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions” report cites several studies which look further into this phenomenon. This report is accessible at https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf, and was prepared by the National Wind Coordinating Collaborative (NWCC). The mission of the NWCC Wildlife Workgroup is “to identify, define, discuss, and through collaboration address wind-wildlife and wind-habitat interaction issues by seeking broad stakeholder involvement on scientific and public policy questions”.

To read more about other mitigation strategies, see the response to question B3.

B28. How many birds die from windmills compared to airplane, automobiles, or window panes?

Response: Although data about how many birds die from human activities is limited, the estimates show that bird deaths from wind farms are significantly lower than deaths from other anthropogenic sources. A study on collision mortality rates in birds puts the actual danger of wind turbines in context by comparing them to other causes of death. Their results are shown in the table below; for the full report, see “A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions,” at

http://www.fs.fed.us/psw/publications/documents/psw_gtr191/Asilomar/pdfs/1029-1042.pdf. These findings were written by wildlife experts and published in a US Forest Service technical report.

Summary of predicted annual avian mortality.

| Mortality source | Annual mortality estimate | Percent composition |
|---|----------------------------------|----------------------------|
| Buildings | 550 million | 58.2 percent |
| Power lines | 130 million | 13.7 percent |
| Cats | 100 million | 10.6 percent |
| Automobiles | 80 million | 8.5 percent |
| Pesticides | 67 million | 7.1 percent |
| Communications towers | 4.5 million | 0.5 percent |
| Wind turbines | 28.5 thousand | <0.01 percent |
| Airplanes | 25 thousand | <0.01 percent |
| Other sources (oil spills, oil seeps, fishing by-catch, etc.) | not calculated | not calculated |

B29. What guidelines are being followed regarding effects on wildlife, in particular avian? Is anyone consulting with the national Audubon organization? Reputable sources/best experts must be consulted when any siting decision is made. While the towers may be sited away from regular migration paths, there could be a problem with lights on those towers especially with many towers.

Response: Some guidelines for wind farms in the state of Michigan are outlined in the “Michigan Siting Guidelines for Wind Energy Systems” document, published by the State’s Department of Labor and Economic Growth. This document is online at:

http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf

The U.S. Fish and Wildlife Service also has a list of recommended guidelines for wind developers in its “Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines” (online at <http://www.fws.gov/habitatconservation/wind.pdf>) and has published a useful draft of its “Land-Based Wind Energy Guidelines”(online at http://www.fws.gov/windenergy/docs/WEG_July_12_%202011.pdf).

While compliance to these guidelines is not required, many states and individual developers choose to follow them in order to lessen the impact on wildlife. Furthermore, a variety of local and national organizations – like the Audubon Society – have suggested ways to reduce the wildlife impact of wind farms (see: “The Michigan Audubon Society Resolution 2008-02: Wind Turbine Generated Electricity,” accessible at <http://www.michiganaudubon.org/file.../9e566586-29a0-4eec-9005-bddade0a9052>). The decision to follow such suggested guidelines is ultimately that of wind developer.

Original Questions:

1. What does the scientific literature say about the health/mental effects of shadow flicker? **See response below.**
2. What are the effects of people who experience shadow flicker in a home? **See response to question C1.**
3. Is there a safety hazard if turbines cast shadow flicker over a road or highway? **See response below.**
4. What are the scientifically documented effects of shadow flicker on those living and working in proximity to wind turbines? **See response below.**
5. Have the people who will be living near these windmills been informed of the side-effect called ‘shadow flicker’? This is the constant shadow/light/shadow/light that is very visible (and annoying) inside a home when the home is in the shadow of the windmill. **Comment not question.**
6. How much of each day and at what distance would a resident living or employee working in proximity to a wind turbine experience shadow flicker? **See response to question C8.**
7. How many hours are appropriate for shadow flicker on a residence? **See response to questions C1 and C8.**
8. When there is a “flicker” problem that affects someone’s domicile, typically how many days a year does this occur, and for how long each day? **See response below.**
9. What will be done to protect owners and homes and land from the “flicker” effects of the wind turbines? **Project specific.**
10. What kind of liability does the developer have if blade throw or failure causes damage to life or property? **See response below.**
11. For a turbine with a hub height of 330 feet, and a total blade tip height of 485 feet, what is the theoretical limit for ice throw? **See response to question C12.**
12. Ice throw in northern climates is an issue. How do you calculate a safety zone to prevent injuries from ice throw? **See response below.**
13. Has the icing effect been taken into account during our long winters? **Needs further clarification, but see response to question C12.**
14. Does living with a wind turbine really affect people’s health and safety when compared with normal, everyday environmental factors? **See response below.**
15. Please present honest and truthful studies that these turbines can be harmful to health of humans and people. Those studies are out there, please present both sides. Will you show both sides of the coin? Flicker effect, noise, sleep deprivation, etc. **Comment not question.**
16. The health hazards as we get older are a real concern for us, plus the shadows and sound that these will generate. Please don’t ruin this quaint little town. (Arcadia) **Comment not question.**
17. Why does the wind industry continually try to discredit the physicians and audiology professionals studying wind turbine syndrome? **Comment not question.**
18. How does the township board plan to deal with “competing experts” – conflicting testimony regarding medical impacts? **Beyond scope of project. Project/township specific.**
19. If there’s a turbine fire and it causes a wildfire and destroys property can the developer be held responsible? **See response below.**
20. Who is responsible for any ecological, physiological, or medical consequences of wind? **Beyond the scope of this project.**
21. What is the speed (MPH) of the blade tips at maximum revolution for a 495 foot turbine? **See response below.**
22. What is the maximum wind speed that contemporary turbines are designed to withstand? **See response below.**
23. Are the fumes toxic if one of these catches fire? **See response below.**
24. Can the township require that utility grid systems have fire suppression systems since there is no fire equipment that will reach that high? **See response below.**

25. The wind industry says that wind turbines do not cause health effects, numerous doctors and studies provide evidence of health impacts. Should the wind industry use residents as guinea pigs or should definitive medical studies be completed before wind developers are allowed to be built? **Comment not question, but see response below to question C14.**
 26. Re: Ethics of the Wind Industry in regards to the dismissal and denial of any ill effects on people living within the wind project footprint. This is a fundamental public health issue. Rather than be responsive and better understand exactly what the effects are in order to determine appropriate siting the wind industry in general seems to be taking the stance that there are no ill effects. It cannot be ignored that people do have problems associated with living in close proximity to large wind facilities. An in-depth and scientific inquiry needs to be pursued regarding rural wind farms and health effects. How can a community or an individual help to initiate such an inquiry? **Comment not question, but see response below.**
 27. What types of insurance and how much per turbine should the township require for the wind developer to carry? **See response below and response to D9 for general information about township insurance.**
 28. What percentage of people living within 1500 foot of a large industrial turbine reported sleep loss? **See response below.**
 29. The ordinance should specify that Duke or subsequent owners will reimburse the township and its residents for any costs associated with handling any turbine-related emergencies – e.g. fires started in turbines, etc. **Comment not question. Project specific.**
 30. Do industrial wind turbines interfere with emergency communications? **See response below.**
 31. What would the impact of the wind turbine-generated noise be on people, pets, and wildlife? **See response below.**
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Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

C1. What does the scientific literature say about the health/mental effects of shadow flicker?

Response: Shadow flicker is a relatively well-understood wind energy phenomenon. When rotating turbine blades cast a shadow over a building, the changing in light intensity is called shadow flicker. This usually occurs for a period in the evening or morning when the sun is at a low angle in the sky. Shadow flicker does not occur on cloudy days or when the turbine is not operating. Shadow flicker has been a longstanding concern in Northern European countries like Norway, Sweden and Finland where the high latitude and low sun angle exacerbate the effect.

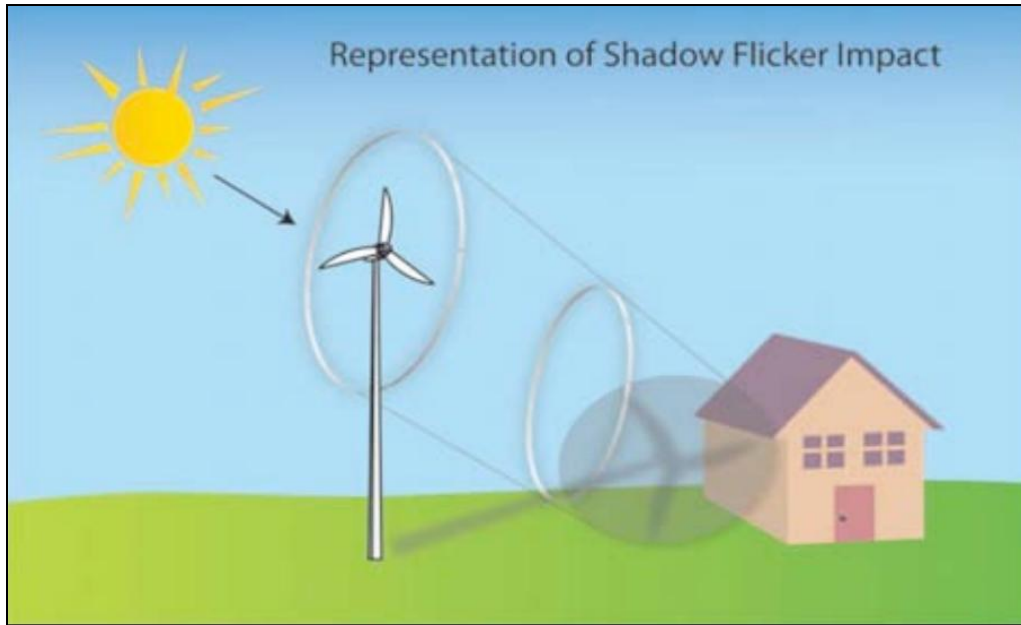


Image Credit: American Wind Energy Association

Shadows that fall on a home may be disruptive and constitute a nuisance. It is a common concern that shadow flicker may induce seizures in people with epilepsy, but the frequency of the flickering effect is too slow to cause a reaction. Various epilepsy advocacy groups, including the British group Epilepsy Action, have not found evidence that wind turbines, especially larger wind turbines, could induce a seizure. Current research suggests that the risk to human health from shadow flicker is quite minimal. For other health effects, see response below to question C14.

There are several ways to mitigate the effect of shadow flicker. Because the area affected by shadow flicker can be reliably calculated (because the position of the sun and the height of the turbine are known on any given day), developers can choose wind turbine locations that will not cause extensive shadow flicker on a dwelling, usually at least 1000 feet from a dwelling. When the shadow of a wind turbine does fall on a dwelling, it usually does so for a short period of time, often no greater than 30 minutes in the worst case scenario. This means that the wind turbine could be turned off during periods when shadow flicker becomes a nuisance. In addition, physical barriers, including trees, can be used to mitigate the impact.

For additional information, see the section on shadow flicker in the National Academy of Sciences publication, "Environmental Impacts of Wind Energy Projects". This is accessible at http://books.nap.edu/openbook.php?record_id=11935&page=160

Also see questions C3 and C8 for more about shadow flicker.

C3. Is there a safety hazard if turbines cast shadow flicker over a road or highway?

Response: If a turbine is close to a highway, the movement of the large rotor blades and possible resulting flicker can distract drivers when they drive beneath the shadow. However, we did not discover evidence of a documented death as a result of distracted driving near wind turbines. This risk can be reduced by simply increasing the distance between turbines and roads. In Ireland, for example, it is recommended that turbines be setback roads at least 300 meters, or about 1000 feet, from public roads.

For more on shadow flicker, see questions C1.

- C8. When there is a “flicker” problem that affects someone’s domicile, typically how many days a year does this occur, and for how long each day?

Response: The duration of shadow flicker varies greatly depending on a dwelling’s proximity to a wind turbine, latitude, weather patterns (including frequency of days when it is both windy and sunny at the same time) and any barriers blocking the shadow of the turbine. Shadow flicker does not occur when the sky is cloudy, there is no wind, or at night. In worst case scenario planning, a dwelling could be affected by shadow flicker for up to a half an hour per day for several weeks during the winter when the sun is low in the sky.

Wind developers can use modeling software to calculate where the shadow of wind turbines is likely to fall. During the siting process or the preparation of an environmental impact assessment, developers can use this information to site wind turbines in a way that minimizes shadow flicker for residents.

Ottawa County, Michigan, has issued a model wind ordinance that local governments can choose to adopt or modify. The model ordinance requires wind developers to analyze shadow flicker to determine where the shadows would fall and for how long over the course of one year. It also mandates that shadow flicker on an occupied building not exceed 30 hours per year.

For additional information, see the section on shadow flicker in the National Academy of Sciences publication, “Environmental Impacts of Wind Energy Projects”. This is accessible at http://books.nap.edu/openbook.php?record_id=11935&page=160

For more on shadow flicker, see question C1.

- C10. What kind of liability does the developer have if blade throw or failure causes damage to life or property?

Response: Full liability based on tort or personal injury based on negligence, and possibly on the basis of a nuisance condition to adjacent landowners.

- C12. How do you calculate a safety zone to prevent injuries from ice throw?

Response: “Icing” of wind turbine blades occurs under specific meteorological conditions where a layer of ice, called “rime,” forms on an exposed surface, such as the blades of a tall wind turbine. Ice throw potential is calculated using blade length, hub height, blade shape, and rotor speed and will vary based on these parameters. Risk for injuries from ice throw is at its greatest when the turbine is at rest and construction workers are working around the base of the turbine. A British study calculated that the risk of being hit by ice throw while within 230 meters (750 feet) of a wind turbine is slightly greater than the risk of being struck by lightning within that same area. This ice throw study was completed by a British renewable energy consulting agency. This is accessible at <http://easthavenwindfarm.com/filing/feb/ehwf-ml-reb4.pdf>.

Modeling software programs calculate the zone in which ice throw may occur. During the siting process and/or the preparation of an environmental impact assessment, developers can use this information to site wind turbines in a way that minimizes this risk to nearby residents and property.

For more information, see a German risk analysis of ice throw. This is accessible at <http://web1.msue.msu.edu/cdnr/icethrowseifertb.pdf>.

- C14. Does living with a wind turbine really affect people’s health and safety when compared with normal, everyday environmental factors?

Response: In general, living near a large wind turbine has fewer documented, general health risks than living near other kinds of electricity generating facilities, like a coal plant. Wind turbines do not emit carbon dioxide or other pollutants into the air when generating electricity.

There is ongoing research about how the sound created by wind turbines affects people who live nearby (for more about wind turbine noise, see the questions in section A “Noise/Sound Level”). There is evidence that people who live near busy highways, oil and gas facilities, and airline flight paths are more likely to develop certain health problems than those who do not, but the noise generated by wind turbine is much quieter than most of these sources. It appears that the majority of people who live near wind turbines do not experience adverse health effects, but there is a significant minority of people who do complain about wind turbines, and more research is needed in order to understand these complaints.

For more information on potential health effects of wind turbines on nearby residents, see:

- World Health Organization’s “Night Noise Guideline Report,” which details the effects of all types of noise on human health, not simply from wind turbines:
www.euro.who.int/_data/assets/pdf_file/0017/43316/E92845.pdf
- The Acoustic Ecology Institute’s Wind Turbine Noise Fact Sheet:
www.acousticecology.org/docs/AEI%20Wind%20Turbine%20Noise%20FactSheet.pdf
- Grand Valley State University’s Wind Brief #2, which describes the potential noise and health effects of wind turbines: www.gvsu.edu/wind/project-documents-3.htm

C19. If there's a turbine fire and it causes a wildfire and destroys property can the developer be held responsible?

Response: Again, yes, if negligence and tort liability, or nuisance conditions get out of control and cause damage.

C21. What is the speed (MPH) of the blade tips at maximum revolution for a 495 foot turbine?

Response: The maximum speed of the blade tips varies greatly among large-scale wind turbines from about 130mph to 230mph depending on the size of the turbine. The tips of the blade will always move many times faster than the inner edge of the wind turbine blades. The maximum blade tip speed for each model is controlled because after a certain wind speed the wind turbine will “cut-out” and will change position to minimize risk of a wind turbine being knocked over. (For more on cut-out speed, see question C22). The maximum speed of the blade tips in miles per hour can be calculated by multiplying the rotor diameter (in meters), by pi (π), by the maximum revolutions per minute, all divided by 26.82 (a conversion factor).

C22. What is the maximum wind speed that contemporary turbines are designed to withstand?

Response: All modern wind turbines are designed with “cut-in speeds”—the wind speed at which the turbine blades begin to rotate and produce electricity, typically around 10 mph—and “cut-out speeds”—the wind speed at which the turbine automatically stops the blades from turning and rotates out of the wind to avoid damage to the turbine, usually around 55 to 65 mph. It is extremely rare for wind turbines to be knocked over by high wind speed. The cut-out speeds vary by manufacturer and turbine model. That information is widely available but depends on the particular turbine model.

C23. Are the fumes toxic if one of these catches fire?

Response: Accidents involving fire in modern wind turbines may occur in the nacelle (where the gear box and generator are), on the tower of the turbine and in a transformer substation on the ground near the wind turbine. The greatest source of fire risk to wind turbines is after lightning strike, but technical malfunctions can also contribute to a turbine fire. Wind energy companies and developers are particularly motivated to reduce fire risk because an accident can result in months of lost revenue and damage the reputation of the company. Given the scale of wind energy development around the world, turbine fires are relatively rare. In 2009, the Caithness Windfarm Information Forum, seeking to catalog all wind turbine related accidents, estimated that there had been 122 reported wind turbine fires in the history of modern wind energy. This may be an underestimate of the actual number of fires because a significant number go unreported.

The primary flammable fluid in wind turbines is hydraulic braking fluid. On large wind turbines there may be up to 750 liters (200 gallons) of this fluid in the nacelle of the wind turbine. While it is likely that inhalation of burning hydraulic fluid or any other fire smoke would be harmful to human health, the height of most wind turbines makes it unlikely that anyone besides a maintenance worker would come into contact with the smoke from a turbine fire.

For more information, see this Fire Protection guide from a German wind turbine insurance agency, available at www.imia.com/downloads/external_papers/EP43_2009.pdf

An article in Wind Systems magazine describes wind turbine fire risk and various suppression systems that exist. This article can be found at www.windssystemsmag.com/article/detail/136/turbine-fire-protection

For more about fires in wind turbines, see question C24.

C24. Can the township require that utility grid systems have fire suppression systems since there is no fire equipment that will reach that high?

Response: Most wind turbine manufacturers build a fire suppression system into the design of a wind turbine without a specific law requiring that it be done. There are many designs of fire suppression systems in wind turbine models and the particular system used will depend on the size, type and manufacturer of the turbine. These systems usually both detect the presence of a fire and automatically release a fire suppressant, such as carbon dioxide gas, into the nacelle of the turbine. A description of wind turbine fire risk and various suppression systems available can be found at:

www.windssystemsmag.com/article/detail/136/turbine-fire-protection.

Local and state governments can also train their fire fighting forces in correct protocol for responding to a wind turbine fire. An example of a memo released in the province of Ontario, Canada can be found here: www.ffao.on.ca/documents/content_310.doc.

In the State of Michigan, control over local wind farm zoning ordinances falls under the jurisdiction of the township. Townships create their own ordinances governing wind energy projects. See question D1 for more about ordinance formation.

For more about fires in wind turbines, see question C23.

C26. Re: Ethics of the Wind Industry in regards to the dismissal and denial of any ill effects on people living within the wind project footprint. This is a fundamental public health issue. Rather than be responsive and better understand exactly what the effects are in order to determine appropriate siting the wind industry in general seems to be taking the stance that there are no ill effects. It cannot be ignored that people do have problems associated with living in close proximity to large wind facilities. An in-depth and scientific inquiry needs to be pursued regarding rural wind farms and health effects. How can a community or an individual help to initiate such an inquiry?

Response: The research team cannot speak to the ethics surrounding the development of wind energy projects. To date, there has been no large scale epidemiological study comparing the health of people who live near wind turbines with that of people who do not (See question C14). Such a study could be conducted by a research team through funding either from an academic center, foundation or a federal source like the National Institutes of Health. The results of such a study would likely be published in a peer-reviewed academic journal, which would mean the study would likely adhere to strict methodological and ethical codes and therefore produce more reliable results.

C27. What types of insurance and how much per turbine should the township require for the wind developer to carry?

Response: The insurance should cover personal and property damage claims, and exclusions in the policy should be very carefully studied. Limits should be as high as the potential damages to persons or property with an estimate of the number of people in homes or working or traveling within area of risk to determine the cap for aggregated claims (eg. \$3-5 million per person, \$10-15 million per incident).

C28. What percentage of people living within 1500 foot of a large industrial turbine reported sleep loss?

Response: There is competing evidence about the impact of large scale turbines on sleep loss. To date, there has been no large scale epidemiological study comparing the sleep disturbances of people who live near wind turbines and people who do not (See question C14). There are calls from various organizations to undertake such a study.

The World Health Organization's "Night Noise Guideline Report," compares sources of noise (not including wind turbine noise) and their sleep and health effects:

[www.euro.who.int/ data/assets/pdf file/0017/43316/E92845.pdf](http://www.euro.who.int/data/assets/pdf_file/0017/43316/E92845.pdf).

There are anecdotal accounts of sleep loss that have been reported by residents living near some wind turbines. Sleep loss is one of the symptoms addressed by Nina Pierpoint in her volume "Wind Turbine Syndrome". Dr. Pierpoint's book reports that two-thirds of her test group, fourteen out of twenty-one individuals, presented "disturbing symptoms". Other sleep experts, associated with Dr. Pierpoint, have claimed that low-frequency vibrations of large scale wind turbines is more disruptive to sleep than traffic, aircraft and industrial noise.

In contrast, the American and Canadian wind industry associations commissioned a study to investigate the peer reviewed literature on the health impacts of turbines. This 2009 study by a group of medical doctors and acoustical experts found that there is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects. That study is available at

[www.canwea.ca/pdf/.../Wind Turbine Sound and Health Effects.pdf](http://www.canwea.ca/pdf/.../Wind_Turbine_Sound_and_Health_Effects.pdf).

C30. Do industrial wind turbines interfere with emergency communications?

Response: Electromagnetic interference (EMI) is where the towers or blades of a wind turbine change the direction or block entirely the transmission of signals from TV stations, cell phone towers, military or other radar and potential emergency communication that travels along these pathways. A disruption to communication due to EMI could clearly be a hazard in the event of an emergency situation. Different types of communication are affected differently by the presence of wind turbines. AM and FM radio and cell phone signals are not significantly affected by the presence of wind turbines, but TV broadcasts, point-to-point ("direct link") radio transmission, and radar can all be disrupted by the presence of wind turbines. Due to the fixed nature of these types of transmission, however, careful siting can avoid the majority of potential EMI and also avoid disruption of emergency communication and other transmission.

For a more detailed explanation of electromagnetic interference, see the section on this topic in the National Academy of Sciences publication Environmental Impacts of Wind Energy Projects (from page 169), accessible at http://books.nap.edu/openbook.php?record_id=11935&page=169#p20012f909970169002.

C31. What would the impact of the wind turbine-generated noise be on people, pets, and wildlife?

Response: The environmental effects of wind turbine noise are controversial, complex and inconclusive. New research on the topic is emerging. For more information, see section A "Sound/Noise Level".

These sources provide basic information on the science behind wind turbine noise as well as the policies and controversy surrounding it:

- The Acoustic Ecology Institute has produced one fact sheet and two full-length reports concerning Wind turbine Noise:
 - Wind Turbine Noise Fact Sheet:
www.acousticecology.org/docs/AEI%20Wind%20Turbine%20Noise%20FactSheet.pdf
 - “Wind Farm Noise 2011, Science and Policy Overview”:
www.acousticecology.org/wind/winddocs/AEI_WindFarmNoise2011.pdf
 - “Wind Farm Noise: 2009 in Review”:
www.acousticecology.org/docs/AEI_WindFarmNoise_2009inReview.pdf
- Grand Valley State University’s Wind Brief #2, describes the potential noise and health affects of wind turbines: www.gvsu.edu/wind/project-documents-3.htm
- The Minnesota Department of Health produced a report of the Public Health Effects of Wind Turbines, which gives more information about sound created by wind turbines and its affect on humans: <http://energyfacilities.puc.state.mn.us/resource.html?id=24519>
- “Environmental Impacts of Wind Energy Projects,” and online book, has a chapter about noise, which gives more detail about the level and type of noise that wind turbines produces: http://books.nap.edu/openbook.php?record_id=11935&page=157

Original Questions:

1. What type of authority do townships have to regulate and control wind farm developments? **See response below.**
2. How do townships ensure corporations are doing business within an ordinance? **See response below.**
3. Will Township officials for both Manistee and Benzie counties have ordinances in place to manage this wind turbine industrial development? **Project specific, but see responses below to D1 and D6.**
4. Should both counties have the same elements in their ordinances to address similar problems if they arise? **See response below.**
5. What right does a township have to make ordinances? How are these rights defended? **Beyond scope of project, but see response to D6.**
6. What is the process for the township's decisions on the wind ordinance? I do not know if any township officials have signed personal contracts with Duke; however, I have strong concerns about Duke signing non-disclosure contracts with any township official who will be making decisions about any ordinance regarding wind turbines. It is definitely a conflict of interest and raises questions of ethics. Has an attorney reviewed this issue? Any official with a signed contract should recuse him/herself from any votes related to the Gale project. I am not accusing anyone of misconduct, but the potential situation raises serious concerns. **See response below.**
7. From such protections stipulated in wind royalty lease arrangements, can the local authority impose its own? Are such stipulations ever used for other kinds of development—such as shopping malls, industrial applications such as gravel pits, processing plants, amusement parks or other large developments that strongly affect the local landscape? **See response below.**
8. How are rights of corporations and townships controlled to ensure intimidation doesn't happen? **Beyond scope of project, but see response below to D9.**
9. Will our townships be able to defend against intimidation tactics by wind developers? Are there funds available on the state or federal level to defend our enacted ordinances? **See response below.**
10. What kind of language can be put in the township ordinance to protect itself from an applicant going bankrupt during the lease/install, etc.? **See response below.**
11. What kind of language can be put in the township ordinance to protect itself from mid-project pull out? For example, if subsidies are taken away and the company decides to stop the project. **See response below to question D10.**
12. How can a township protect itself from a large corporation suing and bankrupting the township in order to get what it wants? **Beyond scope of this project.**
13. How do townships protect themselves legally from liability if a participating land owner's home is too close to a wind turbine and it results in sleep disturbance and eventually health effects? **See response below.**
14. What is the liability and exposure to officials? **Needs further clarification.**
15. Regarding planning, zoning, and permits, what type of legal and financial liability exists for local units of government, for the unit and individual elected officials? **Beyond scope of project, but see responses below to D10, D11 and D13.**
16. Who in the townships is qualified and who will work with the energy company and stand up to it/negotiate as need be on behalf of the township? Is this job too big for the people we have available now. Will the township have to spend money on more lawyers, consultants, etc.? **See response below.**
17. How do officials ensure they are educated on issues? **Value judgment.**
18. Should townships go to other communities for best practices? **See response below.**
19. Are we allowed to enact ordinances that hold to a specific vision of our townships even if it does not include industrial wind energy generation facilities? **See response below.**

20. Should township officials be allowed to be leaseholders, people who benefit from the decisions made about wind energy, can they hold leases and earn direct money from them when they are overseeing them? What are the safeguards against corruption, if that is what the above is? We should define "corruption" first. [See response below.](#)
21. Will there be a public hearing regarding the placement of these turbines? Public comments welcomed? [Project specific.](#)
22. (formerly G10). Can the township restrict already conserved property in any way? [See response below.](#)

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

D1. [What type of authority do townships have to regulate and control wind farm developments?](#)

Response: Townships have broad authority to regulate the use of land and structures, including windmills, through zoning, as authorized by the Michigan Zoning Enabling Act. In general, the zoning power is used to regulate land *uses*, and not the activities themselves, although the impacts or risks from activities of a land use may be considered in establishing restrictions and standards. All restrictions on wind farms in a zoning ordinance must be reasonable and rationally related to a legitimate governmental interest, such as protecting the public health, safety, or general welfare.

The Michigan Zoning Enabling Act specifically recognizes the following valid purposes for the regulation of the use of land and structures: meeting the needs of the state's citizens for food, fiber, energy, and other natural resources, places of residence, recreation, industry, trade, service, and other uses of land; ensuring that use of the land is situated in appropriate locations and relationships; limiting the inappropriate overcrowding of land and congestion of population, transportation systems, and other public facilities; facilitating adequate and efficient provision for transportation systems, sewage disposal, water, energy, education, recreation, and other public service and facility requirements; or promoting public health, safety, and welfare.

Zoning is also subject to other applicable limitations. For example, if the regulation of windmills is different or more stringent than the regulation for other similar uses, then there must be a reasonable justification for treating windmills differently. Moreover, the township cannot ban windmills, or impose regulations so restrictive that they have the effect of banning windmills, unless the Township determines that there is no land in the Township that is suitable for a windmill or that there is no demonstrable need for windmills in the Township or the region (see Question R6 addressing exclusionary zoning). In addition, a local zoning ordinance cannot conflict with state or federal law, permit something state law prohibits, or regulate a concern that state law so fully regulates that it preempts local zoning.

Typical regulations in a zoning ordinance might address issues related to the placement, size, and density of windmills, often with the goal of ensuring compatibility with surrounding land uses. Restrictions that might be adopted include: minimum setback distances between a windmill and the road or neighbouring properties; limitations on height; limitations on sound levels; and requirements that the windmill be designed in a manner that addresses certain safety or environmental concerns. For an example, see the model wind energy zoning ordinance discussed in question D4.

In addition to zoning ordinances, townships have the authority to adopt township "police power" ordinances to regulate certain activities that involve potentially harmful effects or risks, provided such

regulation is related to the health, safety and welfare of citizens and concerns of the township and not preempted by state law that regulates the same activities.

D2. How do townships ensure corporations are doing business within an ordinance?

Response: The zoning ordinance will designate an official or officials, often a zoning administrator, who is responsible for enforcing and administering the provisions of the zoning ordinance. The official enforcing the zoning ordinance may impose a fine or other penalty for a failure to comply with the ordinance or the conditions imposed on any permit or site plan issued to the corporation. If the landowner refuses to comply, an injunction may be sought in court to require the landowner to comply with the zoning ordinance.

D4. Should both counties have the same elements in their ordinances to address similar problems if they arise?

Response: Typically Wind Energy System ordinances contain many of the same elements as they are fashioned after model ordinances developed by their respective states. The State of Michigan has a model ordinance titled “Michigan Siting Guidelines for Wind Energy Systems”, see http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf

The elements typically found provide a comprehensive approach for communities to regulate the land use. While they may contain the same elements, the specific requirements of each element may be different. The specifics of the ordinance are based on the uniqueness of each community and should reflect sound scientific evidence, best practices and public input. But, by coordinating various aspects of the ordinances between municipalities you can achieve a regional approach to regulating the land use. A regional approach to regulating land use erases municipal boundaries and considers regional uniqueness, assets, opportunities and barriers. For example, many natural features cross municipal boundaries and therefore require multi-jurisdictional coordination and regulation at the local levels. By both counties containing the same elements in their ordinances and even coordinating the specific regulations as they relate to shared issues will help ensure that regionally land use is regulated in a comprehensive and coordinated manner providing the highest level of oversight.

D6. What is the process for the township’s decisions on the wind ordinance?

Response: Where the process starts depends on what a given township has in place today. Assuming a township does not allow wind energy generating facilities of any type (usually due to a maximum height limit for structures), two types of amendments would precede any wind development: one for anemometers to test the wind, and one for the generating facilities themselves. Five years ago these two uses were dealt with in separate ordinance changes, but today they are often done together.

Under the Michigan Zoning Enabling Act, the ordinance amendment starts with the township planning commission. The planning commission can first evaluate the issue with meetings, including conducting studies, gathering information, and holding public meetings for comments. The planning commission then considers various ways to address wind energy systems and facilities, and whether it should include an amendment to the township’s plan, such as establishing wind zones and overlay districts to enact special use permit regulations. Once an ordinance is drafted based on the plan, the commission holds a public hearing or hearings. After the public hearing, the township planning commission submits a recommended ordinance amendment or set of amendments to the county planning commission if there is one. The county planning commission has 30 days to review and offer its opinion on the proposed amendments. Then the township planning commission submits the proposed amendments and a summary of the public hearing to the township board. The township board may hold another public hearing, and must hold one if a property owner requests a hearing by certified mail addressed to the township clerk.

If the township board passes the ordinance amendment, it takes effect within 7 days after publication in the newspaper, unless a different period is specified. However, within those 7 days a registered voter may submit to the township a letter stating that he or she intends to file a petition to submit the ordinance amendment to the voters of the township in a referendum. The petition proponents then have 30 days to collect signatures representing 15% of the number of registered voters who voted in the preceding governor's election. If such a petition is filed, the matter is set for referendum. If 30 days expire, the ordinance takes effect.

Typically, zoning ordinances regulating anemometers and wind energy generating facilities require a special use permit and approval of a site plan prior to construction. In some instances, a township may decide to amend the land use plan to address whether specific areas qualify for wind generation and the goals to be achieved through zoning or other measures; based on the plan amendment, overlay districts may be enacted by amendment to the ordinance, as well as special use permit provisions tied to the overlay district and general standards for special uses. These administrative permit processes involve an application and supporting information, another public hearing in front of the township planning commission, and depending on the desire of the community, they can also involve a review by the township board. The process involves the exercise of judgment and discretion by the members of these bodies in determining whether a project meets the standards of the ordinance, and if it approves a project the township has the authority to impose reasonable conditions to protect the public health, safety, and welfare.

- D7. Aside from such protections stipulated in wind royalty lease arrangements, can the local authority impose its own? Are such stipulations ever used for other kinds of development—such as shopping malls, industrial applications such as gravel pits, processing plants, amusement parks or other large developments that strongly affect the local landscape?

Response: This question needs clarification. If the question is asking whether a township can negotiate private land use restrictions or limitations, the answer is probably “no.” Lease “stipulations” are negotiated by private agreement. However, if “stipulations” is meant to include “conditions” that limit certain aspects of the siting or regulation of wind energy systems, townships are authorized to impose reasonable conditions on special land use permits or site plans.

- D9. Will our townships be able to defend against intimidation tactics by wind developers? Are there funds available on the state or federal level to defend our enacted ordinances?

Response: Most local units of government carry insurance policies that include coverage for zoning lawsuits. These contracts obligate the insurance carrier to provide the township with defense counsel, and to pay any settlement or judgment against the township, up to the policy limits. Cases are covered by these contracts if the plaintiff requests monetary relief in addition to requesting court orders barring enforcement of the challenged ordinance. If no money damages are requested, the policies do not provide coverage. There are some limited legal defense funds and assistance for local units of government nationally, but their work is limited to extraordinary cases and issues, and we are not familiar with such a fund becoming involved in zoning litigation involving wind energy generating facilities.

- D10. What kind of language can be put in the township ordinance to protect itself from an applicant going bankrupt during the lease/install, etc.?

Response: Before the Township approves a special permit or other approval for construction of a wind generation system, in order to ensure compliance with the zoning ordinance and any conditions imposed under the zoning ordinance, the Township can require that landowner/wind generator operator to deposit with the Township clerk a cash deposit, certified check, irrevocable letter of credit, or surety bond that covers the cost of faithful completion of the proposed wind farm, compliance with conditions, including those that might be imposed for purposes of remediation or correction should a company fail to comply with a condition. If the Township requires a cash deposit, it should establish procedures for refunding the

deposit according to the percentage of the project that has been completed. If the project is not completed, the Township would retain the remainder of the money.

D13. How do townships protect themselves legally from liability if a participating land owner's home is too close to a wind turbine and it results in sleep disturbance and eventually health effects?

Response: Townships are legally immune from tort liability, with a limited number of specific exceptions set forth in the governmental immunity statute. There is no exception in the governmental immunity statute for actions claiming that a local unit of government granted a permit to a third party, and the third party's activity under that permit caused harm. Therefore, townships would have no liability in the hypothetical posed by the question. Health effects and disturbances to use of a home and property should be considered at the outset in the careful planning for and enactment of zoning amendments that regulate wind generation facilities.

D16. Who in the townships is qualified and who will work with the energy company and stand up to it/negotiate as need be on behalf of the township? Is this job too big for the people we have available now. Will the township have to spend money on more lawyers, consultants, etc.?

Response: Ensuring that townships have qualified individuals to deal with applications for Wind Energy Systems is very helpful in making sure that the project receives the appropriate attention to detail and correctly proceeds through the review process. While townships have dedicated volunteers that work tirelessly on the issues pertaining to their community, it would be advisable to hire professionals to work with the Township Boards and Planning Commissions on an application the size and scope of a Wind Energy System.

A thorough review of the Township Fee Schedules may help in understanding if the current fee schedule is set at levels that will cover the cost of hiring the professionals, if they are not already on staff, necessary to process a Wind Energy System application. Arcadia Township currently has a fee schedule that utilizes escrow accounts which are established, among other reasons, to be used to pay for the professionals needed to work with applicants and review submittals. The applicant is required to maintain the escrow account at certain levels. Conversely, the applicant will be reimbursed for any monies not spent in the escrow account once the project has concluded. This method ensures that the community has the resources to hire the appropriate consultants to deal with projects as needed.

Another approach is to work into the approval process a stipulation that the applicant pays for the professionals, whose hiring is determined by the Township Board or Planning Commission, necessary to help the community process a land use/zoning application. If a community doesn't have a zoning ordinance or doesn't have an ordinance dealing with wind energy systems, they may chose to enter into a Development Agreement with the applicant regarding the entire project at which point you would make as a stipulation that the applicant agrees to pay all fees associated with their application. The Township Board, or oversight committee, is then responsible to determining the fees necessary based on the experts they had to hire to deal with the application.

D18. Should townships go to other communities for best practices?

Response: Yes, townships can certainly learn from other communities, both within Michigan and in other states. However, the specific contexts – political, economic, environmental, and social – in one township may vary greatly from another. Each wind energy development proposal is also unique. Therefore, while townships can learn from each other regarding the best practices of wind energy development, best practices can also be specific to certain communities and not apply to others. In Michigan, some townships model their zoning policies off of the Michigan Department of Labor and Economic Growth's guidelines.

These guidelines can be accessed at

http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidlines_Draft_5_96872_7.pdf.

D19. Are we allowed to enact ordinances that hold to a specific vision of our townships even if it does not include industrial wind energy generation facilities?

Response: Township planning and zoning is often guided by a master planning process that takes into account the unique character and assets of a community. Townships can create restrictive zoning that limit forms of utility scale wind development. See D1 for more information about ordinance formation.

D20. Should township officials be allowed to be leaseholders, people who benefit from the decisions made about wind energy, can they hold leases and earn direct money from them when they are overseeing them? What are the safeguards against corruption, if that is what the above is? We should define "corruption" first.

Response: Under Michigan law, "corruption" means intentional or purposeful misbehavior or wrongful conduct pertaining to the requirements and duties of office by an officer. It is a crime punishable by up to five years in prison. A public official who corruptly accepts a gift or act beneficial to the officer in return for voting a particular way is also guilty of a crime, punishable by up to ten years in prison and being forever disqualified to hold public office.

Corruption therefore needs to be distinguished from a conflict of interest. A conflict of interest is a situation in which a person's regard for a duty leads or might reasonably be expected to lead him or her to disregard another duty. The issue that can arise in some zoning scenarios is a conflict of interest, or the appearance of a conflict of interest.

Michigan law states that government decision-makers must avoid a conflict of interest or the appearance of a conflict in all administrative decisions. A conflict may arise when a decision-maker (1) has a financial interest in the outcome; (2) has been the target of personal abuse or criticism from a party; (3) is enmeshed in other matters involving a party; or (4) might have prejudged the case because of prior participation as an accuser, investigator, fact finder, or initial decision-maker.

Under these principles, a township board or planning commission member who had leased property to a wind developer would have at least the appearance of a conflict of interest, because the member would have a financial interest in the outcome and because he or she would be enmeshed in other matters involving the wind developer. This situation would require the member to recuse from participating in any administrative proceeding involving a wind energy project - such as approval of a special use permit or site plan.

The conflicts doctrine applies slightly differently to the process of amending a zoning ordinance, but the likely result is the same. Amending a zoning ordinance is a legislative decision. Judicial review of a legislative enactment is limited to a consideration of the legislation and documented legislative history, and the motive of the legislators may only be examined for fraud, personal interest or corruption. A zoning ordinance amendment may only be struck down if it is arbitrary in a constitutional sense. To be arbitrary in that sense, the local government's action must "shock the conscience." While shocking the conscience is a very high standard, a personal financial interest in the subject matter by local officials is at least a relevant consideration. Therefore, recusal of a township board or planning commission member who had leased property to a wind developer is at least advisable, out of an abundance of caution if for no other reason.

D22 (formerly G10). Can the township restrict already conserved property in any way?

Response: This answer assumes that the question refers to property that is subject to a conservation easement or similar conservation mechanism. In short, yes. All uses of property in the Township, including

property that is already subject to conservation easements, must comply with any applicable Township ordinances. If a conservation easement is less restrictive than the applicable Township ordinance, then the more restrictive provisions of the Township Ordinance would still apply. In addition, conservation easements are voluntary agreements between a landowner and a township and/or non profit conservancy. These easements can be used to address wind generation. For the township to engage in such an effort would require planning, carefully drafted and enacted ordinances, and a bond or other source of funding.

Original Questions:

1. How do these corporations live up to promises? Are they a good corporate citizen? **Project specific. Value judgment**
2. Does Duke have arrangements with Consumers Energy or Cherryland Electric? Should these be in place before they break ground? **Project specific.**
3. What approaches have wind energy companies taken that do not succeed in communities? **Beyond scope of this project.**
4. What can we do to protect ourselves against the deep pockets of the energy companies? There have been stories in the press about their unresponsiveness. Do companies have to pay fines for operating outside of agreed hours, ignoring resident complaints, not paying taxes, etc.? Will there be some sort of fine system and will there be a "fund" of some kind to ensure that money is available for these things? **See response below.**
5. Is Duke Energy proposing a master plan for all of these counties, or is this a first step and we can expect to see, once they have their toe in the door so to speak, that more turbines will be proposed? Is there a way to look at the whole counties and hear what they plan in total for the future? **Project specific.**
6. Can you build a legitimate business model for wind as a private, viable, competitive, profitable, and sustainable enterprise? **Needs further clarification. Beyond scope of this project.**
7. Why did the wind developer conduct a POST-lease signing survey about community support? Why was this not completed prior? **Project Specific**
8. Are there alternative companies [to Duke Energy]? **Project specific. Beyond scope of project.**
9. Are there sources available that give credibility, ethical, and financial information of companies? **See response below.**
10. What legal or moral right does Duke or any other wind turbine company have to take out noise free quiet, clear starry nights, and loss of property value to force these massive obtrusive wind towers onto our rural community? **Value judgment.**
11. How can an energy company submit a proposal to a power purchasing requester if the current area being considered for the proposal is under a moratorium and therefore, no rules are yet in place to determine key questions asked on those proposal submittals? **See response below.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- E4. What can we do to protect ourselves against the deep pockets of the energy companies? There have been stories in the press about their unresponsiveness. Do companies have to pay fines for operating outside of agreed hours, ignoring resident complaints, not paying taxes, etc.? Will there be some sort of fine system and will there be a "fund" of some kind to ensure that money is available for these things?

Response: Local townships have the authority to ask developers to create such requirements. See Theme GG for information about bonding.

- E9. Are there sources available that give credibility, ethical, and financial information of companies?

Response: A comprehensive answer to this question is beyond the scope of this project. However, there are many ways for a consumer or citizen to do background research on corporations, including their stated

financial resources. For example, all domestic and foreign companies are required to file registration statements, periodic reports, and other forms electronically with the US Securities and Exchange Commission's Electronic Data Gathering, Analysis, and Retrieval system (EDGAR). Anyone can access and download this information for free from <http://www.sec.gov/edgar/searchedgar/companysearch.html>. Another source of information is the Annual Report to Shareholders filed by all public companies. There is limited third party information verifying the socially responsible or ethical conduct of companies.

Specific to wind energy, the Attorney General's office in New York State (under Andrew Cuomo) created a code of ethics for wind energy operations as part of a task force to ensure compliance and oversee complaints. A legal analysis of this code of ethics, and its limitations, was written for the New York Bar Association and is available at <http://www.nysba.org/Content/NavigationMenu18/EthicsforMunicipalLawyers/MunicipalLawyerEthicsColumnns/EthMuniLawWin09.pdf>.

E11. How can an energy company submit a proposal to a power purchasing requester if the current area being considered for the proposal is under a moratorium and therefore, no rules are yet in place to determine key questions asked on those proposal submittals?

Response: Most townships do not have permanent moratoria in place restricting wind development. Instead, they often have temporary moratoria while the Township decides upon appropriate zoning ordinances. For more about ordinance creation see the response to question D1.

Original Questions:

1. What are Duke Energy's setbacks based on (scientific data, etc.)? **Project specific.**
2. What are GE's setback recommendations for a wind turbine not to be heard in a rural area? **See response below.**
3. Setbacks—who determines the appropriate setback for the placement of a turbine, by a lake, house, etc.? Township officials or Duke Energy? Should those setbacks be uniform across the counties? **See response below.**
4. Can AES or MAP look into other countries for their turbine setbacks? Denmark, Germany, Australia, Canada and UK? **See response below.**
5. I would like to see in one document a listing of the setbacks that have been used by other government entities for wind farms as large (both turbines and number of turbines) as the proposed one, including those countries in Europe and elsewhere where wind energy is more advanced and where longer term results could be helpful. I would also like to see a document which includes the above and addresses how setbacks may have changed over time, as a result perhaps of larger turbines, larger installations, or resident considerations/complaints. **See response below.**
6. If sound levels are limited by ordinance, what is the purpose of physical distance setbacks for wind turbines, and what setback would be protective for a wind turbine? **See response below.**
7. I would like to understand how often and where a wind farm of this size (both turbines and size of farm) fits into communities which look like Benzie and surrounding counties in their land size, surrounding towns and homes. If setbacks were increased to a certain level, would this project go away because the economy of scale could not be reached? What is that break even setback? Do we need to be mindful of profit motive which may lay behind Duke's proposed setbacks? **Project specific.**
8. What is the average setback from residences for industrial wind turbines of 500 feet, 400 feet, and 300 feet? **See response below.**
9. What are the average setbacks globally? **See response to question F4.**
10. Will the developers abide by the 1-2 mile setback recommended in all of the recent literature on setbacks from people's homes? **Project specific.**
11. GE, a manufacturer of turbines, says that in a rural area, for a turbine not to be heard, they must be placed one mile away. Can a township require that setback? **See response below.**
12. What are the recommended and required setbacks for Duke's proposed wind turbines from Lake Michigan, its shore, and other sensitive or protected lands, including conservancy-protected land? **Project specific.**
13. Re: Setbacks – Considering the World Health Organization recommendation of a 6600 ft. setback, the French National Academy of Medicine recommended setback of 1500 m, approximately 1 mile, the U.S. National Research Council recommended setback of 2500 feet, Vesta manufacturer's manual recommendation that workers wear a hard hat if within 1300 ft. of a turbine, and many, many other recommended setback distances in order to protect people from noise, ice and blade throw, etc. How does the wind industry consider a 1000 ft. minimal setback defensible? Where does this 1000 ft. setback come from? How does a community determine exactly what is a reasonable and responsible setback? **Value judgment. Project specific, but see responses below to related questions**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- F2. What are GE's setback recommendations for a wind turbine not to be heard in a rural area?

Response: We did not locate a published set of specific recommendations for GE turbine setbacks for sound; instead, they state that setbacks are the responsibility of the developer themselves. They did publish a document called “Setback Considerations for Wind Turbine Siting”, in which they make recommendations for structural distance, but they do not mention noise considerations as a reason for their setbacks. This document is accessible at <http://documents.dps.state.ny.us/public/Common/ViewDoc.aspx?DocRefId=%7bF6A567D4-3F56-4125-968F-28CBF62BD6F6%7d>.

- F3. Setbacks—who determines the appropriate setback for the placement of a turbine, by a lake, house, etc.? Township officials or Duke Energy? Should those setbacks be uniform across the counties?

Response: The state of Michigan has created guidelines for the distance between all utility-scale wind turbines and adjacent private property to be at least the height of the turbine itself, and the distance between on-site, smaller scale turbines and property lines be at least 1.5 times the height of the turbine. This is a recommendation but townships can create their own zoning restrictions. This is described in the Michigan Department of Labor and Economic Growth’s “Siting Guidelines for Wind Energy Systems,” online at http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf.

- F4. Can AES or MAP look into other countries for their turbine setbacks? Denmark, Germany, Australia, Canada and UK?

Response: Turbine setbacks vary greatly across the nations mentioned above, and are usually decided on a case by case basis. Setbacks can also refer to visual impacts, noise impacts or structural safety. If setbacks are legislated, it is often at the county or province level. For example, the Ministry of Environment in Ontario, Canada has established a setback of 550 meters. This is the most stringent in North America. The National Wind Watch website, an organization generally opposed to large scale wind development, provides a list of European setbacks. See <http://www.wind-watch.org/documents/european-setbacks-minimum-distance-between-wind-turbines-and-habitations/> to read more. This research has not been verified by the research team because it is beyond the scope of this project.

- F5. I would like to see in one document a listing of the setbacks that have been used by other government entities for wind farms as large (both turbines and number of turbines) as the proposed one, including those countries in Europe and elsewhere where wind energy is more advanced and where longer term results could be helpful. I would also like to see a document which includes the above and addresses how setbacks may have changed over time, as a result perhaps of larger turbines, larger installations, or resident considerations/complaints.

Response: While this question is beyond the scope of this project, the National Regulatory Research Institute is completing a large research project to collect and examine the wind energy siting (with a focus on setbacks) practices in all 50 states. This will be available in late 2011.

- F6. If sound levels are limited by ordinance, what is the purpose of physical distance setbacks for wind turbines, and what setback would be protective for a wind turbine?

Response: Setbacks are most often put in place as a protective measure against potential structural risks, such as fire or tower collapse. Setbacks are established to eliminate the possibility that someone would be injured in such an event. The state of Michigan requires that the distance between the nearest private structure and the base of the turbine be at least the height of the turbine. For more information on the need for such setbacks, see the New York State Energy Research and Development Authority’s “Public Health and Safety” report. This is accessible at http://www.powernaturally.org/programs/wind/toolkit/18_publichealthandsafety.pdf

- F8. What is the average setback from residences for industrial wind turbines of 500 feet, 400 feet, and 300 feet?

Response: The state of Michigan has recommended setbacks of at least the height of the turbine as a setback between utility-scale turbines and property lines. See the “Siting Guidelines for Wind Energy Systems” for more details. This document can be accessed at http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidlines_Draft_5_96872_7.pdf).

F11. GE, a manufacturer of turbines, says that in a rural area, for a turbine not to be heard, they must be placed one mile away. Can a township require that setback?

Response: Townships throughout the nation have established restrictive setbacks, including a mile away. Some of these have been challenged in court as exclusionary zoning. In one recent case in Minnesota, a township’s ½ mile setback from non-participating landowners was rejected by the Public Utilities Commission. See the website of A Better Plan, an organization critical of wind energy development, for a list of ordinances with ½ to 1 mile setbacks. This can be accessed at <http://betterplan.squarespace.com/wind-siting-ordinances/>.

Also see responses to questions in Theme D and Theme R about ordinances and potential exclusionary zoning.

Original Questions:

1. Explain the pooling arrangements Duke will make with some farmers. How will they affect the locals around the turbine who don't have a lease? Do they benefit in any way? **Project specific.**
2. Are the landowners hosting the windmills being fairly compensated? **Project specific.**
3. How much money will landowners make? **Project specific.**
4. Who is really getting rich from this? Duke or the farmers/land leasees? **Project specific.**
5. What parties will benefit the most financially from this project? **Project specific.**
6. Property owners with leases for the wind turbines receive a financial benefit. What compensation process is available to an adjacent property owner who may encounter health issues or property devaluation due to the turbine's existence? **See response below.**
7. Why are federal and state lands not being considered for industrial size wind turbines? **See response below.**
8. Why aren't public lands considered for locations? **See response to question F7.**
9. How many acres of public land will be taken for the proposed project and what will be the remuneration for taxpayers and citizens of Michigan for taking land that is currently in the public trust? **Project specific.**
10. Can the township restrict already conserved property in any way? **Moved to D22 "Township Governance".**
11. I own 30 acres in Luce County and am willing to allow windmills to be installed, but I understand inland isn't be looked at and small parcels aren't considered. Is this true? Couldn't adjoining properties, if all gave consent, create a large enough buffer? **Needs further clarification.**
12. I would like to know how I can find out if my property is a good wind site. Is it possible to "test" the site somehow? Rent a turbine for 6 months or so and see the results? And how much can that cost? And lastly, is there a directory that I can use to choose a business in my area? **See response below.**
13. How does a lending institution, such as a local bank, recognize this long-term lease and its equitable value? Could a leaseholder borrow 80% of the projected \$12,000/100 acres? What is the REAL value of this lease? **See response below.**
14. Would there be an option for landowners to renegotiate certain terms of a lease after this report is published and new information is learned? Is this something a wind developer would be open to? **Project specific.**
15. Are non-disclosure clauses in wind royalty leases that cover items other than payment schedules both legal and typical? **See response below.**
16. Are wind rights severable? That is can someone sell property and keep the wind rights? Can someone speculate in wind rights? If a lease is signed for a piece of property does the lease stay with the property, or can the original lessee sell the property and continue profiting from the lease? **See response below.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- G6. Property owners with leases for the wind turbines receive a financial benefit. What compensation process is available to an adjacent property owner who may encounter health issues or property devaluation due to the turbine's existence?

Response: Compensation for non-participating landowners varies from project to project depending on the developer and any possible township ordinances. There is precedent for "good neighbor agreements" that provide a fixed annual fee to non-participating landowners. These payments can range in value. However, in

return for payment the landowner agrees not to challenge or otherwise interfere with the successful operation of the project.

G7. Why are federal and state lands not being considered for industrial size wind turbines?

Response: Federal and state lands are being considered for wind energy development across the United States. Some of the best wind resources are often found on public lands. There are different processes for getting a permit on state and federal land. For example, development on federal lands triggers the preparation of an environmental impact assessment. For more information about the siting process for federal lands, see the Bureau of Land Management's Programmatic EIS requirements at <http://windeis.anl.gov/>

G12. I would like to know how I can find out if my property is a good wind site. Is it possible to "test" the site somehow? Rent a turbine for 6 months or so and see the results? And how much can that cost? And lastly, is there a directory that I can use to choose a business in my area?

Response: It is not clear if this question is asking about a small turbine for a home/farm or about having a utility scale turbine sited on one's property. Many states have anemometer loan programs. See <http://www.windpoweringamerica.gov/> to see if your state has one. It is unlikely that an interested resident could rent a turbine for 6 months but you may be able to get an anemometer put up at your site for 6 months to a year. If not, you may find nearby wind speed data being collected at weather stations or airports nearby for the last few years.

G13. How does a lending institution, such as a local bank, recognize this long-term lease and its equitable value? Could a leaseholder borrow 80% of the projected \$12,000/100 acres? What is the REAL value of this lease?

Response: The answer depends on the lending institution. Generally, the leaseholder should be able to borrow against that value. However, this depends on how the particular lender values the lease. Because wind leases are relatively new, it may be the case that some bankers are less experienced with the topic and may need additional resources.

G15. Are non-disclosure clauses in wind royalty leases that cover items other than payment schedules both legal and typical?

Response: Non-disclosure clauses are common and are typically legal. Landowner groups and local governments have approached this differently. In South Dakota, there was attempt to have the leases filed publicly with the county clerk or another public official. In Wyoming, the state legislature is considering a unitization law that would make profits from a wind turbine shared with the owners of surrounding property whose own wind rights are being affected by the development.

The North Dakota State University's Agricultural Extension Service put together a report for potential landowners considering leases. It is available at www.ag.ndsu.edu/pubs/agecon/market/ec1394.pdf.

In addition, Windustry has a similar guidebook available at <http://www.windustry.org/leases>.

G16. Are wind rights severable? That is can someone sell property and keep the wind rights? Can someone speculate in wind rights? If a lease is signed for a piece of property does the lease stay with the property, or can the original lessee sell the property and continue profiting from the lease?

Response: A landowner may grant an easement or lease to another to use his or her land for just about any use so long as it is lawful under the zoning ordinance or other laws and regulations. This would include a wind easement - a perpetual right to use the land for wind generation - to a party who does not own the land.

While there is no legal authority in Michigan that answers the question of whether a landowner could sever and retain such an easement upon selling the property, then grant the easement to another party, the law of property, easements and licenses, and contracts would apply. Essentially, rights to use land and to extract minerals, such as oil and gas, are recognized as rights transferred apart from the ownership of the land. On the other hand, water rights, which cannot be extracted because water passes through and is not part of the land, are not severable. Water's moving and flowing character through or over land is used to benefit the land for reasonable uses. Unlike oil and gas, the landowner does not own the water but enjoys a right to use it. In some instances, such as bottled water or municipal water systems, water itself is transferred for use elsewhere, so long as the transfer does not unreasonably interfere with other adjacent landowners who use and enjoy the water.

While there is no case law or statute in Michigan directly addressing these issues, wind moves over land as air currents, and in that sense is more like water. So water law could be applied as a rough analogy. The landowner enjoys the benefit of wind passing over the land because of location, and as landowner has a right to use the currents, i.e. the wind, but does not own the wind in the sense that it can be sold. This is comparable to water passing through a hydroelectric dam that may be used to produce energy that can be transferred and sold.

A lease typically stays with the land - there is an owner and tenant. However, once a lease is signed and revenues produced, it would seem that a landowner who sells his or her property could retain the right to receive revenues from the benefit of the lease as a matter of contract or agreement with the new owner.

Original Questions:

1. Will there be any effort to document the ecological impacts of the project once developed? If yes, will the information be made public? **Project specific.**
2. FERC and state wildlife agencies have roles in determining the ecological impacts of certain power generating facilities. Does FERC or the State of Michigan regulate or otherwise have a role in determining the ecological impacts that a wind energy development may cause? **See response below.**
3. Are there either State or Federal requirements or voluntary measures that are or can be undertaken to mitigate ecological harm (e.g. habitat restoration)? **See response below.**
4. What are the environmental benefits of wind energy compared to coal, oil, natural gas and nuclear? **See response to question L7.**
5. Looking at Duke Energy's Gail Windpower Project proposal as an example, what trees would be removed, land excavated, roads constructed, electricity delivery poles or pylons placed in order to support the turbine system and connect it to the national grid? In other words, what will be the total impact that could result in losses to the existing natural/agricultural/residential environment? I am especially concerned about trees being cut down and habitats disturbed. Do cable trenches connecting turbines usually run 'as the crow flies', slicing across hills, fields, forests and creeks? **Project specific.**
6. Will the earth return to its natural state? Platforms removed and plants restored? **Needs further clarification, but see response to question H3.**
7. Clean up of any contamination allotted for? Restore to natural settings—plants, trees, grasses, food for the animals, so they return? **Needs further clarification.**
8. What are the Environmental Impact methods, Migratory Bird Study methods that should be followed? Are there ASTM Methods or other standard protocols that should be followed for these environmental studies? **See response below.**
9. How does the environmental impact of having wind energy compare with those of solar, coal, natural gas, oil, and nuclear? **See response to question L7.**
10. The US Fish and Wildlife Service suggest a 3-mile buffer along the Lake Michigan shoreline within which wind turbines should be construction. Could the Wind Initiative find out what data was used by USFW to establish this buffer? **See response below.**
11. Is there less impact to the environment and communities if a large wind project is constructed off-shore in Lake Michigan vs. on-shore? **Project specific, but see response below.**
12. Will the developer be held responsible for any erosion or run-off from cleared lands and new roads and any other effect on stream and lake water quality? Who will monitor this effect? **See response below.**
13. Can the community/township require that the applicant share all wind data and environmental studies so that the township expert can examine and determine whether the data warrants turbines? **See response below.**
14. What are the environmental and social impacts of large wind farms? **See response below.**
15. Could the massive foundation for the turbines have an impact on groundwater? **See response below.**
16. Are we allowed to use supporting documentation and/or guidelines and recommendations from the Dept. of Interior, DNRE and/or National Park Service in order to enact ordinances in our township that restrict development of wind energy facilities near lakeshores, inland lakes and sensitive wildlife habitats? **Needs further clarification given the range of possible documentation/guidelines.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this

will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- H2. FERC and state wildlife agencies have roles in determining the ecological impacts of certain power generating facilities. Does FERC or the State of Michigan regulate or otherwise have a role in determining the ecological impacts that a wind energy development may cause?

Response: The Federal Energy Regulatory Commission does not regulate these impacts. However, the “Michigan Siting Guidelines for Wind Energy Systems” address the kinds of environmental impact assessments that should be conducted prior to construction in order to gauge the ecological damage that may occur. The precise language is available on page 7, and can be read at http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf.

- H3. Are there either State or Federal requirements or voluntary measures that are or can be undertaken to mitigate ecological harm (e.g. habitat restoration)?

Response: There are a number of recommendations and guidelines that have been created to reduce the impact of wind energy on wildlife. Ecological mitigation strategies are similar, and often overlap with wildlife considerations, which are discussed further in response to question B29.

- H8. What are the Environmental Impact methods, Migratory Bird Study methods that should be followed? Are there ASTM Methods or other standard protocols that should be followed for these environmental studies?

Response: The state of Michigan’s Department of Labor and Economic Growth outlines the environmental and wildlife impact assessments that must be undertaken before wind farms may be constructed. Both must be carried out by qualified professionals, and must “take appropriate measures to minimize, eliminate or mitigate adverse impacts identified in the analysis”. To read more about Michigan’s requirements, see the Michigan Siting Guidelines for Wind Energy Systems, online at http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf.

- H11. Is there less impact to the environment and communities if a large wind project is constructed off-shore in Lake Michigan vs. on-shore?

Response: This is project specific; the impacts will vary by community and depends on the scale of the project and where it is being sited off-shore and how electricity will be transmitted. See response to question DD1 for a description of off-shore wind development impacts.

- H12. Will the developer be held responsible for any erosion or run-off from cleared lands and new roads and any other effect on stream and lake water quality? Who will monitor this effect?

Response: It is beyond the scope of this project to respond to potential impacts of the Duke Energy project. In general, township ordinances can require strategies be adopted to control for erosion, road monitoring and include decommissioning measures to restore, regrade and replant areas where foundations, roads, and buildings were located. See response to question I1. Some elements of a wind energy project (i.e., road construction or grading plans) are similar to the requirements for any development project. Monitoring may be performed to verify that site work is adequately protecting sensitive environmental areas and that road conditions following construction have not degraded. In general, it is the responsibility of local authorities to monitor water quality.

- H13. Can the community/township require that the applicant share all wind data and environmental studies so that the township expert can examine and determine whether the data warrants turbines?

Response: The Township can require that the applicant provide as much information as is reasonably needed for the Township officials to evaluate whether the proposed windmill conforms with any applicable

standards in the zoning ordinance. For example, if wind turbines are permitted as a “special use” site plan, or other required approval within the Township, or require the submission of the site plan for approval, or if the Township adopts additional, wind turbine specific requirements, all of these types of regulation might very well include standards for which wind data and environmental studies might be necessary for their evaluation.

In addition, if authorized by a Township ordinance or policy, the Township can require that the applicant pay for experts that the Township hires to provide an independent analysis. See more about this by referring to the response to question KK4.

H14. What are the environmental and social impacts of large wind farms?

Response: Answering this question comprehensively is beyond the scope of this project. For an extensive description of the many impacts – both environmental and social – of wind energy, read the report by the National Research Council titled “Environmental Impacts of Wind Energy Projects”. It can be downloaded at http://www.nap.edu/catalog.php?record_id=11935.

H15. Could the massive foundation for the turbines have an impact on groundwater?

Response: The impact of a turbine foundation on groundwater depends both on the landscape and the construction strategies used at the time of development. These potential impacts would most likely be documented in a project’s environmental impact assessment. In one example, a groundwater assessment study was specifically commissioned for the Jordanville Wind Project in New Jersey (see: “Report of the Potential Impacts to Groundwater and Karst Topography During Construction of the Jordanville Wind Farm” at <http://www.njwind.com/jordanville/pdf/SDEIS/3-Appendices/D-Groundwater%20Analysis/Revised%2011-06-06%20GZA%20Jordanville%20Groundwater%20Response.pdf>), and their study found that the wind farm construction – if carried out using best management practices to limit the impact of construction– would have no effect on groundwater in the area.

Original Questions:

1. Once they are in the area, will a “live” person be available for troubleshooting or to take calls from concerned citizens that have valid complaints? How quickly will these issues be addressed, i.e. —noise, dead birds and animals, etc. **Project specific, but see response below.**
2. What are the maintenance requirements (lubrication, parts & labor) of the turbines? **See response below.**
3. What about vandalism? Will extra police be added to the already low road coverage to protect these turbines for hunters or kids with guns? **Project specific.**
4. What is the blade-attachment failure rate for turbines installed in the past five years (i.e., the most modern variety)? **Beyond scope of this project, but see response below.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

11. **Once they are in the area, will a “live” person be available for troubleshooting or to take calls from concerned citizens that have valid complaints? How quickly will these issues be addressed, i.e. —noise, dead birds and animals, etc.**
Response: Depending on the requirements of the permit, developers can be asked to establish a compliance monitoring program in advance. This agreement should make sure that the project is being properly monitored and operators should communicate with community members to solve problems as – and often before – they arise. However, this depends upon the developer’s permit and contract, and it is a concern that should be brought up directly with the permitting authorities. The National Wind Coordination Collaborative discusses this in their handbook, “Permitting of Wind Energy Facilities”. This document can be accessed at <http://www.nationalwind.org/assets/publications/permitting2002.pdf>.
12. **What are the maintenance requirements (lubrication, parts & labor) of the turbines?**
Response: Answering this question comprehensively is beyond the scope of this project. Each turbine manufacturer has specific requirements. For one example, see Proven Energy’s “Wind Turbine Maintenance Instructions” manual for a description of the procedures and schedule necessary for proper turbine maintenance. For a general description of turbine maintenance tools and strategies, see the World Wind Energy Association’s technology guide at http://www.wwindea.org/technology/ch03/en/3_4_3.html.
14. **What is the blade-attachment failure rate for turbines installed in the past five years (i.e., the most modern variety)?**
Response: This information is often proprietary and was unavailable to the research team. The failure is most often not at the point of the blade attachment but with the blade itself.

Original Questions:

1. Data to show the impacts on tourism and economic development. **See response to question N9.**
2. Are there studies that look at areas where tourism is a factor? **See response below.**
3. Do large wind projects (100+ turbines) negatively impact tourism? **See response to question J2.**
4. If a wind farm is placed in a mixed use resort/residential/agriculture/natural beauty area, what is the true potential for loss of existing resort and tourism economies in such an area? **See response to question J2.**
5. How will trout fishing and tourist activities be effected by large-scale turbines over designated trout streams and lakes? **See response below.**
6. Our economy is primarily tourist based and relies heavily on our natural and scenic landscapes. What guarantees will you provide that there will not be more jobs lost than those gained? **Project specific.**
7. How will tourism be measured if they are in place? What will bring someone to see 112 windmills? What's the draw? Will the hotels, motels, restaurants, party stores, police forces be ready for the influx of tourists? **Project specific. Comment not question, but see response to question J2.**
8. My concern is, given the importance of tourism to the region, that Duke Energy's enthusiasm to reap subsidies is not permitted to outrank the local considerations of a tourism-based economy. **Comment not question.**
9. We visit this area for about 5-6 months of the year and this will not be a pleasant place if these wind energy come to close to the area. We will need to find a more pleasant place to visit. **Comment not question.**

Questions and Responses:

These questions may have been re-categorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

J2. Are there studies that look at areas where tourism is a factor?

Response: There are multiple studies that have been undertaken regarding the observed and modeled impacts of wind farms on tourism. However, there have been no extensive studies over time of a wind farm on tourism. One study reports on a survey which asked Delaware beach visitors if offshore wind turbines would affect their vacationing habits, and the results indicate that more than 70% of people say that they would not change which beach they visited and more than 60% said they would be likely to visit a new beach in order to see the offshore wind farm. To read the study, see "The Effect of Wind Power Installations on Coastal Tourism" which can be found at www.mdpi.com/1996-1073/3/1/1/. A Scottish survey of tourists suggests that wind farms would have little impact on local tourism and an Australian report concludes the same. The Australian study can be found at: www.windri.org/survey/references/tourism.pdf. While this body of work points to little impact on tourism, experiences are likely to vary place to place. It is important to note both Scotland and Australia already have many wind farms, so tourists have likely seen them more often than they have in the United States.

J5. How will trout fishing and tourist activities be effected by large-scale turbines over designated trout streams and lakes?

Response: There is no evidence that the presence of wind turbines will negatively affect the survival or health of fish in nearby lakes, streams and rivers. For more on the impacts of wind turbines on other forms of wildlife, see Theme B questions about wildlife. There is little evidence that fisherman will change their

travel habits due to the presence of wind turbines. See question J2 for more information on the affects of wind farms on tourism.

Original Questions:

1. Compare property values by similar density (i.e. homes per square mile vs. turbines per square mile). [See response to question K3.](#)
2. Provide data/studies on the impact of property values (evaluate based on proximity, view corridor, visual impact, etc.). [See response to question K3.](#)
3. I would like to see a compilation of all the studies done on the effects on property values. There is so much floating around, I don't know what to believe. [See response below.](#)
4. What analysis, if any, has been done to examine the property value and resulting tax reduction for the township? I realize the study Duke cites says there is no adverse impact on property value. But, I understand the housing in that study was not reflective of Benzie County. How will the schools, already in dire economic situations, be impacted? [Project specific; Beyond the scope of this project, but see response to question K3.](#)
5. Would the government be able to condemn property by eminent domain where transmission lines and substations are to be placed? If so, how are properties valued when taken by eminent domain? [Answer pending](#)
6. Re: Property Value Issue. The Takings Clause of the 5th Amendment states that serious sustained physical invasions of property requires payment of compensation equal to the difference between market value prior to and after invasion. How does this apply to the wind industry's use of private land and the effect on non-participating property owners and the community in general, in regards to a property value issue, specifically devaluation of property and a township's ability to protect/guarantee property value through its zoning ordinance? Is noise pollution a taking? Consider the scale of the project: encompassing approx. 25 square miles, 4 townships, thousands of property owners, one hundred and twelve 500 ft. tall industrial wind turbines, associated access roads, transmission lines, sub-stations, etc. and the length of the project, a 25 year lease in this case. [See response below.](#)
7. If a wind farm is placed in a mixed use resort/residential/agriculture/natural beauty area, such as this, what is the true potential for real property value loss? [See response to question K3.](#)
8. There are claims that wind farms harm property values in "mixed use" settings, but not in strictly or strongly agricultural settings? Is that what the extant studies say, as far as you can tell? [See response to question K3.](#)
9. Property values are bound to go down, how will this be addressed? Will studies be performed in this area? [See response below.](#)
10. In a decade or more, would having a wind farm (several turbines) nearby be a positive or negative for selling a home and/or piece of property? In other words, if you live next to a wind farm, is that going to negatively or positively affect your ability to get a good price for your home or farm? [See response to question K3.](#)
11. Are there ordinances that have a property value guarantee? Can you reference these community ordinances? Have they been challenged? [See response below.](#)
12. Do homes lose property value if they are located within a one mile radius of an industrial wind energy project with 100+ turbines? [See response to question J2.](#)
13. Will non-participating property value increase if within one mile of an industrial wind energy facility? Can you provide examples? [See response below and response to question J2.](#)
14. The DOE/Lawrence Berkeley Study on Residential Property Values states that wind farms have no impact on residential property values. There have been several examinations of this report. Mr. Albert Wilson (AR Wilson, LLC specializes in environmental financial risk management and impaired value analysis) examined the methodology used in the analysis. He states, "As stated in the title, the primary basis for the conclusions drawn in the report are hedonic analysis of residential real estate sales data. A hedonic analysis in turn is based on the assumption that the coefficients of certain explanatory variables in the regression represent accurately the marginal contribution of those variables to the sale price of the property." He further states, "If the regression does not conform to recognized standards then we have no independent assurance of the accuracy or reliability, as in this case." This study was done for the "Wind Industry." The Wind Industry funded the study and the wind industry got the results

they wanted. One critical flaw in the study is that less than 10% of the properties had any view of the turbines with only 2.1% of the property rated the view greater than minor. 64% of the properties were 3 miles or more from the wind farm and the turbines could not be seen at the properties. This skews the data significantly where little impact on property values is measured. The study was also too short a period. Is the conclusion of the Lawrence Berkeley study that there is not impact on property values from wind farms correct, or are there deficiencies in the study?
Comment not question.

15. Keeping in mind the current state of dropping home values in general, is it valid to say that property values increase or decrease after a wind farm is developed? **See response to question K3.**
16. I have a smaller parcel of land I want to build a home on in the future. It is surrounded by adjacent property owners that have signed wind leases. If wind turbines are constructed closer to my property because presently there is no structure on my property, my parcel is now worthless. I or no one else would want to build on my parcel, with wind turbines so close to my parcel. How am I compensated for the loss of a buildable parcel that no one would consider constructing on, with industrial wind turbines so close to it? **See response below.**
17. Some residents argue that the sight of a Wind Farm would lower their property values. Articles that I have read suggest that property values may decrease during the construction phase, but return to normal and increase after the wind turbines are operational. **Comment not question; this study is addressed in the response to question K3.**
18. Are there actual decreased property values of those residences that are non-participating? **See response to question K3.**
19. Can an ordinance include a Property Value Guarantee? If not specifically excluding wind but pertaining to any industrial application? **See response to question K11.**
20. Will the total number of property studies used to determine property values impacts from wind development be disclosed? **Project specific.**

Questions and Responses:

These questions may have been re-categorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- K3.** I would like to see a compilation of all the studies done on the effects on property values. There is so much floating around, I don't know what to believe.

Response: The response to this question is intended to address several questions within this thematic area that pertain to the impacts of wind farms on property values. It appears that the question that was at the core of most other questions is “Is there an affect of wind farms on property values? If so, under what circumstances and to what degree?” This response provides a summary of available evidence on the effects of wind farms on nearby home property values.

As with many other issues, the impacts of wind turbines on nearby property values are hotly contested. It is difficult to identify studies that have been conducted by a research group from a neutral source of funding. An added complication is the housing bubble burst in 2007 that decreased the values of all homes, not just those near wind turbines. Furthermore, it is possible that wind turbines are built in places with already declining or lower property values, an economic problem called “endogeneity.” What is clear is that more economic analysis should be undertaken and published in peer-reviewed journals to better understand this issue, and it is likely that the effects of wind farms on property values varies greatly according to the preferences of the local community as well as land use patterns near the wind farm.

The National Research Council’s volume “The Environmental Impacts of Wind-Energy Projects,” published in 2007, contains a section on property value studies (That section may be found at http://books.nap.edu/openbook.php?record_id=11935&page=163). This text presents a list of variables that

could possibly influence the affect that wind turbines have on nearby property values. The contributors to this book summarize: “On the one hand, to the extent that a property is valuable for a purpose incompatible with wind-energy projects, such as to experience life in a remote and relatively untouched area, a view that includes a wind-energy project—especially one with many turbines—may detract from property values. On the other hand, to the extent that the wind-energy project contributes to the prosperity of an area, it may help to bring in amenities and so may enhance property values.”

Since the NRC book was published in 2007, several other studies examining the affects of wind farms on property values have been conducted. A 2009 study by the Lawrence Berkeley Lab in California (<http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf>) analyzed properties near multiple wind farms and found no link between distance from wind farms and property values, but the authors acknowledge that individual properties could still be affected in some cases. A 2010 study of a large wind farm in Illinois came to a similar conclusion (<http://indianadg.files.wordpress.com/2010/11/2010-wind-farm-proximity-and-property-values1.pdf>). Preliminary research in Britain and Australia has shown no significant change in property values near wind farms compared to property values further away from wind farms. In contrast, a September 2009 study by Appraisal Group One, a condemnation appraisal consultant firm, conducted an opinion survey of realtors in Dodge and Fond Du Lac counties in Wisconsin. They found property values declined 12 to 47 percent from 2006 to 2009, depending on the proximity of turbines within an existing wind farm region. That study can be found at www.scribd.com/doc/23858548/Ago-Wind-Turbine-Property-Value-Impact-Study. None of these studies were published in a peer-reviewed economics or finance journal.

Two more recent studies were conducted in Illinois. Hinman’s 2010 study, “Wind Farm Proximity and Property Values”, looked at the effect of Twin Groves Wind Farm, with 240 turbines, on nearby property values in McLean County, Illinois. The study found that property value impacts vary based on the different stages of wind farm development. When the wind farm was initially announced, property values near the prospective wind farm site sold for less than those located elsewhere. However, during the operational stage of the wind farm project, property values rebounded and soared higher in real terms than they were prior to wind farm approval. The study found that these stages of wind farm development roughly correspond to the different levels of risk as perceived by local residents and potential homebuyers.

Another recent study is Carter’s 2011 “The Effect of Wind Farms on Residential Property Values in Lee County, Illinois” which also utilized a hedonic price model to assess the impacts on 1,298 real estate transactions from 1998 to 2010. The projects in the county include the Lee-Dekalb Wind Center, Mendota Hills and the GSG Wind Farm. The analysis indicates that residential properties located near wind turbines in Lee County have not been affected by their presence. This study argues that it is tough to reconcile the consistent findings that wind farms do not affect neighboring property values with general public perception to the opposite. While there is evidence to suggest that wind farms do not affect the ease of selling a home, additional exploration of the issue should occur.

Heintzelman and Tuttle’s 2011 “Values in the Wind: A hedonic analysis of wind power facilities,” study, which evaluated 11,369 properties in upstate New York over a period of 9 years, found a significant and negative impact of wind turbines. The authors of this study found that properties within one mile of a wind turbine experience a drop in value ranging from 7% to 14%. The results of this study are markedly different from previous studies, which according to the authors is due to the use of methodology that better controls for analysis bias. The authors argue that these results represent a need to compensate nearby non-leasing property owners for a drop in property values.

There are no extensive studies of the effect on property values in western Michigan. None of the above studies focus on property value impacts in a resort and tourism based economy.

K6. Re: Property Value Issue. The Takings Clause of the 5th Amendment states that serious sustained physical invasions of property requires payment of compensation equal to the difference between market value prior to

and after invasion. How does this apply to the wind industry's use of private land and the effect on non-participating property owners and the community in general, in regards to a property value issue, specifically devaluation of property and a township's ability to protect/guarantee property value through its zoning ordinance? Is noise pollution a taking? Consider the scale of the project: encompassing approx. 25 square miles, 4 townships, thousands of property owners, one hundred and twelve 500 ft. tall industrial wind turbines, associated access roads, transmission lines, sub-stations, etc. and the length of the project, a 25 year lease in this case.

Response: The Fifth Amendment of the United States Constitution and Art. 10, Sec. 2 of the Michigan Constitution most likely do not apply to this situation because the Taking Clauses only apply to actions of the government and land that is appropriated or "taken" for a "public use." In other words, it is not possible for one private landowner's private use of their property to amount to a "taking" of a neighbor's property in violation of the Constitutions.

Instead, the neighboring private landowner's remedies are limited to pursuing a private lawsuit in court, such as pleading a "nuisance" claim that the windmill unreasonably interferes with the neighbor's enjoyment of his or her property. The fact that a Township permits windmills under a zoning ordinance would not be relevant; that is to say, the failure to prohibit a private land use does not amount to a taking of properties affected by that land use, even if the land use rises to the level of nuisance. But, on the other hand, the fact that a windmill owner is in compliance with a local zoning ordinance also would not protect the owner from a nuisance suit.

The only way in which the Taking Clauses might apply would be if the government took action by passing a law, stating that a windmill could never be treated as a nuisance, depriving a landowner who has been harmed of their legal property rights to redress a nuisance, or if the government, itself, constructed the windmill like any landowner.

K9. Property values are bound to go down, how will this be addressed? Will studies be performed in this area?

Response: Property values of nearby homes will not necessarily decrease due to the presence of wind turbines. See question K3. We are not aware of property values studies being performed in Manistee and Benzie Counties.

K11. Are there ordinances that have a property value guarantee? Can you reference these community ordinances? Have they been challenged?

Response: Property value guarantees are not a common element of wind energy ordinances. However, in Denmark property owners who lose more than 1 percent in value of their property as a result of the installation of a wind turbine are ensured full compensation for their loss. In this case, if you own the property you have the option to voluntarily enter into an agreement with the wind energy company to compensate you for the loss of the value of the property as part of your initial agreement to lease your land. Information about this case is available at http://www.ens.dk/en-US/Info/Legislation/Energy_Supply/Documents/Promotion%20of%20Renewable%20Energy%20Act%20-%20extract.pdf

The Town of Hammond, New York passed a Wind Energy Facilities law that requires the applicant to submit for review a "Property Value Analysis" that is prepared by a licensed appraiser. The analysis is reviewed and approved by the Variance and Project Oversight Board. This analysis is used to determine the potential impact of values on properties. The law also requires a Residential Property Value Guarantee Agreement that attempts to deal with the issue of protecting the value of real property within a 2 mile radius of a Wind Energy System project. This law was enacted in 2011 and has not been tested in a court of law. For more information about this law, see [http://www.townofhammondny.com/uploads/documents/Hammond_Wind_Law-Proposed_Revisions_021311_\(2\).pdf](http://www.townofhammondny.com/uploads/documents/Hammond_Wind_Law-Proposed_Revisions_021311_(2).pdf)

In addition, in 2009 DeKalb County, Illinois a property owner entered into a property value guarantee agreement. The agreement is fashioned after a template developed by attorneys working for the State of Illinois. This is available at

<http://renewableenergy.illinoisstate.edu/wind/conferences/speaker%20presentations/022410%20Siting%20Zoning%20Taxing%20Conf/PM%200230%20A%20Ruth%20Anne%20Tobias.pdf>

K16. I have a smaller parcel of land I want to build a home on in the future. It is surrounded by adjacent property owners that have signed wind leases. If wind turbines are constructed closer to my property because presently there is no structure on my property, my parcel is now worthless. I or no one else would want to build on my parcel, with wind turbines so close to my parcel. How am I compensated for the loss of a buildable parcel that no one would consider constructing on, with industrial wind turbines so close to it?

Response: See the response to question K6. Assuming the turbines are operated in compliance with all applicable laws, then the neighbor's remedy would be a private lawsuit against the wind turbine owners or operators.

Original Questions:

1. Can you provide a comparison matrix of energy sources including but not limited to coal, wind, solar, nuclear, and natural gas that addresses cost, carbon footprint, subsidies, health risks, historical costs associated with health and environmental impacts, etc.? [See response below.](#)
2. How does wind compare with other green energy options based on cost, energy efficiency, and environmental impacts? [See response below.](#)
3. What forms of renewable energy might respect the independence and pride of small rural, agricultural communities such as Frankfort, allowing the residents and landowners to take the lead in energy development that would benefit them? The current process in which huge corporations such as Duke Energy use state-of-the-art methods to market their product and project, and the massive size of the turbines themselves, dominates the local people and leaves them dependent on the corporation to make good on its claims. This is not the way of Benzie County's people. [See response below.](#)
4. Gas looks better than coal, but rock fracturing is hard on the ecosystem 3. Hydro also destroys lots of ecosystems 4. Nuclear - Safety problems could be solved, but we need to deal with waste and the mining of the uranium ore 5. Solar - a long way from economical 6. Geothermal, fuel cells, biofuels 7. Wind - compared to above, maybe we should give it a chance. [Comment not question.](#)
5. Coal is not yet clean, and the mining of it is destroying vast land areas ("mountain top removal") in the east. [Comment not question.](#)
6. Can wind compete with coal or nuclear without subsidy? [See response below.](#)
7. Compare and constant (sic) wind energy to coal (emissions). [See response to question L6.](#)
8. If we don't go with this form of wind energy, what else is being discussed for the area? Offshore wind farms? Solar? [See response below.](#)
9. Is there something out there that is more expensive for Duke Energy but would affect taxpayers/residents less? [Project specific.](#)
10. Recommendations made in the *Final Report of the Michigan Wind Energy Resource Zone Board*, October 15, 2009, are being cited as reason to support extensive utility wind turbine development in 4 of Michigan's prime natural areas: Allegan County, Charlevoix County, Huron County ("The tip of the thumb") and Benzie/Leelanau Counties ("The little finger"). What form of renewable energy might be more compatible than utility turbines with the longstanding statewide priority to protect and promote "Pure Michigan" (See: michigan.org)? What form of renewable energy will assure that these lands remain free of industrial development, that their beauty is preserved and that the ecosystems are supported? [Value judgment.](#)
11. Are there any permits being considered to drill the deep well fracturing sites in our area? Are there any Q and A meetings proposed on this technology? What footprint will these facilities leave to drill, fracture, and produce? How many are being considered? [See response below.](#)
12. Does wind power in Michigan have real potential to reduce or eliminate the current base load power supplied by more consistent sources of power, like coal, natural gas, and nuclear? Has wind power been verifiably credited with reducing traditionally reliable base load sources of power anywhere in the world? [See response below.](#)
13. How is power currently generated for Benzie and Manistee Counties? Does the existing infrastructure use the newest technology to protect the environment or are they grandfathered under older laws that are less restrictive? What is their carbon footprint and what are their plans to reduce it? [See response below.](#)
14. What happens when other alternative energies are more viable than wind turbines? [Beyond scope of this project.](#)
15. Are there other fuel sources that are more consistent than wind energy? [See response below.](#)
16. What are the comparisons of traditional energy sources and wind energy based on cost, energy efficiency, and environmental impacts? [See responses to questions L1, L2, L16, and AA1.](#)
17. How does a cap and trade, a tax on carbon or a clean energy standard impact the economics of a wind generator relative to the economics of a coal, oil or natural gas plant? What is the likelihood that a cap and trade, tax on carbon, or clean energy standard will be enacted in the next 25 years? [See response below.](#)

18. Why would we move forward with any utility turbine projects that will spoil our extraordinary natural heritage when there are new renewable energy products/processes rapidly emerging that are less invasive, sized to be more manageable, more versatile, and comparably or more efficient? (See: flat panel wind generators, accioenergy.com; solar shingles, dowsolar.com). **Value judgment.**
19. Could we find common ground for serious dialogue that leads to a good plan, and implementation of that plan through community action, by agreeing that we will strengthen the renewable energies that guarantee we will never develop nuclear power in the Benzie or Leelanau areas? Surely, this will require compromise on all sides. Those who are enthused about utility wind turbine development will need to listen to and accept higher setbacks from residences, lakes/rivers/creeks, shorelines, park/forest preserves. Those who are grieving the loss of pristine panoramas, unspoiled natural acreage and loss of a peaceful, undisturbed environment will need to listen to and accept the mandate to support reasonable local development of clean energy. There will be losses for everyone, but greater gains for all are a hope worth striving for. **Comment not question.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- L1. Can you provide a comparison matrix of energy sources including but not limited to coal, wind, solar, nuclear, and natural gas that addresses cost, carbon footprint, subsidies, health risks, historical costs associated with health and environmental impacts, etc.? What are the comparisons of traditional energy sources and wind energy based on cost, energy efficiency, and environmental impacts? What is the actual net production output as a percentage of the rated capacity of other sources of energy such as solar, coal, natural gas, and nuclear?

Response: A comprehensive response to these questions is beyond the scope of this project. However, this question has been answered by other scholars and experts. For example, the Carnegie Mellon Electricity Industry Center’s lifecycle analysis of coal, natural gas, oil, nuclear, hydro, biomass, wind, and solar is available at https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_03_05.pdf. For a more simplified version, the Union of Concerned Scientists also provides a brief summary of different energy sources. See http://www.ucsusa.org/clean_energy/clean_energy_101/the-sources-of-energy.html.

- L2. How does wind compare with other green energy options based on cost, energy efficiency, and environmental impacts?

Response: All renewable energy resources, like wind, solar, and geothermal energy, are considered “sustainable” because their energy/fuel source does not run out and can be replenished over a short period of time. Additionally, because renewable energy sources are not extractive like fossil fuel sources are, and because they don’t produce harmful emissions (like carbon dioxide or mercury) or generate toxic waste like traditional energy sources, they pose a significantly smaller risk to overall human and ecological health.

Despite the fact that all renewable sources have similar environmental and health benefits, not all renewable resources are currently cost competitive with more traditional fossil fuels. Due to a number of economic and technological factors, wind energy tends to be the most cost efficient renewable resource for generating utility-scale electricity generation.

For more information on comparing renewable energy options, see the Union of Concerned Scientists Clean Energy 101 page at http://www.ucsusa.org/clean_energy/clean_energy_101/.

To read about lifecycle analysis of wind, biomass, and solar energy, see the Carnegie Mellon University study at https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_03_05.pdf.

- L3. What forms of renewable energy might respect the independence and pride of small rural, agricultural communities such as Frankfort, allowing the residents and landowners to take the lead in energy development that would benefit them? The current process in which huge corporations such as Duke Energy use state-of-the-art methods to market their product and project, and the massive size of the turbines themselves, dominates the local people and leaves them dependent on the corporation to make good on its claims. This is not the way of Benzie County's people.

Response: This research team is unqualified to comment on the Duke project. However, we can address the more general question about the legal power that landowners and citizens have over energy development in Benzie and Manistee Counties. Concerning wind energy development, the state of Michigan leaves all zoning, siting, and review processes up to township governments. Therefore, the scale and attributes of renewable energy development can be incentivized and regulated through local zoning ordinances. To read the Michigan Department of Labor and Economic Growth's guidelines for wind energy siting, look here: http://www.michigan.gov/documents/Wind_and_Solar_Siting_Guidelines_Draft_5_96872_7.pdf

- L6. Can wind compete with coal or nuclear without subsidy? Compare and contrast (sic) wind energy to coal (emissions).

Response: A comprehensive response to this question is beyond the scope of this project. In general terms, Michigan derives 60% of its energy from coal, and as coal is not found in large quantities within Michigan, the state spends \$2.6 billion dollars annually securing coal energy from other states and countries. Similarly, Michigan derives 26% of its energy from nuclear sources and exports \$696 million annually to secure nuclear energy. Wind, on the other hand, is found in abundance within Michigan's borders, but only currently supplies .3% of electricity in Michigan. In terms of environmental impacts, coal emits mercury, carbon dioxide, and other gasses which, as they accumulate, can have negative consequences for human health, ecosystem health, and can alter the composition of the atmosphere. Though nuclear energy doesn't pose the same emissions problems, it does generate toxic radioactive waste, which poses longterm safety hazards to workers, nearby residents and the environment. In comparison, wind energy does not emit any harmful gasses, does not produce toxic waste, and is renewable instead of extractive. Wind energy does have environmental impacts. See the responses to questions L1,L2, L16, AA1 for these details.

The federal government subsidizes all major energy markets through direct expenditures, tax credits, and investments in the research and development of energy technologies. Wind, nuclear, and coal are also subsidized through these three avenues. For example, wind energy receives federal tax credits based on the kWh of energy produced, the upfront cost of wind energy development, or the property values of development sites. Coal is subsidized through coal royalty payments, tax credits for nonconventional fuels, and handful of other tax credits, development subsidies, and research and development grants for coal capture technology. Nuclear energy development also receives tax credits, capital subsidies, and liability limitations from the federal government. To quantify these subsidies, the Energy Information Administration reports that in 2007 the coal industry received \$3.3 billion dollars in subsidies, the nuclear industry received \$1.26 billion in subsidies, and the wind industry received \$724 million dollars in subsidies. While coal and nuclear receive more total subsidies than wind, it is important to remember that they receive fewer subsidies per unit of electricity because coal and nuclear constitute a greater portion of the nation's energy production.

For more information about federal energy subsidies, read the Environmental Law Institute's study on government subsidies: http://www.elistore.org/Data/products/d19_07.pdf. For more information about subsidies for different energy sources, visit the Energy Information Administration's study on Federal Financial Interventions into energy markets: <http://www.eia.gov/oiaf/servicerpt/subsidy2/pdf/execsum.pdf>. For more information on the technologies behind coal, nuclear, and wind energy, visit the Union of Concerned Scientists: http://www.ucsusa.org/clean_energy/coalvswind/brief_coal.html ; http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-wind-energy-works.html ; http://www.ucsusa.org/nuclear_power/nuclear_power_101/.

- L8. If we don't go with this form of wind energy, what else is being discussed for the area? Offshore wind farms? Solar?

Response: Michigan's two large investor-owned utilities, Detroit Edison and Consumers Energy, have proposed to the Michigan Public Service Commission to invest \$1 million each in the collaborative research and development of offshore wind energy. The MPSC also made a \$1.3 million grant to Grand Valley State University to conduct research on offshore wind technology. We are not aware of any pending applications for governmental approvals for offshore wind development in Michigan at this time.

With one or two exceptions, most solar development in Michigan is being done on a pilot program basis and is limited to small installations on residential and commercial buildings. The residential systems are typically no more than 20 kW and the commercial no more than 150 kW of capacity. There are net metering and some small feed-in-tariff programs to support these installations. Consumers Energy recently agreed to continue its feed-in-tariff program up to an additional 3 MW of capacity that will be allocated in cycles using a lottery system between now and 2015.

- L11. Are there any permits being considered to drill the deep well fracturing sites in our area? Are there any Q and A meetings proposed on this technology? What footprint will these facilities leave to drill, fracture, and produce? How many are being considered?

Response: Deep well hydraulic fracturing typically refers to the emerging use of this technology to develop natural gas wells in the Utica/Collingwood Shale. As of September 14, 2011, the Michigan Department of Environmental Quality ("MDEQ") lists no permits or permit applications for drilling in the Utica-Collingwood Shale in Benzie or Manistee County. Hydraulic fracturing is used at a much smaller scale in shallower Antrim formation wells, which have been around for a long time and in numerous locations. Several environmental organizations are negotiating with the MDEQ for protective regulatory standards or a moratorium on deep shale fracking until such standards are in place.

- L12. Does wind power in Michigan have real potential to reduce or eliminate the current base load power supplied by more consistent sources of power, like coal, natural gas, and nuclear? Has wind power been verifiably credited with reducing traditionally reliable base load sources of power anywhere in the world?

Response: While we were unable to locate studies that have focused on Michigan, studies have been conducted in the Midwest about wind's potential to supply base load power and potentially decrease our dependence upon fossil fuels or nuclear sources for a consistent supply of energy. One such study, conducted by Christina Archer and Mark Jacobson from Stanford University's Department of Civil and Environmental Engineering, looked at the ability of interconnected wind farms in areas with high wind potential to generate base load power for the grid. In this study, Archer and Jacobson compared base load power potential between integrated systems of 3, 7, 11, 15, and 19 wind farms located in an area spanning the southeast corner of Colorado, eastern New Mexico, the northern tip of Texas, the western half of Ohio, and southwest Kansas. As the interconnected system borrowed extra energy produced by one farm to compensate for lulls in energy production at other farms, Archer and Jacobson found that a system of 19 interconnected wind farms across diverse terrain had the potential to produce base load power for 79% of the year. That is just slightly less than the average coal plant, which supplies base load power for 79-92% of the year. Further, Archer and Jacobson found that at a large enough scale, a wind farm system could devote 1/3 of the energy it produced to supply base load power while it used the rest to provide some flexibility to the system and generate energy for transportation. According to their results, wind has the potential to supply base load electricity and energy to other energy sectors, though this would require investment in electricity transmission and the integration of wind farms.

To read the Stanford University study on interconnected wind farms and base load power, see:
http://www.stanford.edu/group/efmh/winds/aj07_jamc.pdf

- L13. How is power currently generated for Benzie and Manistee Counties? Does the existing infrastructure use the newest technology to protect the environment or are they grandfathered under older laws that are less restrictive? What is their carbon footprint and what are their plans to reduce it?

Response: Michigan operates under a deregulated energy market, meaning that homeowners and businesses can choose their electricity provider and providers have to compete for their business. Thus, electricity in Manistee and Benzie Counties is not generated uniformly. Technologies, sources, emissions, and rates all vary by provider. There are two main providers for Manistee and Benzie, and by looking at their production practices, it is possible to understand electricity generation and impacts in Manistee and Benzie.

Consumers Energy, the main subsidiary of CMS Energy, provides electricity to much of Michigan, including some parts of Manistee and Benzie Counties. As a company, it generates 80% of its electricity from fossil fuel sources, such as coal, oil, and natural gas. Coal is the single largest source of energy, and in total it generates 50% of the electricity Consumers Energy supplies. Renewable sources, primarily waste wood and hydropower, generate 5% of the electricity supplied. In 2009, Consumers Energy emitted 18 million metric tons of carbon dioxide for every megawatt hour of electricity it supplied, an amount that has varied little in the last two years.

Cherryland Electric Cooperative is the other main electricity provider in Manistee and Benzie Counties, and it buys all of its electricity from Wolverine Power Cooperative. Similar to Consumers, of the electricity that Cherryland supplies, 80% is derived from coal, 12% from nuclear, and 4% from renewable sources. Of those renewable sources, 3.3% is generated from wind. In 2009, Cherryland emitted 1,814 lbs of carbon dioxide for every megawatt hour of electricity it supplied.

Both Cherryland Electric Cooperative and Consumers Energy have programs in place to increase their energy derived from renewable sources, clean up old power plants, and reduce their emissions of carbon dioxide. To read more information about these providers, go to <http://www.cecelec.com/> and <http://www.consumersenergy.com/>.

- L15. Are there other fuel sources that are more consistent than wind energy?

Response: Consistency is based on both short term reliability and long term sustainability. In the short term, wind is less consistent than other energy sources, but over the long term it is significantly more consistent because it is a renewable resource. For example, as wind speeds fluctuate during the day, the amount of energy a turbine can produce can fluctuate as well. It is possible to compensate for this variability, though, through interconnected wind farms. For more information about reducing the variability of wind resources, see L12. There are other energy sources, such as coal, oil, and natural gas, which have less short term variability than wind, as they can be extracted and converted to energy as a steady rate. Yet the long term sustainability of fossil fuels is limited as deposits of coal, oil, and natural gas are being depleted and take billions of years to replenish. On the other hand, wind energy has significant long term reliability as wind is an infinite resource. Therefore, though some sources of energy are more consistent than wind in the short term, these same sources are generally less consistent in the long term.

- L17. How does a cap and trade, a tax on carbon or a clean energy standard impact the economics of a wind generator relative to the economics of a coal, oil or natural gas plant?

Response: A comprehensive response to this question is beyond the scope of this project. In general, there are two major market mechanisms for lowering emissions: a carbon tax and cap and trade systems. In comparison, a renewable energy standard is a regulation that requires the increased production of energy from renewable sources.

A carbon tax refers to a tax imposed on CO₂ emissions, and has been implemented by many nations including South Africa, India and the Netherlands. A carbon tax could be calculated as follows: According to

the US Energy Information Administration, emissions from petroleum are about 20 pounds of CO₂ per gallon (2.4 kilograms per litre, 2.4 kg/L), so a tax of \$100 per ton of CO₂ would translate to a tax of about \$1.00 per gallon (\$0.26 per litre). In comparison, under a cap and trade program, an overall emission tonnage cap is set for an affected sector or set of plants. The nation's first cap and trade program was initiated under the Clean Air Act in 1990 and applied to sulfur dioxide (SO₂) for electric utility generators to address acid rain.

There are also voluntary regional cap and trade programs in place in the US, including the [Chicago Climate Exchange](#). A carbon tax would not apply to wind energy generation because it is only implemented on the burning of fossil fuels in proportion to their carbon content. A carbon tax, however, would increase the cost of producing electricity from fossil fuels and would make the production of wind energy more attractive.

Under a cap and trade system, wind energy producers could receive an allocation of emission allowances and then sell them to emitting generators. They could also receive allowances and retire them on behalf of customers when they participate in voluntary markets.

For more information specifically about cap and trade and wind power, see the National Renewable Energy Lab's study titled Incorporating Wind Generation in Cap and Trade Programs at http://www.windpoweringamerica.gov/pdfs/wpa/policy_cap_trade.pdf

Original Questions:

1. Is there an ironclad agreement for someone to remove the towers when and if they become obsolete for any reason? [See response below.](#)
2. Are there any agreed upon ways to structure a decommissioning escrow fund that guarantees sufficient funds if a wind farm needs to be decommissioned? [See response below to M1.](#)
3. How are decommissioning costs determined? What is the best way to determine accurate decommissioning costs? Do subsequent purchasers of an energy project automatically become liable for decommissioning costs? If not, what language should there be in our ordinance for that to happen? [See response below.](#)
4. How can the township make sure there are funds to insure the wind project is decommissioned properly and the land restored back to normal when the wind projects life is completed? [See response to questions M1, M3 and M14.](#)
5. Can the community/township ask for cash only on a decommissioning fund? [Needs further clarification.](#)
6. What kind of escrow protections are typically used to protect landowners and the communities from abandonment of a turbine or wind farm? [See response below.](#)
7. What assurance do we have for the decommissioning procedure? Is there a bond that will be imposed? If the contract includes decommissioning and removal, why would this be a “deal breaker?” [Project specific.](#)
8. What is the proper language regarding decommissioning of turbines, specifically bonding certified letters of credits from agencies or companies that are familiar with decommissioning large projects such as landfills, etc.? [See response to question FF4.](#)
9. What type of bond should be required from the energy companies to ensure proper decommissioning and/or resolution is funded? [See responses to question D10 and D11.](#)
10. Once the “life span” of 20-25 year of the wind turbine is up, will these bonds be there for demolition? [See response to question D10 and M1.](#)
11. What controls are in place that will ensure these don’t become abandoned if any of the companies installing and/or using the wind turbines should fail? [See response to question M1.](#)
12. What will happen to the equipment if a particular facility is abandoned and what will happen to the base the equipment sits on should the facility be abandoned? [See response to question M1.](#)
13. How long is the anticipated life of a wind turbine tower? Who will clean them up when their original owners are gone? [See responses to questions M3 and M14.](#)
14. What is the life of a turbine? What happens when the turbine ceases to work, or is superseded by a more efficient means of generating power? Are there plans in place to dismantle the windmills if and when they become obsolete, or will they be a landmark/eyesore on our Lake Michigan skyline forever? [See response below.](#)
15. Wind turbines are audio-ally, visually, and perhaps ultrasonically polluting, who dismantles or is responsible for these devices after their service life? [See response to question M1.](#)
16. Who becomes responsible for their removal once they are no longer used? [See response to question M1.](#)
17. How many projects in the country are there currently that have not been properly decommissioned beyond a one year time limit of their suspension? What is happening to those projects? [Beyond scope of project.](#)
18. As green technology advances and the inevitable loss of subsidies and tax incentives, the likelihood of the turbines becoming obsolete is a real concern. Therefore, proper decommissioning ordinance language and acceptable funding methods to remove the obsolete turbines is needed. What guarantees will be provided from Day 1 for decommissioning and removal? [See response to question M1.](#)
19. Are there any examples where a good job of decommissioning was done? [See response to M3.](#)
20. When would the wind turbines be removed? Would removal include removing the poured foundations & access roads? [See response to question M14.](#)

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

NOTE: The U.S. Fish and Wildlife Service (USFWS) has published a document titled “Wind Turbine Guidelines Advisory Committee”, which provides recommendations for decommissioning wind facilities (pages 65-66). Although their guidelines are not legally enforced – and in many cases they will not be followed precisely by wind developers – they are helpful in understanding how decommissioning may occur for some projects. The full report can be accessed online at http://www.fws.gov/habitatconservation/windpower/Wind_Turbine_Guidelines_Advisory_Committee_Recommendations_Secretary.pdf

M1. Is there an ironclad agreement for someone to remove the towers when and if they become obsolete for any reason?

Response: The decommissioning, along with other operational and maintenance responsibilities, varies from project to project based on the terms of the contract signed by the developer. Typically these compliance monitoring agreements will include conditions to be met before, during, and after wind farm operation. For a detailed list of common responsibilities often taken up in these contracts, refer to the “Active Compliance Monitoring” section in Chapter 2 of the “Permitting of Wind Energy Facilities” handbook. This is online at <http://www.nationalwind.org/assets/publications/permitting2002.pdf>.

M3. How are decommissioning costs determined? What is the best way to determine accurate decommissioning costs? Do subsequent purchasers of an energy project automatically become liable for decommissioning costs? If not, what language should there be in our ordinance for that to happen?

Response: Decommissioning cost varies based on the project, the equipment, and the agency doing the monitoring. Decommissioning provisions are an important part of the final negotiations and involve the removal of turbines and equipment from the project site, and restoring the site to its original conditions. A bond or Letter of Credit is often posted to assure the cost of the decommissioning. The amount posted depends on the projected salvage value of the turbines and other equipment.

M6. What kind of escrow protections are typically used to protect landowners and the communities from abandonment of a turbine or wind farm?

Response: See responses to questions D10 and D11. The Township can require a performance guarantee to the extent necessary to insure the faithful completion of the wind project.

M14. What is the life of a turbine? What happens when the turbine ceases to work, or is superseded by a more efficient means of generating power? Are there plans in place to dismantle the windmills if and when they become obsolete, or will they be a landmark/eyesore on our Lake Michigan skyline forever?

Response: Although decommissioning varies by project, the responsibility to do so is that of the wind farm developer. The USFWS’s “Wind Turbine Guidelines Advisory Committee” provides some useful guidelines which may be followed. This document is online at http://www.fws.gov/habitatconservation/windpower/Wind_Turbine_Guidelines_Advisory_Committee_Recommendations_Secretary.pdf.

Likewise, it is useful to look through other projects’ decommissioning plans to get a sense of what the process will look like (although it will ultimately be carried out differently). For examples, see the “Hounsfield Wind Farm Decommissioning Plan” from New York. It is accessible at http://www.dec.ny.gov/docs/permits_ej_operations_pdf/hnsfldappendixu.pdf. Also see North Dakota’s “Wind Turbine Decommissioning Legislation” for a sample of what is being developed elsewhere. It is accessible at <http://www.legis.nd.gov/information/acdata/pdf/69-09-09.pdf>. A model ordinance for

Theme: Economic Impact

ID Letter: N

Original Questions:

1. Are the generators/windmills manufactured/built in the USA? In Michigan? What power company is involved? How much are they paying, and how much is government funded? **Needs further clarification, but see response below.**
2. If wind power projects locate in Benzie and Manistee Counties, will that increase the chance that wind related manufacturing operations will locate there too? Does the city of Manistee have manufacturing, workforce and infrastructure capacity to support new wind-related industries? Do wind manufacturing facilities tend to locate near wind power projects? **Beyond scope of project; see responses below to question N4.**
3. Can a community/township develop a renewable energy program that only allows Michigan made products or county-made products? **See response below.**
4. What economic benefits have been recognized by communities who have participated in wind energy projects? **See response below.**
5. What analysis has been done on the economic impact on the township and county, overall? Other than the landowners who will get a payment for the use of their land, what other economic benefits will be gained for the township? I understand these payments mean a lot to these people. **See response to question N4.**
6. If the turbines are built, how will it affect future growth in the county? Let's say for example, landholder A puts up turbines on his property and then his neighbor B wishes to sell his property for residential development. But B has lots of property that cannot be built because it is within the setback of turbines on property A. Has anyone looked at the potential conflicts that might arise in these situations and also how this might affect the growth patterns in the county? **Needs more clarification.**
7. Would it be prudent for the township to look into the future as to how they see their community with or without wind turbines and project? How each would further or limit the growth or vision of the community? If it is determined that grid-scale wind turbine development inhibits the future of the community, can they exclude them or confine them to a small area? **See response below.**
8. At the end of this discussion, what will our bottom line be? I have seen editorials written by the owner of Crystal Mountain Resort in which he says he knows the situation isn't perfect, but we need to get started and "do something" anyway, a sort of plunge in because it's better than being beholden to oil attitude. The second school of thought I have seen takes a more cautious approach, which is that even if alternative energy is out there, it should fit the needs of the community at its most local level, and if it doesn't we should have the courage to pass for now. **WHAT DOES THE COUNTY WANT AS ITS BOTTOM LINE APPROACH? Beyond scope of this project.**
9. Data to show the impacts on tourism and economic development. **See response below.**
10. If a wind developer is stating that it is going to create so many dollars and so many local jobs for the community, can we make it mandatory? **See response below.**
11. What have been the job and tax revenue losses in Benzie and Manistee Counties over the last 3 – 5 years? How many construction jobs, full-time operations jobs, and indirect service jobs could be gained by Benzie and Manistee counties if the proposed 200 MW Gail Windpower Project and other future wind project developments locate in the counties? What potential tax revenue could be gained if the proposed 200 MW Gail Windpower Project and other future wind project developments locate in the counties? **Project specific.**
12. Re: Cost-Benefit Analysis of Industrial Scale Wind Energy – Where is the hard data and evidence of viability, actual performance rather than “capacity”? What is the cost and CO2 emission of the entire process including mining of all materials involved, manufacturing of all components of a large wind industry facility, including turbines, concrete

bases, access roads, transmission lines, transportation, installation, environmental impact on natural rural areas, and actual performance balanced against all. What is the impact on land, wildlife and citizens? How much CO2 emission is actually being offset? How “green” is industrial wind energy? Does it really cut coal use by any significant amount? If it comes down to a very small contribution, is it really justifiable to pursue this scale of industrialization of rural areas and otherwise natural environments, or to place the burden of this industrialization on small rural communities? At what cost – in both tangible and intangible ways? [See response below.](#)

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- N1. [Are the generators/windmills manufactured/built in the USA? In Michigan? What power company is involved? How much are they paying, and how much is government funded?](#)

Response: This question needs further clarification. Michigan does have some utility-scale wind turbine manufacturers, and several others exist in the United States. For example, Northern Power Systems builds direct drive wind turbines in its Saginaw facility. Other companies, like Three M Tool & Machine Inc. in Oakland County, produce gearbox housings. The decision about where to buy parts is up to the developer. Government incentives, including federal stimulus grants and loans, have helped kick start some of these industries in Michigan. To view a list of wind turbine manufacturers in Michigan, visit <http://energy.sourceguides.com/businesses/byGeo/US/byS/MI/byP/wRP/byB/mfg/mfg.shtml>.

- N3. [Can a community/township develop a renewable energy program that only allows Michigan made products or county-made products?](#)

Response: All forms of renewable energy production require many materials and a range of specialized expertise; some can be acquired locally, but many others must be found elsewhere. See the response to N1 for information on wind turbine manufacturers in Michigan.

- N4. [What economic benefits have been recognized by communities who have participated in wind energy projects?](#)

Response: It is important to note that economic impacts can vary tremendously across projects, and depend on the contracts negotiated among township officials, developers and community members. Economic benefits will also vary based on the size of the project, the region in which it is built, and the types of policies in place regarding wind energy generation in the area. A general list of benefits is described in Illinois State University’s Center for Renewable Energy report on “Wind Energy Development in Illinois,” online at <http://renewableenergy.illinoisstate.edu/wind/publications/2011%20FINAL%20Economic%20Impact%20Report.pdf>. For instance, wind energy projects can create a need for skilled labor and create some job opportunities (both temporary and permanent), provide steady income to leasing landowners, increase tax revenues for local governments, benefit school districts, and provide upgrade and improvements to road conditions.

Likewise, a report on Vermont’s wind energy provides an in-depth analysis of many similar economic benefits that wind energy has provided to the state: see, “The Economic Benefits of Windfarm Development in Vermont,” accessible at http://www.vermont.org/article/windfarm_benefits.pdf. In addition, the Department of Energy’s National Renewable Energy Lab has published a report that assesses the economic benefit of wind energy development to various communities around the United States: “Analysis: Economic Impacts of Wind Applications in Rural Communities”. This full report can be found online at http://www.windpoweringamerica.gov/pdfs/wpa/econ_dev_casestudies_overview.pdf.

- N7. Would it be prudent for the township to look into the future as to how they see their community with or without wind turbines and project? How each would further or limit the growth or vision of the community? If it is determined that grid-scale wind turbine development inhibits the future of the community, can they exclude them or confine them to a small area?

Response: See response to question DD5 about restricting the density of development. Townships usually do go through visioning processes to create a master plan for economic development and landscape protection. This will incentivize or restrict aspects of wind development based on the desires of the community. This decision will ultimately be up to the members of the community and local officials.

Arcadia and Bear Lake Townships in Manistee County and Blaine and Gilmore Townships in Benzie County have agreed to partner in developing a collaborative master plan and implementation strategy. When completed, it will provide a master plan to serve the needs of each township but also identify opportunities for collaboration which may encompass service sharing and joint efforts involving economic development, tourism, recreation, agriculture, agribusiness and others. The project will begin in January 2012 and be completed during the first quarter of 2013, assuming full funding is secured by the Alliance for Economic Success, the organization coordinating the project.

- N9. Data to show the impacts on tourism and economic development.

Response: For information on the effects of tourism, see section J.

The National Renewable Energy Lab's 2005 document, "Analysis: Economic Impacts of Wind Applications in Rural Communities," provides further information about the economic impact of wind farm development on communities across the United States. It is accessible at http://www.windpoweringamerica.gov/pdfs/wpa/econ_dev_casestudies_overview.pdf

There is also an economic model, the Jobs and Economic Development Impacts (JEDI) Wind model, that allows users to estimate economic development impacts from wind power generation projects. Model users can enter as much project-specific data as possible, including information about construction materials and labor costs, annual operating and maintenance costs (personnel, materials, and services) and land lease and financing parameters. This model can be found at http://www.nrel.gov/analysis/jedi/about_jedi_wind.html.

- N10. If a wind developer is stating that it is going to create so many dollars and so many local jobs for the community, can we make it mandatory?

Response: Contractual agreements are created on a per-project basis, providing different economic conditions for different wind developments. In addition, many agreements about compensation are determined by the performance of the project, which cannot be guaranteed as it is greatly influenced by meteorological conditions, maintenance costs and the prevailing price of energy.

- N12. Re: Cost-Benefit Analysis of Industrial Scale Wind Energy – Where is the hard data and evidence of viability, actual performance rather than "capacity"? What is the cost and CO2 emission of the entire process including mining of all materials involved, manufacturing of all components of a large wind industry facility, including turbines, concrete bases, access roads, transmission lines, transportation, installation, environmental impact on natural rural areas, and actual performance balanced against all. What is the impact on land, wildlife and citizens? How much CO2 emission is actually being offset? How "green" is industrial wind energy? Does it really cut coal use by any significant amount? If it comes down to a very small contribution, is it really justifiable to pursue this scale of industrialization of rural areas and otherwise natural environments, or to place the burden of this industrialization on small rural communities? At what cost – in both tangible and intangible ways?

Response: This question relates to many of the thematic areas being addressed in this report. Refer to L1 and EE24 for more information on this topic. The Carnegie Mellon Electricity Industry Center's lifecycle

analysis of coal, natural gas, oil, nuclear, hydro, biomass, wind, and solar is available at https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_03_05.pdf.

Original Questions:

1. What are the temporary jobs created for this project? What are their qualifications? Will these be new jobs or existing workers (concrete service)? What are the long-term jobs, their qualifications, and have these jobs been promised to people already? **See response below.**
2. How many full time jobs will the Gail Wind Project produce? **Project specific.**
3. For a wind project that has about 100 turbines, how many permanent jobs are typically generated? **See response below.**
4. For a large (100 turbine) wind project how many jobs with the construction phase generate? **See response below.**
5. How many locally-filled jobs will be created for the erection and maintenance of these windmills? **See response to question O1.**
6. Will there be that many local jobs to satisfy the unemployment rate of Benzie/Manistee counties? Long term benefits? Short term ramifications? **See responses to questions O1 and O7.**
7. How many jobs, what percent, are likely to be filled by local workers and what percent are specialize jobs that will likely be from outside the local area? **See response below.**
8. Would a local ordinance with a “hire local first” requirement for erecting, operating, and maintaining a wind farm be legally enforceable? Are there precedents for this? **See response below.**
9. If wind is successful, what is the negative impact on jobs from other energy sources? **See response to question Y4.**
10. I would like to see the economics laid out for the dollar benefits to the county. I have read stories about how wind energy does not increase jobs long term (and the hotel/restaurant surge will only happen during construction, and since it is very capital intensive, perhaps we should question this claim). **Project specific. Needs more clarification.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- O1.** What are the temporary jobs created for this project? What are their qualifications? Will these be new jobs or existing workers (concrete service)? What are the long-term jobs, their qualifications, and have these jobs been promised to people already?

Response: The U.S. Bureau of Labor Statistics website provides a very detailed description of the types of jobs created by wind energy development, as well as the necessary qualifications, education, and earnings. It categorizes the jobs as Manufacturing (which includes Research and Development and General Manufacturing), Project Development (including Land Acquisition-related occupations, Scientists, Construction Workers, and Project Managers), and finally Operation and Maintenance (such as Service Technicians). More details can be found on their website under “Occupations in Wind Power,” accessible at http://www.bls.gov/green/wind_energy/#occupations.

- O3.** For a wind project that has about 100 turbines, how many permanent jobs are typically generated?

Response: According to the National Renewable Energy Laboratory’s “Wind Energy Update,” approximately 6-10 permanent jobs are created per 100 megawatts produced. This entire document is available online at http://www.windpoweringamerica.gov/pdfs/wpa/wpa_update.pdf.

O4. For a large (100 turbine) wind project how many jobs with the construction phase generate?

Response: According to the National Renewable Energy Laboratory's "Wind Energy Update," approximately 100-200 temporary construction jobs are created per 100 megawatts produced. This entire document is available online at http://www.windpoweringamerica.gov/pdfs/wpa/wpa_update.pdf.

O7. How many jobs, what percent, are likely to be filled by local workers and what percent are specialize jobs that will likely be from outside the local area?

Response: The number of local workers hired for wind development projects depends entirely on how many workers in the area are qualified to do the necessary labor. Typically, developers will try to hire local workers, but when this is not possible they are likely to bring in outside labor. A 2005 NREL study examined economic impacts from wind development through a series of project case studies located in five states. The study found that small rural communities with few large industries saw greater leakage of revenue into nearby towns that provide those services. These small communities therefore experience less indirect and induced impact of a wind installation than a larger community with the ability to provide a greater number of services. Read more about this in the National Renewable Energy Laboratory's "Analysis: Economic Impacts of Wind Applications in Rural Communities" at http://www.windpoweringamerica.gov/pdfs/wpa/econ_dev_casestudies_overview.pdf.

O8. Would a local ordinance with a "hire local first" requirement for erecting, operating, and maintaining a wind farm be legally enforceable? Are there precedents for this?

Response: "Hire local first" requirements are outside the permissible objects of zoning, the purpose of which is to regulate land use. Ordinances granting preference to local contractors are typically limited to the purchasing and hiring requirements of a local unit of government for projects that the local unit is undertaking and paying for. The Michigan Clean, Renewable, and Efficient Energy Act does provide an incentive of 1/10 of a renewable energy credit for each megawatt hour of electricity from a renewable energy system built by a Michigan workforce.

Original Questions:

1. Is there a way to conserve or ration energy consumption? **See response below.**
2. Can a township encourage conservation through an ordinance? **See response below.**
3. Is there any organized, concerted effort at electrical power conservation being pushed by any agency anywhere? I'm not thrilled with the idea of putting up a bunch of wind towers so folks can continue to take electricity for granted no matter what the source. I really don't need to listen to Willy Nelson when I'm gassing up my vehicle at Wesco. The solution is not always "more." **Comment not question.**
4. If consumers could be persuaded and/or educated into conserving energy, could the energy demand be reduced such that neither industrial wind, nor additional coal-fired plants are needed? **See response below.**
5. Is serious consideration being given to effective conservation education and persuasion? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

P1. Is there a way to conserve or ration energy consumption?

Response: Energy consumption can be conserved and rationed through a variety of policy measures, technical efficiencies, and personal lifestyle changes. Conservation can vary based upon whether it is being practiced by residential, industrial or agricultural sectors. Though these options are too broad to be discussed thoroughly here, see <http://www.epa.gov/reg5rcra/wptdiv/p2pages/energy.pdf> for more information. The Pew Center also has a website that describes residential end-use energy efficiency. See that project at <http://www.pewclimate.org/technology/factsheet/ResidentialBuildingEnd-Use>

P2: Can a township encourage conservation through an ordinance?

Response: Yes. Several communities in Michigan have adopted local policies requiring that their buildings meet energy efficiency standards, typically LEED certification. These communities include Grand Rapids, Rochester Hills, East Lansing, and Novi. East Lansing additionally required private projects that receive local tax incentives such as TIF to meet LEED certification, and Rochester Hills is developing incentives for private development that achieves LEED certification. We are not aware of any local ordinance in Michigan that mandates energy efficiency measures for private projects that are not tied to incentives. Moreover, the broader meaning of "conservation," as in conservation of natural resources, is also a valid objective for zoning ordinances. See the response to question D1.

P4. If consumers could be persuaded and/or educated into conserving energy, could the energy demand be reduced such that neither industrial wind, nor additional coal-fired plants are needed?

Response: The answer to this question varies greatly by scale, as energy demand is different for counties, states, and the country. See the response to question AA4 about wind energy and efficiency. Further, governments, developers, and individuals are looking to wind energy not only to meet future demand, but also to replace existing pollution emitting sources with renewable sources and generate local economic development.

P5. Is serious consideration being given to effective conservation education and persuasion?

Response: This question needs further clarification in terms of how, who and where the education is occurring. In general, there are many regional and national non-profit organizations and utility-sponsored programs focused on energy education. Social marketing efforts, like those sponsored by the group Smart

Power (www.smartpower.org) produce ads, videos and competitions to persuade consumers to conserve energy. One effort by the Sacramento Municipal Utility District found that customers were induced to change their energy habits when they were presented with information on what their neighbors were doing. For more information about this effort and others see this NY Times story <http://www.nytimes.com/2009/01/31/science/earth/31compete.html>

Original Questions:

1. If there is excess power generation, can the power be placed onto the grid? **See response below.**
2. How does wind energy work on the MISO grid? Presumably when the wind blows wind farms spike electric production to the grid. How is that spike handled by the grid operator? Is the power integrated into the grid and used later when demand is there? Is the power lost if the wind spikes production and grid demand? Is the power lost if the wind spikes production and grid demand remains steady or decreased? Does the extra power fill the pump storage facility in Ludington? **See response below.**
3. What percentage of energy from wind farms will go into the grid? **See response below.**
4. Wouldn't it offer some added acceptance if local residents used the power produced in their back yards rather than ship it away via the grid? **Value judgment.**
5. Does Duke have the necessary infra-structure in place to connect to this grid? How much construction will that entail? Will this entail more forests to be removed? More equipment on roads? More roads to be cut through woods? **Project specific.**
6. What are the current regulations on wind generated power from private property...can it be fed back into the grid with the property owner receiving compensation? **See response below.**
7. Can the community/township only allow grid tied units in certain zoning districts, like industrial areas or agricultural zone for large tracts? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- Q1.** If there is excess power generation, can the power be placed onto the grid?

Response: Yes, if a wind energy system produces an abundance of energy at a particular time, because the wind is blowing at an appropriate speed and with a low turbulence, the electrons it generates can be placed on the grid and distributed to an area that needs energy.

- Q2.** How does wind energy work on the MISO grid? Presumably when the wind blows wind farms spike electric production to the grid. How is that spike handled by the grid operator? Is the power integrated into the grid and used later when demand is there? Is the power lost if the wind spikes production and grid demand? Is the power lost if the wind spikes production and grid demand remains steady or decreased? Does the extra power fill the pump storage facility in Ludington?

Response: Starting in 2009, the MISO grid integrated its 26 operating centers and began to run out of a single balancing area, decreasing the need for reserve power and allowing spikes in generation to be distributed to areas that need it. This integration compliments wind energy well as it allows peaks and lulls in production at one farm to be compensated for at other farms. Additionally, the use of real time markets allows the operating center to distribute energy in an economical way. This allows the grid to run more efficiently, decreasing energy loss and minimizing the need for energy storage.

Q3. What percentage of energy from wind farms will go into the grid?

Response: The response to this question depends upon the scale of the wind project. Some people have residential turbines, which they either use to power their home or sell a portion back to the grid. Utility scale wind farms, on the other hand, transmit 100% of the electricity they generate to the grid.

Q6. What are the current regulations on wind generated power from private property...can it be fed back into the grid with the property owner receiving compensation?

Response: These options are called either feed-in tariffs or net metering. In net metering the electricity meter runs backwards when the homeowner is generating electricity in surplus. This excess energy is sold to the utility and is transmitted back through the transmission lines. With feed-in tariffs, a homeowner has two meters, one measuring consumption and the other generation. This second meter allows different pricing for consumption and generation.

Net metering for wind is available in 29 states at varying rates. For more information about net metering programs by state, see this website for the Department of Energy http://apps3.eere.energy.gov/greenpower/resources/maps/netmetering_map.shtml. The New Rules project provides information about existing net metering regulations in several states, available at <http://www.newrules.org/energy/rules/net-metering/net-metering-selections-other-states>.

A January 2010 report by the National Renewable Energy Lab (NREL) provides a legal analysis for how states could implement feed-in tariffs and still comply with US federal law. See the "Renewable Energy Prices in State-Level Feed-in Tariffs: Federal Law Constraints and Possible Solutions" report at <http://www.nrel.gov/docs/fy10osti/47408.pdf>

In Michigan, net metering for utility scale wind is available to Investor-Owned Utilities. There are net metering and some small feed-in-tariff programs to support some small scale installations. The Consumers Energy net metering site is <http://www.consumersenergy.com/content.aspx?id=1800>

This 2010 paper by the Michigan PSC describes possible feed-in tariff programs: <http://www.itcni.org/uploads/image/MPSC%20Staff%20Discussion%20Paper%20for%20FIT%2007%2027.pdf>

Q7. Can the community/township only allow grid tied units in certain zoning districts, like industrial areas or agricultural zone for large tracts?

Response: Probably. See response to question D1. The township can reasonably limit land uses to certain zoning districts for purposes such as protecting of the public health, safety, or general welfare, or ensuring compatibility of adjacent land uses. It seems likely that in many instances a Township could reasonably determine that utility-scale windmills are a use best suited for industrial or agricultural areas and not compatible with intensive residential or commercial uses. This would include a careful evaluation and possible amendment of the township land use plan and the adoption of an overlay district with either planned development approval for the larger area of wind development or special use permits for the wind turbines, or both.

Original Questions:

1. Is it legal for a township to have no zoning? **See response below.**
2. Since it is going to be a wind farm, should it be treated as a “farm” or an industrial park? (Farms are totally different than an industrial setting and there should be regulations in place to address this.) **Project specific/Needs more clarification**
3. At what point would land zoned as agriculture become commercial/industrial and be taxed as such? **See response below.**
4. Accommodate in zoning for wind. Can/cannot be zoned out. **Needs more clarification**
5. Wind turbines are very different from other industrial equipment in a township. Should a wind ordinance be written to stand alone or should it be tied (reference) to other zoning ordinance sections? **See response below.**
6. In its final report, the MWERZB stated that grid scale wind power may not be an appropriate land use in all communities. In his testimony before MPSC, the chair of the MWERZB reiterated the same assertion: that wind power is a community decision and that it may not be an appropriate land use in all communities. The final report of the MPSC again reiterated that statement and, additionally, did not include the Manistee/Benzie or Leelanau areas as high potential wind resource zones, even though they were included in the MWERZB report to the MPSC. Given these statements, would a decision that wind power is not an appropriate land use is their community and ordinance language prohibiting the use be “exclusionary zoning?” **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- R1. Is it legal for a township to have no zoning?**

Response: Yes. A Township may, but is not required, to adopt a zoning ordinance. However, in the absence of Township zoning, a county zoning ordinance may apply.

- R3. At what point would land zoned as agriculture become commercial / industrial and be taxed as such?**

Response: The question pinpoints an issue of interpretation in the State's property tax code. Local assessors classify assessable property by the first Monday in March each year. The definition of agricultural property under the Michigan General Property Tax Act is "parcels used partially or wholly for agricultural operations, with or without buildings." Agricultural operations are defined broadly to include all sorts of farming and livestock.

Industrial property under the same statute includes parcels used as sites for generating plants and substations, among other things. Machinery and equipment not exempt by law, transmission and distribution systems, and substation equipment are all classified as personal property.

The issue requiring interpretation is that a property used partially for farming operations and partially for wind generation meets both the definition of agricultural property and the definition of industrial property. The Michigan Tax Tribunal has yet to issue an opinion in a tax appeal that addresses this issue.

- R5. Wind turbines are very different from other industrial equipment in a township. Should a wind ordinance be written to stand alone or should it be tied (reference) to other zoning ordinance sections?**

Response: Assuming this question is referencing a zoning ordinance, any provision addressing wind turbines in a zoning ordinance will likely be tied to the rest of the zoning ordinance because there are certain procedures and standards in a zoning ordinance that will apply across the board. For example, if wind turbines are permitted as a “special use” and require the submission of a “site plan” for approval, then the wind turbines would be subject to those same procedures and standards that apply to other site plans and special uses. However, in addition to the broadly applicable procedures and standards, the Township could adopt additional regulations that apply to wind turbines. For an example, see the model wind energy zoning ordinance discussed in Question D4. This is permissible as long as the additional restrictions are reasonable, rationally related to legitimate zoning purpose, and do not treat wind turbines differently than other similar uses without a reasonable basis for doing so.

R6. In its final report, the MWERZB stated that grid scale wind power may not be an appropriate land use in all communities. In his testimony before MPSC, the chair of the MWERZB reiterated the same assertion: that wind power is a community decision and that it may not be an appropriate land use in all communities. The final report of the MPSC again reiterated that statement and, additionally, did not include the Manistee/Benzie or Leelanau areas as high potential wind resource zones, even though they were included in the MWERZB report to the MPSC. Given these statements, would a decision that wind power is not an appropriate land use in their community and ordinance language prohibiting the use be “exclusionary zoning?”

Response: It could still be considered exclusionary zoning, and the cited evidence would be largely irrelevant to this determination.

Under the state exclusionary zoning statute, a Township cannot totally prohibit a certain land use from a Township, or adopt regulations that have the effect of totally prohibiting a land use, if there is a demonstrated need for that land use in the Township or the surrounding area. The only exceptions are if there is no location in the Township where the use can be appropriately located or the use is unlawful. It is unlikely that the exceptions would apply here because whether an area is the most efficient location for a use is not the same question as whether the use is “appropriate” in that area.

Therefore, the main question is probably whether there is a “demonstrated need” for wind power in the surrounding area. In general, the “demonstrated need” must be a public need, not the private economic need of the landowner, and whether there is a need for the use will be evaluated in the context of the surrounding area, including nearby local governments, and not only the immediate Township. Courts have held that there is not a demonstrated need if there is a lack of need for the land use, in general, or an overabundance of similar existing uses in the surrounding area.

There is no clear guidance on how Michigan courts would apply the statute in this context. Regardless, evaluating an exclusionary zoning claim would require location- and fact-specific analysis that would not be established one way or the other by broad statements about the extent to which there may or may not be a need across the state as a whole.

Original Questions:

1. What is the actual efficiency of these wind turbines? I have seen numbers generated by the Mackinac Group that show these turbines operating below 10% of the rated capacity on an annual basis. It seems that a 90% loss on investment is a terrible idea. [See response to question AA4.](#)
2. How efficient are they? [See response to question AA4.](#)
3. What is the efficiency of industrial turbines located and operating in MI? [See response to question AA4.](#)
4. Is wind energy a consistent energy source? [See response to question L2.](#)
5. Can you compare the energy return on energy invested for wind, solar, coal, natural gas, oil, and nuclear? [See response to question L1.](#)
6. How much of a normal urban setting (residences and small businesses) can be supported by wind generation? In the case of some industrial uses, can a turbine supply three-phase electricity? [See response below.](#)

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- S6. [How much of a normal urban setting \(residences and small businesses\) can be supported by wind generation? In the case of some industrial uses, can a turbine supply three-phase electricity?](#)

Response: The answer to this question depends upon both the scale of the wind farm and the energy use of an urban setting. The average U.S. household consumes about 10,000 kWh of electricity each year. The general rule is that 1 MW of electricity is enough to power 220-300 homes. Generally, a 30 MW wind farm can produce enough energy for approximately 9,000 average American homes over a year. This is an aggregated calculation of wind energy production over a year.

Regarding the supply of three-phase electricity, most household loads are single-phase. In North America and a few other places, three-phase power generally does not enter homes. Even in areas where it does, it is typically split out and the individual loads are fed from a single phase.

Original Questions

1. If there were no energy subsidies available to these projects, do you think wind developers would be installing them? **See response to question T3.**
2. What if tax incentives weren't offered—would this project be feasible? **Project specific.**
3. How much of the proposals for wind power are dependent on governmental subsidies? If there were no government subsidies (our taxpayer dollars) available for wind power, would putting windmills in this area be affordable? **See response below.**
4. Are wind project sustainable without subsidies and tax breaks? **See response to question T3.**
5. Without government subsidies, are your turbines cost effective? **Project specific.**
6. If the U.S. Government does not renew the current renewable energy tax credit or grant, how does that affect a wind power project that was already under construction under such a regime? **See response to question T3.**
7. Can you outline all the subsidies and tax breaks a large wind project can get from the federal, state and local governments? **See response to question T3.**
8. What state, federal, and local tax incentives are being offered to Gail Wind? What incentives are offered to oil/gas producers? **Project specific.**
9. If tax incentives are allowed, once the initial investor on a project receives a subsidy, are the subsequent purchasers of that project able to also take those same incentives/subsidies again on the same project? If in fact they do receive the subsidies again, do the subsequent purchasers also have the option of accelerated depreciation on the remaining balances not subsidized? **Beyond scope of project; Project specific.**
10. Wind developers promise local government (county and township) will see a big boost in tax revenue. How do we ensure that this money is guaranteed with changing tax incentives for “renewable energy companies?” **See response below.**
11. Subsidies on ethanol has been shown to be a huge mistake since it takes more energy to produce a gallon of ethanol than you get from a gallon of ethanol. Wind energy is not profitable without subsidies. What happens to wind farms when subsidies stop and the wind farms are not profitable? **Value judgment.**
12. The state government of Michigan is on its knees financially. What help, in terms of consulting, legal, research, enforcement etc., are they able/required to give us long term? Is this something that could be cut from state budget and leave the local governments high and dry? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- T3. How much of the proposals for wind power are dependent on governmental subsidies? If there were no government subsidies (our taxpayer dollars) available for wind power, would putting windmills in this area be affordable?

Response: Wind energy has grown increasingly cost competitive within the energy market. With subsidies figured in, the levelized cost of electricity generated by wind is 9-13 cents per kWh (<http://www.pewclimate.org/technology/factsheet/wind>) whereas the average cost of electricity in 2011 was around 9.66 cents per kWh (<http://www.eia.gov/electricity/monthly/index.cfm>). Therefore, wind is cost competitive with traditional fuels in many states, and the Energy Information Administration estimates that by 2016 it may even be cheaper.

Just as the federal government subsidizes wind, it has historically subsidized all major forms of energy production (to learn about what those subsidies are, see the “Alternatives to Energy” section, question L7). Yet, the subsidies that wind energy receives are dwarfed by the total subsidies received by fossil fuels, as the graph below from the Environmental Law Institute suggests.

Because the federal government has always subsidized energy production through research and development, tax credits, loan guarantees, and liability limitations, it is impossible to grasp what the cost of any energy technology would be without subsidies. According to the Energy Information Agency, “government R&D expenditures are typically targeted at the investigation of new technologies for which either the risk or the long lead time incurred prior to realization of a return on investment make such expenditures financially prohibitive to the private sector”. For further information, see Chapter 5 of the EIA report at <http://www.eia.gov/oiaf/servicerpt/subsidy2/pdf/chap5.pdf>. The EIA is currently updating the 2007 review of subsidies to the US energy sector. This updated version is intended to broaden the scope of what counts as a federal subsidy.

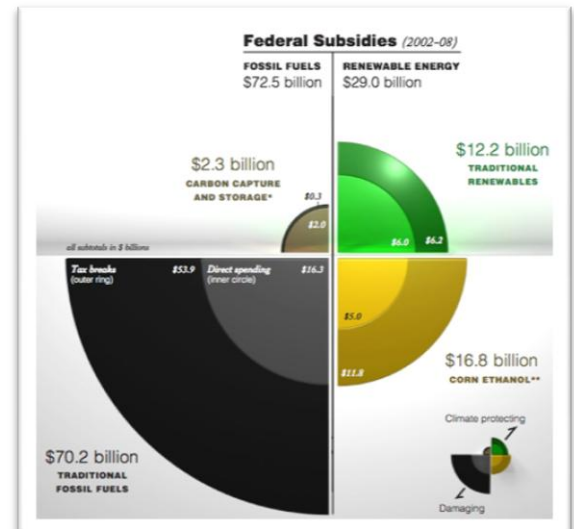


Image Credit: Environmental Law Institute http://www.eli.org/Program_Areas/innovation_governance_energy.cfm

T6. If the U.S. Government does not renew the current renewable energy tax credit or grant, how does that affect a wind power project that was already under construction under such a regime?

Response: Federal subsidies for wind development include the production tax credit, which subsidizes energy on a per kWh basis, the investment tax credit, which subsidizes wind energy based on the upfront cost of development, and treasury department subsidies, which subsidize projects based upon property values. Over the years, each of these subsidies has expired, and some have been renewed. The production tax credit, which has been the most effective at supporting the growth of the wind industry, expired in 1991, 2001, and 2003, and is set to expire again in 2012. In order to receive the PTC, a wind farm must be operational before December 21, 2012. Additionally, the wind farm has guaranteed access to that tax credit for ten years after the farm begins to generate electricity. For projects that are still under construction when the PTC expires, it becomes uncertain whether or not they will receive an extension and how they will finance their project.

T7. Can you outline all the subsidies and tax breaks a large wind project can get from the federal, state and local governments?

Response: There are three main federal tax incentives that a wind developer can choose from when planning to finance its utility scale wind farm: a production tax credit, which provides a company with 2.2 cents for every kWh of electricity it produces, an investment tax credit, which provides a company with 30% of the initial cost of development for a wind project, and treasury department subsidies, which finance a project based upon the property values of the site. In addition to these, there are a few federal programs which individual projects may qualify for. The first program is the Department of Energy’s 1705 Loan Guarantee Program, which insures a company in case they default on a loan, and the second program is a bonus depreciation tax schedule which allows a company to deduct the entire upfront cost of their project the first year of generation. Though these two incentives are available to projects, they are not nearly as common or widespread as the production and investment tax credits. Michigan also provides a number of

tax incentives for utility scale wind development. To read more, see:
http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html. A few of these include Recovery Act grants and research and development grants for renewable energy companies that the state distributes. To read more about state incentives, see:
http://www.michigan.gov/documents/mdcd/Clean_Energy_309936_7_313369_7.pdf

T 10. Wind developers promise local government (county and township) will see a big boost in tax revenue. How do we ensure that this money is guaranteed with changing tax incentives for “renewable energy companies?”

Response: There is no way to guarantee that representations about increased tax revenue to local governments will be realized in this context. The conventional wisdom at the present time is that the Legislature will eliminate taxation of personal property and it is unclear what, if anything, will replace that revenue. In addition, any property owner has the right to appeal any property tax determination to the local board of review and the Michigan Tax Tribunal. Conditioning zoning approval on a waiver of these rights would be unusual and could be outside of the legitimate objects of zoning.

T12. The state government of Michigan is on its knees financially. What help, in terms of consulting, legal, research, enforcement etc., are they able/required to give us long term? Is this something that could be cut from state budget and leave the local governments high and dry?

Response: The State of Michigan, through the Public Service Commission, conducts research on numerous matters related to wind energy development and makes the results public as they are available. We are not aware of any State programs providing assistance to local governments with legal work or enforcement related to wind energy development.

Original Questions:

1. Can the community/township place height limitations just like they do in all current zoning districts? **See response below.**
2. Can the community/township place height limitations of 199' in order to keep lights off units (night sky preservation)? **See response to question U1.**
3. Can we restrict the height of wind turbines in an effort to preserve our night skies (so that no lights are mandated by the FAA or other agencies)? **See response to question U1.**
4. Is it within the rights of a township to restrict the height of a turbine so they do not require FAA lighting? This would be to protect the dark night time sky. **See response to question U1.**
5. Does the FAA issue variances on height if the turbines are determined to be too tall or are they made to stay at the restricted height? Under what circumstances is an energy company entitled to a variance, for say height of wind turbines from the FAA? **Answer pending**
6. Where in the U.S. are there taller wind turbines than Duke's proposed ones here? How much taller? Are any of them in close proximity to homes? **See response below.**
7. How tall would these wind turbines be to their nose and to the top the blade's highest reach? **Project specific.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- U1.** Can the community/township place height limitations just like they do in all current zoning districts?

Response: Yes, communities can create zoning ordinances to limit towers of certain heights. For instance, Arcadia Township has already created a height restriction of 300 feet.

- U6.** Where in the U.S. are there taller wind turbines than Duke's proposed ones here? How much taller? Are any of them in close proximity to homes?

Response: There are several large wind farms in the United States that use turbines that are greater than 400 feet tall. The largest wind farm in the United States, for instance, is called Snyder Wind, located in Texas with 21 3-megawatt Vestas 90 turbines, each reaching a height of 492 feet from base to blade tip. Patrick & Henderson, the company which built the foundations for the project, provides more details about Snyder Wind in their "P&H Foundations for Wind Turbine Support" report, page 8. The full document is available online at http://earthsys.com/Library/P%20and%20H%20Presentations/P_H-Foundations.pdf. Distance from homes varies significantly for every development, depending on the terrain, population density, and local zoning.

Original Questions:

1. Can a community/township identify and protect certain viewsheds? *See response below.*
2. Are we allowed to enact a scenic viewshed ordinance that protects our viewsheds? *See response to question V1.*
3. Can you provide innovative examples of turbine siting not based solely on the zoning of a parcel that take natural resources into consideration, specifically resources that are not protected by existing regulations, such as viewsheds? *See response to question DD8.*
4. Will the view spaces be considered before turbine placements on ridges? *Project specific, but see response to question V1.*
5. Do people have any legal right over their view of other residents' property? *See response below.*
6. What is the overall width of the proposed wind towers (base and at the top)? At what distance will you be able to see a portion of these towers? I am trying to understand the percentage of property in Benzie County that will have sightings of these towers. *Project specific.*

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

V1. *Can a community/township identify and protect certain viewsheds?*

Response: Yes, the Township can identify and protect viewsheds in a zoning ordinance, subject to the limitations discussed in Question D1, to the extent that the regulations are related to valid zoning purposes identified in the Michigan Zoning Enabling Act. Michigan courts have recognized that aesthetics are a proper concern of zoning but have also held that an otherwise legitimate use of a property cannot be excluded solely due to aesthetic objections to the use. For an example of a reasonable zoning regulation, see the model wind energy zoning ordinance discussed in Question D4, which requires that wind turbines be sited in a manner that avoids state, federal, or locally-recognized viewsheds. In addition, the land use plan could be amended to identify wind zones or areas, and the township could enact an overlay district ordinance, with PUD and/or special use permit provisions.

V5. *Do people have any legal right over their view of other residents' property?*

Response: No. In the absence of a statute or private easement or contract, landowners generally do not have a private right to limit their neighbors' use of their property unless the use rises to the level of a nuisance or trespass. See response to question BB1. Courts have held that a landowner generally does not have a right to air, light, and view over an adjoining property, although the Michigan Supreme Court has held that a property owner cannot construct a fence solely with the malicious intent to block light and air from a neighbor's property. As a result, although local governments may regulate to protect viewsheds as part of a valid exercise of the zoning power, the effect of a neighbor's lawfully constructed structure on the viewshed is not likely to rise to the level of a nuisance in the absence of malice. The only practical way views can be protected would be through the land use plan and zoning ordinance measures. It is also possible to protect viewsheds through a purchase of development rights ordinance backed by a township bond measure to fund it.

Theme: Costs of Wind Energy

ID Letter: W

Original Questions:

1. How much does wind energy cost to produce in comparison to other forms of energy? *See response to question Y10.*
2. How does the cost of wind power compare to that of a new coal plant? *See response to question L1.*
3. Is the price of energy from wind as volatile as energy prices from fossil fuels? *See response below.*
4. Are consumers paying for the “cost” of green energy? *Needs further clarification.*
5. What is the cost if we don’t switch to green, renewable energy? *See response below.*
6. What is the true cost of wind energy? Will it raise our cost of energy? *See response to question Y10.*
7. Why does Denmark, who gets 20% of their energy from wind, pay the highest rates for electricity in the world? *Beyond scope of this project.*
8. What exactly is the savings in energy costs for a household in the areas affected? I understand that landholders will benefit directly from the value of their leases, but what will the effect be on the typical resident of a town? *Project specific.*
9. How about some cost/benefit figures? Is the power generated by the windmills worth the expense of the installation and the actual cost of purchasing the windmills? *See response below.*
10. What are the facts that support wind energy as a financially viable source of power? Has Duke Energy, DTE, Consumers Power, GE or others produced reliable financial projections that demonstrate the viability and affordability of wind energy? *See response to question L1 and Y10.*
11. What will be the projected increase in utility bills for residents of the area and in the State of Michigan? *Needs further clarification.*
12. If a wind project is built in a township there will be significant administrative costs to the township. Can you make an estimate of the cost per turbine that should be required by the developer to put in escrow to pay for township administrative costs? *See response below.*

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

W3. *Is the price of energy from wind as volatile as energy prices from fossil fuels?*

Response: In general, the price of wind energy is not nearly as volatile as the price of energy from fossil fuels. Because nearly half of our oil is imported and fossil fuels are becoming more scarce, the price of energy for these sources can fluctuate dramatically within a short period of time. Wind energy, because it is produced domestically and is a renewable resource, does not have comparable extreme price fluctuations. To read more information on the price of wind energy compared to fossil fuels, see the response to question Y10 in the “Oil and Gas Industry” thematic section.

W5. *What is the cost if we don’t switch to green, renewable energy?*

Response: A comprehensive response to this question is beyond the scope of this project. Traditional fossil fuel energy sources have already had numerous impacts on humans and the environment, ranging from health impacts, ecosystem disruptions, and political instability. Many scholars have tackled this question. For further information, read *The End of Oil* by Paul Roberts. Additionally, the Union of Concerned Scientists has

information about the costs of traditional fuels in the country http://www.ucsusa.org/global_warming/ and in the Midwest http://www.ucsusa.org/global_warming/regional_information/midwestern-states.html and why renewable fuels are important http://www.ucsusa.org/clean_energy/.

W9. How about some cost/benefit figures? Is the power generated by the windmills worth the expense of the installation and the actual cost of purchasing the windmills?

Response: In recent years, wind energy has become increasingly cost competitive, both in terms of manufacturing and construction, and in terms of the price of electricity it generates. To read more about the lifecycle costs of wind energy, see the studies provided in response to question L1 in the “Alternative Forms of Energy” thematic section. To read more about the price of electricity from wind energy, see the response to question Y10 in the “Oil and Gas Industry” thematic section.

W12. If a wind project is built in a township there will be significant administrative costs to the township. Can you make an estimate of the cost per turbine that should be required by the developer to put in escrow to pay for township administrative costs?

Response: There should be no added cost to the Township. All expenses would be handled through an escrow account. The escrow account should be set at an initial \$15,000.00 per application. Various professional, planners, engineer, attorney and township administrative staff would charge at their respective hourly rate. Other costs related to the township's processing of the application would be paid out of the escrow account (advertising, mailings, copies, postage).

Original Questions

1. Have any of the panelists ever read the “living with turbines” blog about the family in DeKalb, IL? If so, what do they conclude it’s like living within close proximity of industrial energy facilities? **See response below.**
2. Have they offered to arrange for local people to visit and talk with folks who actually live with a wind farm comparable to the proposed wind farm? Has anyone who has offered an opinion, or taken a position either pro or con, actually stood under a 500 foot turbine, observed a landscape with comparable ratios of population density and turbine numbers, or visited? **Project specific.**
3. Can AES or MAP find similar wind projects that have similar densities of turbines per square mile, as well as residents per square mile, and determine what impacts on those residents have taken place, i.e. survey/study? **Project specific.**
4. What are impacts on homes that are 1/4 mile away from active turbines in a variety of wind speeds and weather conditions? Look at Health and safety, property values, because there is a range of impacts. **See response below.**
5. What are the environmental and social impacts of large wind farms? **See response below.**
6. Do industrial wind turbines create television interference? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- X1. Have any of the panelists ever read the “living with turbines” blog about the family in DeKalb, IL? If so, what do they conclude it’s like living within close proximity of industrial energy facilities?

Response: There are many testimonials available on the internet describing what it is like to live near wind turbines. Individual experiences vary, and have been reported to be both positive and negative. For more information, see the “Health and Safety” thematic section of this report.

- X4. What are impacts on homes that are 1/4 mile away from active turbines in a variety of wind speeds and weather conditions?

Response: The impact on homes that are ¼ mile away from turbines is site specific and varies greatly by the terrain of the land, the size and model of the turbine, and the siting of the turbine. Therefore, there is a very large range of potential impacts. For more specific information, see the “Property Values” and “Health and Safety” thematic sections of this report.

- X5. What are the environmental and social impacts of large wind farms?

Response: A comprehensive response to this question is beyond the scope of this project. There is a very large range of potential environmental and social impacts from large wind farms. These impacts are both very broad in scope and very site specific – depending upon the siting of the farm, mitigation strategies that were utilized, the local environment, etc. Additionally, these impacts can be both positive and negative for the host community. To read a comprehensive study of the environmental and social impacts of utility scale wind, see the National Research Council’s study Environmental Impacts of Wind Energy Projects, accessible at http://books.nap.edu/openbook.php?record_id=11935&page=1.

- X6. Do industrial wind turbines create television interference?

Response: The answer to this question is site specific and largely depends upon the kind of television connection you have, the siting of the turbines, and the local environment. However, just like large structures and unique terrain can disrupt television reception, wind turbines can do so as well. There are ways that developers can mitigate this problem through proper siting and Geographic Information Systems' studies of the area. To read more information about television interference, see: http://www.comsearch.com/files/Wind_Energy_White_Paper.pdf. To read more information about mitigation, see: http://www.ewec2010proceedings.info/allfiles2/286_EWEC2010presentation.pdf.

Original Questions:

1. How much electricity is produced by foreign oil in the United States? **See response below.**
2. How do Oil and Gas companies (Jordan Development, Presidium Energy) feel about Duke Energy coming in and offering more on a wind turbine lease per year, than on a gas/oil lease? **Project specific.**
3. How many of the four township boards are currently making a living (50% or better) from oil/gas production? **Beyond scope of project.**
4. How many full time jobs do gas/oil production support in the same four townships? How many of these jobs will be lost due to wind power coming to our area? **Beyond scope of project.**
5. What percentage of oil/gas production is being used for electric production? What percentage is being stored? What percentage is being exported from Michigan? **See response below.**
6. Can the windmill project in any way restrict the production of oil or natural gas? **See response below.**
7. How many waste disposal sites from oil/gas production are in our 4 townships? (Large pits with rubber liners to contain waste products.) How long will they remain? What permits are needed to place one on a property? Does the public get a question and answer opportunity to place a waste storage area? Can this waste contaminate our drinking water wells? **Beyond scope of project.**
8. Are there any bi-products from oil/gas production or use that can be recycled to produce anything useful? **See response to question L12.**
9. How much property does it take to build a natural gas electric generating facility? Are there any of these being built in our area or in Michigan? How many are being proposed? **See response below.**
10. Is the price of energy generated from fossil fuels expected to go up in the future? Are fossil fuel generators exposed to price risk on fuel inputs and emission outputs (i.e. SO₂, NO_X, Carbon and Mercury)? Do wind energy generators have price risk on either fuel input or emission output? Can wind energy replace some of America's dependence on foreign countries for its energy needs? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- Y1. How much electricity is produced by foreign oil in the United States?

Response: Every day, the US consumes on average 19.1 million barrels of petroleum products, 49% of which comes from other countries. Oil, and particularly foreign oil, meets many of our domestic energy needs. Yet, oil and petroleum products are used generally for transportation, and not electricity generation in the United States. Though oil accounts for 2/3 of all transportation fuel, it only generates 1% of electricity in the U.S. Most electricity produced in the United States is derived from coal, natural gas, and nuclear sources.

For more information on the role of foreign oil and energy in the U.S. see:

http://www.eia.gov/energy_in_brief/foreign_oil_dependence.cfm.

For more information on electricity production in the U.S., see:

http://www.eia.gov/cneaf/electricity/epa/epa_sum.html.

- Y4. How many of these jobs [from oil and gas production] will be lost due to wind power coming to our area?

Response: Jobs created by wind development would not directly displace jobs that have already been created by the oil and gas industry, but rather add to the total number of jobs created by energy development in the area. This is because wind energy proposals don't correlate with the decommissioning of other energy projects. In general, while the number of jobs for each wind energy project varies based on the size of the project, it is estimated that for every 100 MW of installed energy, 6-10 permanent jobs are created. For more information on job creation and the economic impacts of wind energy, see the National Renewable Energy Laboratory document at <http://www.nrel.gov/docs/fy04osti/33590.pdf>

- Y5. What percentage of oil/gas production is being used for electric production? What percentage is being stored? What percentage is being exported from Michigan?

Response: Though oil is generally used for transportation and not electricity, natural gas is a primary fuel for electric production. In Michigan, oil accounts for 1% of electric production and natural gas accounts for 11% of electric production. Coal is the largest source of energy for Michigan, and generates over 60% of the state's electricity. For more information, see: http://www.ucsusa.org/assets/documents/clean_energy/UCS-BCBC-factsheet-Michigan.pdf.

Though Michigan is a net importer of electricity, and spends \$26 billion dollars annually importing energy from other states and countries, it is a net exporter of natural gas. In 2009, Michigan imported 12,216 million cubic feet of natural gas while it exported 673,318 million cubic feet. This data is available at http://www.eia.gov/dnav/ng/ng_move_state_dc_u_smi_a.htm.

Conversely, Michigan is a net importer of oil, and imports 82% of the state's oil and petroleum needs. This data is available at <http://www.dleg.state.mi.us/mpsc/reports/energy/energyoverview/>

While the data for Michigan's stored energy is unavailable, according to reports from 2009, the country as a whole has a petroleum reserve of 727 million barrels. For more information, see: http://www.eia.gov/energyexplained/index.cfm?page=oil_home#tab2

- Y6. Can the windmill project in any way restrict the production of oil or natural gas?

Response: In general, wind energy proposals are aimed to generate new sources of renewable energy and do not directly deal with decommissioning or restricting of other forms of energy production.

- Y8. Are there any bi-products from oil/gas production or use that can be recycled to produce anything useful?

Response: Oil and natural gas can be refined to create different products that we use on a regular basis. To read a complete lifecycle analysis of these energy sources, see the Alternative Forms of Energy Section, Question L12.

- Y9. How much property does it take to build a natural gas electric generating facility? Are there any of these being built in our area or in Michigan? How many are being proposed?

Response: Michigan is one of the largest producers of natural gas in the Great Lakes Region. Currently there are 9,700 wells producing gas from the Antrim Shale, and in 2010, 53 new permits were granted in Northern Michigan. Natural gas production includes the wells, pipelines, and generating facilities – all of which require land. Though the size of a natural gas processing plant varies by facility, a large plant can be anywhere around 60 acres. For more information on natural gas production in Michigan, see: http://www.michigan.gov/documents/deq/GIMDL-USGSOFR9575K_303059_7.pdf

- Y10. Is the price of energy generated from fossil fuels expected to go up in the future? Are fossil fuel generators exposed to price risk on fuel inputs and emission outputs (i.e. SO₂, NO_x, Carbon and Mercury)? Do wind energy generators have price risk on either fuel input or emission output? Can wind energy replace some of America's dependence on foreign countries for its energy needs?

Response: Because of the volatilities in the energy market, the price of energy generated from fossil fuels is expected to increase. According to the Energy Information Administration, the price of a barrel of oil is expected to increase to \$125-\$200 by 2035. Prices could increase for two reasons – fossil fuels become scarce and/or a carbon tax is established. For more detailed energy price forecasts, see the Energy Information Administration’s Annual Energy Outlook, published in 2011: [http://www.eia.gov/forecasts/aeo/pdf/0383\(2011\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2011).pdf).

We interpret the question about price risk for fossil fuel generators to be asking about the externalized cost of pollution, and the same regarding wind energy. Currently, the cost of energy derived from fossil fuels does not internalize the social, environmental, and economic costs of pollution that are levied on people and environments. While the real price of fossil fuel energy depends upon the source, some economists have estimated that if you were to internalize all the impacts of natural gas, the price would jump from \$.03/kWh to \$.07/kWh. Different pricing systems, like a carbon tax, could internalize these costs. Wind energy, like other renewables, does not emit carbon dioxide or other pollutants. This means that the price of wind energy – \$.04/kWh on average – does not change when environmental externalities are internalized. To read more information about the internalized cost of energy, see: http://www.awerbuch.com/shimonpages/shimondocs/VGlobal_0305.pdf.

To answer the last question, America depends on foreign countries for energy generated from different sources. For example, we import oil from the Middle East and hydropower from Canada. While wind energy can certainly replace coal, natural gas, hydro electricity from foreign countries, it is more difficult for it to replace foreign oil as oil and petroleum products are generally used for transportation. To read more about foreign oil and domestic electricity, see the response to question Y1.

Original Questions:

1. Are we getting "sucked into" a big surge of activity that has to do with MI's law requiring 10% of energy to come from alternative sources? If this law didn't exist, would we be moving in this direction with confidence? **Value judgment.**
2. How much of state mandate for renewable energy has been met? **See response below.**
3. In meeting the 10% renewable energy by 2015 Michigan mandate, is the required 10% renewable energy to be measured as the rated capacity of the source, or the actual net production output? **See response below.**
4. Does state law require that townships allow wind energy (i.e. industrial)? **See response below.**
5. Why should Michigan be asked to produce so much energy (more than Michigan itself needs)? **Value judgment.**
6. How can the state require large wind developments not have any accompanying legislation to protect its citizens? **Value judgment.**
7. Can a community/township develop its own renewable energy program to meet the mandates which may or may not include wind? **See response below.**
8. Is renewable energy generation required by the state of Michigan? Relative to the rest of Michigan, do Benzie and Manistee counties contain a good source of wind energy? Do Benzie and Manistee Counties have a competitive advantage in this area that it could use to create a new industry and jobs? **See response below.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

Z2. How much of state mandate for renewable energy has been met?

Response: The February 2011 "Report on the Implementation of the P.A. 295 Renewable Energy Standard" provides this information. Electric providers are directed by the Act (MCL 460.1051(1)) to file annual reports for each plan year beginning with 2009. The first set of Michigan electric provider annual reports were filed during 2010 covering calendar year 2009. According to the Public Utilities Commission, based on the data provided for the 2009 calendar year, the renewable energy percentage is 3.6 percent. This is an increase from 2.9 percent in 2007 which was the most recent year this data was compiled. The report states that "Michigan's electric providers are on track to meet the 10 percent renewable energy requirement. The renewable energy standard is resulting in the development of new renewable capacity and can be credited with the development of 700 MW of new renewable energy projects since the Act became law". The following website provides links to each electric provider's renewable energy plan http://www.michigan.gov/mpsc/0,1607,7-159-16393_53570-240176--,00.html

Z3. In meeting the 10% renewable energy by 2015 Michigan mandate, is the required 10% renewable energy to be measured as the rated capacity of the source, or the actual net production output?

Response: According to the Michigan Public Service Commission, compliance with the renewable energy standard is demonstrated through the use of renewable energy credits. One renewable energy credit is created for each megawatt-hour (MWh) of renewable energy generated. See the February 2011 "Report on the Implementation of the P.A. 295 Renewable Energy Standard" for information about the renewable energy plans filed by electric provider toward meeting the renewable energy standard requirements. This is available at

Z4. Does state law require that townships allow wind energy (i.e. industrial)?

Response: There is no express requirement in state law that townships allow wind energy. However, although townships can regulate wind energy through carefully evaluated and adopted land use plans and ordinance provisions, it is possible that there are certain types of local wind energy regulation that would not be permitted by state law. For example, any township zoning regulation is subject to the limitations described in the response to question D1, including a potential exclusionary zoning challenge, and the township cannot regulate in a manner that directly conflicts with state law or in a manner that is pre-empted by detailed state legislation in that same area.

Z7. Can a community/township develop its own renewable energy program to meet the mandates which may or may not include wind?

Response: The mandates refer to electricity generating utilities in the state. Communities and townships can certainly develop renewable energy and efficiency programs, and they may receive support from local utilities to do so.

Z8. Is renewable energy generation required by the state of Michigan? Relative to the rest of Michigan, do Benzie and Manistee counties contain a good source of wind energy? Do Benzie and Manistee Counties have a competitive advantage in this area that it could use to create a new industry and jobs?

Response: In 2008, Michigan created a renewable portfolio standard for energy production, mandating that 10% of Michigan's electricity be generated from renewable sources by 2015. See questions Z2 and Z3 for information about impacts of the Act. In general, Michigan has been identified as having significant wind resources. In particular, Manistee and Benzie Counties have been identified as "having the largest potential" for wind energy by the Michigan Wind Energy Resource Zone Board because of wind speed, terrain, and other environmental factors. This makes these counties attractive for wind development. One of the potential benefits from wind energy development is job creation, and because Michigan has a large manufacturing base, many hope that wind energy will generate new jobs for the state. See thematic section N on "Economic Impacts" for more information about jobs.

Original Questions:

1. What is the actual net production output as a percentage of the rated capacity of other sources of energy such as solar, coal, natural gas, and nuclear? **See response to question L1.**
2. What is the actual net production output of the Ubly (Thumb Michigan) wind farm as a percentage of rated capacity? How about Stoney Corners or other operating Michigan wind farms? **See response below.**
3. What would be the net production output as a percentage of the rated capacity of a wind farm, such as Duke's proposed Gail Wind project? (The wind doesn't blow all the time; thus, if wind powered a turbine 25% of the time a 100 mw capacity system would produce 25 mw net, not considering maintenance shutdowns, etc.) **Project specific.**
4. What is the efficiency of wind energy and what are its effects on transmission loss, coal plant shut downs, and the grid? **See response below.**
5. What percentage of the electric generation for Michigan can be realistically produced by wind turbines? **See response below.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- AA2. What is the actual net production output of the Ubly (Thumb Michigan) wind farm as a percentage of rated capacity? How about Stoney Corners or other operating Michigan wind farms?

Response: The Ubly Project is a 69 MW farm, and the Stoney Corners project is a 19 MW farm. Net production is very site specific as it depends upon wind speed, terrain, the model of turbine, and the design of the project. Since these are fairly recent projects, there is limited information available concerning net production as a percentage of their rated capacity.

- AA4. What is the efficiency of wind energy and what are its effects on transmission loss, coal plant shut downs, and the grid?

Response: The maximum efficiency a turbine can operate at, according to the Betz' Law, is 59%. If the blades of a turbine were to capture 100% of wind energy, they would act as a wall, stop all air movement, and harness no energy. On average, the amount of energy extracted by wind turbines as a percentage of the total energy available, taking into account friction, technical design, and other factors, ranges between 20-40%. The average is 33%. Once turbines convert wind energy into electricity and transmit it to the grid, it acts as any other form of energy and does not have any unique transmission loss. For more information, see <http://www.windenergyplanning.com/wind-turbine-efficiency/>. Also, see http://www.ucsusa.org/clean_energy/technology_and_impacts/energy_technologies/how-wind-energy-works.html#The_Mechanics_of_Wind_Turbines.

- AA5. What percentage of the electric generation for Michigan can be realistically produced by wind turbines?

Response: Michigan is currently ranked 14th in the country for onshore and offshore wind potential. Wind energy has the potential to power 71% of Michigan's electricity, as measured by electricity sales in the last decade. This statistic is drawn from the Union of Concerned Scientists and can be accessed at http://www.ucsusa.org/assets/documents/clean_energy/acfgpapzz.pdf

Information on the estimated availability of wind energy in Michigan was also developed for Michigan's Wind Working Group, with the assistance of experts at the National Renewable Energy

Laboratory (NREL). Currently, 3.6 percent of the electricity generated in the state is from renewable energy. Less than one percent of Michigan's electricity is produced by wind. For more information, see <http://cdn.publicinterestnetwork.org/assets/gRgnxFImBODlvsogFisDcA/Energizing-Michigans-Economy.pdf>.

Original Questions:

1. How far from an adjacent property does the turbine have to be without infringing on neighbor's rights? **See response below.**
2. What is the role/weight of individual property rights in decision making? **Beyond scope of this project.**
3. Who will protect homeowners from wind turbines' excessive noise, daytime flicker, night time flashing lights, massive tower heights, and huge loss of property values if local townships do not have a wind ordinance established? **Value judgment. Comment not question.**
4. As a resident of the southernmost part of Gilmore Township, apparently only yards from the presumed locations of a cluster of the turbines, I'm concerned about my "rights" and "protections" from the impacts -- whatever they may be -- of the turbines in Blaine Township. If zoning and permitting are done on a strictly township by township basis, what provision is there for providing protections to an adjacent or nearby residence in a different township? It appears that I could be impacted far more than most of the people in the two townships identified by Duke Energy as its target area, yet I have not seen anything in the media about Gilmore Township participation in the zoning and planning discussions. **Moved from section BB "Property Rights" to section D "Township Governance".**
5. Will the concerns of other property owners be considered, if they are not interested in having a turbine in their backyard? How good of a neighbor will Duke really be? **Project Specific.**
6. If these turbines adversely affect the leaseholder's crops (ex: no bees for pollination) are the growers still eligible for subsidies? **Beyond scope of project.**
7. Do farmers and landowners in general have the right to use their land to generate income from wind, oil and gas, farming or forestry? **See response below to question G19.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

BB1: How far from an adjacent property does the turbine have to be without infringing on neighbor's rights?

Response: There is no black and white answer to this question. Under the law of nuisance, a landowner's use of their property cannot unreasonably interfere with their neighbor's private use and enjoyment of their own property, or significantly interfere with the public's health, safety, peace, comfort, or convenience. But the determination of when a wind turbine might rise to one of these levels would be a fact-specific inquiry dependant on location-specific factors, such as the type of neighboring land use and the type of windmill.

However, a Township does have the authority to adopt a zoning ordinance that sets a specific, required setback, subject to the general limitations on the Township's zoning authority discussed in Question D1. For example, the model wind energy zoning ordinance discussed in Question D4 suggests requiring a setback that is at least as high as the size of the tower.

BB7: Do farmers and landowners in general have the right to use their land to generate income from wind, oil and gas, farming or forestry?

Response: In general, yes, but farmers and landowners still must comply with applicable laws. All of those uses are subject to restrictions found in local zoning and, in some cases, state and federal law.

Original Questions:

1. How will a township benefit financially from the placement of a wind farm? **See question N4.**
2. How will property taxes be derived from each turbine installation? Will there be an income stream to local government based on the energy generated? **See response below.**
3. Project tax revenues assuming impact. **Needs further clarification.**
4. Are wind turbines (structure) currently taxed? Are transmission lines and substations taxed? If so, at what approximate rate? **See response below.**
5. If the state's Personal Property Tax is eliminated, how much will this decrease the tax revenue to local governments? **See response below.**
6. Have any large energy companies entered into community-based profit-sharing agreements that go beyond the tax encumbrances attached to the development, usually through a property tax? **See response below.**
7. Can we require pay in lieu of taxes in the event that the way they are currently taxed gets altered in such a way that it takes money away from the county and township? **See response below.**
8. Can we require the developer not have the choice to opt-in (?) to no taxes paid to the school fund? **Needs further clarification.**
9. What are some of the tax breaks given to the townships, counties? What will they do with this money? Fix roads? Keep schools open? Where will that money go? **Beyond scope of project.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- CC2. How will property taxes be derived from each turbine installation? Will there be an income stream to local government based on the energy generated?

Response: The answer to this question is site specific and can vary greatly by community, zoning ordinances, and developer. Further, it is not possible to answer questions about future local tax changes in Manistee and Benzie Counties. In general, a community and developer usually arrange a compensation agreement that is shaped by zoning ordinances, the developer's resources, and the permitting process. Sometimes, the developer pays personal property taxes on the turbines. Other times, the contract requires a Payment in Lieu of Taxes Agreement, which establishes a fixed annual payment directed toward the local community. Both arrangements have benefits and drawbacks for generating revenue for the local community. To read the National Renewable Energy Laboratory's Wind Energy Guide for County Commissioners, which delves into the issue of taxation, see: <http://www.nrel.gov/wind/pdfs/40403.pdf>.

- CC4. Are wind turbines (structure) currently taxed? Are transmission lines and substations taxed? If so, at what approximate rate?

Response: The state of Michigan and local government tax land and personal property. Wind turbines, as they are not affixed to the land and owned by a business, are considered personal property and are taxed. The same is true for transmission lines and equipment attached to substations. If a developer or company owns the land that any of their personal property is sited on, then they must also pay property taxes in addition to personal property taxes. Though tax rates can vary by location, there are certain statewide requirements that exist. These requirements limit the property tax rate to \$15 dollars per every \$1000 dollars of taxable value, except in counties which have voted to increase the rate. To read a brief summary

of wind turbine taxation in Michigan, see:

http://www.michigansthumb.com/articles/2010/07/21/news/local_news/doc4c46c9844b2fc328431959.txt.

To read the Michigan Department of Treasury's information on taxation, see

http://www.michigan.gov/taxes/0,4676,7-238-43535_43537-154835--,00.html.

CC5: If the state's Personal Property Tax is eliminated, how much will this decrease the tax revenue to local governments?

Response: The 2010 numbers for personal property tax revenue in the Understanding Wind Initiative Townships are: Arcadia \$4,302, Bear Lake \$22,832, Blaine \$423, Joyfield \$1,943, Onekama \$7,958, and Pleasanton \$5,585. The Michigan Municipal League compiled these numbers from Michigan Department of Treasury Records. This information was found at <http://www.mml.org/advocacy/replace-dont-erase/personal-property-impacts-all.pdf>.

Information does not yet exist to determine the potential future loss of personal property tax revenue from wind energy systems if the systems were built and the tax was eliminated.

CC6. Have any large energy companies entered into community-based profit-sharing agreements that go beyond the tax encumbrances attached to the development, usually through a property tax?

Response: Yes, many energy companies have created Payment in Lieu of Taxes Agreements or established community ownership agreements (or good neighbor agreements) where their projects are sited as alternatives to property taxes. A PILOT agreement replaces personal property taxes by having the developer pay the local community a fixed annual rate for a certain number of years. Often, communities decide to direct portions of this money to local school districts and the government. Community ownership agreements, as another model for profit-sharing, attempt to give communities a greater financial stake in the project as communities own a portion of the development. These compensation arrangements can vary greatly by location, community, developer, and local policy.

CC7: Can we require pay in lieu of taxes in the event that the way they are currently taxed gets altered in such a way that it takes money away from the county and township?

Response: No. There is no authorization for Townships to impose this type of requirement, and it likely would be pre-empted by or in conflict with state law.

Original Questions:

1. Is it better to build large wind projects (100+ turbines) off-shore or on-shore? Please compare the pros and cons of each location? **See response below.**
2. How close can turbines be to Lake Michigan? **See response below.**
3. Can we join together to assure that a wide corridor (5-10 miles) of land running along the Lake Michigan shoreline be declared off-limits to utility wind turbines or any other industrial energy development that would spoil our unique land trust? This land already has its mandated purpose: natural recreational retreat. Considering the critical need for places where whole-person health may be restored, this use of Michigan's northwestern lands deserves to be our first priority. Industrial energy production belongs in places where the land is open, plain and uninhabited. Many other states are better suited for utility wind development, such as Texas. **Comment not question.**
4. Are the numbers of turbines limited at this time to 112 or can the number increase higher and higher? **Project specific.**
5. Is there or will there be some sort of density restrictions so we don't end up with continuous wind towers along the entire West Michigan coast and in the lake itself? **See response below.**
6. How can we control widespread development, versus contained development, of utility turbine projects to prevent them weaving in and through our most beautiful, pristine lands? How can we limit the expanse of acreage developed and the footprint of developments? How can we put a cap on, or set a maximum allowance for the number of turbines in a project, preventing unlimited future growth and guarding against increasing dominance of an agricultural/residential/natural region? **See response below.**
7. Can an overlay district for wind only include certain areas of the township? **See response below.**
8. Can you provide innovative examples of turbine siting that address residential areas within agricultural districts, taking into consideration density, parcel size, etc.? **See response below.**
9. What is the distance between each tower? **See response below.**
10. When you see large turbine installations out west or in Indiana near the highway or in other states, you don't see any residential units near them. Why would it be okay for a large industrial wind energy project to be placed near residential homes? **Value judgment.**
11. Why is Denmark proposing banning on-shore wind? **See response below.**
12. I would like to know whether Duke Energy, or any other energy company, has developed plans, or is in process of developing plans, to install industrial wind towers in Leelanau County. **Project specific.**
13. For that matter, how do we know that the Blaine-Gilmore township boundary is the real and firm northern boundary of the project and that Duke hasn't tried to secure leases outside those two townships? I understand the property rights involved in this situation, but the secrecy does not contribute to a transparent and trustworthy process that you and others are working to create. **Project specific.**
14. Are thousands of 400 foot-plus, wind towers in our agricultural community an acceptable answer to our energy needs? **Value judgment.**
15. According to the 2007 Michigan wind siting document, designated scenic areas are not to be encroached upon; is the township authorized to designate this or is there some other way it has to be designated? **See response below.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

DD1. Is it better to build large wind projects (100+ turbines) off-shore or on-shore? Please compare the pros and cons of each location?

Response: Offshore wind farms offer some opportunities for wind energy that would not be viable on land, but they can also have significant drawbacks. When deliberating over the pros and cons of on-shore versus off-shore wind farms, many considerations must first be made about the specific location and requirements of the proposed farm. In some areas, off-shore generation may be a more effective option, while in other places it should not be considered. The West Michigan Wind Assessment’s report on the subject, “Offshore Wind Energy: Public Perspectives and Policy Considerations”, offers a good list of potential pros and cons to consider:

| | |
|---|--|
| Some advantages of offshore wind: <ul style="list-style-type: none">• Stronger and more consistent winds• Larger and faster turbines• Closer proximity to large cities and energy centers• Located where noise is less likely to disturb people | Some drawbacks of offshore wind: <ul style="list-style-type: none">• Public acceptance (more complex opposition)• Higher construction costs• Could negatively affect people’s connection to a landscape |
|---|--|

This report is available online at http://www.gvsu.edu/cms3/assets/E72B5288-BE34-4625-761F7F3984B33D8C/wind_brief_3.pdf.

DD2. How close can turbines be to Lake Michigan?

Response: Although both government agencies and nongovernmental actors have developed guidelines for wind farm location considerations, there are currently no set distance restrictions between Lake Michigan and wind farms. For instance, the U.S. Fish and Wildlife Service has recommended a buffer zone between turbines and Lake Michigan; however, these restrictions can only be implemented if the wind farm is proposed on federal land, uses federal funding or impacts a federally listed species. Meanwhile, local governments can require that turbines not be built in areas due to threats to wildlife or natural resources, which in many cases will restrict project development in that given area. The “Michigan Renewable Energy Program” responds to this question in more depth – see http://www.michigan.gov/documents/mpsc/FAQ_Guidelines_for_Siting_Near_Great_Lakes_Shorelines_321044_7.pdf

DD5. Is there or will there be some sort of density restrictions so we don't end up with continuous wind towers along the entire West Michigan coast and in the lake itself?

Response: It is unlikely that the entire coast of West Michigan will contain wind energy systems. While the Model Zoning Ordinance for Wind Energy Systems in Michigan does not contain provisions suggesting a density restriction, or the number of towers allowed within a community, region or within the state, there are only certain areas that have been determined to possess enough wind to support development.

The Michigan Wind Energy Resource Zone Board (WERZB) was established by Public Act 295 of 2008 (PA 295). PA 295 is a comprehensive energy legislation that contains a provision for the WERZB to identify a list of areas in the State with the highest wind energy potential. WERZB identified four regions of highest wind energy potential in the State of Michigan. The final report includes a number of maps that show where the

WERZB designated areas with the highest wind potential are located. These can be viewed at http://www.dleg.state.mi.us/mpsc/renewables/windboard/werzb_final_report.pdf

Note that the maps exclude roads, airports, wetlands, Great Lakes shoreline, and other natural and man-made features to determine the land available for potential use by wind energy systems (see “NOTE” in Exhibit 2 on page 4 of the WERZB report). It is in these areas that have the greatest wind potential and therefore the most likely be developed

The WERZB continues to recommend that decisions regarding wind energy siting be determined by local communities. Through setback requirements, consideration of natural features, wildlife protection, requirements of the industry to show wind potential and other development restrictions, the siting of wind turbines will be site specific and limited to certain regions.

Subject to the limitations discussed in Question D1, individual local governments can place reasonable restrictions the construction of wind towers, including on the density of wind towers.

DD6. How can we control widespread development, versus contained development, of utility turbine projects to prevent them weaving in and through our most beautiful, pristine lands? How can we limit the expanse of acreage developed and the footprint of developments? How can we put a cap on, or set a maximum allowance for the number of turbines in a project, preventing unlimited future growth and guarding against increasing dominance of an agricultural/residential/natural region?

Response: Concerns like these are ultimately the decision of township officials, guided by citizen input. Many of these issues can be addressed through the master planning process. Arcadia and Bear Lake Townships in Manistee County and Blaine and Gilmore Townships in Benzie County have agreed to partner in developing a collaborative master plan and implementation strategy. When completed, it will provide a master plan to serve the needs of each township but also identify opportunities for collaboration which may encompass service sharing and joint efforts involving economic development, tourism, recreation, agriculture, agribusiness and others. The project will begin in January 2012 and be completed during the first quarter of 2013, assuming full funding is secured by the Alliance for Economic Success that is serving to coordinate the project.

DD7. Can an overlay district for wind only include certain areas of the township?

Response: Yes. Subject to limitations discussed in the response to question D1, a Township can make reasonable determinations about the locations that are generally most suitable for wind power in the Township, and enact a planned unit development (PUD) or special use permit (SUP) zoning amendment to address wind generation within the overlay district.

DD8. Can you provide innovative examples of turbine siting that address residential areas within agricultural districts, taking into consideration density, parcel size, etc.?

Response: The National Wind Coordinating Committee’s Siting Workgroup studied communities’ reactions to local wind development projects, with the goal of identifying welcomed projects from projects that were not accepted by communities. They also examined changes in community perceptions before, during, and after project construction, as well as recognizing what wind project developers can do to address the concerns that often recur at wind project sites. Many case studies are presented, including from southwestern Minnesota, central New York, and southcentral/western Oklahoma. This document can be found at http://nationalwind.org/publications/siting/Wind_Power_Facility_Siting_Case_Studies.pdf.

Also see project case studies on our research website, at www.macalester.edu/windvisual/.

DD9. What is the distance between each tower?

Response: The distance between wind turbines is determined by the specific characteristics of the wind farm terrain and location, with every project having different layouts. The design of the wind farm will be decided upon by the developer, based on data about wind speed and direction, the local topography, the size of the turbines, and other technical and economic factors. The New York State Energy Research and Development Authority's "Wind Power Project Site Identification and Land Requirements" report provides a good description of how wind farm layout is determined, and gives some examples of turbine distances in different locations. This report is available online at http://www.powernaturally.org/programs/wind/toolkit/13_windpowerproject.pdf.

DD11. Why is Denmark proposing banning on-shore wind?

Response: Our research has not found any evidence of such a ban in Denmark.

DD15. According to the 2007 Michigan wind siting document, designated scenic areas are not to be encroached upon; is the township authorized to designate this or is there some other way it has to be designated?

Response: Assuming the wind siting document is a model zoning ordinance, then, yes, as discussed in Question V1, the Township can identify viewsheds that it determines are worth protecting, in accordance with the limitations described in D1. Most ideally, these areas would be identified in the Township Master Plan.

Questions:

1. Can electrical transmission lines be buried underground from the wind turbine to the substation? [See response below.](#)
2. Can the electrical transmission lines be buried from the substation to the high voltage transmission lines? [See response to question EE1.](#)
3. Do the turbines take electricity to operate? [See response below.](#)
4. Where will the transmission lines that will connect these turbines and existing transfer stations be placed? Will the transmission lines be underground or overhead? How wide will they be if they go overhead? Will they cross non-participating properties? Will the property be condemned or seized by eminent domain? Will there be a map that shows the placement of transmission lines before erected? [See response below.](#)
5. Will the transmission lines for the grid be underground? [See response to question EE1.](#)
6. Can the township require transmission lines to be buried? Can the township do anything to limit the impact of substations on a non-participating land owner? [See response below.](#)
7. What is the total distance the new power lines will run? [Project specific.](#)
8. Who will benefit from the generation of power by the windmills? Is it used locally? [See response below.](#)
9. Will the power generated locally be used locally? Can it be? [See response to question EE8.](#)
10. Does the majority of the population that is leasing their property to Duke realize that this power they generate does not “benefit” our area? Do they know it’s for Detroit Edison? [Project specific.](#)
11. Does the public realize that Duke is supplying to Detroit Edison? [Project specific.](#)
12. Is there any guarantee that we can require that the electricity generated in our community stays in our community? [See response to question EE8.](#)
13. How much land would be cleared for power lines and other utilities? [See response below.](#)
14. What infrastructure improvements will be necessary to support and connect the proposed turbines and who will pay for this? [See response below.](#)
15. Will Duke be sharing roads, power lines, etc. with already established companies? [Project specific.](#)
16. At what speed does the tip of a blade on a wind turbine rotating at its maximum go? How fast before the breaking system kicks in? [See response to question C12.](#)
17. Are the turbines speed limited, and if so, why? Is there an RPM limit at which the current output does not increase appreciably? [See response below.](#)
18. Since it can only supplement energy under the right circumstances, why is it worth it? [See response to question EE20.](#)
19. How would wind projects in Benzie and Manistee Counties fit into and help maximize the \$800 million upgrade investment planned by Consumers Energy and DTE for the Ludington Pumped Storage Facility? [See response below.](#)
20. What happens to the energy produced by a wind turbine if it’s not being required? Is it stored? [See response below.](#)
21. Can we limit the amount of energy generated by a project in our township ordinance? Say, 2.5 times what our township used last year? [See response to question D1.](#)
22. Since Michigan has lost 1,000,000 million people and many manufacturing companies, we actually have a surplus of electricity. Why do we need any industrial wind turbines in our area? Where will the energy actually go? [See response below.](#)
23. Can a community/township develop a renewable energy program that only allows community wind or limits the amount of MWH produced by the community, like 1.5 times what the community uses, or restrict it to the communities’ benefit only? [See response to question D1.](#)

24. For each tower's total carbon footprint, which includes road building, transportation of materials, and transmission lines, how long does it take to "work off" the negative of carbon footprint versus the positive of "pollution-free" energy generation? **See response below.**
25. Can radio-active wind produce energy for a windmill? **See response below.**
26. We have always been very supportive of wind energy, but, not too long ago, we were coming through an area in northern Indiana (I believe this is where it was) and over half the windmills were turned off! Why would this be? **Needs further clarification.**
27. Would wind energy be considered an essential service? **Needs further clarification.**
28. Can a community/township say that only point of use wind or solar would be allowed, i.e. at home or business and not large grid-tied units? **See response to question EE21.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

- EE1. Can electrical transmission lines be buried underground from the wind turbine to the substation? Can the electrical transmission lines be buried from the substation to the high voltage transmission lines?**

Response: Transmission lines can be buried underground from a wind turbine to a substation, but this is significantly more expensive – both to install and to maintain – than traditional overhead transmission lines. Generally, underground transmission lines are 5 to 6 times more expensive to install than above ground transmission lines. As transmission costs account for roughly 7% of a consumer's electricity bill, higher transmission costs can mean more expensive electricity for individuals. Transmission lines are usually only buried in particularly sensitive areas where there are overhead restrictions. The technical feasibility and environmental impact of underground vs. overhead transmission must also be considered when transmission lines are being sited and constructed. For more information, see: <http://www.modernizethegrid.com/index.html> and [http://www.nationalwind.org/assets/transmission/TM_Planning_Principles - Feb 2004.pdf](http://www.nationalwind.org/assets/transmission/TM_Planning_Principles_-_Feb_2004.pdf).

- EE3. Do the turbines take electricity to operate?**

Response: Wind turbines do not require electricity in order to operate. They generate electricity by working like the inverse of a common household fan. Instead of using electricity to turn the blades, the rotating blades generate power. As the wind blows past the blades, the movement turns an internal shaft which is connected to a generator, creating electricity.

- EE4. Where will the transmission lines that will connect these turbines and existing transfer stations be placed? Will the transmission lines be underground or overhead? How wide will they be if they go overhead? Will they cross non-participating properties? Will the property be condemned or seized by eminent domain? Will there be a map that shows the placement of transmission lines before erected?**

Response: While questions about the specific details about possible future transmission line construction in Manistee and Benzie Counties is project specific and beyond the scope of this report, we can provide some basic information about how federal, regional, and state policy can shape electricity transmission in the area. At the federal level, the Federal Energy Regulatory Commission and the Departments of Energy, Agriculture, and the Interior regulate rights of way and land use management. At the regional level, the MISO conducts regional planning and can help provide access to transmission. State and local governments are primarily responsible for regulating the siting and placement of transmission lines. These three levels of regulation, along with an environmental review statement can answer more specific questions about siting, placement, and mapping of transmission lines. For more information, see the Department of Energy's Primer on Transmission <http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/primer.pdf>.

EE 6: Can the township require transmission lines to be buried? Can the township do anything to limit the impact of substations on a non-participating land owner?

Response: Under most circumstances, a township cannot require transmission lines to be buried. The Electric Transmission Line Certification Act requires electric utilities to apply to the Michigan Public Service Commission for a certificate of public convenience and necessity for any transmission line that is at least 5 miles long and carries a voltage of at least 345 kV. The Act allows the utility to seek a certificate for transmission lines with voltages lower than 345 kV as well. If the utility applies for and is granted such a certificate, any local ordinance in conflict with the certificate is preempted.

The Michigan Supreme Court has held that the MPSC's rules governing underground electric lines trump any local ordinances related to undergrounding that conflict with those rules. More generally, the Michigan Court of Appeals invalidated a local zoning ordinance that specified minimum corridor width, minimum distance from dwellings, and maximum noise levels for transmission lines. The Court of Appeals held that these requirements conflicted with the Transmission of Electricity Act, which authorizes the MPSC to regulate the safety, capacity, need, and service requirements of transmission lines. The Michigan Supreme Court has held that there is some zoning authority over the location through which a transmission line runs, but that opinion precedes the other opinions discussed in this answer and its current status is unclear.

A local unit of government's zoning authority over substations is very limited, as well. The Electric Transmission Line Certification Act mentioned previously also applies to substations. It defines a transmission line as "all structures, equipment, and real property necessary to transfer electricity at system bulk supply voltage of 100 kilovolts or more." The Michigan Public Service Commission has found on at least one occasion that this definition of transmission lines includes substations. Therefore, a certificate of public convenience and necessity will preempt local zoning related to substations, as well.

Townships do have the right to grant franchises for the use of rights-of-way for electric lines and other utilities, subject to those reasonable regulations as the township may prescribe from time to time. However, a township may not unreasonably withhold consent to a utility that requests a franchise.

EE8. Who will benefit from the generation of power by the windmills? Is it used locally? Will the power generated locally be used locally? Can it be? Is there any guarantee that we can require that the electricity generated in our community stays in our community?

Response: While residential and small wind systems can supply energy directly to a home or location, utility scale wind farms are connected to the electricity grid. Once the wind energy enters the grid it is mixed with all other electricity generated by other sources. The MISO grid distributes energy across the Midwest and parts of Canada depending on demand levels. Therefore, it is difficult to tell from exactly what source and location a community is receiving their energy at a given time. However, utilities often have programs where for a premium, consumers can purchase wind energy ensuring that at least part of their electricity supply is being generated through these sources. For example, by enrolling in Detroit Edison's "Greencurrents" program, consumers can purchase a 100 kWh of renewable energy for an additional \$2.50 per month.

EE13. How much land would be cleared for power lines and other utilities?

Response: While much of this information is site specific and could be answered by an environmental impact statement, we can provide general information regarding land clearance for wind energy development. In terms of transmission lines, the amount of land required depends upon the design and site for the system. Generally, the width of a strip of land cleared for a transmission line ranges between 80-140

feet. To read more about types of transmission lines and rights of way, see this document from the Public Service Commission of Wisconsin <http://psc.wi.gov/thelibrary/publications/electric/electric09.pdf>.

In terms of access roads for wind development, developers often try to use previously constructed roads for operation and maintenance instead of clearing land for new roads. If new roads need to be developed, the average width of land that needs to be cleared for temporary access for large equipment is 40 feet, while the average width of land that needs to be cleared for permanent access is 16 feet. For wind turbines themselves, their average land footprint is 0.25 acres. To read more information, see: http://www.nrel.gov/analysis/power_databook/calc_wind.php.

EE 14. What infrastructure improvements will be necessary to support and connect the proposed turbines and who will pay for this?

Response: Based on depreciation filings by Consumers Energy and Detroit Edison, typical infrastructure improvements for wind energy generating facilities include roads, drainage, foundations, FAA lighting, a collection system, a collection substation, a transformer, an HV distribution line, and transmission. All of these improvements except transmission are paid for by the customers of the utility purchasing or generating the energy. Transmission is paid for separately. How it is paid depends on who owns the system - an independent transmission company or a system operator.

EE17. At what speed does the tip of a blade on a wind turbine rotating at its maximum go? How fast before the braking system kicks in? Are the turbines speed limited, and if so, why? Is there an RPM limit at which the current output does not increase appreciably?

Response: The specifics about the speed of blade tip rotation and braking systems vary across turbine models. However, the Tip Speed Ratio (TSR) is an important factor which influences a turbine's energy output. If the blade turns too slowly for the amount of wind that is passing through, then the turbine can't harness optimal energy. Conversely, if the blades turn too quickly, the blades actually block wind from passing through and don't generate optimal energy. Therefore, the TSR and braking systems on turbines are important as they influence energy production. See question C21 for more information.

EE19. How would wind projects in Benzie and Manistee Counties fit into and help maximize the \$800 million upgrade investment planned by Consumers Energy and DTE for the Ludington Pumped Storage Facility?

Response: It is possible that the upgrades to the Ludington Pumped Storage Facility could increase the capacity of wind facilities that are either owned by Consumers Energy or Detroit Edison, or whose energy will be purchased by one of those two utilities. Increasing the capacity will in turn increase the energy these facilities can produce, and lower the cost of that energy.

The Ludington plant has a capacity of 1,872 MW. Consumers Energy owns 51% of the facility, and Detroit Edison owns the remaining 49%. The plant uses electricity during off-peak hours to pump water uphill from Lake Michigan into a reservoir. Then, during peak hours, the water is released, flows through turbines and generators in a powerhouse, and makes electricity.

Consumers Energy is beginning a major overhaul of the plant, which will be completed by 2019. The upgrade will increase the plant's total capacity by 300 MW. Consumers Energy states that the purpose of the upgrade is to maintain safety and operating condition, as well as to re-license the plant with the Federal Energy Regulatory Commission.

The primary purpose of the plant is to supply electricity during peak hours so as to avoid purchasing those MWh from the spot market. However, there is significant added value in the ability to convert off-peak energy from an intermittent generation source like wind into capacity that can be used to supply energy during times when the wind facilities are not generating due to weather conditions.

EE20. What happens to the energy produced by a wind turbine if it's not being required? Is it stored?

Response: Wind energy can be stored by different methods. The most popular method is pumped hydro storage. During low-cost off-peak times, water is pumped from a lower elevation reservoir to a higher elevation. During high electricity demand periods, the stored water can be released to generate hydro power. See response above to question EE19.

Compressed air energy storage systems can also use off-peak electricity from wind farms by pumping air underground. The high pressure air acts like a huge battery that can be released on demand to turn a gas turbine and make electricity.

Though storing wind energy is possible, storage is not always necessary when wind energy is integrated on the electricity grid. Using smart grid technologies, wind forecasts, interconnected markets and farms, and predictions of demand, excess energy produced in one area can be dispatched to an area of need instead of stored. For more information about wind energy flexibility and reliability see Section L: Alternative Forms of Energy, specifically question 12, and these studies:

http://www.stanford.edu/group/efmh/winds/aj07_jamc.pdf.

http://digitalcommons.library.unlv.edu/cgi/viewcontent.cgi?article=1017&context=renew_pubs&sei-redir=1#search=%22studies%20wind%20energy%20flexibility%22.

EE22. Since Michigan has lost 1,000,000 million people and many manufacturing companies, we actually have a surplus of electricity. Why do we need any industrial wind turbines in our area? Where will the energy actually go?

Response: Michigan is a part of a much larger, interconnected electricity grid connecting the Midwest and parts of Canada. Additionally, Michigan is investing in wind energy in part because of its Renewable Portfolio Standard, which requires that 10% of Michigan's electricity be produced by renewable sources by 2015. To read more information about MISO, see question EE 8,9,12. For more information about Michigan's Renewable Portfolio Standard see theme Z.

EE24. For each tower's total carbon footprint, which includes road building, transportation of materials, and transmission lines, how long does it take to "work off" the negative of carbon footprint versus the positive of "pollution-free" energy generation?

Response: Of all energy technologies, wind energy has one of the smallest carbon footprints. Wind energy emits no carbon dioxide as it generates electricity. The majority of its footprint is generated during the manufacturing of the turbines and the construction of the wind farm. A very small portion of a wind farm's carbon footprint is derived from maintenance trips and inspection. The total carbon footprint for onshore wind during its entire lifecycle is estimated at 4.64 g CO₂ eq/kWh. Comparatively, coal's total carbon footprint, Michigan's largest energy source, is 1,000 g CO₂ eq/kWh. To read a comparison of carbon footprints by electricity generating technologies, see this report from the UK Parliament

<http://www.parliament.uk/documents/post/postpn268.pdf>

EE25. Can radio-active wind produce energy for a windmill?

Response: If this question refers to wind that is carrying radioactive fallout, the response is that radioactive wind still functions like wind and can produce electricity. For more information about how turbines generate electricity, see response to question EE3.

Original Questions:

1. If conflicts arise, what type of conflict resolution requirements should be in the ordinance? **See response below.**
2. One of the citizen concerns is regarding a proper complaint resolution process that would include penalties in order to enforce any wind developer to comply or mitigate potential problems such as noise, flicker, critical habitat impacts, property value impact, etc. **See response below.**
3. Are we likely to get into situations where neighbors end up in litigation? What happens to the neighbor who doesn't want a turbine/s on their property and ends up living close to one on their neighbor's property, say 1500 feet, and begins to exhibit symptoms such as sleeplessness, depression, or already is compromised by these conditions when the turbine is installed and things get worse for them, etc.? Will that neighbor have to move from their property? **See response below.**
4. I would like to understand how conflicts might be resolved and who would pay for any resolutions of conflicts that involved removal or relocation of turbines. For example, once the turbines are installed does the township have any recourse for non-payment of taxes, turbines that are installed in a manner not according to contract, turbines that are installed under false pretenses (suppose the company says that the turbine will not sound like more than a humming refrigerator and that turns out not to be the case)? What can be done? What government entity has controls over the companies and what are the specific controls. Could this pit the state government against the township government and cause a gridlock that will be harmful to residents. **See response below.**
5. What should be a complaint resolution process if people living close to wind turbines have a complaint on sound? **See responses below to questions FF1, FF2, and FF3.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another "theme" area (this will have been explained in red under the "Original Questions" section). In other cases two or more questions will be answered with one response.

FF 1. If conflicts arise, what type of conflict resolution requirements should be in the ordinance?

Response: The Michigan Zoning Enabling Act does not delegate a procedure for compelling an applicant, township, or other interested or affected person, to a special use or other proceeding for a permit or approval from a township planning commission, zoning board of appeals, or township board. Accordingly, a conflict resolution procedure would have to be made available to the parties, by contracting with a conflict resolution service, such as the Conflict Resolution Service ("CRS"), Traverse City, where one or more of the parties or persons would request a mediation of a dispute or issue arising out of the request for special use or other permit or approval for wind turbine location, system, setbacks, or other conditions that are imposed upon a permit.

The CRS has a form and procedure for mediation by a facilitator who is neutral and meets with all the parties, who voluntarily agree to participate. These are called "stakeholders" in the conflict resolution process. The facilitator helps the stakeholders or participants reach their own agreement that resolves all or part of the dispute and issues. This could be offered by the Township or the CRS to the persons involved in these proceedings, and all could agree to participate in good faith, but they would have to agree separately to do so, by contract, because in our opinion it cannot be compelled as a condition to the permit or built into the ordinance. This is unfortunate, because some townships have done this, but it is unlikely absent express delegation of authority under the state zoning law, that a party can be forced to do so.

On the other hand, by making it available on a voluntary basis, it is usually to the parties or affected persons benefit to seek a resolution if for nothing more than understanding each other and the issues better, which

can lead to other resolutions or at least trust later on in an adversarial process should it not resolve itself through the CRS process.

However, it is possible that something akin to conflict resolution could be built into the ordinance as part of the application process. An application must meet certain informational requirements, related to various standards that must be reviewed to assure compliance with the ordinance. This is typically part of the township zoning administrator's responsibility in determining whether an application for a special use permit is "administratively complete." As part of the wind turbine or generator ordinance, there undoubtedly will be standards that address noise, vibration, visual impacts, setbacks, and other issues dealing with the impacts and compatibility of wind turbines and related facilities with adjacent land uses, residences, property owners, and the character of the surrounding area. Neighbors, who live adjacent in the area, will have concerns about impacts and these issues.

As part of the application process the applicant wind turbine developer and company could be required, as an informational requirement, to meet with all landowners, occupants, and neighbors in the surrounding area, and discuss and go through a list of their concerns, and how they addressed those concerns, with agreement from the neighbor, no agreement, or disagreement; the applicant company would have to file this "neighborhood impact and compatibility" assessment, listing all neighbors, occupants, or land owners, and the issues or concerns, and the status of agreement. This document would then be used as part of the information submitted by the applicant in advance so that issues or concerns are "scoped" and addressed, and if not addressed, the issues will be a base line of information that must be considered related to the standards and health, safety, and welfare or reasonableness of the decision that ultimately must be made; it will also identify areas that need to be addressed satisfactorily by evidence as part of the decision making process. This is a suggested approach that could in its application bring about some resolution of conflicts, and if not at least an identification of potential conflicts to address.

FF 2. One of the citizen concerns is regarding a proper complaint resolution process that would include penalties in order to enforce any wind developer to comply or mitigate potential problems such as noise, flicker, critical habitat impacts, property value impact, etc.

Response: The township zoning ordinance could establish, and condition to each special use permit, a process for a complaint with the zoning administrator or a board, such as the zoning board of appeals, under the heading "interpretation" or claimed violation of the ordinance or special condition to a special use permit. The township can in its ordinance provide for misdemeanor and penalties, but this will have to be addressed also by a separate township ordinance, and townships are limited to misdemeanors and fines, so the process would be limited, and the township would enforce in court by prosecution, criminal or civil, as other infractions or violations.

However, if there are standards that address the issues mentioned (i.e. flicker, habitat, noise) they can be treated as a "good neighbor" or nuisance provision, and enforced by cease and desist or other remedy, issued by township, on complaint of an affected person. If the company fails to comply, it could be enforced in circuit court, as criminal or civil infraction or as injunctive remedy, under an ordinance or perhaps as a public nuisance statute violation. The key is the strictness and clarity of the standard that prohibits the violation or concern that you seek to address.

However, the problem is the creation of a process with sufficient penalties to enforce the violation. The township cannot create rights or remedies in affected persons, that is a matter left to the legislature by statute or the common law, such as the law of nuisance, where people can bring court actions for injunctive relief and/or damages. But a township can enforce its own standards or conditions of a permit, and specify who can file a complaint with the township, and how that complaint for violation would proceed.

In short, "a standard or condition to a special use permit can be declared to have the force of law, and enforced as any other violation of the zoning ordinance."

FF 3. Are we likely to get into situations where neighbors end up in litigation? What happens to the neighbor who doesn't want a turbine/s on their property and ends up living close to one on their neighbor's property, say 1500 feet, and begins to exhibit symptoms such as sleeplessness, depression, or already is compromised by these conditions when the turbine is installed and things get worse for them, etc.? Will that neighbor have to move from their property?

Response: The affected neighbor has only the remedies, per above, or those by Michigan statute or common law giving him or her the right to bring a claim for injunction and/or damages in circuit court, such as an action for private or public nuisance. Symptoms that constitute unreasonable interference with use and enjoyment of property, form the basis of a claim for nuisance, although the remedy and extent of injunction or damages includes "reasonable" interference. A person more vulnerable than another will still have to demonstrate unreasonableness to the ordinary person as well. However, again, the ordinance could provide some remedy per FF 2 above, and again, the affected person would either have to file a lawsuit or move; it would be simply a matter of choice.

While it would have to be researched, the other possibility is to require as a condition of a special use permit, or an entire turbine development in a township, that the company establish a trust fund for violations, remedies, costs and fees of experts to investigate and correct problems. This was done when landfills and hazardous waste facilities were sited in the late 1970s and 1980s, and in some instances set up as a condition of issuing a special use permit because the zoning act authorizes a township to impose conditions, and the trust fund would be provided for problems, including a company that abandoned a turbine and just walked away from it.

FF 4: I would like to understand how conflicts might be resolved and who would pay for any resolutions of conflicts that involved removal or relocation of turbines. For example, once the turbines are installed does the township have any recourse for non-payment of taxes, turbines that are installed in a manner not according to contract, turbines that are installed under false pretenses (suppose the company says that the turbine will not sound like more than a humming refrigerator and that turns out not to be the case)? What can be done? What government entity has controls over the companies and what are the specific controls. Could this pit the state government against the township government and cause a gridlock that will be harmful to residents.

Response: See answers to FF1 and FF2 above. All of these issues could be handled by imposing compliance and enforcement as a condition of a special use permit (SUP) or overall development of wind turbines by a company in a township. Again, the conditions could then be enforced if violated, and to back up non-payment or remedial costs, a trust fund or large bond/letter of credit could be required. Until the state government passes its own siting and operational limitations and enforcement or permit controls, the matter is left up to townships based on the strength of its zoning ordinance or township police power ordinances.

The situation described could pit state government against local government, but only if state government passes its own siting law and expressly preempts local zoning or township police power ordinances that are more stringent than the state statute. This has often happened in the case of siting waste disposal facilities, because state law allows for a solid waste plan in each county, and if permitted by state in accordance with the plan, local zoning requirements, in most instances, are prohibited. No such state law exists at this point for wind turbines and/or siting them.

While not directly related, one suggestion would be for a company wanting to develop wind turbines to apply for a preliminary approval of its entire development plan in one or more townships, by PUD (planned unit development), and then, and only, then could a SUP be applied for and obtained for a particular turbine. This would address the planning, impacts, and remedies, and concerns comprehensively, perhaps

even more initially as part of an amendment to a master plan. The company could be required to do all kinds of things to provide information, and to pay for costs of township for independent reviews, studies, as part of the development of a turbine plan for one or more townships. This way there would be a PUD step, cumulative and comprehensive as to the plan, and SUP step, site and turbine specific, should a turbine for specific site be authorized and within the PUD comprehensive planned development.

Theme: Bonds

ID Letter: GG

Original Questions:

1. Will the necessary bonds be in place for construction and decommissioning, prior to even breaking ground for a single or first wind turbine? Will those bonds be placed in local banks, or ones in North Carolina that are under Duke's jurisdiction? **Project Specific**
2. Can the community/township require bonding for the installation of the project and road damage? **See responses to questions D10, D11 and FF3. The Township can require a performance guarantee to the extent necessary to insure the faithful completion of the wind project.**

Theme: Questions on the Experts

ID Letter: HH

Original Questions:

1. What are the qualifications of the people answering these questions? What precautions were taken to ensure that they are unbiased? What documents and studies did they rely on? **Please see the introduction to this report.**
2. How are neutral experts defined and found? **Please see the introduction to this report.**
3. Will a full bibliography of reference and research studies be disclosed to the public? **Please see the introduction to this report.**
4. Will the total number of PhDs and M.D.s that have studied health and noise effects of turbines be disclosed? (i.e. number who see harmful effects vs. numbers who see no effect) **Beyond scope of this project.**
5. How many are making wages from Gail Wind Project? **Project specific.**
6. For each of the panelists: Do you stand to gain in any way from a wind energy facility in any form? **Please see the introduction to this report.**
7. Have any of the panelists ever received contributions or any type of payment or incentive from anyone connected to the wind energy industry or a wind energy producing company? **Please see the introduction to this report.**
8. Has anyone who has offered an opinion, and taken a position either pro or con, actually stood under a 500 foot turbine, observed a landscape with comparable ratios of population density and turbine numbers, or visited homes that are 1/4 mile away from active turbines in a variety of wind speeds and weather conditions (sunny day vs. cloudy day)? **Value judgment. Comment not question.**

Original Questions:

1. Are the roads in both counties in good enough condition to handle the weight of all the equipment that is involved in the assembly of these turbines? Will Duke pay for the repairs due to washouts on gravel/dirt roads, ruts in winter? Will there be a county road commission fund established by Duke for necessary repairs? **Project specific but see response below to questions II2 and II3.**
2. What is the amount of road widening and new roads (including access roads during construction) that will occur? Will access roads be paved? **See response below.**
3. Can we require the wind energy developers to bring our road conditions to better repair than they are currently at? **See response below.**
4. When under construction, how many acres of land are disturbed for the wind generator site, access roads, and infrastructure? **See response below.**
5. What is the quantity of Green House Gases (GHG) that is emitted from the manufacturing, transportation to the construction site and erection of a 495ft wind turbine? How does this compare with the GHG for solar energy? **See response below.**
6. How much concrete will it take to make this concrete pad? **See response below.**
7. What is the cubic area of the concrete pad of each tower? **See response to question II6.**
8. How much cost will the public bear in emergency response, roads, and other necessary public upgrades? **See response to question D1, D4 and FF4 and Theme KK.**

Questions and Responses:

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- II2. What is the amount of road widening and new roads (including access roads during construction) that will occur? Will access roads be paved?

Response: Typically, temporary access roads for construction are 40 feet wide to accommodate the vehicles travelling to and from the site. During construction, they are covered in gravel, but post-construction the size is reduced to 16 feet across. We Energies published a concise summary of the typical road construction procedures that occur during the creation of wind farms, called “Developing and Constructing Wind Energy,” which is based upon their construction of the Blue Skies Green Fields wind farm in Wisconsin. This document is accessible at <http://www.wiwindinfo.net/projects/BSGF%20photo%20book%209.16.08.pdf>.

- II4. When under construction, how many acres of land are disturbed for the wind generator site, access roads, and infrastructure?

Response: The scale of construction disruption varies based on the size of the project, the topography of the area, and the types of species that exist there. The National Wind Coordinating Collaborative’s “Permitting of Wind Energy Facilities” handbook suggests that construction impacts about three to five percent of the total project area, depending on the size and type of development. This document is available online at <http://www.nationalwind.org/assets/publications/permitting2002.pdf>. According to the Department of Energy, per turbine, temporary construction can impact 0.2 to 1.0 hectares of land (page 111 of the “20% Wind Energy by 2030: Increasing Wind Energy’s Contribution to U.S. Electricity Supply” report, accessible at <http://www.nrel.gov/docs/fy08osti/41869.pdf>).

II5. What is the quantity of Green House Gases (GHG) that is emitted from the manufacturing, transportation to the construction site and erection of a 495ft wind turbine? How does this compare with the GHG for solar energy?

Response: It is difficult to isolate the GHG's produced from the construction phase of wind energy from other emissions, but estimates show that approximately 8-30 grams of CO₂ are produced per kWh of energy produced by an onshore turbine. Of this, 72-90% is from construction. In comparison to solar energy, at 43-73 grams per kWh, this is significantly less. These values are listed in a study called "An Assessment of the Life Cycle Costs and GHG Emissions for Alternative Generation Technologies", for more information on how these numbers were calculated and used, refer to the article, available online at <http://www.worldenergy.org/documents/congresspapers/482.pdf>

II6. How much concrete will it take to make this concrete pad?

Response: A typical foundation is approximately 15-20 meters in diameter and located between 1-2 meters below the surface (deeper in the center). The exact measurements will depend on the turbine selected and the underlying geology. According to WE Energies "Developing and Constructing Wind Energy" document, each turbine uses approximately 325 yards of concrete to create the foundation. This full document is online at <http://www.wiwindinfo.net/projects/BSGF%20photo%20book%209.16.08.pdf>.

Original Questions:

All of the below questions pertain either to the Gail Wind Project or Duke Energy Corporation and are beyond the scope of this project.

1. What is Duke's total project cost?
2. How much investment and how much profit would Duke make in this project?
3. Has Duke Energy offered area residents and County and Township officials the opportunity to tour wind farms comparable with this proposed project in terms of equipment, set-backs, and noise level?
4. Has Duke Energy offered area residents and County officials the opportunity to tour comparable wind farms in terms of equipment, set-backs, noise level, etc.? Have they offered to arrange for local people to visit and talk with folks who actually live with a wind farm comparable to the proposed wind farm?
5. What are you able to discern about Duke Energy's track record responding to noise, flicker, property value, tax, and other real, not theoretical, disputes in the other communities where it has erected wind turbines?
6. Will Duke really be a good neighbor? What proof can they provide?
7. Duke should maintain a physical presence in northwest Michigan permanently to handle any problems that arise for Dukes installations – or be able to have a representative in the county within 24 hours? (This may be overkill, but since Duke is an out-of-state company, I do not want them building and leaving.)
8. Has there been any thought of Duke providing funding for energy-related education programs for the county – technical training so that local people are trained to do the maintenance on the turbines? I don't know the ethics of this, but paying \$20,000 or whatever the contract says to the landowners does not off-set the potential disruption to the residents. Local people should at least be trained and hired for the jobs.
9. If the FAA does not approve the site, what is Duke's next step to get a waiver or approval?
10. What is the total number of Duke-proposed wind turbines in all phases of stages of the project in Benzie and Manistee Counties?
11. Is Duke studying other sites in Benzie, Manistee, Leelanau, or Grand Traverse Counties for additional wind turbines?

Original Questions

1. Any ordinance should include language that Duke or subsequent owners should bear the financial responsibility of investigations into allegations regarding violations of the ordinances. The financial responsibility should not fall on the township or its residents. It might be appropriate to bundle allegations into one or two investigations a year to be fair to Duke. **Comment not question.**
2. The ordinance should specify that Duke or subsequent owners will reimburse the township and its residents for any costs associated with handling any turbine-related emergencies – e.g. fires started in turbines, etc. **Comment not question.**
3. What safeguards can communities and local units of governments put into place to provide to protect themselves from financial and legal liability associated with large scale developments, such as pooling resources, to create a fund for future legal fees? **See response below.**
4. Can the community/township ask for administration funds from the applicant to hire experts, attorneys and administration/enforcement to review applications? **Yes. See response to questions D16 and H13.**
5. Are there examples from other states or projects in which mitigation was a requirement by the local unit of government via zoning or a landowner via their lease? **See response below.**
6. When does it become a referendum issue? **See response to question D6.**

Questions and Responses

These questions may have been recategorized and reorganized. Some may have been sent to another “theme” area (this will have been explained in red under the “Original Questions” section). In other cases two or more questions will be answered with one response.

- KK3.** What safeguards can communities and local units of governments put into place to provide to protect themselves from financial and legal liability associated with large scale developments, such as pooling resources, to create a fund for future legal fees?

Response: Please see answer D9. Most local units of government obtain their insurance through a pool arrangement. The Michigan Municipal Risk Management Authority (MMRMA) and Michigan Township Participating Plan (Par Plan) are both essentially self-insurance pools for local units of government.

- KK5.** Are there examples from other states or projects in which mitigation was a requirement by the local unit of government via zoning or a landowner via their lease?

Response: There are many townships, counties, and states that have incorporated issues of mitigation into their wind energy zoning ordinances. To provide a local example, Huron County, MI, home to one of Michigan’s largest wind farm, addresses concerns about siting, setbacks, health, safety, wildlife impacts, and other mitigation issues in their zoning. These mitigation requirements guided how Harvest Wind Farm was constructed and is operated.

To read Huron County’s zoning ordinances, see:

http://www.co.huron.mi.us/documents/WindEnergyOverlayZoningOrdinance_000.pdf

To read how the Michigan Department of Labor and Economic Growth’s recommends that mitigation be addressed in zoning, see

http://expeng.anr.msu.edu/uploads/files/26/michigan_department_of_energy_growth.pdf.

Original Questions:

1. Will Michigan remain a regulated state? **Question needs clarification.**
2. How much electrical energy (MWH) is being used annually in Benzie and Manistee counties? This will help people to get a better grip on their consumption as well as the scale of power supply needed for the 21st century assuming certain growth characteristics. I think you could get this data from Cherryland and Consumers Energy. Somehow we need to help people to better understand how their consumption has impacts to someone, somewhere and that we need to be willing to accept these responsibilities for our consumption as opposed to exporting the impacts.
Question not comment, Original question is moved to section P "Energy Conservation".
3. What is a "Taking?" If a landowner is denied their right to develop their land for a grid WES does that constitute a "Taking?" **This question relates to the U.S. Constitution's Fifth Amendment Takings Clause concerning property rights and government compensation. Moved to section BB "Property Rights".**
4. The wind project in the "thumb" of Michigan has been sold three time is just over 6 years of operation. What is the reason for the sale of the wind project? **Beyond scope of this project.**
5. New Coast Guard station tower is 400' and has a strobe light. Is the same type of lighting, or what type of lighting would be on one of the turbines? **Project Specific.**