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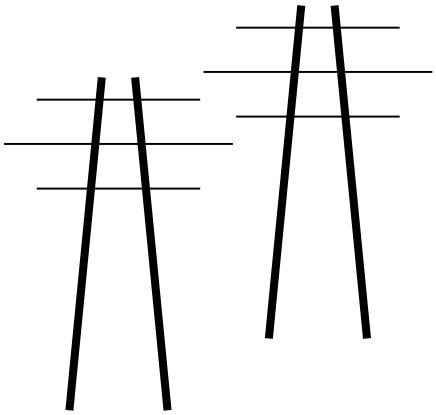

May 20, 2021

Jim Mortenson
Administrative Law Judge
OAH
P.O. Box 64620
St. Paul, MN 55164-0620

eFiled and eServed

RE: Comments of Walleye Neighbors in Minnesota and South Dakota
Walleye Wind - OAH Docket: 05-2500-37275
MPCU Dockets: IP-7026/CN-20-269 and IP-7026/WS-20-384

Dear Judge Mortenson:

On behalf of Walleye Neighbors of Minnesota and South Dakota, enclosed please find below our Comments on the Certificate of Need and Siting Permit applications.

I. Reliance on Small Wind (under 25MW) Permit Standards for siting Large Wind Energy Conversion Projects is unacceptable.

In this docket, the Applicants, and Commerce-EERA in the Environmental Report and Draft Site Permit, repeatedly rely on small wind permit standards. The Order caption is clear in intent to apply to projects less than 25 megawatts:

In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts	ISSUE DATE: January 11, 2008 DOCKET NO. E,G-999/M-07-1102 ORDER ESTABLISHING GENERAL WIND PERMIT STANDARDS

Exhibit A, Order Establishing General Wind Permit Standards, PUC Docket No. E,-999/M-07-1102.

The inapplicability of these small wind siting standards to LWEC projects such as the Walleye Wind project have repeatedly been raised, yet this inexplicable reliance continues. See ER, fn. 20, p. 12 and fn.. 183, p. 101 (citing Order Establishing General Wind Permit Standards, PUC

Docket No. E,-999/M-07-1102). Exhibit A, Order Establishing General Wind Permit Standards, PUC Docket No. E,-999/M-07-1102.

The ER states, "As proposed, the Project layout incorporates the wind energy conversion facility siting criteria outlined in the Commission's General Wind Permit Standards." ER, p. 12, citing Small Wind Order, fn. 20.

The Application, Environmental Report and Draft Site Permit are invalid to the extent that they rely on inapplicable standards.

II. Commerce-EERA admits that project predicts unreasonably high levels of shadow flicker that must be addressed.

When asked about the high levels of shadow flicker reported in the project's Application and Shadow Flicker modeling in Appendix C, Commerce-EERA admitted that this project had an issue with shadow flicker that must be addressed.

In the ER, Commerce-EERA readily admits that "there are no ules for a Minnesota "light standard' defining the amount of shadow flicker that is acceptable for a commercial wind proect, the default industry standard is for **no occupied residence** to receive more than 30 hours per year of shadow flicker." ER, p. 77 (emphasis added). This project's modeling results show astonishingly high levels predicted:

Table 15: Predicted Shadow Flicker Impacts at Participating Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	127:54
Maximum Shadow Flicker - Expected Case	45:49

Table 16: Predicted Shadow Flicker Impacts at Targeted Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	134:15
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Table 17: Predicted Shadow Flicker Impacts at Non-Participating Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	107:26
Maximum Shadow Flicker - Expected Case	38:36

The "worst case" scenario is 3+ to 4+ times the informal maximum, and after massaging the numbers, the best the project can "expect" is 38-45 hours annually, still above the informal limit.

Note that the project is improperly distinguishing between "non-participating," "targeted," and "participating" landowners, which EERA does not allow for that distinction, instead considering shadow flicker for any "occupied residence." The notion of use of "occupied residence" is crucial, because as admitted in the public hearing, the leases include "effects waivers" which mean that those signing the leases have given up all rights to claims regarding impacts of "effects," in essence an adhesion contract as those signing would have no idea of the meaning or impact of shadow flicker.

This project should not be permitted until project layout is changed or residences bought out sufficient to bring project into compliance with the informal limit of 30 hours annually of shadow flicker. How this is to be accomplished must be produced publicly and with provision for public review and comment, and not in private closed-door after-permitting agreements as was done for the Freeborn Wind project after it was found it had not demonstrated probable compliance with the noise standard. How will the project gets from 107, 127, and 134 hours of shadow flicker to an "acceptable" number of hours? This must be vetted publicly, and not be a secret agreement.

III. Comments on Draft Site Permit

Again, the origin of the setbacks found in the Draft Site Permit is the "Order Establishing General Permit Standards[1]," for SMALL WIND:

In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts	ISSUE DATE: January 11, 2008 DOCKET NO. E,G-999/M-07-1102 ORDER ESTABLISHING GENERAL WIND PERMIT STANDARDS

See Order Establishing General Wind Permit Standards, PUC Docket No. E,-999/M-07-1102). Ex. A, Order Establishing General Wind Permit Standards, PUC Docket No. E,-999/M-07-1102.

After being challenged on this repeatedly, the Commission has stepped back from citing the small wind standards, apparently in recognition of the impropriety of use of small wind standards as basis for siting large wind project. However, the setbacks established in those small wind standards are still being used.

Draft Site Permit, Section 4.1 – Wind Access Buffer. The Draft Site Permit provides no citation to the 3 x 5 RD siting convention, and improperly allows siting closer with permission of the Commission. Because this is a protection for landowners not participating in the project, under no circumstances should siting less than the 3x5 distance be allowed. Further, for the 2.82

[1] Order Establishing General Permit Standards, January 11, 2008 (M-07-1102), eDocket ID 4897855.

turbine with rotor diameter of 417 feet, 3x = 1,251 feet, and 5x = 2,082. For the 2.32 turbine, 3x = 1,146 and 5x = 1,910. Are turbines sited at sufficient distance?

Further, to the extent that the 3x5 rotor diameter siting setbacks are based on the small wind siting standards, they are illegitimate. This is not a small wind project under 25MW.

Draft Site Permit, Section 4.2 – Residences. The commonly used 1,000 foot setback, as found in Section 4.2 of the Walleye Draft Site Permit is based, as stated in the Environmental Report, p. 12 and 101, on the Small Wind Standards.

However, use of this setback, and use of small wind standards for siting large wind projects, is illegitimate. There is no setback for large wind based in statute, rule, or standards, and use of this small wind standard is arbitrary.
When questioned about use of this 1,000 foot setback from residences, Commerce-EERA staff claims the origin is unknown:

> Q: … it lists 1,000 feet as a setback from residences. Where does that number come from? It's for the SDP template. Where do you get that number?
> A: For the template or for what we've submitted for the preliminary?
> Q: Both, really. But where do you get – where does the thousand foot come from?
> A: Thousand foot. I don't know exact – the exact location of where that comes from. But in the most recent site permit applications that have been approved in the most recent site permits that have been issued by the Commission, that has been the standard distance that they've approved, along with the consideration of noise standards being met.

Freeborn Wind contested case hearing, EERA-Davis, Tr. Vol. 2, p. 171-173; see also Freeborn Wind contested case Exhibit EERA-8, Draft Site Permit, p. 3 (use of 1,000 foot setback), PUC Docket WS-17-410.

In other cases, setbacks have been much larger:

> Q: Are you familiar of any siting permits that provided for one-half-mile setbacks?
> A: I am.
> Q: And how many times – or explain?
> A: I know of only one in Minnesota, and actually this hearing was the first place that I'd ever heard of it, is Lakewinds up in Clay County, Minnesota where they have half-mile setbacks. And I do not know the basis of those setbacks. I don't know the discussions that led to them.

Id., Freeborn Wind contested case, EERA-Davis, Tr. Vol 2, p. 173, l. 5-14.

The distance of setbacks for residences, and generally, are completely arbitrary, with no basis in

law, rule, or standard, and no basis in science. To the extent that the siting setbacks are based on the small wind siting standards, they are illegitimate. This is not a small wind project under 25MW. These standards are not applicable.

Draft Site Permit, Section 4.3 – Noise. The Walleye Wind project's noise study impermissibly and materially understates the potential noise of the project by use of a ground factor of 0.5 rather than the typical ground factor of 0.0 appropriate for an elevated noise source. The Public Utilities Commission is on notice, has been for some time, of the use of improper ground factor in wind noise modeling, particularly since the Freeborn Wind permit was first issued in 2019, and since a letter filed in the Power Plant Siting Act docket and 13 wind siting dockets that were using improper ground factors for noise modeling. See Exhibit E, Correspondence, PPSA Docket M-19-18, Document ID **201912-158454-10** (also filed in 13 wind siting dockets).

A ground factor of 0.0 is to be used for wind modeling because the wind noise source is elevated high in the air, and ground conditions do not impede the direct path from a greatly elevated source to the "receptor." A ground factor of 0.5 is not appropriate because of the elevation of the noise source. See Exhibit E, testimony of Dr. Paul D. Schomer, from the Highland Wind CPCN proceeding (WI PSC Docket 2535-CE-100) and testimony of Mike Hankard, from the Badger Creek Solar CPCN proceeding (WI PSC Docket 9697-CE-100). Mike Hankard performed the pre-construction ambient noise testing for the Walleye Wind project, and he had this to say regarding use of 0.5 ground factor in the Badger Hollow solar docket (WI PSC Docket 9697-CE-100).[2]

A The model that we use has been shown to predict conservatively with 0.5. I mean, 0.5 ground factor is used in probably -- well, with the exception perhaps of wind turbine projects which are different because the source is elevated. But for projects like a typical power plant, a solar plant where the sources are relatively close to the ground, I would say 90 to 99 percent of the studies use 0.5. And when consultants like myself go out and measure these plants after they're constructed to verify our modeling assumptions, that assumption checks out as being, if anything, overpredicting the levels. So there's no need to -- there would be no justification to use something like a .2 or .3 which would predict yet higher levels because we're already demonstrating that the model is probably overpredicting. So that would not be justified for those reasons.

MR. NOWICKI: Thank you. No further questions.

[2] Transcript at PSC REF #358548. Tr. 45-234 Party Hearing Session, online at: https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=358548

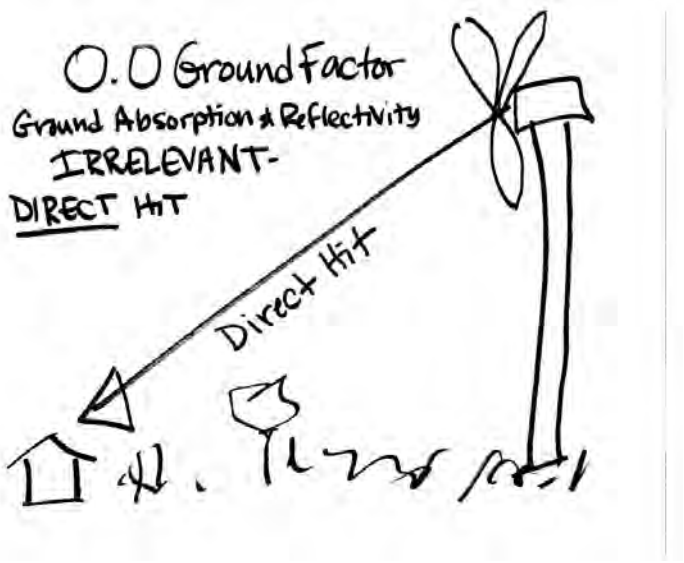
Ground factor represents conditions on the ground and things that can come between the noise source and the "receptor." See ISO 9613-2 (standards for noise modeling):

7.3 Ground effect (A_{gr})

7.3.1 General method of calculation

Ground attenuation, A_{gr}, is mainly the result of sound reflected by the ground surface interfering with the sound propagating directly from source to receiver.

This represents the travel of noise from a wind turbine to a "receptor" on the ground:



There is nothing impeding, interfering, with the sound propagating from the source several hundred feet in the air and the "receptor" on the ground.

What is impact of use of an improper ground factor that understates noise? The result can be seen in the Blazing Star docket, where multiple parties have complained of noise immediately as the turbines began to operate, in initial testing, even before the project was operational. In the Blazing Star docket, at least four families have filed complaints, with 12 turbines at issue. These complaints, filed roughly a year ago, remain unresolved. Exhibit F, Blazing Star Compliance Filing, PUC Docket WS-16-686, May 14, 2021,Document ID **20215-174171-02** (selected).

Projects sited understating noise run the risk of noise standard exceedences, as occurred in Bent Tree, demonstrated by Commerce-EERA noise monitoring studies,[3] and resulting in two landowner family buyouts[4]. The greater risk to the project is that once a wind project turbine is installed, if there are noise issues, there is little that can be done to address that problem short of shutting down the turbine or buying out the landowner "receptor" suffering under the noise

[3] The Commerce-EERA Noise Monitoring Studies, Phase I and Phase II, may be found here: https://legalectric.org/weblog/16728/

[4] The settlement agreements of the Hagen and Langrud families may be found here: https://legalectric.org/weblog/16950/

exceedence. For this reason, no wind turbine should be issued for a project using a 0.5 ground factor in noise modeling – the risk of noise issues is high. Where six turbines are expected to be run "NRO" (5,6,27,32,33 and Alt 8) before even built, increased from 3 in the Initial Application, there is a high probability of excessive noise – and how are regulators to tell if turbines are indeed being run at the lower production rate NRO? This is a set up for problems.

Draft Site Permit, Section 4.4 Roads; 5.3.13. The Draft Site Permit proposes just 250 foot setbacks from the edge of the nearest public road right-of-way. This is insufficient. In February, 2018, an ice throw from the Bent Tree wind project struck a truck traveling on Highway 13 just north of Albert Lea.

Exhibit B, Comment of Commissioner Belshan, including photo of damage; GE Ice Shedding and Ice Throw—Risk and Mitigation (recommending setback 1.5 times hub height + rotor diameter); Alliant 2/23/2018 letter re: shutdown of turbines),filed in Freeborn Wind PUC Docket WS-17-410.

Alliant quickly settled with the truck owner. Exhibit C, Letter of Alliant Energy, April 2, 2018.

The DOT has concerns about safety and has requested larger setbacks. When asked at the Walleye Wind public hearing about DOT requesting setbacks from roads, Walleye Wind was not aware of any desire on the part of the DOT for larger setbacks.

The DOT has requested review of setbacks. At the Power Plant Siting Act Annual Hearing in 2019, Ms. Kotch Egstad of the DOT made oral comments and submitted written comments for the record, where she encouraged the Commission to update the current 250 foot setback requirement to follow a more restrictive setback that many counties use in the state. MnDOT recognizes that it has "no legal jurisdiction outside of MnDOT owned land, however, its request is based on a desire to help insure the safety of the traveling public first and foremost and secondly, to allow flexibility in future ROW expansion." See Exhibit D, written comments of Egstad, DOT, PPSA Record, PUC Docket M-19-18; see also ALJ Report, p. 6-7:

> MnDOT recommends that the Commission ask applicants to "evaluate the effects of consolidation of collection lines, crane paths and other points of access prior to intersecting trunk highways."[70] Ms. Kotch Egstad encouraged the Commission to update the current 250 foot setback requirement to follow a more restrictive setback that many counties use in the state.[71] MnDOT recognizes that it has "no legal jurisdiction outside of MnDOT owned land, however, its request is based on a desire to help insure the safety of the traveling public first and foremost and secondly, to allow flexibility in future ROW expansion."[72]

The Walleye project has not taken the DOT's concerns into account, and should, by increasing setback from ROW to a distance sufficient to address DOT concerns.

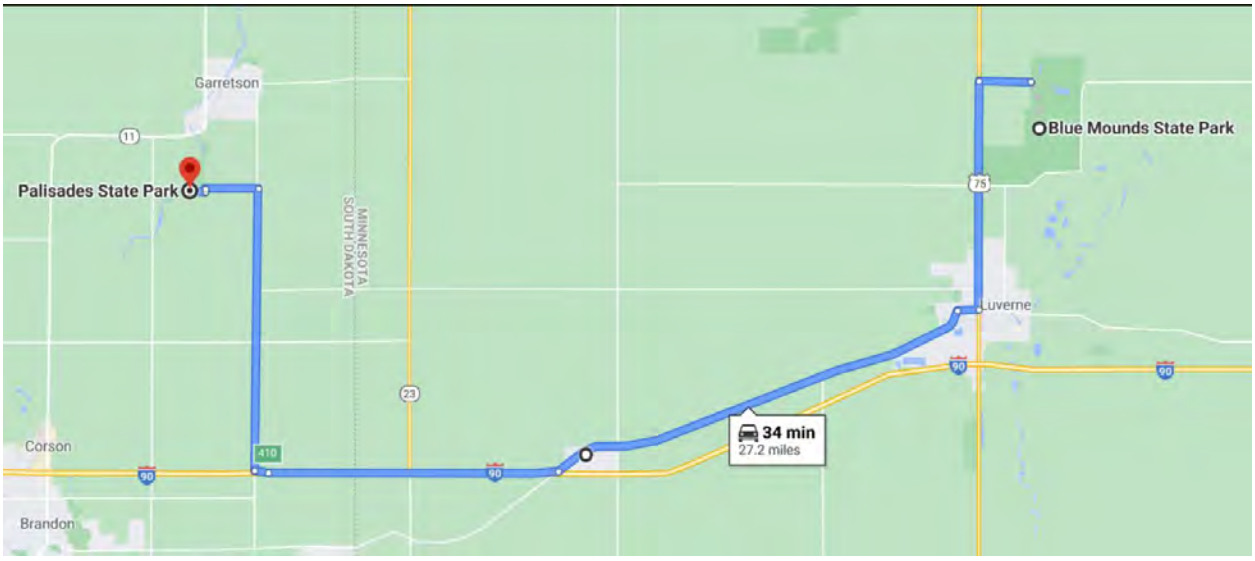
Draft Site Permit 4.5 Public Lands In Section 8.5.1 of the Cover letter "Visual Impacts" and Section 8.5.1 Visual Impacts on Public Resources, Blue Mounds State Park is the only public land referenced. In the Cover Letter, the Applicant notes that:

> In the Initial application, the nearest proposed turbine for the project was approximately 4.3 miles southwest of Blue Mounds State Park. This distance has now increased to 6.7 miles in this Application Amendment. Visual impacts to Blue Mounds State Park are not expected to be a concern.

Cover letter, p. 15, November 4, 2020.

Blue Mounds State Park is on the other side of Luverne, east of the project. South Dakota's Palisades State Park, a public land, is much closer to the project, and is given no consideration.

The project's turbines nearest the border, T-21, T-22, Alt-2, T-27, T-28,and T-29 should be shifted eastward an equal distance from this public land.



Draft Site Permit 4.10 Turbine Spacing The Draft Site Permit cites the 3x5 siting in prevailing and non-prevailing wind directions, and allows that "up to 20 percent of the towers may be sited closer than the above pacing. First, once more with feeling, the 3x5 standards are for SMALL WIND PROJECTS, and not for LARGE wind. Second, this provision of the permit gives Permittee full license to move turbines, without Commission, Commerce-EERA or landowner review and oversight. That is not acceptable.

Draft Site Permit 5.1 Permit Distribution This section includes providing "complaint procedures" to affected landowners. As has been demonstrated in dockets such as Bent Tree, Big Blue, Blazing Star, and Freeborn, the complaint procedures are not adequate. The Complaint process must be revised and made responsive to complaints, must direct that mitigation efforts be timely, not require a landowner to sign an effects agreement or any sort of waiver to get relief, and provide compensation to those affected by the project.

Draft Site Permit 5.3.17 Interference The Draft Site Permit should have an additional sentence regarding mitigation:

> Should the project cause interference, the problem must be corrected without requirement of signing of any waiver by complainant.

This has been an issue in other wind project, essentially extortion, and must be prevented.

Draft Site Permit, Section 7.2 Shadow Flicker. Section 7.2 does not have any limitation on hours of shadow flicker and no regulatory process stated whatsoever. This is not acceptable. Shadow flicker hours predicted are admittedly far, far above that typically allowed in permits, but again, this is just Commission practice because there are no rules or standards for siting large wind projects.

Predicted shadow flicker, as above, taken from cover letter to Application Amendment, p. 17:

Table 15: Predicted Shadow Flicker Impacts at Participating Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	127:54
Maximum Shadow Flicker - Expected Case	45:49

Table 16: Predicted Shadow Flicker Impacts at Targeted Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	134:15
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Table 17: Predicted Shadow Flicker Impacts at Non-Participating Residents

	Duration (hrs:mins/yr)
Maximum Shadow Flicker – Worst-Case	107:26
Maximum Shadow Flicker - Expected Case	38:36

Despite this material overage in hours of shadow flicker predicted, this is the Walleye Wind Draft Site Permit, Section 7.2:

7.2 Shadow Flicker

At least 14 days prior to the pre-construction meeting, the Permittee shall provide data on shadow flicker for each residence of non-participating landowners and participating landowners within and outside of the project boundary potentially subject to turbine shadow flicker exposure. Information shall include the results of modeling used, assumptions made, and the anticipated levels of exposure from turbine shadow flicker for each residence. The Permittee shall provide documentation on its efforts to avoid, minimize and mitigate shadow flicker exposure. The results of any modeling shall be filed with the Commission at least 14 days prior to the pre-construction meeting to confirm compliance with conditions of this permit.

That is the ENTIRE Draft Site Permit section for Shadow Flicker, with no provisions for regulation of shadow flicker! As an example of a typical Site Permit, this is the Freeborn Wind Site Permit Section 7.2 Shadow Flicker:

> **7.2 Shadow Flicker**
>
> At least 14 days prior to the pre-construction meeting, the Permittee shall provide data on shadow flicker for each residence of non-participating landowners and participating landowners within and outside of the project boundary potentially subject to turbine shadow flicker exposure. Information shall include the results of modeling used, assumptions made, and the anticipated levels of exposure from turbine shadow flicker for each residence. The Permittee shall provide documentation on its efforts to avoid, minimize, and mitigate shadow flicker exposure. A Shadow Flicker Management Plan will be prepared by the Permittee, which will include the results of any shadow flicker modeling, assumptions made, levels of exposure prior to implementation of planned minimization and mitigation efforts, planned minimization and mitigation efforts, and planned communication and follow up with residence. The Shadow Flicker Management Plan shall be filed with the Commission at least 14 days prior to the pre-construction meeting to confirm compliance with conditions of this permit.
>
> Should shadow flicker modeling identify any residence that will experience in 30 hours, or more, of shadow flicker per year, the Permittee must specifically identify these residences in the Shadow Flicker Management Plan. If through minimization and mitigation efforts identified in the Shadow Flicker Management Plan the Permittee is not able to reduce a residence's anticipated shadow flicker exposure to less than 30 hours per year a shadow flicker detection systems will be utilized during project operations to monitor shadow flicker exposure at the residence. The Shadow Flicker Management Plan will detail the placement and use of any shadow flicker detection systems, how the monitoring data will be used to inform turbine operations, and a detailed plan of when and how turbine operations will be adjusted to mitigate shadow flicker exposure exceeding 30 hours per year at any one receptor. The results of any shadow flicker monitoring and mitigation implementation will be reported by the Permittee in the Annual Project Energy Production Report identified in Section 10.8 of this Permit.
>
> Commission staff and EERA staff will be responsible for the review and approval of the Shadow Flicker Management Plan. The Commission may require the Permittee to conduct shadow flicker monitoring at any time during the life of this Permit.

Commission Order Issuing Site Permit and Taking Other Action, December 19, 2018[5].

Walleye Wind is a long way from 30 hours, and the entire second and third paragraphs regulating shadow flicker are missing! Where is the shadow flicker hours limitation?

No permit should be issued for this project unless and until the project has adjusted siting and demonstrated that shadow flicker will not be over 30 hours at any "receptor" residence, and that this demonstration has been produced, filed in the docket, and open for public review and comment PRIOR to issuance of the permit. If this production and demonstration is allowed 14

[5] Freeborn Wind, WS-17-410, Document ID **201812-148595-01.**

201812-148595-01	PUBLIC	17-410	WS	PUC	ORDER--ORDER ISSUING SITE PERMIT AND TAKING OTHER ACTION	12/19/2018

days prior to start of construction, there is no ability for the public to review, and in essence, it is done in secret and, as with the Freeborn Wind noise agreement, the integrity of the result is in question.

Draft Site Permit 7.4 Noise Studies Post-construction noise monitoring should be completed within 6 months to confirm noise levels predicted by noise modeling.

This section of the permit should also include a directive to conduct noise monitoring studies immediately upon substantive complaints of any "receptor" resident in the project footprint. These noise monitoring studies should be conducted without delay, timely performed without making residents live with noise unabated through administrative dawdling.

Draft Site Permit 7.5.2 Avian and Bat Protection Plan Large turbines are presenting issues with avian and bat deaths. A lesson should be taken from, again, the Blazing Star project, which repeatedly has had to file incident reports of avian and bat mortality. For example, just this week, another Compliance Filing in the Blazing Star docket this week stated:

> On May 14, 2021, the consultant conducting post-construction mortality monitoring at the Blazing Star Wind Farm (WEST, Inc.) notified Xcel Energy of finding a total of six bird and bat fatalities during the May 9-15 survey period (four birds and two bats; see Attachment A; Table 1). In accordance with Section 7.5.3, Xcel Energy reported the finding of over five fatalities to the Commission, U.S. Fish and Wildlife Service (USFWS), and the Minnesota Department of Natural Resources (DNR) within 24 hours. Xcel Energy will work with the Commission, DNR, and USFWS to determine appropriate next steps in response to the incident.

Blazing Star Compliance Filing – Incident 5/18/2021 PUC Docket WS-16-86, Document ID **20215-174278-01.**

The Avian and Bat Protection Plan must be sufficient proactive and consider the significant issues with the Blazing Star project – issues known to Commerce-EERA and the Commission. Incident reports can result in curtailment in addition to that specified in Draft Site Permit Section 7.5.5.

Draft Site Permit Section 8.1 The Draft Site Permit states that the project has until 14 days prior to the pre-construction meeting to demonstrate it has wind rights and other rights necessary to construct and operate the project. How absurd. No permit should be granted until the project has **all** rights necessary to construct and operate the project. This project submitted its Initial Application with only 39.7% of land needed. The November 4, 2020 Cover letter states that as of October 26, 2020, Walleye Wind has only "70% of the land required for successful construction and operation of the Project." In a December 21, 2020 compliance filing, Walleye Wind states, "As of December 18, 2020, Walleye Wind has executed and recorded landowner agreements for approximately 12,305 acres within the Site, which is approximately 80% of the land required to complete the Project." There is not a more recent compliance filing regarding land rights.

Draft Site Permit Section 9 Complaint Procedures. Complaint procedures for wind projects have been demonstrated to be inadequate – complaints are made and linger on for years. See e.g., Bent Tree, PUC Docket WS-08-573; Big Blue, PUC Docket WS-10-1238; Blazing Star, PUC Docket WS-16-686. The Public Utilities Commission needs to open a miscellaneous docket to update and strengthen complaint procedures to be quickly responsive to resident and landowner complaints. The resulting updated Complaint Procedures must then be incorporated into all wind dockets.

Draft Site Permit 10.1 Pre-Construction Meeting The Pre-Construction meeting should be public, with at least 10 days notice published in the docket so that affected landowners and interested parties can attend. If the meetings are not noticed, they are essentially private, secret meetings, and it is impossible for those with an interest to verify if studies and documents are produced, and review and comment.

Draft Site Permit 10.2 Pre-Operation Meeting As with Pre-Construction meetings, the Pre-Operation meeting should be public, with at least 10 days notice published in the docket so that affected landowners and interested parties can attend. If the meetings are not noticed, they are essentially private, secret meetings, and it is impossible for those with an interest to verify if studies and documents are produced, and review and comment.

Draft Site Permit 10.11 Emergency Response The Emergency Response Plan should include plans and timeline to provide information and training to Emergency Responders.

Draft Site Permit 11 Decommissioning Plan This project is nearly unique in that a Decommissioning Plan was provided, including detailed cost estimates. Many projets do not, and Commerce-EERA has had a past practice of postponing Decommissioning Plans until AFTER permitting, to be provided prior to the Pre-Construction meeting. Provision of this plan is much appreciated.

Technical issues focus on the literal level of decommissioning planned, specifically that structures will be removed only to a 4 foot level. While the pedestal that the turbine sits on will be removed, there is a 55 foot diameter (or more) slab several feet thick underground that should be removed. That much concrete will limit use and productivity of the land forever, and leachate into the soil and ground water would be expected. The entire foundation should be removed.

Cost of decommissioning is a concern. Although this is not a nuclear plant, decommissioning always tends to cost more than expected. A wiggle-room factor should be stated.

Another concern is the cost of labor, in large part included in the cost estimate, but the overall figure, in terms of FTE created, would be useful. Double checking personnel and time would also be useful, as, for example, the personnel needed to decommission the NextEra Grant County Solar, stated as “6” was instead “60,” off by a factor of 10!

An estimate of time to return land to reasonable productivity would also be useful, and a detailed explanation of measures to be taken to return land to productivity, particular those areas compacted for roads, and those areas over the large concrete turbine foundation. In transmission

construction, easement compensation typically includes a 5 year sliding scale of compensation for decreased production, with production expected to return to "normal" after 5 years. For a turbine site and access road, in place for much longer than transmission line temporary use for construction, the return to production would take more effort and time. This should be made clear in the decommissioning plan.

The Decommissioning Plan section of the permit should also prohibit contractual transfer of responsibility for decommission to a landowner. This contract, as do most all contracts, includes a provision whereby if a project is no longer operational but is not decommissioned, the landowner "can" decommission it, and then seek compensation from the owner. If the project owner does not decommission the project, if the project owner no longer exists, then the landowner is stuck with infrastructure, hassle, and expense of decommissioning or living with it. For this reason, contractual transfer of this responsibility should be expressly prohibited in the permit, and the financial assurance should be sufficient to cover the costs plus some reasonable wiggle-room factor.

Impact of Project on Property Values and Marketability

The Draft Site Permit does not address property values or marketability of property in or adjacent to a wind project.

The ER states that "impacts on property values due to the development of the Walleye Wind Project are difficult to quantify." ER, p. 86. The ER cites only one study, over 12 years old, regarding property values, but which does state, summarized in the ER, that "individual homes or small numbers of homes may be negatively impacted." It is not credible that this is the only study worth referencing.

I offer two reports regarding property values and impacts of wind projects on values and marketability, not quite as old as that offered by Commerce-EERA. The first found:

> We find that nearby wind facilities significantly reduce property values in two of the three counties studied. These results indicate that existing compensation to local homeowners/communities may not be sufficient to prevent a loss of property values.

Exhibit G, Values in the Wind: A Hedonic Analysis of Wind Power Facilities, Heintzelman and Tuttle, July 16, 2011[6].

The Heintzelman study notes that there is an "externality problem" that must be considered, and there is little study of these impacts and how they are distributed. Having found only two studies, Heintzelman reviewed different types of scenarios, and found that local landowners paid the price, they were the most negatively affected.

[6] Online at: Http://ssm/com/abstract=1803601

> In moving forward with wind power development then, it is important to understand the costs that such development might impose. Unlike traditional energy sources, where external/environmental costs are spread over a large geographic area through the transport of pollutants, the costs of wind development are largely, but not exclusively, borne by local residents. Only local residents are likely to be negatively affected by any health impacts, and are the people who would be most impacted by aesthetic damages, either visual or audible. These impacts are likely to be capitalized into property values and, as a consequence, property values are likely to be a reasonable measuring stick of the imposed external costs of wind development.

Heinzelman's conclusions?

> From a policy perspective, these results suggest that existing compensation schemes may not be fully compensating those landowners near wind developments, in some areas, for the externality costs that are being imposed. Existing PILOT programs and compensation to individual landowners are implicitly accounted for in this analysis since we would expect these payments to be capitalized into sales prices, and still we find largely negative impacts in two of our three counties. This suggests that landowners, particularly those who do not have turbines on their properties and are thus not receiving direct payments from wind developers, are being harmed and have an economic case to make for more compensation. That is, while the 'markets' for easements and PILOT programs may be properly accounting for harm to those who allow parcels on their property, it appears not to be accounting for harm to others nearby. This is a clear case of an uncorrected externality. If, in the future, developers are forced to account for this externality through increased payments this would obviously increase the cost to developers and make it that much more difficult to economically justify wind projects. Importantly, in Lewis County, landowners do appear to be receiving sufficient compensation to prevent decay of property values.

The findings in the McCann appraisal were also clear:

Briefly stated, based upon my review of the proposed CVEC facility, location, the density, height, type and intensity of the proposed utility scale turbines, the proposed use does not comply with the applicable Brewster Code (Code), as it is not compatible with adjacent and nearby residential uses and, specifically, will have a significant averse effect on the market value of the neighboring residential property.

Further, the Applicant has failed to even attempt to mitigate the impact on aesthetics and values of residential properties, as could have been accomplished to some degree with the provision for an owner/developer Property Value Guarantee (PVG).

While the Brewster Code focuses on undue adverse impact criterion for residential property values, I am also aware of potential impacts on the ability to continue to use a radio transmission facility, a municipal golf course and two (2) facilities nearby that are currently used for elderly housing and care; the Pleasant Bay nursing home and the Woodlands assisted living facility, which are less than ½ mile from the nearest proposed turbine..

Exhibit H, McCann Appraisal, CVEC Property Value Impact and Zoning evaluation used to evaluate a wind project proposed by Cape & Vineyard Electric Cooperative. Another study, a county review from a county website, offers another perspective: https://www.leelanau.gov/downloads/whitepaper_4_property_values.pdf

Put succinctly, "Building wind turbines where they're not wanted brings down property values."[7]

Concerns about property values are legitimate and substantiated.

The Walleye Wind Draft Site Permit displays problems, as above, that must be addressed and corrected and then put forth for public review and comment before the project is ready for review by the Commission in preparation for issuing a Site Permit.

Please let me know if you have any questions or require anything further.

Very truly yours,

Carol A. Overland
Attorney at Law

Enclosure – Affidavit and Exhibits

cc: Walleye Neighbors

[7] Online at https://phys.org/news/2019-01-turbines-theyre-property-values.html

OAH Docket No. 5-2500-37275
MPCU Docket Nos. IP-7026/CN-20-269
IP-7026/WS-20-384

STATE OF MINNESOTA
OFFICE OF ADMINISTRATIVE HEARINGS
FOR THE PUBLIC UTILITIES COMMISSION

In the Matter of the Application of Walleye Wind, LLC for a Certificate of Need and Site Permit for the up to 110.8 MW Walleye Wind Project in Rock County

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AFFIDAVIT OF OVERLAND IN SUPPORT OF COMMENT ON WALLEYE WIND APPLICATION AND DRAFT SITE PERMIT

I, Carol A. Overland, after being duly sworn on oath, state and depose as follows:

1. My name is Carol A. Overland, and I am an attorney in good standing licensed in Minnesota, License No. 254617.

2. I am representing the Walleye Wind Neighbors in Minnesota and South Dakota for the purpose of submitting comments attached.

3. Attached as Exhibit A is a true and correct copy of the Public Utilities Commission's Order Establishing General Wind Permit Standards, Docket No. E,G-999/M-07-1102, entitled "In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts, dated January 11, 2008. This order is referenced as the basis for siting in the Commerce-EERA Environmental Report in the Walleye Wind docket, Document ID **20213-172427-01.**

4. Attached as Exhibit B is a true and correct copy of a Comment filed by Freeborn County Commissioner Dan Belshan, dated 3/13/2018 and filed 3/14/2018, in the Freeborn Wind docket, PUC Docket WS-17-410, Document ID **20183-140987-01.** This comment is regarding a Bent Tree wind project ice throw and damage to a truck traveling on Highway 13 which includes a photo of the damaged truck; GE Energy "Ice Shedding and Ice Throw – Risk and Mitigation" with setback recommendation; and 2/23/2018 letter from Alliant Energy regarding the ice throw and turbine shutdown as precaution during investigation.

5. Attached as Exhibit C is a true and correct copy of a letter filed by Alliant Energy disclosing settlement with the truck owner whose truck was damaged, filed in the Bent Tree Wind docket, PUC Docket No. WS-08-573, Document ID **20184-141632-01.**

6. Attached as Exhibit D is a true and correct copy of the comments of MN DOT's Egstad at the 2019 Power Plant Siting Act Annual Hearing, submitted orally and in writing for the record. PUC Docket 19-18, Document ID **01912-158481-05**. The report of the ALJ also addresses the DOT comments on p. 6-7, Document ID **01912-158481-05** in the same docket.

7. Attached as Exhibit E is a true and correct copy of correspondence to the PUC regarding use of improper ground factor for noise modeling filed in PPSA Docket 19-18, Document ID **201912-158454-10** (also filed in 13 wind siting dockets).

8. Attached as Exhibit F, is a true and correct copy of a Blazing Star Compliance Filing, PUC Docket WS-16-686, May 14, 2021,Document ID **20215-174171-02** (selected). Exhibit F is a Compliance Filing reporting complainant, complaints filed, subject of complaint, turbines affected, and what is being done, including resolution, if any. These four complaints are unresolved. It should be noted that if the same person is complaining about the same issue, making multiple complaints, the multiple complaints are not separately noted.

9. Attached as Exhibit G is a true and correct copy of "Values in the Wind: A Hedonic Analysis of wind Power Facilities," Heintzelman & Tuttle, July 16, 2011.

10. Attached as Exhibit H is a true and correct copy of a CVEC Property Value Impact and Zoning evaluation used to evaluate a wind project proposed by Cape & Vineyard Electric Cooperative.

Further your affiant sayeth naught.

May 20, 2021

Carol A Overland

Signature

Signed and sworn to before me
this 20th day of May, 2021.

Lori A. Anderson

Notary Public

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

LeRoy Koppendrayer	Chair
David C. Boyd	Commissioner
Thomas Pugh	Commissioner
Phyllis A. Reha	Commissioner

In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts

ISSUE DATE: January 11, 2008

DOCKET NO. E,G-999/M-07-1102

ORDER ESTABLISHING GENERAL WIND PERMIT STANDARDS

LEGISLATIVE HISTORY

In 1995, the Minnesota Legislature enacted the Minnesota Wind Siting Act[1] which established jurisdictional thresholds and procedures to implement the state's authority to issue site permits for large wind energy conversion systems (LWECS). Permanent rules to implement the Wind Siting Act were adopted by the Minnesota Environmental Quality Board (EQB) in February 2002.[2]

In 2005, the Legislature transferred the site permitting authority for LWECS (with a combined nameplate capacity of 5 megawatts or more), to the Minnesota Public Utilities Commission. Site permits for wind facilities with a combined nameplate capacity of less than 5 megawatts (small wind energy conversion systems, or SWECS) are permitted by local units of government.

Amendments to the Wind Siting Act were enacted during the 2007 legislative session. The amendments:

- establish definitions and procedures requiring the commissioner of the Department of Commerce to make LWECS project size determinations for permit applications submitted by counties, and set forth that an application to a county for a LWECS permit is not complete without a project size determination from the commissioner;
- provide the option for counties to assume the responsibility for processing applications for permits required by the Wind Siting Act for LWECS facilities less than 25 MW in total nameplate capacity commencing January 15, 2008;

[1] Minnesota Statutes Chapter 216F.

[2] Minnesota Rules Chapter 7836.

- provide that the Commission shall establish general permit standards by January 15, 2008; and

- allow the Commission and counties to grant variances to the general permit standards and allows counties to adopt ordinance standards more restrictive than the Commission's general permit standards.

PROCEDURAL HISTORY

At its August 23, 2007 meeting, the Commission requested that the Department of Commerce's Energy Facility Permitting staff consult with stakeholders and prepare for the Commission's consideration general permit standards and setback recommendations to satisfy the legislative mandate.

On September 28, 2007, the Energy Facility Permitting staff issued a notice of comment period to all Minnesota county planning and zoning administrators, to the Power Plant Siting Act general mailing list and to persons on recent wind project mailing lists. The Energy Facility Permitting staff also made presentations about this proceeding to pertinent associations in St. Cloud, Winona, Fergus Falls, and Pope County.

The Commission received some 26 written comment letters during the comment period. Comments were submitted by:

- Wadena County
- Southwest Regional Development Commission
- Lyon County Board of Commissioners
- Dakota County
- Lyon County Public Works
- Minnesota Department of Natural Resources
- PPM Energy
- The Minnesota Project
- Community-based energy development (C-BED) project participants and supporters [3]

On December 20, 2007, the Commission met to consider the matter. Michael Reese and Steve Wagner, representing Pope and Stevens County C-BED projects, appeared and made comments.

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[3] Seventeen persons who identified themselves as participants and advocates for C-BED projects submitted an identical form letter regarding setback issues, the wind access buffer, elimination of wind right requirements for small acreages, and capping costs of required permit studies.

FINDINGS AND CONCLUSIONS

I. The Comment Process

Through written or oral comments, most stakeholders indicated general agreement that the state wind site permitting process, standards and setbacks provide public safety protections, protect the wind rights of landowners and require permittees to conduct due diligence to avoid unforeseen impacts, which has resulted in orderly wind development.

Several of the comments recommended that the general wind permitting standards and setbacks should require that wind projects permitted by Minnesota counties be subject to the same level of pre-construction studies, due diligence, and wind access buffer setbacks as LWECS projects. Other comments focused on specific areas of concern and requested that the Commission modify certain existing LWECS permit setbacks or conditions for the general permit standard.

Some persons making comments suggested changes to some of the Commission's established standards and setbacks, which will be discussed below.

II. Commission Action

After careful consideration, the Commission herein adopts the attached "General Wind Turbine Permit Setbacks and Standards for LWECS Facilities Permitted by Counties Pursuant to Minnesota Statute 216F.08." Exhibit A. These standards and setbacks maintain most of the Commission's established LWECS permit standards and setbacks which have been in effect for the last twelve years, with the relatively minor changes set forth below.

A. Wetland Setbacks

The Minnesota Department of Natural Resources (DNR) initially recommended that the Commission establish a 1000 foot turbine setback from all wetlands, streams, rivers and lakes listed in the state Public Waters Inventory and those listed on the National Wetlands Inventory.[4] The DNR submitted a letter on December 7 which supported deferring action on the wetland setback issue to provide time to further explore the issue.

The DNR's proposal with respect to wetlands would encompass a large and significant change from the Commission's existing standards, which prohibit placement of wind turbines in wetlands, but require no setbacks from wetlands. Were the Commission to adopt this proposal, it would exclude significant amounts of land from future wind development. As the DNR has agreed to defer the issue pending further factual development, the Commission will retain its current practice of prohibiting placement of wind turbines in wetlands, but requiring no setback from them, as an interim standard.

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[4] The DNR's proposed wetland setback would not apply to Minnesota Wetlands Conservation Act "exempt" or "farmed" wetlands.

Having determined that the Commission cannot act on the DNR's recommendation unless and until there is further record development of this issue, the Commission will request the Energy Facility Permitting staff to investigate wetland setback issues with stakeholders and develop recommendations for future Commission consideration.

B. Wind Access Buffer Setback

Seventeen C-BED participants and advocates filed comments on setback issues.[5] They asserted that the wind access buffer setback historically applied by the Commission[6] to protect the wind rights of landowners adjacent to, but not participating in, the permitted project is overly conservative and does not economically or efficiently utilize state wind resources. The C-BED advocates requested a reduction of the wind access buffer to a distance of two rotor diameters on the cross wind axis and four rotor diameters on the predominant axis.

The DNR requested that the Commission require the same three rotor diameter by five rotor diameter wind access buffer setback to publicly owned conservation lands, such as state wildlife management areas.

Another commentor, PPM Energy, supported the current wind access buffer setbacks, considering the prevailing wind directions in Minnesota and the wake effects, or turbulence, between wind turbines.

The Energy Facility Permitting staff informed the Commission that their own experience, as well as information from experts and practitioners in the field of wind turbine siting, has consistently affirmed that wind turbines be spaced at least four rotor diameters and up to twelve rotor diameters apart on the predominant wind axis to minimize the effects of wind turbine induced turbulence downwind.

Therefore, the Commission will maintain its current setbacks of three rotor diameters on the secondary wind axis and five rotor diameters on the predominant axis. This buffer setback has been shown to protect wind rights and future development options of adjacent rights owners. At the request of the DNR, the Commission will also apply this same setback to public lands.

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[5] The wind access buffer setback is an external setback from lands and wind rights outside of an applicant's site control, to protect the wind and property rights of persons outside the permitted project boundary and persons within the project boundary who are not participating in the project.

[6] The Commission has historically imposed a wind access buffer of three rotor diameters on the crosswind or secondary axis (typically east-west) and five rotor diameters on the predominant or downwind axis (typically north-south).

1. Setbacks from Small Parcels

C-BED participants requested that the Commission eliminate the wind access buffer setback from non-participating property owners with land parcels less than fifteen acres in size.

The Commission declines to do so. Historically, the wind projects for which Commission review and permits have been granted have been composed of dozens of individual parcels of land and wind rights, totaling thousands of acres of land for each LWECS project. For these many years, permittees have been able to develop projects while applying the wind access setbacks from small, non-participating landowners. After consideration, the Commission finds no rationale in statute or rule to treat one person's wind rights differently from another's.

2. Internal Turbine Spacing

C-BED advocates also requested that the Commission not regulate turbine spacing within an LWECS facility, nor require wake analyses prior to construction, claiming that these provide only a snapshot of expected performance at a facility.

The Commission declines to implement this request. The purpose of the internal turbine spacing setback and requirement that wake loss studies be submitted is to ensure that LWECS projects permitted by the Commission are designed and sited in a manner that ensures efficient use of the wind resources, long term energy production, and reliability.[7]

Maintaining the Commission's three rotor by five rotor dimension internal turbine spacing setback and requirement to submit wind wake loss studies is a reasonable means by which to accomplish these goals.

3. Setbacks from Roads and Recreational Trails

The DNR and Dakota County suggested increasing setbacks from public road rights-of-way to total turbine height; the DNR proposed applying the same setback from state trails and other recreational trails.[8]

As amended, Minn. Stat. § 216F.081 allows counties to adopt more restrictive public road setback ordinances than the Commission's general permit standards. The amended statute also directs the Commission to take those more restrictive standards into consideration when permitting LWECS

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[7] *See* Minn. Stat. § 216F.03 and Minn. Rules Part 7836.0200.

[8] Dakota County also proposed establishing new, unspecified setbacks where high volume roads are present or to accommodate planned transportation expansion projects. The Commission's general permit standards ensure that LWECS are sited in a manner which will not interfere with future urban developments, including taking into consideration local comprehensive plans when reviewing LWECS site permits.

within such counties. Finally, the Commission or a county may require larger road setbacks on a case-by-case basis in situations where a greater setback is justified.

Here, maintaining the existing minimum 250 foot turbine setback from the edge of public road rights-of-ways continues to be reasonable. The purpose of the setback is to prevent ice from shedding off wind turbines onto public roads. No reports of ice shed from turbines being deposited onto public roads has come to the attention of state regulators, despite inquiries made to wind developers, maintenance technicians, and local government officials about the subject.

The Commission will therefore adopt a case-by-case approach to handling issues of this type where necessary and in the public interest. The Commission will adopt this same case-by-case approach to address setbacks from high volume roads that may be widened in future transportation expansion projects.

The Commission also concludes that setbacks should be developed and applied to state trails on a case-by-case basis. State trails, which are generally multi-use recreational trails, traverse a wide variety of terrains and landscapes across the state. Setbacks are primarily to enhance the aesthetic enjoyment of the trail user; however, the needs and desires of the owner of the property through which the trail runs must also be considered.

A case-by-case analysis is best suited in recognition of many types of permanent and temporary recreational trails situated across the state.

C. Miscellaneous Issues

Finally, comments and recommendations were offered on a variety of matters as set forth below. After review, the Commission finds that no changes to the Wind Siting Rules or General Permit Standards are necessary to address these issues.

Comments and recommendations were made concerning decommissioning and facility retrofit, urging review of permits if a permittee seeks to retrofit or otherwise modify the permitted facility. The Wind Siting Rules and Commission-issued LWECS permits have always required decommissioning plans nearly identical to the language recommended by the commentor. The Commission or counties have the ability to reassess and/or amend requirements for decommissioning plans as needed throughout the life of the LWECS facility permitted. Also, a facility retrofit or expansion would require Commission siting process review and site permit action, in accordance with Minn. Rules, Chapter 7836. These comments support the need to retain such requirements in the general wind permit standards.

The Southwest Regional Development Council offered comments on transportation issues related to transporting wind project equipment to the site, bridge and weight restrictions, local road permits required and construction related road damages. Issues such as these will continue to be handled by the governmental bodies controlling each road right-of-way, as set forth in Commission wind permit conditions. These comments support the need to retain such requirements in the general wind permit standards.

The Southwest Regional Development Council requested clarification on determination of project size. Minn. Stat. § 216F.011 provides a process and standards for the Commission and the Department of Commerce to use in making LWECS size determinations. Training materials and sessions will also be provided by the Department of Commerce Energy Facility Permitting staff.

Finally, the C-BED participants requested that permit costs for the site permit and any additional studies be capped at $1000.00. Costs associated with site permit processing by the Commission are governed by Minn. Rule, part 7836.1500, which establishes that permit applicants shall pay the actual costs in processing an application.

ORDER

1. The Commission herein adopts the Large Wind Energy Conversion System General Wind Turbine Permit Setbacks and Standards proposed by the Department of Commerce Energy Facility Permitting staff, attached as Exhibit A. The general permit standards shall apply to large wind energy conversion system site permits issued by counties pursuant to Minn. Stat. 216F.08 and to permits issued by the Commission for LWECS with a combined nameplate capacity of less than 25,000 watts.

2. The Commission requests that the Department of Commerce Energy Facility Permitting staff further investigate wetland setback issues with stakeholders and develop recommendations for Commission consideration.

3. This Order shall become effective immediately.

BY ORDER OF THE COMMISSION

Burl W. Haar
Executive Secretary

(S E A L)

This document can be made available in alternative formats (i.e. large print or audio tape) by calling 651.201.2202 (voice). Persons with hearing or speech disabilities may call us through Minnesota Relay at 1.800.627.3529 or by dialing 711.

Exhibit A

Minnesota Public Utilities Commission

General Wind Turbine Permit Setbacks and Standards for Large Wind Energy Conversion System (LWECS) Permitted Pursuant to Minnesota Statute 216F.08

Resource Category	General Permit Setback	Minimum Setback
Wind Access Buffer (setback from lands and/or wind rights not under permittee's control)	Wind turbine towers shall not be placed less than 5 rotor diameters (RD) from all boundaries of developer's site control area (wind and land rights) on the predominant wind axis (typically north-south axis) and 3 rotor diameters (RD) on the secondary wind axis (typically east-west axis), without the approval of the permitting authority. This setback applies to all parcels for which the permittee does not control land and wind rights, including all public lands.	3 RD (760 – 985 ft) on east-west axis and 5 RD (1280 – 1640 ft) on north-south using turbines with 78 – 100 meter rotor diameters.
Internal Turbine Spacing	The turbine towers shall be spaced no closer than 3 rotor diameters (RD) for crosswind spacing (distance between towers) and 5 RD downwind spacing (distance between strings of towers). If required during final micro siting of the turbine towers to account for topographic conditions, up to 20 percent of the towers may be sited closer than the above spacing but the permittee shall minimize the need to site the turbine towers closer.	5 rotor diameters downwind spacing 3 rotor diameters apart for crosswind spacing
Noise Standard	Project must meet Minnesota Noise Standards, Minnesota Rules Chapter 7030, at all residential receivers (homes). Residential noise standard NAC 1, L50 50 dBA during overnight hours. Setback distance calculated based on site layout and turbine for each residential receiver.	Typically 750 – 1500 ft is required to meet noise standards depending on turbine model, layout, site specific conditions.
Homes	At least 500 ft and sufficient distance to meet state noise standard.	500 feet + distance required to meet state noise standard.
Public Roads and Recreational Trails	The turbine towers shall be placed no closer than 250 feet from the edge of public road rights-of-way. Setbacks from state trails and other recreational trails shall be considered on a case-by-case basis.	Minimum 250 ft
Meteorological Towers	Meteorological towers shall be placed no closer than 250 foot from the edge of road rights-of-way and from the boundaries of developer's site control (wind and land rights). Setbacks from state trails and other recreational trails shall be considered on a case-by-case basis.	Minimum 250 ft
Wetlands	No turbines, towers or associated facilities shall be located in public waters wetlands. However, electric collector and feeder lines may cross or be placed in public waters or public water wetlands subject to DNR, FWS and/or USACOE permits.	No setback required pending further PUC action.

Native Prairie	Turbines and associated facilities shall not be placed in native prairie unless approved in native prairie protection plan (see native prairie standard below). Native prairie protection plan shall be submitted if native prairie is present.	No setback required.
Sand and Gravel Operations	No turbines, towers or associated facilities in active sand and gravel operations, unless negotiated with the landowner.	
Aviation (public and private airports)	No turbines, towers or associated facilities shall be located so as to create an obstruction to navigable airspace of public and private airports in Minnesota or adjacent states and/or providences.	Setbacks or other limitations determined in accordance with MNDOT Department of Aviation and Federal Aviation Administration requirements.

Additional General Permit Standards

Pre-Application Project Size Determination.

Pursuant to Minnesota Statute 216F.011, applications to a county for a LWECS permit are not complete without a project size determination provided by the Commissioner of the Minnesota Department of Commerce. Requests for size determination shall be submitted on forms provided by the Department of Commerce. Upon written request of a project developer and receipt of any supplemental information requested by the commissioner, the commissioner of commerce shall provide a written size determination within 30 days. In the case of a dispute, the chair of the Public Utilities Commission shall make the final size determination.

Pursuant to Minnesota Statute 216F.011, the total size of a combination of wind energy conversion systems for the purpose of determining what jurisdiction has siting authority must be determined according to the criteria below:

The nameplate capacity of one wind energy conversion system must be combined with the nameplate capacity of any other wind energy conversion system that:

(1) is located within five miles of the wind energy conversion system;

(2) is constructed within the same 12-month period as the wind energy conversion system; and

(3) exhibits characteristics of being a single development, including, but not limited to, ownership structure, an umbrella sales arrangement, shared interconnection, revenue sharing arrangements, and common debt or equity financing.

Wind Turbines Design Standards. All turbines shall be commercially available, utility scale, not prototype turbines. Turbines shall be installed on tubular, monopole design towers, and have a uniform white/off white color. All turbine towers shall be marked with a visible identification number.

Underground and Overhead Electric Collection and Feeder Lines. The permittee shall place electrical lines, known as collectors, communication cables, and associated electrical equipment such as junction boxes underground when located on private property. Collectors and cables shall also be placed within or adjacent to the land necessary for turbine access roads unless otherwise negotiated with the affected landowner. This paragraph does not apply to feeder lines.

The permittee shall place overhead or underground 34.5 kV electric lines, known as feeders within public rights-of-way or on private land immediately adjacent to public rights-of-way if a public right-of-way exists, except as necessary to avoid or minimize human, agricultural, or environmental impacts. Feeder lines may be placed on public rights-of-way only if approval or the required permits have been obtained from the governmental unit responsible for the affected right-of-way. In all cases, the permittee shall avoid placement of feeder lines in locations that may interfere with agricultural operations. Not withstanding any of the requirements to conduct surveys before any construction can commence, the permittee may begin immediately upon issuance of a LWECS site permit to construct the 34.5 kV feeder lines that will be required as part of the project.

Any guy wires on the structures for feeder lines shall be marked with safety shields.

Topsoil and Compaction. The permittee must protect and segregate topsoil from subsoil on all lands unless otherwise negotiated with affected landowner. Must minimize soil compaction of all lands during all phases and confine soil compaction to as small area as possible.

Fences. The permittee shall promptly repair or replace all fences and gates removed or damaged during project life and provide continuity of electric fence circuits.

Drainage Tile. The permittee shall take into account, avoid, promptly repair or replace all drainage tiles broken or damaged during all phases of project life unless otherwise negotiated with affected landowner.

Equipment Storage. The permittee shall negotiate with landowners to locate sites for temporary equipment staging areas.

Public Roads. The permittee shall identify all state, county or township roads that will be used for the LWECS Project and shall notify the permitting authority (PUC or county) and the state, county or township governing body having jurisdiction over the roads to determine if the governmental

body needs to inspect the roads or issue any road permits prior to use of these roads. Where practical, existing roadways shall be used for all activities associated with the LWECS. Where practical, all-weather roads shall be used to deliver cement, turbines, towers, assembled nacelles and all other heavy components to and from the turbine sites.

Prior to construction, the permittee shall make satisfactory arrangements (including obtaining permits) for road use, access road intersections, maintenance and repair of damages with governmental jurisdiction with authority over each road. The permittee shall notify the permitting authority (PUC or county) of such arrangements upon request.

Turbine Access Roads. The permittee shall construct the smallest number of turbine access roads it can. Access roads shall be low profile roads so that farming equipment can cross them and shall be covered with Class 5 gravel or similar material. When access roads are constructed across streams and drainage ways, the access roads shall be designed in a manner so runoff from the upper portions of the watershed can readily flow to the lower portion of the watershed.

Private Roads. The permittee shall promptly repair private roads, driveways or lanes damaged unless otherwise negotiated with landowner.

Soil Erosion and Sediment Control. Prior to commencing construction, the Permittee shall submit its National Pollution Discharge Elimination System (NPDES) construction permit issued by the Minnesota Pollution Control Agency (MPCA) to the permitting authority (PUC or county).

Cleanup. The permittee shall remove all waste and scrap that is the product of construction, operation, restoration and maintenance from the site and properly dispose of it upon completion of each task. Personal litter, bottles, and paper deposited by site personnel shall be removed on a daily basis.

Tree Removal. The permittee shall minimize the removal of trees and shall not remove groves of trees or shelter belts without the approval of the affected landowner.

Site Restoration. The permittee shall, as soon as practical following construction of each turbine, considering the weather and preferences of the landowner, restore the area affected by any LWECS activities to the condition that existed immediately before construction began, to the extent possible. The time period may be no longer than eight months after completion of construction of the turbine, unless otherwise negotiated with the landowner. Restoration shall be compatible with the safe operation, maintenance, and inspection of the LWECS.

Hazardous Waste. The permittee shall be responsible for compliance will all laws applicable to the generation, storage, transportation, clean up and disposal of hazardous wastes generated during any phase of the project's life.

Application of Herbicides. Restrict use to those herbicides and methods approved by the Minnesota Department of Agriculture. The permittee must contact landowner prior to application.

Public Safety. The permittee shall provide educational materials to landowners within the site boundaries and, upon request, to interested persons, about the Project and any restrictions or dangers associated with the LWECS Project. The permittee shall also provide any necessary safety measures, such as warning signs and gates for traffic control or to restrict public access to turbine access roads, substations and wind turbines.

Fire Protection. Prior to construction, the permittee shall prepare a fire protection and medical emergency plan in consultation with the fire department having jurisdiction over the area prior to LWECS construction. The permittee shall register the LWECS in the local government's emergency 911 system.

Native Prairie. Native prairie plan must be submitted if native prairie is present and will be impacted by the project. The permittee shall, with the advice of the DNR and any others selected by the permittee, prepare a prairie protection and management plan and submit it to the county and DNR Commissioner 60 days prior to the start of construction. The plan shall address steps to be taken to identify native prairie within the Project area, measures to avoid impacts to native prairie, and measures to mitigate for impacts if unavoidable. Wind turbines and all associated facilities, including foundations, access roads, underground cable and transformers, shall not be placed in native prairie unless addressed in the prairie protection and management plan. Unavoidable impacts to native prairie shall be mitigated by restoration or management of other native prairie areas that are in degraded condition, or by conveyance of conservation easements, or by other means agreed to by the permittee, DNR and PUC or county.

Electromagnetic Interference. Prior to beginning construction, the permittee shall submit a plan for conducting an assessment of television signal reception and microwave signal patterns in the Project area prior to commencement of construction of the Project. The assessment shall be designed to provide data that can be used in the future to determine whether the turbines and associated facilities are the cause of disruption or interference of television reception or microwave patterns in the event residents should complain about such disruption or interference after the turbines are placed in operation. The assessment shall be completed prior to operation of the turbines. The permittee shall be responsible for alleviating any disruption or interference of these services caused by the turbines or any associated facilities.

The permittee shall not operate the LWECS and associated facilities so as to cause microwave, television, radio, telecommunications or navigation interference contrary to Federal Communications Commission (FCC) regulations or other law. In the event the LWECS and its associated facilities or its operations cause such interference, the permittee shall take timely measures necessary to correct the problem.

Turbine Lighting. Towers shall be marked as required by the Federal Aviation Administration (FAA). There shall be no lights on the towers other than what is required by the FAA.

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

Archeological Resource Survey and Consultation: The permitee shall work with the State Historic Preservation Office (SHPO) at the Minnesota Historical Society and the State Archaeologist as early as possible in the planning process to determine whether an archaeological survey is recommended for any part of the proposed Project. The permitee will contract with a qualified archaeologist to complete such surveys, and will submit the results to the permitting authority (PUC or county), the SHPO and the State Archaeologist. The SHPO and the State Archaeologist will make recommendations for the treatment of any significant archaeological sites which are identified. Any issues in the implementation of these recommendations will be resolved by permitting authority (PUC or county) in consultation with SHPO and the State Archaeologist. In addition, the permitee shall mark and preserve any previously unrecorded archaeological sites that are found during construction and shall promptly notify the SHPO, the State Archaeologist, and the permitting authority (PUC or county) of such discovery. The permittee shall not excavate at such locations until so authorized by the permitting authority (PUC or county) in consultation with the SHPO and the State Archaeologist.

If human remains are encountered during construction, the permitee shall immediately halt construction at that location and promptly notify local law enforcement authorities and the State Archaeologist. Construction at the human remains location shall not proceed until authorized by local law enforcement authorities or the State Archaeologist.

If any federal funding, permit or license is involved or required, the permittee shall notify the MHS as soon as possible in the planning process to coordinate section 106 (36 C.F.R 800) review.

Prior to construction, construction workers shall be trained about the need to avoid cultural properties, how to identify cultural properties, and procedures to follow if undocumented cultural properties, including gravesites, are found during construction. If any archaeological sites are found during construction, the permittee shall immediately stop work at the site and shall mark and preserve the site and notify the permitting authority (PUC or county) and the MHS about the discovery. The permitting authority (PUC or county) and the MHS shall have three working days from the time the agency is notified to conduct an inspection of the site if either agency shall choose to do so. On the fourth day after notification, the permittee may begin work on the site unless the MHS has directed that work shall cease. In such event, work shall not continue until the MHS determines that construction can proceed.

Project Energy Production: The permittee shall, by July 15 of each year, report to the PUC on the monthly energy production of the Project and the average monthly wind speed collected at one permanent meteorological tower selected by the PUC during the preceding year or partial year of operation.

Site Plan: Prior to commencing construction, the permittee shall submit to the permitting authority (PUC or county) a site plan for all turbines, roads, electrical equipment, collector and feeder lines and other associated facilities to be constructed and engineering drawings for site preparation, construction of the facilities, and a plan for restoration of the site due to construction. The permittee may submit a site plan and engineering drawings for only a portion of the LWECS if the permittee is prepared to commence construction on certain parts of the Project before completing the site plan and engineering drawings for other parts of the LWECS. The permittee shall have the right to move or relocate turbine sites due to the discovery of environmental conditions during construction, not previously identified, which by law or pursuant to this Permit would prevent such use. The permittee shall notify the permitting authority (PUC or county) of any turbines that are to be relocated before the turbine is constructed on the new site.

Pre-construction Meeting: Prior to the start of any construction, the permittee shall conduct a preconstruction meeting with the person designated by the permitting authority (PUC or county) to coordinate field monitoring of construction activities.

Extraordinary Events: Within 24 hours of an occurrence, the permittee shall notify the permitting authority (PUC or county) of any extraordinary event. Extraordinary events include but shall not be limited to: fires, tower collapse, thrown blade, collector or feeder line failure, injured LWECS worker or private person, kills of migratory, threatened or endangered species, or discovery of a large number of dead birds or bats of any variety on site. In the event of extraordinary avian mortality the DNR shall also be notified within 24 hours. The permittee shall, within 30 days of the occurrence, submit a report to the permitting authority (PUC or county) describing the cause of the occurrence and the steps taken to avoid future occurrences.

Complaints: Prior to the start of construction, the permittee shall submit to the permitting authority (PUC or county) the company's procedures to be used to receive and respond to complaints. The permittee shall report to the permitting authority (PUC or county) all complaints received concerning any part of the LWECS in accordance with the procedures provided in permit.

As-Built Plans and Specifications: Within 60 days after completion of construction, the permittee shall submit to the county and PUC a copy of the as-built plans and specifications. The permittee must also submit this data in a geographic information system (GIS) format for use in a statewide wind turbine database.

Decommissioning Plan. As part of its permit application, the permittee must submit a decommissioning plan describing the manner the permittee plans on meeting requirements of Minnesota Rule 7836.0500, subpart 13.

Special Conditions: Pursuant to Minnesota Statute 216F.04 and Minnesota Rule 7836.1000, the permitting authority (PUC or county) may adopt special permit conditions to LWECS site permits to address specific issues on a case-by-case basis.

March 13, 2018

Daniel Wolf
Executive Secretary
MN Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101-2147

VIA ELECTRONIC FILING

Re: In the Matter of the Application of Freeborn Wind Energy LLC for a Large Wind Energy Conversion System Site Permit for the 84 Megawatt Freeborn Wind Farm in Freeborn County
PUC Docket No. IP-6946/WS-17-410
OAH Docket No. 80-2500-34633

Dear Mr. Wolf,

I am a County Commissioner in Freeborn County, Minnesota. I represent citizens in the portion of Freeborn County directly in the footprint of Invenergy's/Xcel's proposed Freeborn Wind project. The vast majority of the residents I represent are strongly opposed to this wind project. I want the OAH and the MPUC to address the clear, consistent concerns of my constituents. I do not want citizens' well-researched, well-documented concerns dismissed, as appears to have been the action taken in the Commission's siting of the Bent Tree Wind project (08-573) which is also located in Freeborn County.

In particular, I would like to highlight the grave danger posed by ice throw from wind turbines. I am recommending that the MPUC and Administrative Law Judge LauraSue Schlatter demand that Invenergy/Xcel provide the Vestas Installation and Operations Safety Manual for the turbine models proposed. If ice management is not a part of that manual, then the proposer must provide documentation of the ice management recommendations of Vestas.

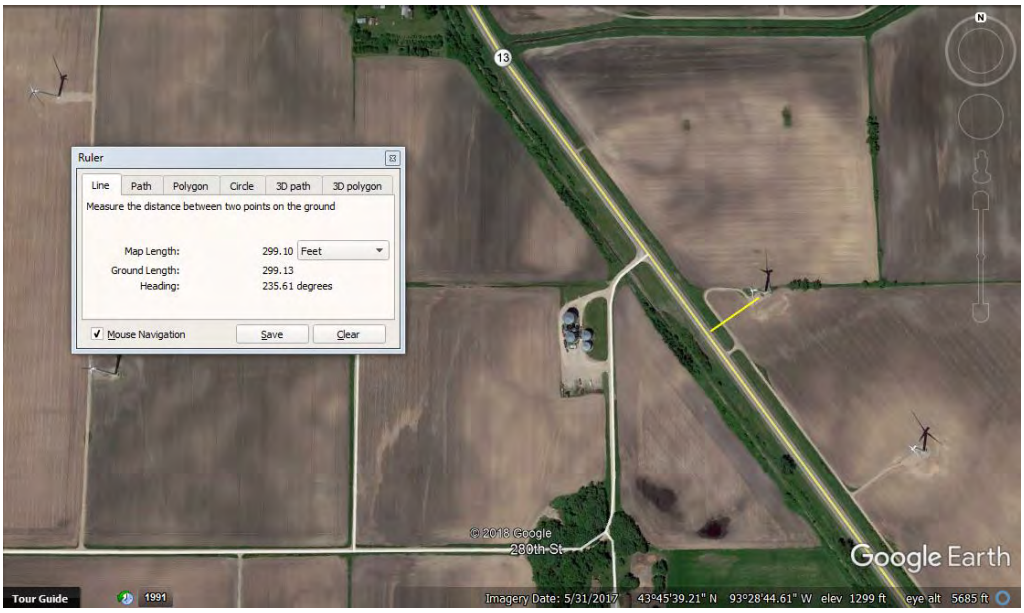
On February 22, 2018, a wind turbine in Alliant's Bent Tree project pitched a large chunk of ice which struck and damaged a semi-truck on the driver's side cab and gas tank area. According to the State Patrol and witnesses, the semi was southbound on State Highway 13, south of Hartland, MN at approximately 4:30 p.m. State Patrol responded to the scene and filed a property damage Incident Report - R18101039. According to the State Patrol, Alliant Energy accepted responsibility for, and paid for the damage to the semi-truck. Alliant also filed an "extraordinary event" report with the Commission (DOC-ID 20182-140446-01; attached)

Freeborn Wind is proposing to adhere to the Freeborn County Land Use Zoning ordinance requiring a setback of 1.1 times the height of the turbine from a public roadway. Although this is farther than the absurd and dangerous minimum of 250 feet required by the MPUC for turbines in Bent Tree and other permitted wind projects in Minnesota, this is still far short of the distance recommended by turbine manufacturers.

US-based General Electric's publication "Ice Shedding and Ice Throw – Risk and Mitigation" recommends 1.5 times (hub height + rotor diameter). The proposed Freeborn Wind turbines are from Vestas, not GE, but the same principles apply. The hub height in Freeborn is 263 feet; the rotor diameter is 361 feet for the V110; 381 feet for the V116. (263 + 361) X 1.5 = 936 feet; (263 + 381) X 1.5 = 966 feet. Also, since the source of ice throw is the blades, the measurement should be taken from the tip of the blade, not from the center of the turbine tower. This means: V110 = 1117 feet from the tower to the roadway; V116 = 1157 feet from the tower to the roadway.

2-22-18 photo of damage from Bent Tree Wind turbine ice throw on Hwy 13

Based on review of the scene and Google Earth, it appears that the closest Bent Tree turbine tower to Hwy 13 on the east side of the road near the site of the ice-strike is about 300-feet. This is a likely source of the ice that hit the semi on 2-22-2018.



It seems ironic that this ice strike happened within hours of the completion of the contested case hearing on Freeborn Wind during which Invenergy's representatives continued to dismiss the health and safety concerns raised by citizens. The photo of the damage to the semi shows a large dent just behind the driver's door, as well as shattered cowling over the gas tank area. If this hit just a couple of feet higher, it seems likely this could have shattered the driver's window, with the potential to cause serious injury. If the ice had hit a small to medium-sized passenger vehicle, I hate to imagine what would have happened. Serious injury? Fatality?

Because wind turbines operating in Minnesota have not just the potential, but recorded significant ice-throw, I recommend the V110 turbines be no closer than 1117 feet; and the V116 turbines no closer than 1157 feet from the tower to the roadway. Otherwise, if Vestas recommends a longer distance, then the site permit should reflect that.

Sincerely,

Dan Belshan
Freeborn County Commissioner, (District 2)
85486 157th ST
Glenville, MN 56036
Mobile 507-402-3250

Attachments (2)

GE
Energy

Ice Shedding and Ice Throw – Risk and Mitigation

David Wahl
Philippe Giguere
Wind Application Engineering

GE Energy
Greenville, SC

Ice Shedding and Ice Throw – Risk and Mitigation

Introduction

As with any structure, wind turbines can accumulate ice under certain atmospheric conditions, such as ambient temperatures near freezing (0°C) combined with high relative humidity, freezing rain, or sleet. Since weather conditions may then cause this ice to be shed, there are safety concerns that must be considered during project development and operation. The intent of this paper is to share knowledge and recommendations in order to mitigate risk.

The Risk

The accumulation of ice is highly dependent on local weather conditions and the turbine's operational state.[2,4] Any ice that is accumulated may be shed from the turbine due to both gravity and the mechanical forces of the rotating blades. An increase in ambient temperature, wind, or solar radiation may cause sheets or fragments of ice to loosen and fall, making the area directly under the rotor subject to the greatest risks[1]. In addition, rotating turbine blades may propel ice fragments some distance from the turbine—up to several hundred meters if conditions are right.[1,2,3] Falling ice may cause damage to structures and vehicles, and injury to site personnel and the general public, unless adequate measures are put in place for protection.

Risk Mitigation

The risk of ice throw must be taken into account during both project planning and wind farm operation. GE suggests that the following actions, which are based on recognized industry practices, be considered when siting turbines to mitigate risk for ice-prone project locations:

- **Turbine Siting:** Locating turbines a safe distance from any occupied structure, road, or public use area. Some consultant groups have the capability to provide risk assessment based on site-specific conditions that will lead to suggestions for turbine locations. In the absence of such an assessment, other guidelines may be used. Wind Energy Production in Cold Climate[6] provides the following formula for calculating a safe distance:

  1.5 * (hub height + rotor diameter)

  While this guideline is recommended by the certifying agency Germanischer Lloyd as well as the Deutsches Windenergie-Institut (DEWI), it should be noted that the actual distance is dependant upon turbine dimensions, rotational speed and many other potential factors. Please refer to the *References* for more resources.

- **Physical and Visual Warnings:** Placing fences and warning signs as appropriate for the protection of site personnel and the public.[4]

- **Turbine Deactivation:** Remotely switching off the turbine when site personnel detect ice accumulation. Additionally there are several scenarios which could lead to an automatic shutdown of the turbine:

  - Detection of ice by a nacelle-mounted ice sensor which is available for some models (with current sensor technology, ice detection is not highly reliable)
  - Detection of rotor imbalance caused by blade ice formation by a shaft vibration sensor; note, however, that it is possible for ice to build in a symmetric manner on all blades and not trigger the sensor[2]
  - Anemometer icing that leads to a measured wind speed below cut-in

- **Operator Safety:** Restricting access to turbines by site personnel while ice remains on the turbine structure. If site personnel absolutely must access the turbine while iced, safety precautions may include remotely shutting down the turbine, yawing to place the rotor on the opposite side of the tower door, parking vehicles at a distance of at least 100 m from the tower, and restarting the turbine remotely when work is complete. As always, standard protective gear should be worn.

References

The following are informative papers that address the topic of wind turbine icing and safety. These papers are created and maintained by other public and private organizations. GE does not control or guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the order of the references is not intended to reflect their importance, nor is it intended to endorse any views expressed or products or services offered by the authors of the references.

[1] *Wind Turbine Icing and Public Safety – a Quantifiable Risk?:* Colin Morgan and Ervin Bossanyi of Garrad Hassan, 1996.

[2] *Assessment of Safety Risks Arising From Wind Turbine Icing:* Colin Morgan and Ervin Bossanyi of Garrad Hassan, and Henry Seifert of DEWI, 1998.

[3] *Risk Analysis of Ice Throw From Wind Turbines:* Henry Seifert, Annette Westerhellweg, and Jürgen Kröning of DEWI, 2003.

[4] *State-of-the-Art of Wind Energy in Cold Climates:* produced by the International Energy Agency, IEA, 2003.

[5] *On-Site Cold Climate Problems:* Michael Durstewitz, Institut fur Solare Energieversorgungstechnik e.V. (ISET), 2003.

[6] *Wind Energy Production in Cold Climate:* Tammelin, Cavaliere, Holttinen, Hannele, Morgan, Seifert, and Säntti, 1997.

Wisconsin Power and Light Company
An Alliant Energy Company

4902 North Biltmore Lane
Madison, WI 53718

Office: 1.800.822.4348
www.alliantenergy.com

February 23, 2018

Mr. Daniel Wolf, Executive Secretary
Minnesota Public Utilities Commission
121 Seventh Place East Suite 350
St. Paul, MN 55101-2147

RE: Docket No. ET6657/WS-08-573

Dear Mr. Wolf:

Wisconsin Power & Light (WPL) sends this letter to provide notice to the Minnesota Public Utilities Commission (Commission) of an event pertaining to the Bent Tree Wind Project (Bent Tree). Although it is not clear whether this event would meet the definition of an Extraordinary Event under Section H.3 of the Large Wind Energy Conversion System Site Permit (Permit) for Bent Tree, this notice is provided in an abundance of caution to ensure any such requirement is met and to advise the Commission of precautionary measures taken by WPL as it investigates the matter.

At approximately 5:00 PM yesterday, a WPL representative at Bent Tree received a voice mail from the Minnesota Highway Patrol stating that Highway Patrol had received a complaint alleging that turbine ice had contacted a semi-trailer truck traveling south yesterday at approximately 4:30 PM along MN HWY 13. The voicemail advised that the incident was being handled as a property damage event, that no citation was being issued, and that there were no injuries as a result. This is the first event in the history of Bent Tree's operations involving possible turbine ice shedding contact with a passing vehicle.

Following the voicemail from the Highway Patrol, a Bent Tree technician was immediately dispatched to the site to assess the situation and take any turbines offline that were showing signs of ice shedding. The technician reported back to Bent Tree site management that he could find no ice along HWY 13, and that he had not witnessed any turbines shedding ice. However, as a precaution, WPL took 15 turbines along HWY 13 and secondary roads offline while WPL further investigated the matter. Bent Tree site management also communicated to the Freeborn County Sheriff (as the result of being referred by the Highway Patrol) WPL's plan to shut down turbines adjacent to roadways while WPL further investigated.

We are managing these turbines based on wind direction. At the present time, 11 Turbines upwind of a road remain offline. We will continue to actively manage the turbines until we can confirm that there is no ice on the blades.

Further information will be provided as part of Bent Tree's standard reporting processes under its Permit.

Please also contact us if further information is needed in the meantime.

Sincerely,

/s/ Brad Kulka
Brad Kulka, Director
Wind Operations

Cc:

Trisha DeBleekere
Minnesota Public Utilities Commission

Louise Miltich
Minnesota Department of Commerce

Wisconsin Power and Light Company
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Bradley A. Kulka
Director, Operations

April 2, 2018

Mr. Daniel Wolf, Executive Secretary
Minnesota Public Utilities Commission
121 Seventh Place East Suite 350
St. Paul, MN 55101-2147

RE: Wisconsin Power and Light Company
Docket No. ET6657/WS-08-573

Dear Mr. Wolf:

This follow-up report is submitted to the Minnesota Public Utilities Commission (Commission) by Wisconsin Power & Light Company (WPL) regarding a complaint received by the Minnesota Highway Patrol alleging that turbine ice had contacted a semi-trailer truck traveling south along MN HWY 13 at approximately 4:30 PM on February 22, 2018 (the Ice Event). WPL previously provided an initial report of the Ice Event to the Commission on February 23, 2018, noting that it was unclear whether the Ice Event would meet the definition of an Extraordinary Event under Condition III.H.3 of the Large Wind Energy Conversion System Site Permit (Permit) for Bent Tree. On March 31, 2018, Commission staff requested that WPL file the follow-up report set forth in Condition III.H.3 of the Permit. Accordingly, WPL provides the requested information below.

WPL's investigation since February 22 determined that it was possible that turbine ice was responsible for the Ice Event, notwithstanding the distance between Bent Tree turbines and MN HWY 13 and the fact the Bent Tree turbines along that highway were sited in accordance with the road setback requirements of Condition III.C.3 of the Permit. As noted in WPL's initial report filed on February 23, 2018, immediately following the Ice Event, WPL took 15 turbines along HWY 13 and secondary roads offline while WPL further investigated the matter and did not restart those turbines until after they were confirmed to be free of ice.

WPL has been unable to conclusively determine that the Ice Event was the result of ice from a Bent Tree turbine (as opposed to other sources). However, WPL has resolved the matter with the owner of the semi-trailer truck.

In addition, and as a precaution, WPL has developed and is implementing a procedure designed to minimize the risk that any such ice events may occur in the future (the Turbine Ice Procedure). The Turbine Ice Procedure is currently being finalized in written form by Alliant Energy and, in substance, has been in place since March 2, 2018. The Turbine Ice Procedure applies to all Alliant Energy wind generation facilities, including Bent Tree.

The Turbine Ice Procedure requires Alliant Energy site personnel at wind generation facilities to actively monitor turbines along state and federal highways for blade ice formation. Specifically, site personnel will monitor those turbines near state and federal highways at a distance equal to the sum of the rotor diameter and hub height multiplied by 1.5. At Bent Tree, the distance for determining which turbines are near state and federal highways is calculated to be 243 meters (V82 Turbine with a 82 meter rotor diameter plus 80 meter hub height, multiplied by 1.5, equals 243 meters). The following Bent Tree turbines are within that distance of MN HWY 13: T151, T163, T186, T189, T190, T283, T381, T427, and T456. This distance being used for purposes of the Turbine Ice Procedure is more conservative than the Permit's setback distance of 250 feet from the nearest public road right of way. *See* Permit Condition III.C.3.

Site personnel will shut down turbines within 243 meters of state and federal highways when site personnel confirm the presence, or likely presence, of ice on the turbine blades. That confirmation can occur in at least three ways:

1. In their monitoring efforts, site personnel may visually confirm the presence of ice on turbine blades on turbines within the 243 meter distance from state and federal highways.
2. Site personnel may determine that, based on current or forecasted weather conditions (*e.g.,* rain sleet, snow, and/or temperature fluctuations), ice is likely to be present on turbines within the 243 meter distance of state and federal highways.
3. As a back-up measure, the facility data system will automatically notify site personnel when turbine operations and weather indicate the likelihood of ice formation on turbine blades, specifically, when a turbine exhibits four or more hours of 15% derate on at least 50% of the site turbines and temperatures are less than 4 degrees Celsius. When site personnel receive such a notification, site personnel will confirm that weather conditions are conducive to ice formation on the turbine blades.

Upon confirmation of any of these three techniques, site personnel will immediately shut down those turbines within 243 meters of state and federal highways (*e.g.*, MN HWY

13), and will not restart those turbines until site personnel can visually confirm that the turbines blades are free of ice.

In addition to monitoring turbines near state and federal highways, site personnel will also monitor turbines near secondary roads such as county, township, or limited access or low maintenance roadways. Site personnel will immediately shut down turbines within 243 meters of secondary roads and structures when those turbines are visually observed to be shedding ice that would present a possible risk (*e.g.*, in the general direction of a secondary road or structure). Site personnel will not restart any turbines near secondary roads or structures that have been shut down due to ice issues until site personnel visually confirm those turbines are no longer shedding ice.

WPL has developed the Turbine Ice Procedure based, in part, on current best practices recommended by General Electric Company, which can be found at https://www.gepower.com/content/dam/gepower-pgdp/global/enUS/documents/technical/ger/ger-4262-ice-shedding-ice-throw-risk-mitigation.pdf.

To be clear, WPL has been implementing the substance of the temporary Turbine Ice Procedure as described above since March 2, 2018 to ensure that, to the extent turbine blade ice may have been responsible for the Ice Event, WPL can minimize the risk of any future events. WPL apologizes for any inconvenience to the Commission or the Minnesota Department of Commerce to the extent this report was to be filed sooner.

Please contact the undersigned if any further information is needed.

Sincerely,

/s/ Brad A. Kulka
Brad A. Kulka, Director
Wind Operations

CC:
Trisha DeBleekere
Minnesota Public Utilities Commission
Louise Miltich
Minnesota Department of Commerce

STACY KOTCH EGSTAD

MnDOT's Role –

- Protect current and future rights of way
- Protect Minnesota's traveling public
- Ensure safety for MnDOT's construction and maintenance staff
- Evaluate and mitigate potential effects on the State transportation system
- Accommodate public utilities within or as near as feasible to trunk highway rights of way

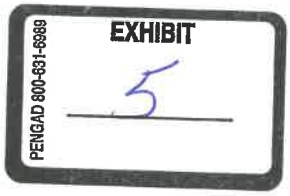
How We Participate –

Pre PUC Permit Approval

- Pre-filing project review, communication and meetings with Applicants
- Submitting Scoping, EA, DEIS or FEIS comments
- Additional route or site review, as needed, incl. DOC staff
- Preparing Applicants with the information and tools needed to successfully submit a MnDOT utility permit for approval

Post PUC Permit Approval

- Detailed project area review meetings as they pertain to MnDOT rights of way
- Connect the Applicants with appropriate MnDOT staff regarding future state projects or other MnDOT offices, if applicable
- Offer Utility guidance, review and issuance of
    - Utility Accommodation on TH ROW -Long Form Permit
    - Miscellaneous Work on TH ROW - Short Form Permit
    - Access/Driveway Permit
    - OSOW Permit



Gauging Impact –

- What are the immediate or obvious effects on the state truck highway system?
- What are the secondary effects on the state trunk highway system?
    - Type of permits needed/infrastructure restrictions/future road work
- What state laws, rules, statutes or MnDOT Accommodation Policy content need to be adhered to?

- What other MnDOT offices are affected?
    - Scenic Easements, Byways, Rest Areas, Rail Corridors or Aeronautics
- Type of road affected?
    - Freeway, Highway or Interstate
- Existing utilities in place that would inhibit construction?
- Clear Zone requirements in project area?
- Traffic control measures?
- Current of future Freeway Design?
- Bridges or other MnDOT structures that would need special attention or are restricted?

Environmental Stewardship –

- In the last year, MnDOT has begun coordination with our OES to review permits that fall within the following sensitive areas:
    - Roadside Vegetation Management – protected plant species
    - Cultural Resources – variety of historic sites (SHPO/THPO)
    - Contaminated & Regulated Materials – cont. soil and ground water
    - Threatened & Endangered Species – predominately bat and bee habitats

This coordination gives us a better overall review of potential project impacts

Recommendations – predominately geared toward wind siting

Ask the Commission to consider requesting that Applicants evaluate the effects of consolidation of collection lines, crane paths or other points of access prior to intersecting trunk highways

Ask the Commission to consider updating the current 250 foot setback requirement from edge of public road ROW to reflect a more restrictive setback followed by many counties within the state (1.1 x total turbine height). MnDOT is aware we have no legal jurisdiction outside of MnDOT owned land, however, this request is based on a desire to help insure the safety of the traveling public first and foremost and secondly, to allow flexibility in future ROW expansion

Legalectric, Inc.
Carol Overland **Attorney at Law, MN #254617**
Energy Consultant—Transmission, Power Plants, Nuclear Waste
overland@legalectric.org

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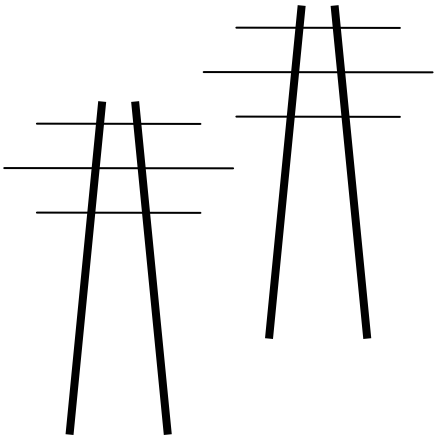

December 18, 2019

Daniel Wolf, Executive Secretary
Minnesota Public Utilities Commission via email and eDockets
121 – 7th Place East, Suite 350
St. Paul, MN 55101

John Wachtler, Energy Program Director via email and eDockets
Commerce – EERA
85 – 7th Place East, Suite 500
St. Paul, MN 55101

RE: **Improper Ground Factors Skew Modeling and Misrepresent Probability of Compliance in ALL 13 Projects Identified by EERA as "LWECS In Permitting Process" or "LWECS Permitted"**
Nobles 2 (WS-17-597)
Freeborn (WS-17-410)
Blazing Star (WS-16-686)
Lake Benton II (WS-18-179)
Community Wind North (WS-08-1494)
Jeffers Wind (WS-05-1220)
Fenton Wind (WS-05-1707)
Buffalo Ridge (WS-19-394)
Three Waters (WS-19-576)
Plum Creek (WS-18-700)
Mower County (WS-06-91)
Dodge County (WS-17-307)
Bitter Root/Flying Cow (WS-17-749)

Dear Mr. Wolf and Mr. Wachtler:

In reviewing the EERA 2019 Project Status handout for the Power Plant Siting Act Annual Hearing,[1] I've noticed that every project listed by Commerce-EERA as "LWECS Permitted" and "LWECS in the Permitting Process" all utilize, improperly, ground factors of 0.5, and in three

[1] https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={90D27E6E-0000-C116-8738-B4CA09BD8487}&documentTitle=201911-157604-01

instances, an absurd 0.7 ground factor. This is not acceptable. Why is this occurring? It's not hard to guess. In both Minnesota and Wisconsin, projects utilizing the appropriate ground factor of 0.0 were not able to demonstrate compliance with the states' noise standards, and subsequently, the developers provided modeling at 0.5 ground factor in those dockets rather than adjust the design of the project to allow for compliance with state law. **This is particularly important where the turbines are now larger and noisier than those of Bent Tree, where exceedences were demonstrated at 1,150 and 1,525 feet.**

A ground factor of 0.0 is to be used for wind modeling because the wind noise source is elevated high in the air, and ground conditions do not impede the direct path from a greatly elevated source to the "receptor." See attached testimony of Dr. Paul D. Schomer, from the Highland Wind CPCN proceeding (WI PSC Docket 2535-CE-100) and testimony of Mike Hankard, from the Badger Creek Solar CPCN proceeding (WI PSC Docket 9697-CE-100).

Below are the 13 projects listed in the "EERA 2019 Project Status" handout for the PPSA Annual Hearing, pps 3-4 (not including the withdrawn Bitter Root project), and I've listed the dockets, by name and number, the ground factor used, and the citation:

Name	Docket	G.F.	Cite	eDockets ID
Nobles 2	WS-17-597	0.5	p 3, Appendix C	201710-136496-03
Freeborn Wind	WS-17-410	0.5	p 7, Attachment E	20198-155331-04
Blazing Star	WS-16-686	0.7	p 52, Attachment B	20189-146376-01
Lake Benton II	WS-18-179	0.5	p 6-4, Appendix C	20185-142740-01
Community Wind	WS-08-1494	0.5	p 2, Appendix F	20193-151362-03
Jeffers Wind	WS-05-1220	0.5	p 2, Appendix F	20193-151486-04
Fenton Wind	WS-05-1707	0.5	p 2,4 Attachment 6	20191-149027-08
Buffalo Ridge	WS-19-394	0.5	p 6-5, Appendix C	20197-154454-07
Three Waters	WS-19-576	0.7	p 8-13, 43, Appendix D	201910-156475-03
Plum Creek	WS-18-700	0.7	p 48, Appendix B	201911-157475-05 201911-157475-06
Mower County	WS-06-91	0.5	p D-5, Appendix D	201912-157979-03
Dodge County	WS-17-307	0.5	p 6-4, Appendix C	201910-156623-03
Bitter Root	WS-17-749	0.5	P 8, Part 4	20184-141999-08 20184-141999-04

Below is a lightly edited summary of the wind modeling ground factor that I'd filed earlier in the Power Plant Annual Siting Act Annual Hearing record, explaining why ground factor matters:

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I. <u>BECAUSE NOISE MODELING WOULD DEMONSTRATE LWECS IN THE SITING PROCESS ARE LIKELY TO VIOLATE STATE NOISE STANDARDS, DEVELOPERS ARE USING WRONG GROUND FACTOR FOR MODELING, GIVING FALSE IMPRESSION OF PROBABLE COMPLIANCE.</u>

Freeborn Wind (PUC Docket 17-410) was the first wind project to be sited acknowledging application of the PPSA, and more importantly, the first contested case for siting. Two prior

contested cases were held on wind projects, one a territorial dispute between developers circa 1995, and more recently, the Goodhue Wind project and applicability of county ordinance under Minn. Stat. §216F.081.

The ALJ's Recommendation in the Freeborn Wind case was that the permit be denied:

SUMMARY OF RECOMMENDATIONS

The Administrative Law Judge concludes that Freeborn Wind has failed to demonstrate that the proposed Project will meet the requirements of Minn. R. 7030.0040, the applicable Minnesota Noise Standards. Therefore, the Administrative Law Judge respectfully recommends that the Commission either deny Freeborn Wind's Application for a Site Permit, or in the alternative, provide Freeborn Wind with a period of time to submit a plan demonstrating how it will comply with Minnesota's Noise Standards at all times throughout the footprint of the Freeborn Wind Project.

The wind promotional lobby was horrified that they might have to demonstrate compliance with the rules, and flat out stated they could not:

> **Judge's ruling against Minnesota wind farm causes alarm for advocates**[2]

From that article:

> *Freeborn Wind's developer, Invenergy, has objected, saying Schlatter's interpretation of state noise rules would be "impossible" to meet. Last week, two wind-industry trade groups and three of Invenergy's competitors also filed objections to Schlatter's recommendation, as did four clean-energy and environmental groups.*
>
> *The judge's "interpretation of the Minnesota Pollution Control Agency's (MPCA) noise standards would have a detrimental impact on other current and future wind-energy projects throughout the state," the Minnesota Center for Environmental Advocacy wrote in its objection.*
>
> **Wind industry says Minnesota pollution control stance will stifle its growth**[3]

And from that article:

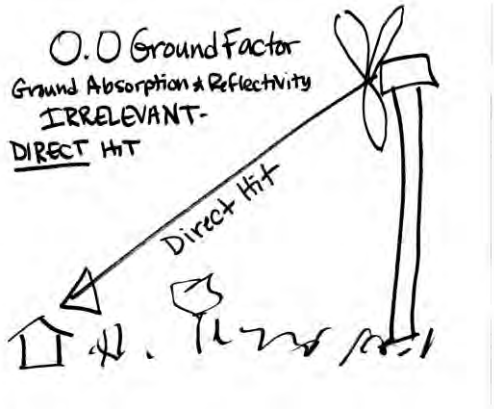
> *The wind-energy industry said an opinion filed by Minnesota pollution-control regulators defining wind-turbine noise will stifle its growth.*

[2] http://www.startribune.com/judge-s-ruling-against-minnesota-wind-farm-causes-alarm-for-advocates/485312391/
[3] http://www.startribune.com/wind-industry-says-minnesota-pollution-control-stance-will-stifle-its-growth/493181151/

The Minnesota Pollution Control Agency (MPCA) said the state's limit for wind-farm noise applies not only to sounds from turbines but also should include background noise such as road traffic, said the filing with the Minnesota Public Utilities Commission (PUC).

The MPCA comment, filed September 11, 2018, and referred to in this article is attached below.

For Freeborn Wind, ground factor, a primary input assumption for noise modeling, was set at 0.0, and all evidence and testimony regarding the predictive modeling was based on this 0.0 ground factor. In an apparent admission that these many wind projects cannot comply with noise standards and cannot demonstrate compliance through modeling utilizing a 0.0 ground factor, the industry is now uniformly improperly utilizing a 0.5 or 0.7 ground factor. Why is this improper? Because wind turbines are elevated, and the sound goes directly to the "receptor" on the ground:



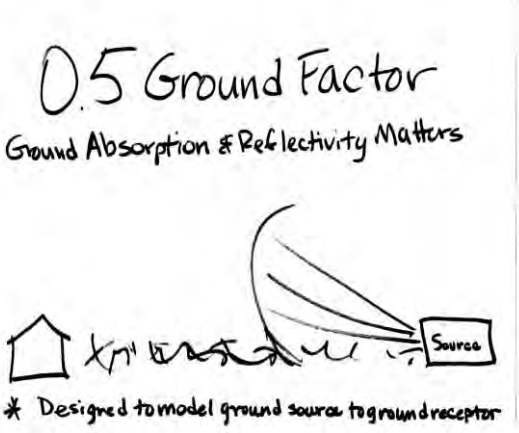
Ground factor represents conditions on the ground and things that can come between the noise source and the "receptor." See ISO 9613-2 (standards for noise modeling):

7.3 Ground effect (A_{gr})

7.3.1 General method of calculation

Ground attenuation, A_{gr}, is mainly the result of sound reflected by the ground surface interfering with the sound propagating directly from source to receiver.

From ISO 9613-2. Here's a depiction of how that works, from ground source to ground receptor:



As the chart on page 2 above shows, 0.5 and 0.7 are currently being used in all projects before the Commission. The use 0.0 of ground factor for wind is what should be standard practice, and a 0.5 ground factor is NOT appropriate for wind because the source is elevated. Use of a 0.7 ground factor is not scientifically justified.

That use of a 0.5 ground factor is not appropriate for wind turbine noise modeling was inadvertently confirmed by Applicant's Mike Hankard in the **Badger Hollow solar docket, also in Wisconsin (PSC Docket 9697-CE-100)**[4]:

A The model that we use has been shown to predict conservatively with 0.5. I mean, 0.5 ground factor is used in probably -- well, with the exception perhaps of wind turbine projects which are different because the source is elevated. But for projects like a typical power plant, a solar plant where the sources are relatively close to the ground, I would say 90 to 99 percent of the studies use 0.5. And when consultants like myself go out and measure these plants after they're constructed to verify our modeling assumptions, that assumption checks out as being, if anything, overpredicting the levels. So there's no need to -- there would be no justification to use something like a .2 or .3 which would predict yet higher levels because we're already demonstrating that the model is probably overpredicting. So that would not be justified for those reasons.

MR. NOWICKI: Thank you. No further questions.

The testimony of Dr. Paul D. Schomer in the Wisconsin Highland Wind docket[5] elaborates on the development of ISO 9613-2, that it is for measuring a ground source to a ground "receptor," and not designed for elevated noise sources with a direct path to "receptors," the purpose and use of the ISO 9613-2 standard and modeling assumptions, and the inappropriateness of use of a 0.5 ground factor for modeling predicted noise from wind turbines. Attached. I have also attached the AFCL Comment in the Freeborn Wind docket (WS-17-410) that addresses 0.5 ground factor improperly used in that docket.

[4] http://apps.psc.wi.gov/vs2017/dockets/content/detail.aspx?id=9697&case=CE&num=100

[5] Online, selected pages from hearing transcript: https://legalectric.org/f/2019/11/Schomer_Pages-from-Transcript-Schomer-see-p-572.pdf

The statements of probable compliance and justifications made in the noise modeling "studies" for the projects listed above are false and misleading, as are any statements that 0.5 is the generally accepted ground factor.

Like the Freeborn Wind project, the Highland Wind project could not meet Wisconsin's state noise standards (45 dB(A) in Wisconsin) using the 0.0 ground factor assumption, and so the developers moved the goal posts and produced noise modeling using a 0.5 ground factor with a claim that the project did meet state noise standards. This is deception, garbage in-garbage out modeling, backwards engineering, moving the goalposts until the desire result appears.

I have asked the Commissioners, on the record, whether they understand what 0.5 ground factor means, and have received repeated, and feisty, assurances that yes, they do know what it means. If Commissioners do understand, they are accepting this deception, and by permitting projects that likely will not comply, they're inflicting sound exceedences on those living near the turbines.

In Bent Tree, we've seen buyouts of two landowner families due to noise exceedences at **1,150** and **1,525** feet from the nearest turbine. The buyouts were hammered out only after SEVEN years of complaining with no action by the Commission until pushed by landowner persistence. Unfortunately, the rights of landowners are funneled through an ineffective and inadequate Complaint process, reliant on repeated landowner complaints and extreme efforts, rather than the Commission holding applicants to state standards at the outset, in permitting. By allowing use of a 0.5 ground factor, by issuing permits for projects despite developer unwillingness and/or inability to demonstrate that they can meet the noise standards, the Commission is inviting further legal action.

Worse yet than acceptance of modeling based on a 0.5 ground factor is the utter absurdity of use of a 0.7 ground factor, as is seen for the Three Waters (WS-19-576) and Plum Creek (WS-18-700). There is no excuse for this.

The Power Plant Siting Act's directive regarding public participation, applicable to siting of wind projects, is particularly important, as the Commission is failing to deal with the need for compliance with noise standards, leaving it to the public to address this failure. Also a problem is moving the filing of noise, shadow flicker, decommissioning and complaint process to "compliance filings," after a permit has been granted. At that point, the public is shut out, and there's no iterative substantive or critical review of the filings. Landowners and residents are at a severe disadvantage, as most members of the public have no way to identify these problems, and certainly cannot afford to intervene, much less hire expert witnesses to address these issues.

++

I am filing this letter in all of the above-identified dockets to provide actual and constructive notice of the deceptions present in each of the projects utilizing other than 0.0 ground factor. Minn. R. 7829.0250.

It should not fall to the public to spot this, or other, deceptions and inadequacies – that is the job of the Commission and Commerce-EERA. Further, no project should be permitted without agency vetting, independent verification of studies, particularly noise, shadow flicker, and decommissioning, etc.. The Commission should hold public and contested case hearings for discovery and cross-examination of witnesses presenting the studies and application.

Wind projects can be designed to comply with Minnesota's noise standard. It is the Commission's job to regulate utilities, to assure that projects comply with state law. The Commission must not site non-compliant projects, must require demonstration of probable compliance, and must use precautionary and preventative siting to avoid impacts and consequences. Once a turbine is up and not in compliance, then what? There aren't many options other than removing the turbine or buying out the landowner. With Bent Tree exceedences at 1,150 and 1,525 feet, careful siting makes good sense.

Very truly yours

Carol A. Overland
Attorney at Law

cc: All parties to all above-identified dockets via eDockets
Dorenne Hansen, Association of Freeborn County Landowners
Marie McNamara, Goodhue Wind Truth

MINNESOTA POLLUTION CONTROL AGENCY

520 Lafayette Road North | St. Paul, Minnesota 55155-4194 | 651-296-6300

800-657-3864 | Use your preferred relay service | info.pca@state.mn.us | Equal Opportunity Employer

September 11, 2018

Daniel P. Wolf, Executive Secretary
Minnesota Public Utilities Commission
127 7th Place East, Suite 350
St. Paul, MN 55101-2147

Filed electronically via edockets.state.mn.us

Re: In the Matter of the Application for Freeborn Wind Energy, LLC for a Large Wind Energy Conversion System Site Permit for 84 MW in Freeborn
County Docket No. MPUC IP-6946/WS-17-410

Dear Mr. Wolf:

Freeborn Wind Energy, LLC (Freeborn) and others have filed comments in this docket regarding the interpretation of Minnesota's noise standards, as applied to Large Wind Energy Conversion System (LWECS) projects. The Minnesota Pollution Control Agency (MPCA) has the authority to adopt or amend state noise standards (Minn. Rules Ch. 7030) under Minnesota Statutes 116.07. This letter is intended to help the Commission understand the MPCA's position regarding the application of the state noise standards to LWECS projects.

First, Freeborn and other wind developers contend that LWECS projects meet the state noise standards in Minn. Rules Ch. 7030.0040 as long as the noise generated from any individual turbine, or a combination of turbines, is below the applicable noise standard, absent the consideration of other sound or noise sources. The MPCA disagrees with this position. The plain language of the adopted standards support the MPCA's position, as the scope of the standards reads "These standards describe the limiting *levels of sound* established...for the preservation of *public health and welfare*." (Minn. Rule 7030.0040, emphasis added). This position is consistent with the letter sent from the MPCA to the Department of Commerce (DOC) on October 8, 2012, where the MPCA states our interpretation of standards as health-based standards for *total, ambient* sound. Thus, the MPCA recommends that the Commission should determine compliance of LWECS projects under the state noise standards by determining if *total* sound levels at nearby residences or other receptors – that is, existing sound levels plus the additional noise from a given turbine or LWECS project – exceed the standards in Minn. Rules Ch. 7030.0040.

We understand that the Commission and the DOC may have, or appear to have, applied the state noise standards in Minn. Rules Ch. 7030 differently in the past for some LWECS site permit actions. Nevertheless, as stated above, the MPCA has historically, and consistently, interpreted and applied said noise standards for *total* sound. The total sound levels at a residential receptor, or any receptor, should meet state standards as laid out in Minn. Rules Ch. 7030.0040, regardless of the source(s) contributing to the total sound levels.

The MPCA also recommends that the Commission continue to include compliance with the state noise standards in its site permits for LWECS projects. Maintaining the compliance provision ensures that a state agency retains regulatory authority to compel compliance with the state noise standards. Since the MPCA for noise standard exceedances would be very difficult. Currently, the MPCA only engages with facilities on compliance with noise standards for facilities that have an air quality permit from the MPCA. In the case of LWECS projects, we do not have a regulatory relationship with LWECS project developers or owners, and would have a very difficult time enforcing the state noise standards on LWECS project developers or owners. The Commission's siting permits include a provision requiring compliance with the state noise standards, which provides a direct mechanism to ensure ongoing compliance.

Finally, the MPCA finds that the Department of Commerce's proposed a reasonable "cause or contribute" approach to address compliance in situations where ambient/background sound is already near or exceeding state standards at one or more nearby residential receptors. The MPCA worked with the Department of Commerce on the approach, and it represents the approach the MPCA uses for the consideration of total, ambient sound standard. Noise from individual wind turbines, LWECS projects in general, or other non-natural sources may only comprise a small fraction of the *total* sound level; completely restricting noise from these projects would, therefore, be an undue burden to developers and utilities. We believe EERA's proposed approach, which allows individual turbines or LWECS projects to contribute to a total sound of no greater than one dBA above the relevant noise standard (as described in Minn. Rules Ch. 7030.0040), is reasonable and appropriate, and that the Commission should apply the approach to siting permits, going forward.

The MPCA appreciates the opportunity to provide this feedback. If you have any questions, feel free to contact me directly at 651-757-2500 or Frank.Kohlasch@state.mn.us.

Sincerely,

Frank L Kohlasch

Frank L. Kohlasch, Manager
Air Assessment Section
Environmental Analysis and Outcomes Division

FLK:cbg

cc: John Wachtler, DOC
Louise Miltich, DOC
David Thornton, MPCA
James Kelly, MDH
Jessie Shmool, MDH

A Yes.

MR. REYNOLDS: Okay.

EXAMINER NEWMARK: And these Exhibits 1 through 4 as well?

MR. WILSON: Your Honor, I think given the discussion of this document, it probably ought to go in as an exhibit.

MR. McKEEVER: Yes.

MR. LORENCE: I'm going to ask a couple questions on it, so you may want to hold off on that.

EXAMINER NEWMARK: Okay. Let me just have him answer. Are Exhibits 1 through 4 -- sir? Mr. Schomer, Exhibits 1 through 4, were they filed -- are they correct to the best of your knowledge?

THE WITNESS: I'm sorry?

EXAMINER NEWMARK: Your Exhibits 1 through 4, are they correct to the best of your knowledge?

THE WITNESS: Yes.

EXAMINER NEWMARK: Okay. Thanks.

All right. Commission staff.

CROSS-EXAMINATION

BY MR. LORENCE:

Q Dr. Schomer, on page 12 of your surrebuttal

testimony, and I'm looking on lines 6 through 8.

A Uh-huh. I guess I'm not fast enough. All right. I got to page 12.

Q On lines 6 through 8 you say, ISO 1996 requires what is termed "downwind" or weather-enhanced propagation conditions so that model predictions are only infrequently exceeded. Do you see that sentence?

A Yes.

Q I have never seen ISO 9613-2 before today. Could you tell me where that's required in this -- in this ISO 9613?

A Those are the questions we just answered, but I can go through it again.

Q Well, you talked about the downwind stuff, but you say it says that it's only infrequently exceeded, and I'm wondering if it says that in here anywhere?

A That's what the downwind nomenclature means, and I believe it's in either 9613 -- I know it's in either 9613 or in 1996, which 9613 incorporates by reference.

Q I have one more question, and again this shows my complete ignorance on this standard. In Section 7.3, that's called ground effects, and again there's not a page number here, but if you could turn to that.

A Okay. 7.3. 7.3, ground effects, yes.

Q Is this section equivalent of the ground factor that we've been talking about the last two days?
A This section is -- makes use of the ground factor. It's not equivalent. This is where the ground factor comes in. What you have is on the next page there's graphs showing the -- what the sound propagation is in different octave bands. And then in the implementation there's a table on the next page, Table 3, and in Table 3 if you look in there, there's A sub S or A sub R in the middle column at the top, and that's for the source or receiver region. We've been talking about there's really three factors, the .5 or the zero whatever. You have a factor for the source region, a factor for the middle, and a factor for the receiver region. And if you look at the formulas under A sub R of the middle column, you'll see a G. That's the ground factor that goes between zero and 1.
Q And that's the ground factor we have been talking about for two days?
A There's three of them technically: one for the source, one for the receiver, and one for the middle.
Q So if we turn back one page where it begins with the letter A, then it says hard ground.
A Hard ground, yes.

Q That first paragraph ends -- it says, for hard ground G equals zero. So this is the ground factor zero that we've been talking about, correct?
A Correct.
Q And then for porous ground in B, it's G equals 1?
A Correct.
Q And then for mixed ground, it says it's someplace in between zero and 1. Do you see that?
A I see that.
Q So this is the ground factor we've been talking about here?
A Yes. But to understand that is a question that was earlier. You've got a source up in the air and not on the ground, so does this standard really apply. And my answer was, it's the best we have, but you can't apply it exactly the way you would if it was on the ground because the source is as high in the air, it changes what the propagation is. So that the definition of what is hard and what is soft, you have a source that's 100 meters in the air on average. That's not on the ground as one of the other counsel's pointed out.
Q But it has to get to the ground -- the sound has to get to the ground eventually, doesn't it?
A It has to get to the ground eventually.

Q And once it's on the ground, won't it travel along the ground?
A No. It's only -- the only thing you have is an effect of the microphone height at your receiver. The other -- it doesn't -- it doesn't come down to the ground and then travel across the ground like this. It doesn't do that. What you're interested in is the path that goes straight from this up in the air source to your receiver, which may be near the ground, but you don't have any other path. If you do, it's because you don't have good propagation. Then it's poor propagation conditions.

MR. LORENCE: Thank you. I have no further questions.

MS. BENSKY: Your Honor, can I follow up on that? This is really important, and I want to make sure I understand.

RECROSS-EXAMINATION

BY MS. BENSKY:
Q So are you saying that if we have a flat -- if we have a flat ground, if there's a source that's close to the ground emanating sound, that sound can just go and be absorbed in the ground, correct?
A Ground absorption -- what happens, and this is more related to people's experience. You know, if we went

through all the details, it would be complicated, but I think people's experience is useful here. First of all, the first rule is that if you're downwind, it's louder than if you're upwind, and there's -- the reason is the downwind, and this is going to seem strange, we think of sound almost as rays, sound rays rather than waves.

And let's put it this way. Let's say you were behind the barrier. You expect it to be quieter. It's quieter because there's no direct path from the sound to you. It has to come around the corner just like if you had a -- something to stop the sun or a reflector of light. You go behind it, it's not as light as in front of it. Sound is the same thing. If you have a barrier or something that prevents the sound from getting to you, it's quieter than if you don't have that. Well, on a sunny day and you're upwind, you don't hear things. But if you're downwind, you do.

Another thing -- example, if you're out in a boat, do you hear things far away out in a boat? You've seen that? This is the hard surface of the water, and frequently above the water there's a temperature inversion because of the cooling and heating of the water. And those two can form two

layers that the sound gets trapped in, and then you have very -- you hear the people whispering on the shore, and it's like they're 10 feet away from you. I'm sure many of you have experienced this. This has to do with the propagation downwind versus upwind, has to do with the propagation.

The physics is complicated, but the effects -- same thing. Ever hear sources very early in the morning? You wake up at 5:00 a.m. and you hear a distant train or horns or the wheels? Have you experienced that? That again has -- at that time of day, you've got a direct path from the source, which is -- you don't hear the rest of the day to you. It has to do with the physics of the situation.

I'm not going to attempt to go into the physics, but I'm trying to give you different examples out of your daily life that show you this is what goes on. We don't want to really go into the details of what's going on.

Q So if there's a source up in the air that's emitting sound, the sound's going to come down and it's going to hit the receptor before it hits the ground and absorbs; is that correct?

A It's going to hit the receptor directly. There will be -- it gets confusing.

Q That's for sure.
A The ground is important only that it gives a reflection that can enhance or interfere with the direct path. But it does hit the microphone, that's the first thing it hits in time. The sound will arrive at the microphone before -- it comes directly from the source, so it will arrive first.
Q So somebody standing outside near a wind turbine or any source up in the air, that sound wave is going to travel down, and it's going to hit that person's ear before it goes down to the ground and gets absorbed?
A Well, won't be totally absorbed but, yes, it does hit you before it's absorbed. And I think your point is good, that as you're traveling along the ground, from ground to ground it will be absorbing some of the sounds, and that alone is -- that's part of the reason that the air-to-ground path is louder.
Q And so do you think it's proper to assume no absorption and use that 0.0 coefficient for this reason?
A That's part of the reason. Part of the reason is the -- in order to have a prediction that is what is called for in the standard, which is a prediction that is -- if you like the term conservative, a prediction that predicts what's going to happen 90

percent of the time or 95 percent of the time or some percentage of the time, I actually think that from the data that I know of, the prediction is probably the -- about 85 percent of the time would be included, and 15 percent of the time you would be above what's being predicted with the 0.00 prediction. It's not the most conservative prediction in the world by any means.

Q But considering we have to use this model because we don't have anything better, the best way to use this model for a source that's 100 meters in the air is to use that 0.0 coefficient?

A 0.00 is the best you can do with this.

MS. BENSKY: Great. That's very helpful. Thank you.

MR. REYNOLDS: Couple questions on redirect.

REDIRECT EXAMINATION

BY MR. REYNOLDS:

Q Dr. Schomer, is it the heart of it that the challenge of creating a model to reflect what the citizens of Forest will actually experience, is that the heart of why it's better to have conservative estimates than not conservative estimates of sound? Because we're trying to figure out what's going to happen to the

citizens in Forest.

A I think there's probably lots of reasons I can think of for doing this. Again, we're dealing with a low frequency sound primarily. The A-weighted sound is going to correlate with it as it does with nearly all noise sources.

I think it's important to understand how the ear hears because that's all a part of this, and the ear doesn't hear all frequencies equally. It doesn't process all frequencies equally, and it gets very different at low frequencies. The ear gets very different at low frequencies, and this is one of the reasons I would say this is important. We -- I think Mr. Hessler testified that the threshold of hearing changes, or maybe it was in that paper that was passed out, but the threshold of hearing is very different from one person to another.

But what's even more important is that at the middle frequencies, like 1,000 hertz, a change of 10 decibels is a doubling or a cutting in half of loudness. At these low frequencies, like let's say 10 hertz, at 10 hertz, about a 2 dB change is a doubling of loudness. So at low frequencies, anything that you're off gets magnified by the ear. If you're off by 5 dB at low frequencies, that's a

factor of four in loudness. Whereas if you're off by 5 dB at a middle frequency in a prediction, that's not even a factor of two in loudness. So errors get magnified at the low frequencies just because of how we hear.

Q That was one of the reasons for looking at the more conservative model. Are there any others?

A Well, let's see. I've talked about the standard calling for it. I've talked about it makes sense from the -- from the way the rule is written. Certainly it makes sense from being conservative from just the standpoint of how the ear hears. I think that just what we've talked about, the health effects and the fact that there's people that may be affected just like in one other community, somehow it seems like it calls for us to be cautious.

I think that if -- if it were some other area where government was involved directly, let's say, we're going to install -- we're going to license fire detectors that only work 90 percent of the time and 10 percent of the time people aren't warned about the fire protector, but that's good enough. People wouldn't say that's good enough, so the fire protection has to work all the time. And I think when we're talking about people literally being

driven out of their homes, we have to be a little bit cautious.

MR. REYNOLDS: Thank you. I don't have anything else.

EXAMINER NEWMARK: Highland?

MR. WILSON: No.

EXAMINER NEWMARK: All right. What are we doing with our ISO 9613-2?

MS. BENSKY: I'd like to move it into evidence.

EXAMINER NEWMARK: All right. Any objections?

MR. LORENCE: I guess I'd like to talk about that for a second.

EXAMINER NEWMARK: Okay.

MR. LORENCE: We've kept out all kinds of reports and exhibits today because they didn't come in at the proper time. Professor Schomer could have put it in at any time with his exhibits. I recognize that counsel here is not -- is not -- his witness is not asking this. But I guess I would ask the ALJ that under the theory that, you know, we've been keeping out late-filed things and this is awfully dense information, whether this should go in the record.

EXAMINER NEWMARK: Okay.

MR. LORENCE: And I just as a second aside for counsel, I'm not positive, but I think that these are usually under copyright, and is this something that we would be able to place on our website and make available to the world if -- I don't want to get you in any kind of copyright trouble if that's the case.

MR. McKEEVER: I'll just say I got it on the internet.

MR. LORENCE: Yeah.

MR. REYNOLDS: And this is the standard that has been used by all the measurers of sound, so this is -- this is kind of the bible of sound measurement.

MR. LORENCE: And I guess that reinforces my question then. Anybody could have put it in. Any of the experts could have put it in from direct testimony on it. So whether we get it here at this late hour or not, I'll defer to the decision, but I'm -- given what we've done today with other things, I just wanted to raise that point.

MS. BENSKY: I guess the nature of this exhibit is totally different. This exhibit doesn't give any opinions. It's just a standard that

everybody -- all the sound people in this case have used and relied upon. So I think it would be helpful to have it in. And even if it wasn't in, I think it's the type of material that could be quoted and briefed anyway, so --

EXAMINER NEWMARK: Let's not get into that.

MR. WILSON: I think at the risk of making it look like Ms. Bensky and I are on the same team --

EXAMINER NEWMARK: We would like to see that.

MR. WILSON: I agree.

EXAMINER NEWMARK: Okay.

MR. WILSON: It should come in.

EXAMINER NEWMARK: I understand.

MR. WILSON: There's a lot of testimony on it.

EXAMINER NEWMARK: Let me say the overarching concern I have or rationale for letting it in is we've cited to equations and all kinds of portions of this document which I think can only be correctly or adequately explained or referenced by having the document. So for the abundance of caution for making the record even larger, I think

it would enhance the Commissioner's review of the testimony we've just heard. So what's the number for this one? It's 9, Schomer 9, is that --

MR. REYNOLDS: I thought it was 5.

EXAMINER NEWMARK: Well, I don't know if we ever marked your other ones. I might have mentioned on the record because Mr. Schomer, I was not accepting his Exhibits 5 through 8, and I am pretty sure I referenced that at the beginning of the hearing. So we're just going to call this 9.

MS. BENSKY: Okay.

(Schomer Exhibit No. 9 marked and received.)

EXAMINER NEWMARK: All right. I think you're done.

THE WITNESS: Thanks.

EXAMINER NEWMARK: You're excused.

(Witness excused.)

EXAMINER NEWMARK: 3 o'clock. Let's take 15 minutes.

(Break taken from 3:05 p.m. to 3:20 p.m.)

EXAMINER NEWMARK: Well, got enough people back, I guess. You want to start off the record?

MR. McKEEVER: Yeah.

(Discussion held off the record.)

EXAMINER NEWMARK: All right. Next?

A I do recall that.
Q Do you believe that it would have been appropriate to apply a ground factor of 0.2 or 0.3 to your analysis of the Badger Hollow project?
A No.
Q Why not?
A The model that we use has been shown to predict conservatively with 0.5. I mean, 0.5 ground factor is used in probably -- well, with the exception perhaps of wind turbine projects which are different because the source is elevated. But for projects like a typical power plant, a solar plant where the sources are relatively close to the ground, I would say 90 to 99 percent of the studies use 0.5. And when consultants like myself go out and measure these plants after they're constructed to verify our modeling assumptions, that assumption checks out as being, if anything, overpredicting the levels. So there's no need to -- there would be no justification to use something like a .2 or .3 which would predict yet higher levels because we're already demonstrating that the model is probably overpredicting. So that would not be justified for those reasons.

MR. NOWICKI: Thank you. No further questions.

5	Chad Peterson	4/2/2020			Noise from Turbines 28, 31, 41, 42 are very	General	Xcel Environmental-Lucas Knowlton	Xcel talked with complainant on 4/3/2020 to gather more information and receive permission to monitor noise levels at the property. Noise report was sent to Lori Pederson on 6/24/2020 and according to the study the noise is under the daytime and nighttime limits. Waiting for the land owner to respond to set up a call to discuss the report.	Resolved	
4	Tim Sanderson	4/16/2020			Noise from Turbine 11 is creating an annoying noise in the house along with interruption in TV signal.	General	Xcel Environmental-Lucas Knowlton	Xcel talked with complainant on 4/16 to receive permission to monitor and record the noise level at the property. Noise report was sent to Complainant on 7/1/2020 and the recommendation is to do more noise monitoring of the property. After receiving permission from the landowner, additional monitoring was performed at residence from 7/15/20 through 8/24/20. Final report was provided to landowner on 12/14/20. Report shows there were some nighttime periods that exceeded the state noise standard. Xcel Energy further evaluates the report's results and data to understand the conditions that caused the exceedance and create a plan to manage operations to ensure compliance.	Pending	
3	Grant Wilson	3/9/2020 Update on 1/15/21			Noise from Turbine 90 is creating an annoying droning noise in house and preventing sleep	General	Xcel Environmental-Lucas Knowlton	Xcel met with complainant on the morning of 3/9/2020 to observe noise at the residence. The complaint was received during a testing period for T-90. Noise monitoring and recording has been taking place since March. Turbine 90 has been curtailed between 1900 to 0700 during that same time. Initial monitoring verified compliance with the daytime noise standard, and recommended additional monitoring for nighttime noise standard compliance. This first report was finalized and shared with the Weverka's in July 2020. Xcel Energy contracted with noise consultant RSG to design a nighttime noise study to be carried out 9/8/20 through 9/29/20. The complaintants made another complaint on 8/31/20, concerned T090 would be operated at night. RSG has finalized its noise monitoring report, which indicated an exceedance of the 50dBA nighttime noise standard occurred on 9/27/20. While Xcel Energy further evaluates the report's results and data to understand the conditions that caused the exceedance, T-090 will continue to be curtailed from 1800-0600 each day. The report verified compliance with the daytime noise standard, as was shown in the July report. Site management distributed the monitoring results to the Weverka's. Xcel Energy continues to work with the Weverka's, and will file additional information with the Commission by Jan. 21, 2021. The Commission met on Feb. 5, 2021 and agreed with Dept of Commerce recommendations to continue study and curtailment until T-90 is in compliance with the state noise standard at all times, and report back to the Commission when that has been accomplished. Working on contract with noise monitoring company to perform noise monitoring at T090.	Pending	
2	Grant Wilson & Chad Peterson	3/17/2020			Noise from Turbines 83, 84, 85, 86 were keeping family awake at night	General	Xcel Environmental-Lucas Knowlton	Xcel called complainant to receive permission to conduct noise monitoring around the property throughout March. Turbines 83, 84, 85, 86 are being curtailed between 1900 and 0700. Noise report was sent to Chad Olsen on 6/25/2020 and the recommendation was to do more noise monitoring of the property. Xcel performed additional monitoring at residence using RSG. RSG set up their equipment on 9/8 and monitored noise through 9/27. RSG noise report was distributed to Chad Olsen on 12/07/2020. Turbine 83 & 85 are still being curtailed from 1800-0600 each day currently, but no exceedances of the daytime or nighttime noise standard were recorded during montoring.	Pending	
1	Matthew Langan	3/24/2020			Noise from Turbines 43, 45 keeping family awake at night and annoying when outside during day	General	Xcel Environmental-Lucas Knowlton	Xcel called complainant to receive permission to conduct noise monitoring around the property throughout March. Turbines 43, 45 are being curtailed between 1900 and 0700. Noise report was sent to Mitch Pederson on 6/17/20 and according to the study the noise is under the daytime and nighttime limits.	Resolved	

Values in the Wind: A Hedonic Analysis of Wind Power Facilities*

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ABSTRACT: The siting of wind facilities is extremely controversial. This paper uses data on 11,331 property transactions over 9 years in Northern New York to explore the effects of new wind facilities on property values. We use a fixed effects framework to control for omitted variables and endogeneity biases. We find that nearby wind facilities significantly reduce property values in two of the three counties studied. These results indicate that existing compensation to local homeowners/communities may not be sufficient to prevent a loss of property values.

1 Introduction

Increased focus on the impending effects of climate change has resulted in pressure to develop additional renewable power supplies, including solar, wind, geothermal, and other sources. While renewable power provides several environmental advantages to traditional fossil fuel supplies, there remain significant obstacles to large-scale development of these resources. First, most renewable energy sources are not yet cost competitive with traditional sources. Second, many potential renewable sources are located in areas with limited transmission capacity, so that, in addition to the costs of individual projects, large-scale development would also require major infrastructure investments. Finally, renewable power projects are often subject to local resistance.

Wind power is, by far, the fastest growing energy source for electricity generation in the United States, capacity and net generation having increased by more than 1,348% and 1,164%, respectively, between 2000 and 2009. No other sources of electricity have even doubled in capacity over that period. This sort of growth for wind energy is expected to continue into the future, although not at quite those high rates.[1] If additional steps are taken to combat global climate change, the demand for wind energy would only increase relative to these forecasts.

There are many outspoken critics who focus on the potential negative impacts of wind projects. These critics point to the endangerment of wildlife including bats, migratory birds, and even terrestrial mammals. Some critics also point to detrimental human health effects including abnormal heartbeat, insomnia, headaches, tinnitus, nausea, visual blurring, and panic attacks.[2] There are also concerns about the aesthetics of these facilities. One oft-quoted critic, Hans-Joachim Mengel a Professor of Political Science at the Free University, Berlin, has likened Wind Turbines to "the worst desecration of our countryside since it was laid waste in the 30 Years War nearly

400 years ago."[3] If wind turbines are perceived to have this manner of impact on local areas, they would have a strong negative impact on local property values.

As regards the noise impacts of these facilities, consider that estimated sound levels for a typical turbine at a distance of 1500 ft. are 50 dBA, equivalent to a normal indoor home sound level (Colby et al., 2009). Typically, distances between wind turbines and receptors are regulated at the local level. The New York State Energy Research and Development Authority (NYSERDA) recommends turbine setbacks of 1000 ft. from the nearest residence (Daniels, 2005). These setbacks focus on general safety considerations such as turbine collapse instead of specific health impacts associated with noise or vibration. The National Environmental Protection Act and comparable New York State Environmental Quality Review legislation prescribe a general assessment process that does not define specific turbine setback requirements. Viewshed impacts are more far reaching but vary widely by property and depend on land cover and property elevations.

As a result of these potential effects, the siting of wind facilities is extremely controversial, and debate about siting has caused delays and cancellations for some proposed installations. Perhaps the most famous case is that of Cape Wind in Massachusetts. First proposed in 2001, this project, approved by the U.S. Department of Interior in April 2010, calls for the construction of 130 turbines, each with a maximum blade height of 440 ft., approximately 5 miles off the shore of Cape Cod between Cape Cod and Nantucket. In response, local activists have organized the "Alliance to Protect Nantucket Sound" to fight the proposal through the courts and other avenues. This is despite the fact that the primary local impact is expected to be the impacted view from waterfront properties.[4] In the case of terrestrial projects, the opposition can be even stronger. In Cape Vincent, NY, in Jefferson County, wind developers have been working since 2006 to construct two separate facilities that include 147 turbines.

Cape Vincent is bordered to the north by the St. Lawrence River and Lake Ontario, within view of an eighty-six turbine wind farm on Wolf Island in Ontario, Canada, and within a short drive to the largest wind farm in New York State. The response to the proposal has been spirited with both pro- and anti-wind factions fighting to determine its fate. In October of 2010, a lawsuit was filed to nullify a town planning board's approval of a final environmental impact statement; the meeting at which it was approved had been disrupted by vocal protestors.[5] Recent reports in the popular media suggest that such controversy over wind turbines is widespread.[6]

At the individual level, property owners willing to permit the construction of turbines or transmission facilities on their property receive direct payments from the developer as negotiated through easement agreements. In terms of community benefits, wind developers claim that their projects create jobs and increase tax revenues by way of payment in lieu of taxes (PILOT) programs. PILOTs are a significant revenue source that can help offset overall town and school tax rates for all residents. These host community benefits are not unlike those made to communities that have permitted the construction of landfills within their municipal boundaries. In the case of Cape Vincent, a town appointed committee evaluated the economic impacts of the proposed facility and concluded that 3.9% of property owners would benefit directly from easement payments made by the developers.[7] Easement payments are negotiated with individual land owners and are not publically available so the magnitude and actual economic benefit to these property owners was not quantified. PILOT agreements between the developers and the Town were estimated at $8,000 per turbine or $1.17 million per year. In the opinion of some Cape Vincent property owners, local officials are negotiating PILOT agreements to the benefit of the municipality, individual property owners are negotiating individual easement agreements to offset their respective property impacts, and property owners in close proximity to turbines

are left with no market leverage to offset the impacts that they believe turbines will have on their property values. This is the externality problem that is at the heart of the issue.

In moving forward with wind power development then, it is important to understand the costs that such development might impose. Unlike traditional energy sources, where external/environmental costs are spread over a large geographic area through the transport of pollutants, the costs of wind development are largely, but not exclusively, borne by local residents. Only local residents are likely to be negatively affected by any health impacts, and are the people who would be most impacted by aesthetic damages, either visual or audible. These impacts are likely to be capitalized into property values and, as a consequence, property values are likely to be a reasonable measuring stick of the imposed external costs of wind development.

The literature that attempts to measure these costs is surprisingly thin. To our knowledge, there are only two peer-reviewed hedonic analyses that examine the impact of wind power facilities on property values. Sims et al. (2008) and Sims et al. (2007) use small samples of homes near relatively small wind facilities near Cornwall, UK and find no significant effect of turbines on property values. The first of these studies has very limited data on homes, just home 'type' and price, and uses a cross-sectional approach. In addition, there is a quarry adjacent to the wind turbines, and other covarying property attributes which makes identification of the wind turbine effect very difficult. They actually do find a significant negative effect from proximity to the turbines but based on conversations with selling agents, attribute this instead to the condition and type of the homes. The second study uses a very small sample of only 201 homes all within the same subdivision and a cross-sectional approach. They focus specifically on whether homes can view the turbines and have very limited data on home attributes. Moreover, given the small geographic scope of the analysis, it is

unlikely that there was sufficient variation in the sample to identify any effect; all of the homes were within 1 mile of the turbines.

In 2003, Sterzinger et al. released a report through the Renewable Energy Policy Project (REPP) which used a series of 10 case studies to compare price trends between turbine viewsheds and comparable nearby regions and found, in general, that turbines did not appear to be harming property values. This analysis, however, was not a true hedonic analysis. Instead, for each project they identified treated property transactions as being within a 5 mile radius of the home and a group of comparable control transactions outside of that range. They then calculated monthly average prices, regressed these average prices on time to establish trends and then compared these trends between treatment and control groups. They did not control for individual home characteristics or any other coincident factors.

Hoen (2006) also focuses on the view of wind turbines, and collects data for homes within 5 miles of turbines in Madison County, NY. His sample is also small, 280 transactions spread over 9.5 years, and he uses a cross-sectional approach. He fails to find a significant impact from homes being within viewing range of the turbines. Hoen et. al (2009) use a larger sample of 7,500 homes spread over 24 different regions across the country from Washington to Texas to New York that contain wind facilities and again find no significant effect. They look at transactions within 10 miles of wind facilities and use a variety of approaches, including repeat sales. However, they limit themselves to discontinuous measures of proximity based on having turbines within 1 mile, between 1 and 5 miles, or outside of 5 miles, or a similar set of measures of the impact on scenic view, and they again find no adverse impacts from wind turbines. In addition, by including so many disparate regions within one sample they may be missing effects that would be significant in one region or another.

There is also a small literature using stated preference approaches to value wind

turbine disamenities. Groothuis, Groothuis, and Whitehead (2008) asked survey respondents about the impact of locating wind turbines on Western North Carolina ridgetops and found that on average households are willing-to-accept annual compensation of $23 to allow for wind turbines, although retirees moving into the area require greater compensation. Similarly, Krueger, Parsons, and Firestone (2011) surveyed Delaware residents about offshore wind turbines and find that residents would be harmed by between $0 and $80 annually depending on where the turbines are located and whether the resident lives on the shore or inland.

This paper improves upon this literature using data on 11,331 arms-length residential and agricultural property transactions between 2000 and 2009 in Clinton, Franklin, and Lewis Counties in Northern New York to explore the effects of relatively new wind facilities. We use fixed effects analysis to control for the omitted variables and endogeneity biases common in hedonic analyses, including the previous literature on the impacts of wind turbines. We find that nearby wind facilities significantly reduce property values in two of the three counties we study. We find evidence of endogeneity bias in the use of fixed effects models with relatively large geographic groupings (census block-groups or census blocks) that appears to be controlled for in a repeat sales approach.

Section 2 provides background information on wind development and on the study area. Section 3 provides detailed information on our data and empirical approach. Section 4 provides the analytical results. Section 5 discusses the implications of our results and Section 6 concludes.

2 Background and Study Area

New York State is a leader in wind power development. In 1999, New York had 0 MW of installed wind capacity, but by 2009 had 14 existing facilities with a combined capacity of nearly 1300 MW, ranking it in the top 10 of states in terms of installed capacity.[8] New York also appears to have more potential for terrestrial wind development than any other state on the east coast.[9] This is borne out by the fact that there are an additional 28 wind projects in various stages of proposal/approval/installation in the state. [10]

New York has also been badly affected by the environmental impacts of traditional energy sources. The Adirondack Park, in particular, has been severely impacted by acid deposition and methyl mercury pollution (Banzhaf et al., 2006). In that sense, the state has much to gain from transitioning away from fossil sources of energy and towards renewable sources like wind. New York, however, has relatively little potential to develop solar, geothermal, or other renewable sources. Existing wind developments are spread throughout the state, with clusters in the far west, the far north, and in the northern finger lakes region. The largest projects, however, are in what is often referred to as 'The North Country,' and are in the three counties - Clinton, Franklin and Lewis Counties - which make up our study area, shown in Figure 1, together with the outline of the Adirondack Park and the location of the wind turbines in this area.

Northern New York is dominated by the presence of the Adirondack Park. The Adirondack Park was established in 1892 by the State of New York to protect valuable natural resources. Containing 6.1 million acres, 30,000 miles of rivers and streams, and over 3,000 lakes, the Adirondack Park is the largest publically protected area in the United States and is larger than Yellowstone, Everglades, Glacier, and Grand Canyon

National Park combined. Approximately 43% of the Park is publically owned and constitutionally protected to remain "forever wild" forest preserve. The remaining acreage is made of up private land holdings. There are no wind facilities within the borders of the Park, but as you can see in Figure 1, the facilities in our study are very close. There are six wind farms in our study area, as summarized in Table 1.[11]

Table 2 presents a comparison of the counties in our study area to the New York State and United States averages for population density, per capita income, and home prices. As that table shows, our study area is a very rural, lightly populated area of small towns and villages that is also less affluent than the state average. The largest population center in our study area is Plattsburgh, NY with a 2000 population of about 18,000.

3 Data and Methodology

Our data consists of a nearly complete sample of 11,331 residential and agricultural property transactions in the Clinton, Franklin and Lewis Counties from 2000-2009. Of these there are 1,938 from Lewis, 3,251 from Franklin, and 6,142 from Clinton Counties. Each observation constitutes an arms-length property sale in one of the three counties between 2000 and 2009. Parcels that transacted more than once provide a greater likelihood of observing specific effects from the turbines on sales prior to and after installation. In total, 3,969 transactions occurred for 1,903 parcels that sold more than once during the study period.[12]

Transacted parcels were mapped in GIS to enable us to calculate relevant geographic variables for use in the regressions. Turbine locations were obtained from two different sources. In Lewis County, a GIS shapefile was provided by the county which contained 194 turbines. According to published information on the Maple Ridge wind

project, there are 195 turbines at the facility (Maple Ridge Wind Farm). Noble Environmental Power would not provide any information on their turbine locations so 2009 orthoimagery was utilized to create a GIS shapefile with the turbine locations in Franklin and Clinton Counties.

Turbine locations in combination with several other datasets were merged using ESRI ArcView GIS software and STATA data analysis and statistical software to form the final dataset. Transacted parcels were mapped in GIS to determine the distance to the nearest turbine. Distances are used as a proxy to estimate the nuisance effects of the turbines (i.e., view-scapes, noise impacts, perceived health effects). The distance to turbines was exported from GIS and combined with the other parcel level details in STATA. Table 3 summarizes the datasets that were used in the analysis and their sources. Table 4 provides summary statistics for many of the variables included in our analysis.

Unfortunately, we have relatively few transactions that are very close to the turbines. In the full sample data there are 461 transactions within 3 miles of a turbine with 92 in Clinton County, 118 in Franklin County, and 251 in Lewis County. In the repeat sales data, there are 142 transactions within 3 miles of a turbine: 41 in Clinton County, 34 in Franklin County, and 67 in Lewis County. Table 5 presents a count of transactions at various distances from turbines by county for each of our two datasets.

3.1 Methodology

Our analytical approach to estimating the effects of wind turbines on property values is that of a repeat sales fixed-effects hedonic analysis.[13] We are attempting to estimate the 'treatment' effect of a parcel's proximity to a wind turbine. There are a number of

difficulties in measuring the effect of turbines. First and foremost, there is a question of when a turbine should be said to 'exist.' The obvious answer is that turbines exist only after the date on which they become operational. However, there is a long approval process associated with development of these projects and local homeowners presumably will have some information about where turbines will be located some years before they actually become operational. To deal with this issue, we run our regressions with three different assumptions about the date of existence - the date the draft environmental impact statement (EIS) was submitted to the New York State Department of Environmental Conservation, the date the final environmental impact statement was approved, and the date at which the turbines became operational.

In addition, given the uncertain and possibly diverse physical/aesthetic impacts of turbines, it is difficult to know how to measure proximity. Is it distance to the turbine, whether or not the turbine can be seen, whether or not the turbine can be heard/felt, or all of the above? For all of these factors, it is reasonable to suspect that distance would work as a proxy measure. That is, homes closer to turbines will be more likely to see the turbines and more likely to hear or feel vibrations from the turbines. In Clinton and Franklin Counties, the turbines are located in a broad river valley (the St. Lawrence) with only small hills that are unlikely to obstruct turbine views; in Lewis County the turbines are on top of a large plateau. In our regions then, proximity should be a good measure of impacts. So, all of the measures that we employ will be distance based, starting with the simplest - the inverse of the distance to the nearest turbine.[14] This inverse distance measure is also calculated with the date of the turbines' existence in mind. So, distance will decrease (inverse distance will increase) for all parcels after new turbines come into existence. Specifically, at the beginning of our sample period there are no commercial turbines in the study counties. However, there are turbines outside of the study counties that are counted

as the 'nearest turbines' for the purposes of measuring distance. The distances to these turbines are approximated by measuring the distance from these facilities to the centroid of each of the study counties. As new facilities are built, both inside and outside the study area, these distances are updated. At the time that the Lewis County facility final EIS is submitted, those become the closest turbines for the entire sample area. When the facilities in Clinton and Franklin facilities come online distances are again updated. Because, initially, the nearest turbines are out of the sample area, we also ran the analysis assuming that the nearest turbine was infinitely far away. The results of this specification however do not change significantly from those reported below.[15]

In addition to the relatively simple distance measure, which imposes a particular functional form to the distance effects, we also include a series of distance dummies which indicate the range in which the nearest turbine lies. This approach allows for non-linear, and non-monotonic, impacts to be measured. These variables also change over time as new turbines are sited, which is necessary to implement a fixed effects approach. Table 6 presents summary statistics for various measures of the effect of wind turbines.

In addition to these various measures of the proximity of homes to wind turbines, we include a number of other covariates. These include distance to the nearest major road, the value of any personal property included in the transaction, whether or not the home is in a 'village,' which would imply higher taxes, but also higher services and proximity to retail stores and restaurants, in addition to standard home characteristics including number of bedrooms, bathrooms, half-baths, the square footage of the house, the age of the home, and the size of the lot. We also include parcel level land cover data which tells us the share of each parcel in a number of different land cover categories (woodland, pasture, crops, water, etc.). To capture possible

information asymmetries between buyers and sellers we include a dummy variable for whether or not the buyer was already a local resident or moving in from outside of 'the North Country.' This is particularly important since there is good reason to believe that local residents would have more information about the future location of turbines, and about any associated disamenities than someone less familiar with the area. Finally we include a series of relatively subjective measures of construction quality and property classification (mobile homes, primary agriculture, whether or not the home is winterized, etc.) that come from the NYSORPS (New York State Office of Real Property Services) assessment database.

3.1.1 Empirical Issues

There are three main empirical issues that we have to deal with in accurately estimating the effects of wind developments on property values through a hedonic analysis: omitted variables, endogeneity, and spatial dependence/autocorrelation. As Greenstone and Gayer (2009), Parmeter and Pope (2009), and others, lay out, omitted variables bias is a major concern in any hedonic analysis. Put simply, there are almost innumerable factors that co-determine the price of a property, and many or most of these factors are unobservable to the researcher. If any of the unobserved factors are also correlated with included factors, then the resulting coefficient estimates will be biased. Equally concerning in attempting to accurately estimate the effects of a discrete change in landscape, like the construction of a wind turbine, is endogeneity bias. This bias has a similar effect as omitted variables bias but a slightly different cause. Endogeneity bias enters when the values of the dependent and one or more independent variables are co-determined. In the case of hedonic models, if property values determine the location of some facility, and that facility also impacts property values, we have endogeneity bias. In our case we do need to be concerned about

this since it is likely that, ceteris paribus, wind turbines will be sited on lower-value, cheaper land. Then, if this is not corrected, we might falsely conclude that wind turbines negatively impact property values or, at least, overstate any negative impacts, simply because wind turbines are placed on cheaper land. This selection effect would cause us to confuse correlation with causation.

As developed in Greenstone and Gayer (2009), Parmeter and Pope (2009), and Kuminoff, Parmeter, and Pope (2010), spatial fixed effects analysis can be a solution to both of these problems in hedonic analysis. Fixed effects work by including a set of spatial dummy variables in the regression which correspond to groupings of the observations. In this way, any static features of the groups that affect property values will implicitly be controlled for by these dummy variables. Essentially, we are allowing for group-specific constant terms. So, many otherwise omitted effects which occur at the level of the groups (the fixed effects scale) will now no longer be omitted. Similarly, if, within groups, the occurrence of the variables of interest (the placement of wind turbines, in our case) is random, we will have controlled for endogeneity bias as well.[16]

The geographic scale of the fixed effects, or the size of the groups, is a critical issue. The smaller the geographic scale of the fixed effects, the tighter the controls will be for endogeneity and omitted variables biases. Following this logic, the cleanest analysis would be using repeat sales where the fixed effects are implemented at the parcel level.[17] There are tradeoffs, however. The first arises since variation in the remaining observable explanatory variables can only be observed within the groups, a smaller geographic scale means less variation and less power with which to estimate these remaining coefficients. That is, if we are interested in the distance from each parcel to the nearest major road, the statistical power to measure this comes only from variation in this distance within the scope of the fixed effects (ie. the census

block). Presumably, since homes within a census block are all close to each other, they will all be a similar distance to the nearest road and thus there is limited variation with which to measure this effect. In a repeat sales analysis, since parcel location and most other characteristics are assumed to be fixed, one can only estimate the effects of time-variant factors. The second tradeoff is that, in general, repeat sales are relatively rare and so to implement such an analysis, one will be forced to ignore a large percentage of all observations. This also brings to light the possibility of a sample selection bias if those homes that sell more than once are not representative of the general population of parcels. In this paper, we experiment with these tradeoffs by using three different levels of fixed effects analysis - census block-group, census block, and repeat sales analysis.[18] To give a sense of the scale of these different approaches, consider that in our study area, there are 92,960 total parcels, 1,997 census blocks, and 17 census block groups, which implies that, on average, there are 46.55 parcels per block, and 5,468.24 parcels per block group. The average census block has an area of just under 2 square miles, and the average census block group, about 232 square miles.[19] We conduct all of our analysis at the county level. That is, we do not pool our datasets from the three counties in the study area but instead run each specification separately for each county.[20]

Finally, we have to be concerned about spatial dependence and spatial autocorrelation. There is no doubt that homes that are close to each other affect each other's prices (spatial dependence) and that unobserved factors for one home are likely to be correlated with unobserved factors for nearby homes (spatial autocorrelation or spatial error dependence). These factors could bias our coefficient and standard error estimates if not corrected. We correct for these issues using fixed effects, again, for the first and error clustering for the second. The fixed effects analysis is akin to employing a spatial lag model with a spatial weights matrix of ones for pairs of parcels

within the same geographic area, the scale of the fixed effects, and zeros for pairs of parcels in different areas. Likewise, the error clustering allows for correlation of error terms for parcels within an area and assumes independence only across areas (Cameron and Trivedi, 2010). This is akin to employing a spatial error model with the spatial weights matrix as described just above to control for spatial autocorrelation.[21] In this way it also controls for heteroskedasticity (Wooldridge, 2002).

Formally, we estimate two regression equations. The first uses census block or block group fixed effects:

$$\ln p_{ijt} = \lambda_t + \alpha_j + z_{ijt}\beta + x_{ij}\delta_{jt} + \eta_{jt} + \epsilon_{ijt} \tag{1}$$

where p_{ijt} represents the price of property i in group j at time t; λ_t represents the set of time dummy variables; α_j represents the group fixed effects; z_{ijt} represents the treatment variables - the different measures of the existence/proximity of turbines at the time of sale; x_{ijt} represents the set of other explanatory variables; and η_{jt} and ϵ_{ijt} represent group and individual-level error terms respectively. This specification is adapted from Heintzelman (2010a, 2010b) and follows from Bertrand, Duflo, and Mullainathan (2004) and Parmeter and Pope (2009).

Following again from Bertrand, Duflo, and Mullainathan (2004), the second regression equation uses the repeat sales approach which is an adaptation of the model above:

$$\ln p_{it} = \lambda_t + \alpha_i + z_{it}\beta + \epsilon_{it} \tag{2}$$

where λ_t represents annual and seasonal dummies, α_i represents parcel fixed effects, z_{it} represents a vector of time varying parcel level characteristics, and ϵ_{it} is the error term. In effect, this analysis regresses the change in ln(price) on the change in any

time-variant factors. In our case these time varying factors (z_{it}) are the variety of measures of the proximity of the parcel to wind turbines. Allowing for error clustering at the parcel level allows error terms to be correlated for different transactions of the same parcel.

4 Results

We first present results for the census block fixed effects analysis. Table 7 shows results for two models for each of the three counties. The first model includes only the log of the inverse distance to the nearest turbine, while model 2 instead includes a set of dummy variables indicating the range in which the nearest turbine is located.[22] All of the results presented here assume that turbines exist at the date the Final Environmental Impact Statement (EIS) is issued. This accounts for the fact that local residents and most other participants in real estate markets will be aware of at least the approximate location of turbines before they are actually constructed. In fact, most of the turbine locations would be known, if not publically, well before this since developers typically negotiate with individual landowners before moving forward with regulatory approvals. Our results are quite robust to adjusting the date of 'existence' forwards to the date of the draft EIS. If we adjust this date backwards to the date of the permit being issued the results are qualitatively similar, but we lose significance - likely because we then have even fewer post-turbine transactions in the 'treatment' group.

First, notice that the covariate results are largely as would be predicted. Homeowners in this region prefer larger homes, with more bathrooms and fireplaces, and homes of higher quality grades. In 2 of three counties, homeowners also take into account the value of included property, while the age of the home has a generally

negative impact on price. The effect of being in a village varies by county, having a negative effect in Lewis (insignificant) and Clinton Counties and a positive impact in Franklin County. Lot size is only a significant factor in Franklin County in the census block fixed effects model, but is positive and significant in the unreported block group model. It also becomes significant in alternative specifications that exclude the village variable but are not reported here.[23] In all counties, local buyers pay somewhat less for homes than others. This result may have to do with asymmetric information, but may also be related to preferences or socio-demographics. Residents appear to not value additional bedrooms, but since we are controlling for house size, this result is likely because, ceteris paribus, more bedrooms means smaller bedrooms (or fewer and/or smaller other rooms). Properties with multiple units, including apartments, or mobile homes on a parcel reduce the price, while 'estates' receive a premium.[24] Seasonal homes have a negative and significant coefficient in 2 of 3 counties. Seasonal homes are generally homes deemed unsuitable for habitation during the winter months. Not surprisingly, parcels with more dedicated agricultural land are priced lower, controlling for acreage, and homes with open water or wetlands are more valuable. These measures are partially proxying for a home being waterfront.

The 'Model 1' results imply that proximity to wind turbines has a negative impact on property values in Clinton and Franklin Counties.[25] These proximity results are also robust to the inclusion of more detail about the location and density of nearby turbines.[26] The results of Model 2 are largely, but not entirely, consistent with those of Model 1. In Clinton and Franklin Counties we see negative impacts for having the nearest turbine within most zones representing proximity of less than 10 miles.[27] However, there are two significant estimates that imply a positive impact - between 0.5 and 1 miles away for Clinton County and between 2 and 3 miles away for Franklin County. In Lewis County, the only significant impact is a positive one at the range of

2-3 miles. These results are largely robust to changes in the size of the zones. When we include dummies for <1 miles, 1-2 mile, 2-3 miles, 3-5 miles and 5-10 miles, the positive result in Clinton County goes away, but those in Lewis and Franklin Counties remain.[28] Importantly, as illustrated in Table 5, we have relatively few observations for which the nearest turbine is within the ranges identified in these dummy variables. The implication of this is that it is relatively difficult to identify these effects. Given the small numbers, it is also possible that individual observations are having an undue impact on the estimates.

Table 8 presents results from the estimation of Equation 2 using parcel-level fixed effects. Here we see similarly negative and significant impacts of proximity to the nearest turbine in Clinton County, negative but insignificant impacts in Franklin County, and a positive but insignificant result in Lewis County. In both Clinton and Franklin Counties the estimated coefficients are somewhat smaller in magnitude in the repeat sales model than they were in the census block model, which is consistent with an endogeneity bias. The insignificance of the impacts in Franklin County is likely caused by the relatively small number of observations as the estimates presented for the ln(inverse distance) variable have p-values in the range of 0.123-0.142 which is approaching significance. In Lewis County, the proximity measure is again positive but highly insignificant. The Model 2 results are largely negative and sometimes significant in Clinton and Franklin Counties, while the only significant results in Lewis County are positive. Adjusting the specification of the dummy variables as above makes no substantial difference in the repeat sales model. Local buyers still pay less than others, but this effect is only significant in Lewis County.

5 Discussion

Overall, the results of this study are mixed as regards the effect of wind turbines on property values. In Clinton and Franklin Counties, proximity to turbines has a usually negative and often significant impact on property values, while, in Lewis County, turbines appear to have had little effect, and, in some specifications, a positive effect. One possible interpretation, since the Lewis County turbines are older, is that the impacts of turbines decay over time so that the impacts we see in Clinton and Franklin Counties may be short-run impacts. To test this, we re-ran the Lewis County analyses having cut out any transactions after 2006 to restrict ourselves to the short-run. These results were not supportive of this interpretation as, if anything, the short-term impacts in Lewis County appeared to be more positive. Another possible interpretation is that there is something about the design or placement of the facilities in Lewis versus Clinton/Franklin Counties which has reduced or eliminated the negative impact on property values. It may also be hetrogeneity in consumer preferences in the various counties that drives this dichotomy.

When turbines do impact values, the magnitude of this effect depends on how close a home is to a turbine. For Model 1, since we are using a log-log specification, the estimated coefficient on the log of the inverse distance measure represents the elasticity of price with respect to the inverse of the distance to the nearest turbine. So, a coefficient of $-\beta$ implies that a 1% increase in the inverse distance (a decrease in distance to the nearest turbine) decreases the sale price by β%. Inverse distance declines as distance increases, so this tells us that the impacts of wind turbines similarly decay. Using the estimated coefficients above, we calculate the percentage change in price from a given change in distance. These results are presented in Table 9 for Clinton and Franklin Counties using estimated βs from Model 1 at both fixed effects

levels.[29] The double log/inverse distance specification enforces that the relationship between percentage price declines and distance be convex. To test for the robustness of this assumption we also tried quadratic and cubic distance specifications which would allow for a concave rather than convex relationship. The quadratic specification confirmed the convex shape of the relationship since the linear term was positive and significant and the quadratic term was negative and significant. The quadratic and cubic terms in the cubic specification were not significant.[30]

From the repeat sales model we see that the construction of turbines such that for a given home in Clinton County the nearest turbine is now only 0.5 miles away results in a 8.8%-14.49% decline in sales price depending on the initial distance to the nearest turbine. For Franklin County, this range is 9.64%-15.81%. For the average properties in these two counties, this implies a loss in value of between $10,793 and $19,046. Obviously, at larger distances, these effects decline. At a range of 3 miles the effects are between about 2% and 8% or between $2,500 and $9,800.

Table 9 also shows that the predicted impacts are more severe when based on the census block model. In the case of Franklin County, we see declines of up to 35% at a distance of 0.5 miles. These results are indicative of endogeneity bias at this larger fixed effects scale. This is because we expect the endogeneity to take the form of turbines being located, all else equal, on lower quality, lower value land. If this is true, then we would expect our estimates to be biased downward. Our results fit this model. Nonetheless, it is heartening that the bias, particularly in Clinton County, does not appear to be especially severe.[31]

Table 10 provides the percentage price changes implied by the estimates from the Model 2 specification. The coefficients have been converted to percentage change following Halvorsen and Palmquist (1980). Although there is limited significance, as reported above, we do see significant declines in both Clinton and Franklin Counties

of up to 26% in the repeat sales model, and positive impacts, of up to 100% in Lewis County. The full sample results are less consistent. On the whole, the coefficients in the repeat sales model are smaller than those in the census block model, which is again suggestive of a selection effect being present in the full sample approaches.

It is also important to remember that our analysis includes year and month dummies to control for county-wide, market-level, price fluctuations, so we are not likely to be attributing these sorts of trends erroneously to the existence of turbines. Furthermore, looking at monthly average prices by county, unlike much of the rest of the country, our sample area did not experience any major upward trends in prices during the sample period, nor a decline towards the end. Being very rural and somewhat isolated also makes these counties relatively immune to national real estate trends.

As we began this analysis, we expected that there might be informational effects at play regarding local or non-local buyers of property since, presumably, local residents will have more information about where and when turbines might be built. We do see that local buyers, on average, pay less for properties than non-local buyers, but there does not appear to be a differential effect for these two categories in the effect of wind turbines. To test this, we ran an alternative specification of the census block model with the local-buyer dummy variable interacted with the proximity variable, and this term was not significant.

Finally, Parsons (1990) argues that the implicit hedonic prices of locational attributes of homes will vary with the size of the lot on which each home sits. We test the effects of lot size on the marginal impact of wind turbines using a lot size/proximity interaction term. In that specification of the census block model, we find that the estimated coefficient on this interaction term is positive and significant in both Clinton and Franklin Counties. This indicates that parcels with larger lots are not as badly impacted by the proximity of turbines as homes with smaller lots.

6 Conclusions

From a policy perspective, these results suggest that existing compensation schemes may not be fully compensating those landowners near wind developments, in some areas, for the externality costs that are being imposed. Existing PILOT programs and compensation to individual landowners are implicitly accounted for in this analysis since we would expect these payments to be capitalized into sales prices, and still we find largely negative impacts in two of our three counties. This suggests that landowners, particularly those who do not have turbines on their properties and are thus not receiving direct payments from wind developers, are being harmed and have an economic case to make for more compensation. That is, while the 'markets' for easements and PILOT programs may be properly accounting for harm to those who allow parcels on their property, it appears not to be accounting for harm to others nearby. This is a clear case of an uncorrected externality. If, in the future, developers are forced to account for this externality through increased payments this would obviously increase the cost to developers and make it that much more difficult to economically justify wind projects. Importantly, in Lewis County, landowners do appear to be receiving sufficient compensation to prevent decay of property values.

This study does not say anything about the societal benefits from wind power and should not be interpreted as saying that wind development should be stopped, even when the property value effects are negative. If, in fact, wind power is being used to displace fossil-based electricity generation it may still be that the environmental benefits of such a trade exceed the costs.[32] However, in comparing those environmental benefits, we must include not only costs to developers (which include easement payments and PILOT programs), but also these external costs to property owners local to new wind facilities. Property values are an important component of any

cost-benefit analysis and should be accounted for as new projects are proposed and go through the approval process.

Finally, this paper breaks with the prior literature in finding any statistically significant property-value impacts from wind facilities. We believe that this stems from our empirical approach which controls for omitted variables and endogeneity biases and employs a large sample size with reasonably complete data on home and property characteristics. Future studies which expand this sort of analysis to wind and other renewable power facilities in other regions are imperative to understanding the big picture of what will happen as these technologies grow in prominence.

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Tables and Figures

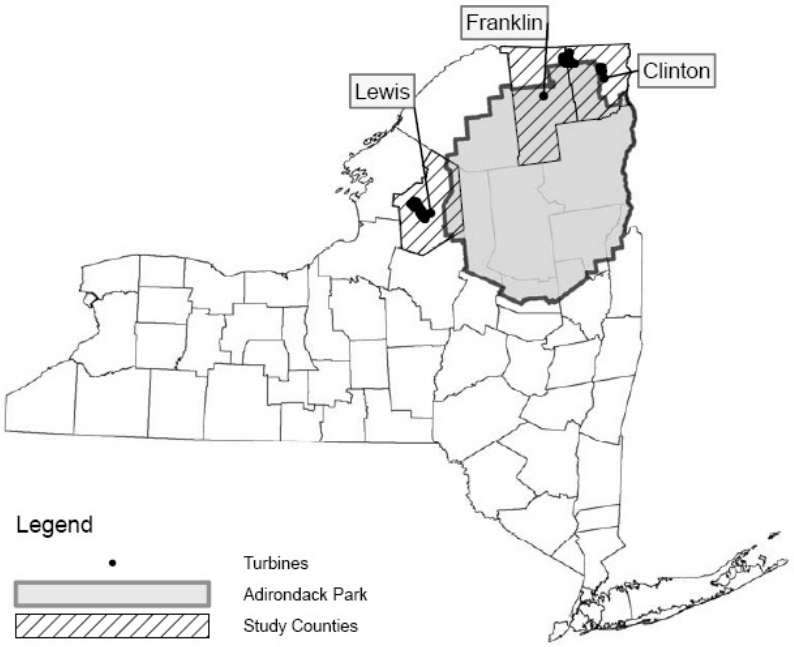


Figure 1: Study Area

Facility	County	Capacity (MW)	Turbines	Startup Year
Maple Ridge	Lewis	320	194	2006
Noble Chateaugay	Franklin	106.5	71	2009
Noble Belmont	Franklin	21	14	N/A
Noble Altona	Clinton	97.5	65	2009
Noble Clinton	Clinton	100.5	67	2008
Noble Ellenburg	Clinton	81	54	2008

Table 1: Study Area Wind Facilities

Geographic Area	**2008 Median Income ($)**	**2000 Pop. Density (ppl/sq. mi.)**	**2008 Median Value Owner-Occupied Homes ($)**
United States	52,029	86.8	119,600
New York State	55,980	401.9	148,700
Clinton	49,988	76.9	84,200
Franklin	40,643	31.4	62,600
Lewis	41,837	21.1	63,600

Table 2: Study Area Demographics (SOURCE: U.S. Census)

Description of Dataset	Source
Turbine Locations, Lewis County	Lewis County
Turbine Locations, Clinton & Franklin Counties	2009 Orthoimagery
2000-2009 Property Sales	NYS Office of Real Property Services (NYSORPS)
2009 Parcel Layer	Clinton, Franklin and Lewis Counties
2009 Parcel Level Details	NYSORPS
80-Meter Wind Potential	AWS Truepower
Census Blocks	NYS GIS Clearinghouse
Elevations	Cornell U. Geospatial Info. Repository
Land Cover	USGS
Streets	NYS GIS Clearinghouse

Table 3: Data Sources

	Clinton		Franklin		Lewis	
Variable	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Sale Price ($)	$122,645	$83,603	$120,466	$354,556	$81,740	$63,207
Building Age (years)	37	41	49	109	50	42
Living Area (sq. ft.)	1,609	611	1,447	643	1,538	690
Lot Size (acres)	5.9	39.3	6.8	25.6	9.0	27.2
Distance to Nearest Major Road (Feet)	1,549	2,493	1,861	3,189	6,094	6,628
Value of Included Personal Property ($)	$63	$965	$324	$6,995	$204	$2,678
Buyer from Local Area	0.913	0.282	0.790	0.407	0.684	0.465
Home in established Village	0.049	0.215	0.395	0.489	0.261	0.439
Full Bathrooms	1.615	0.647	1.312	0.618	1.287	0.630
Half Bathrooms	0.332	0.495	0.226	0.441	0.229	0.431
Bedrooms	3.134	0.936	2.829	1.051	2.929	1.140
Fireplaces	0.306	0.544	0.245	0.484	0.167	0.416
Excellent Grade Building Quality	0	0	0	0	0.0005	0.023
Good Grade Building Quality	0.031	0.173	0.019	0.137	0.013	0.112
Average Grade Building Quality	0.833	0.373	0.584	0.493	0.639	0.480
Economy Grade Building Quality	0.136	0.342	0.381	0.486	0.317	0.465
Minimum Grade Building Quality	0.001	0.028	0.016	0.127	0.031	0.174
Single-Family	0.859	0.348	0.755	0.430	0.677	0.468
Single-Family +Apt	0.001	0.025	0	0	0	0
Estate	0.0002	0.013	0.003	0.058	0	0
Seasonal Residences	0.032	0.175	0.111	0.314	0.181	0.385
Multi-Family Properties	0.054	0.226	0.046	0.209	0.043	0.203
Acreage/Residences with Ag Uses	0.043	0.202	0.054	0.226	0.054	0.225
Mobile Home(s)	0.0003	0.018	0.002	0.039	0.006	0.075
Other Residential Classes	0.007	0.081	0.012	0.107	0.011	0.106
Primarily Agricultural Use	0.005	0.071	0.018	0.135	0.029	0.168
Percent of Parcel Forested	0.202	0.324	0.269	0.353	0.319	0.371
Percent of Parcel Open Water	0.011	0.077	0.031	0.127	0.024	0.123
Percent of Parcel Fields/Grass	0.160	0.293	0.139	0.277	0.292	0.356
Percent of Parcel Wetlands	0.041	0.147	0.068	0.172	0.067	0.170
Percent of Parcel Developed	0.444	0.448	0.226	0.369	0.134	0.293
Percent of Parcel Open	0.141	0.256	0.268	0.344	0.164	0.290
Observations	6,142		3,251		1,938	

Table 4: Summary Statistics by County

	Full Sample Dataset				Repeat Sales Dataset			
Range	Clinton	Franklin	Lewis	Total	Clinton	Franklin	Lewis	Total
0-0.5 Miles	6	4	15	25	3	2	3	8
0.5-1 Miles	11	23	25	59	6	6	7	19
1-1.5 Miles	14	25	32	71	7	6	7	20
1.5-2 Miles	19	27	42	88	8	7	11	26
2-3 Miles	42	39	137	218	17	13	39	69
Total	92	118	251	461	41	34	67	142

Table 5: Count of Transactions with Turbines in Specified Ranges

	Clinton			Franklin			Lewis		
Variable	Mean	Std. Dev.	Max.	Mean	Std. Dev.	Max.	Mean	Std. Dev.	Max.
Distance to Nearest Turbine (miles, date of sale)	95.2	60.5	140.0	98.3	60.0	148.0	25.7	25.2	64.0
Distance to Nearest Turbine (miles, in 2009)	11.1	4.3	28.9	22.8	14.6	53.5	9.6	6.2	26.7
Inverse Distance to Nearest Turbine (date of sale)	0.05	0.19	8.23	0.04	0.21	7.81	0.24	3.18	151.97
Nearest Turbine is within 0.5 Miles	0.0010	0.031	1	0.0012	0.035	1	0.0012	0.035	1
Nearest Turbine is in the range 0.5 - 1 Miles	0.0008	0.029	1	0.0058	0.076	1	0.0058	0.076	1
Nearest Turbine is in the range 1 - 1.5 Miles	0.0005	0.022	1	0.0009	0.030	1	0.0009	0.030	1
Nearest Turbine is in the range 1.5 - 2 Miles	0.0008	0.029	1	0.0006	0.025	1	0.0006	0.025	1
Nearest Turbine is in the range 2 - 3 Miles	0.0037	0.061	1	0.0055	0.074	1	0.0055	0.074	1
Nearest Turbine is in the range 3 - 5 Miles	0.011	0.105	1	0.010	0.100	1	0.136	0.343	1
Nearest Turbine is in the range 5 - 10 Miles	0.104	0.306	1	0.016	0.127	1	0.236	0.425	1
Number of Turbines between 0 and 0.5 Miles	0.008	0.279	16	0.009	0.311	16	0.042	0.514	10
Number of Turbines between 0.5 and 1 Miles	0.028	0.686	23	0.038	0.561	15	0.113	1.120	21
Number of Turbines between 1 and 1.5 Miles	0.046	0.987	36	0.056	0.800	23	0.209	1.711	25
Number of Turbines between 1.5 and 2 Miles	0.062	1.250	43	0.071	0.985	34	0.298	2.091	29
Number of Turbines between 2 and 3 Miles	0.133	2.387	87	0.242	2.574	60	1.096	5.532	50
At Least 1 Turbine between 0 and 0.5 Miles	0.001	0.037	1	0.002	0.039	1	0.010	0.100	1
At Least 1 Turbine between 0.5 and 1 Miles	0.002	0.048	1	0.007	0.081	1	0.016	0.127	1
At Least 1 Turbine between 1 and 1.5 Miles	0.003	0.054	1	0.007	0.084	1	0.020	0.142	1
At Least 1 Turbine between 1.5 and 2 Miles	0.004	0.061	1	0.008	0.090	1	0.029	0.167	1
At Least 1 Turbine between 2 and 3 Miles	0.009	0.094	1	0.013	0.113	1	0.071	0.257	1

Table 6: Summary Statistics for Wind Turbine Variables - All Parcels

	Clinton		Franklin		Lewis	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
ln(Inverse Distance to Nearest Turbine)	-0.052***	-	-0.111***	-	0.036	-
Nearest Turbine is within 0.5 Miles	-	-0.223	-	-0.288*	-	0.389
Nearest Turbine is in the range 0.5 - 1 Miles	-	0.380*	-	-0.417***	-	-0.909
Nearest Turbine is in the range 1 - 1.5 Miles	-	-0.282**	-	-0.492	-	-0.559
Nearest Turbine is in the range 1.5 - 2 Miles	-	-1.086*	-	0.137	-	0.031
Nearest Turbine is in the range 2 - 3 Miles	-	-0.001	-	0.242*	-	0.213*
Nearest Turbine is in the range 3-5 Miles	-	-0.048	-	-0.230	-	0.070
Nearest Turbine is in the range 5-10 Miles	-	-0.054	-	-0.116	-	-0.021
Distance to Nearest Major Road (Feet)	0.000	0.000	-0.000***	-0.000***	-0.000	-0.000
Value of Included Personal Property ($)	0.000	0.000	0.000***	0.000***	0.000**	0.000**
Buyer from Local Area	-0.088***	-0.090***	-0.199***	-0.204***	-0.054	-0.053
Home in established Village	-0.384***	-0.385***	0.192**	0.201***	-0.079	-0.097
ln(Lot Size)	0.002	0.002	0.085***	0.086***	0.052	0.055
Living Area (sq. ft.)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Building Age (years)	-0.002***	-0.002***	-0.002***	-0.002***	0.002	0.002
Building Age Squared	0.000***	0.000***	0.000***	0.000***	-0.000**	-0.000**
Full Bathrooms	0.057***	0.057***	0.157***	0.162***	0.119**	0.114**
Half Bathrooms	0.125***	0.125***	0.184***	0.189***	0.183***	0.184***
Bedrooms	-0.007	-0.007	0.018	0.015	0.002	0.003
Fireplaces	0.124***	0.124***	0.268***	0.270***	0.140***	0.142***
Excellent Grade Building Quality	-	-	-	-	0.150	0.094
Good Grade Building Quality	0.197***	0.194***	0.082	0.095	-0.136	-0.127
Economy Grade Building Quality	-0.160***	-0.156***	-0.325***	-0.323***	-0.301***	-0.303***
Minimum Grade Building Quality	-0.680*	-0.664*	-0.588***	-0.587***	-0.706***	-0.705***
Single-Family +Apt	-0.743*	-0.756*	-	-	-	-
Estate	0.407***	0.406***	0.819**	0.813**	-	-
Seasonal Residences	-0.169**	-0.171**	0.160	0.155	-0.153*	-0.157*
Multi-Family Properties	-0.178***	-0.180***	-0.271***	-0.275***	-0.323***	-0.336***
Acreage/Residences with Ag Uses	-0.041	-0.051	-0.368***	-0.372***	0.057	0.054
Mobile Home(s)	-0.282***	-0.299***	-1.504***	-1.482***	-0.736	-0.752
Other Residential Classes	0.349***	0.339***	-0.206	-0.207	0.201	0.199
Primarily Agricultural Use	-0.193	-0.167	0.110	0.101	-0.248	-0.292
Percent of Parcel Forested	-0.106*	-0.107*	0.038	0.035	0.105	0.116
Percent of Parcel Open Water	0.601***	0.599***	1.509***	1.515***	0.684***	0.699***
Percent of Parcel Fields/Grass	-0.086	-0.083	-0.163**	-0.175**	0.056	0.069
Percent of Parcel Wetlands	0.165**	0.165**	0.237*	0.234*	0.261*	0.294**
Percent of Parcel Developed	0.142***	0.139***	-0.186***	-0.187***	-0.056	-0.054
Constant	10.387***	10.653***	9.877***	10.445***	10.246***	10.108***
Number of Observations	6,142	6,143	3,251	3,251	1,938	1,938
Adjusted R^2	0.277	0.277	0.331	0.328	0.229	0.235
Year and Month Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Errors	Yes	Yes	Yes	Yes	Yes	Yes
note: *** p<0.01, ** p<0.05, * p<0.1						

Table 7: Regression Results (Coefficient Estimates) - Census Block Fixed Effects

	Clinton		Franklin		Lewis	
Variable	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
ln(Inverse Distance to Nearest Turbine)	-0.041**	-	-0.044	-	0.034	-
Nearest Turbine is within 0.5 Miles	-	-0.109	-	-0.065	-	0.435
Nearest Turbine is in the range 0.5 - 1 Miles	-	-0.059	-	-0.027	-	-0.050
Nearest Turbine is in the range 1 - 1.5 Miles	-	0.038	-	-	-	0.740***
Nearest Turbine is in the range 1.5 - 2 Miles	-	0.103	-	-0.302**	-	0.420*
Nearest Turbine is in the range 2 - 3 Miles	-	-0.106*	-	-0.036	-	-0.180
Nearest Turbine is in the range 3-5 Miles	-	-0.166***	-	-0.095	-	-0.008
Nearest Turbine is in the range 5-10 Miles	-	0.070	-	-0.019	-	-0.011
Buyer from Local Area	-0.057	-0.059	-0.046	-0.044	-0.150*	-0.163**
Constant	10.955***	11.162***	10.231***	10.458***	10.504***	10.389***
Number of Observations	2,259	2,259	1,077	1,077	633	633
Adjusted R^2	0.2	0.199	0.233	0.229	0.284	0.297
Year and Month Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Errors	Yes	Yes	Yes	Yes	Yes	Yes
note: *** p<0.01, ** p<0.05, * p<0.1						

Table 8: Regression Results (Coefficient Estimates) - Repeat Sales

	Clinton County		Franklin County	
Distance to Nearest Turbine (Miles)	Repeat Sales	Census Block	Repeat Sales	Census Block
Initial Distance=25 Miles	$\beta = -0.041^{**}$	$\beta = -0.052^{***}$	$\beta = -0.044$	$\beta = -0.111^{***}$
0.1	19.82	27.80	21.57	45.82
0.25	16.82	23.79	18.34	40.02
0.5	14.49	20.61	15.81	35.22
1	12.08	17.30	13.21	30.04
2	9.61	13.84	10.52	24.45
3	8.13	11.76	8.91	20.97
Initial Distance= 15 Miles				
0.1	18.16	22.94	19.79	42.66
0.25	15.11	19.18	16.49	36.52
0.5	12.72	16.21	13.90	31.44
1	10.27	13.14	11.23	25.96
2	7.74	9.95	8.48	20.04
3	6.23	8.03	6.84	16.36
Initial Distance= 5 Miles				
0.1	14.49	18.41	15.81	35.22
0.25	11.29	14.43	12.35	28.29
0.5	8.80	11.28	9.64	22.55
1	6.23	8.03	6.84	16.36
2	3.60	4.65	3.95	9.67
3	2.02	2.62	2.22	5.51
note: *** p<0.01, ** p<0.05, * p<0.1				

Table 9: Estimated Percentage Price Declines using Model 1, Selected Distances

	Repeat Sales			Census Block		
	Clinton	Franklin	Lewis	Clinton	Franklin	Lewis
Nearest Turbine is within 0.5 Miles	-10.37	-6.33	54.53	-19.98	-25.02*	47.48
Nearest Turbine is in the range 0.5 - 1 Miles	-5.73	-2.63	-4.88	46.29*	-34.07***	-59.71
Nearest Turbine is in the range 1 - 1.5 Miles	3.87	-	109.50***	-24.60**	-38.85	-42.83
Nearest Turbine is in the range 1.5 - 2 Miles	10.87	-26.10**	52.17*	-66.25*	14.73	3.15
Nearest Turbine is in the range 2 - 3 Miles	-10.06*	-3.58	-16.45	-0.08	27.44*	23.79*
Nearest Turbine is in the range 3-5 Miles	-15.29***	-9.06	-0.75	-4.71	-20.56	7.26
Nearest Turbine is in the range 5-10 Miles	7.30	-1.90	-1.08	-5.22	-10.94	-2.08
note: *** p<0.01, ** p<0.05, * p<0.1						

Table 10: Estimated Percentage Price Changes using Model 2

Notes

[1]Data on the recent and future expected growth of wind energy are derived from the Energy Information Administration of the U.S. Department of Energy (`http://www.eia.doe.gov`).

[2]These symptoms are described by Nina Pierpont in her book on the topic, *Wind Turbine Syndrome* published in 2009.

[3]Renee Mickelburgh et al., "Huge protests by voters force the continent's governments to rethink so-called green energy", Sunday Telegraph (London), April 4, 2004, p. 28.

[4]See the DOI's Cape Wind Fact sheet (`http://www.doi.gov/news/doinews/upload/04-28-10-Cape-Wind-Fact-Sh pdf`) for details on the regulatory process surrounding the project.

[5] "WPEG sues Cape Vincent; Petition asks judge to nullify approval of impact statement," *Watertown Daily Times*, October 28, 2010.

[6] "Not on My Beach, Please," *The Economist*, August 19, 2010.

[7] "Cape Vincent Wind Turbine Development Economic Impact - Final Report", Submitted by Wind Turbine Economic Impact Committee, Town of Cape Vincent, NY, October 7, 2010.

[8]Department of Energy (`http://www.windpoweringamerica.gov/wind_installed_capacity.asp`).

[9]Department of Energy (`http://www.windpoweringamerica.gov/wind_maps.asp`).

[10]NYS Dept. of Environmental Conservation (`http://www.dec.ny.gov/docs/permits_ej_operations_pdf/windstatuscty.pdf`).

[11]The Final Environmental Impact Statement for the Noble Belmont project in Franklin County was completed in conjunction with the Noble Chateaugay project. Construction for the combined project consisting of 85 turbines was initiated in 2008. While 71 turbines were brought online in 2009, site work for the additional 14 turbines was completed but the turbines themselves were never installed. Since the turbine bases are visible from ortho-imagery and the project environmental review was completed as a single project, these locations have been included in our analysis.

[12]In our repeat sales sample there are 3,251 transactions of parcels that sold twice, 649 that sold three times, 55 that sold four times, and 14 that sold 5 times. All of these that sold four or more times were hand-checked to make sure they seemed reasonable (no multiple sales in the same month, big jumps in price, etc.), and some were eliminated. We also eliminated all transactions that sold more often than this because it appeared that they were parcels that had been subdivided.

[13]For a summary and background on the use of hedonic analysis see Taylor (2003) or Freeman (2003).

[14]We measure the linear distance rather than road network distance since the effects are not a matter of travel to or from the turbines, but instead simple proximity.

[15]For Clinton and Franklin Counties, in fact, there is virtually no effect of this change. For Lewis County, making this change makes the effects of proximity more negative and more significant.

[16]For a thorough treatment of fixed effects analysis, see Wooldridge (2002).

[17]Repeat sales analysis was first developed by Bailey, Muth, and Nourse (1963) in the context of creating real estate price indices. Palmquist (1982) is the first application to environmental economics. There are many examples since then including Parsons (1992) and Gayer, Hamilton, and Viscusi (2002).

[18]To save space, results for the Census block-group analyses are not presented.

[19]We also attempted an instrumental variables approach to this problem using two instruments - the wind potential of each parcel and the elevation of each parcel. The first was strongly correlated with the location of turbines, but also correlated with property values - parcels that are exposed to higher winds are less desirable. The second instrument was not correlated with property values in our sample, but was not a strong predictor of the location of turbines. For these reasons, we abandoned this approach.

[20]F-Tests did not support pooling in the block and block-group level fixed effects analyses because coefficient estimates were significantly different across counties. Pooling of Franklin and Lewis Counties was supported in the repeat sales analysis, but, for simplicity, we have chosen to conduct separate analyses throughout.

[21]Spatial autocorrelation, when applied at the property level in a repeat sales analysis, is similar to serial correlation in that the error term in one transaction is likely to be correlated with the error term in a transaction of the same property at a different date.

[22]In other specifications, we also included a combination of dummy and count variables describing the number of turbines in various ranges up to 3 miles from the parcel. These variables, however, were highly collinear with each other and so estimates were largely insignificant and inconsistent.

[23]These two variables are negatively correlated in our sample. The correlation coefficient is -0.2854.

[24]Estates are defined according to NYSORPS as "A residential property of not less than 5 acres with a luxurious residence and auxiliary buildings."

[25]The interpretation of the coefficient value is somewhat complicated and will be discussed in more detail below.

[26]We also run a series of specifications including other continuous distance measures, as well as dummy and count variables representing geographic ranges up to 3 miles from a parcel. The results of the other distance specifications, while not reported here, are broadly consistent with the results of the log of the inverse distance estimation (Model 1) in that turbines do not seem to impact property values in Lewis County, but have largely negative and significant impacts in Clinton and Franklin Counties. The dummy and count variable results suffer from multi-collinearity, and are difficult to interpret.

[27]Implicitly, the omitted category is those parcels with the nearest turbine being more than 10 miles away.

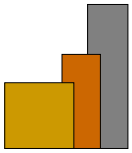
[28]These results are not reported in detail for space considerations.

[29]These results, being based on Model 1 in the tables, do not take into account the dummy or count variables estimates since these are so inconsistent and suspect because of the collinearity.

[30]We also tested log-linear inverse distance and log-linear distance specifications and the results were consistent with those reported here. There was no evidence that these alternative specifications provided a better fit to the data.

[31]Although we do not report results here, estimates from the census block group model show a somewhat larger bias with larger negative effects from wind turbine proximity.

[32]This is the subject of a recent working paper by Kaffine et al. (2011). Their analysis suggests that, in NY, wind is unlikely to create substantial emissions reductions because of the small share of electricity provided by coal-fired generators.



McCann Appraisal, LLC

January 6, 2011

Christopher Senie
Attorney at Law
5 East Main Street, 2nd Floor
Westborough, MA 01581

Re: Property Value Impact & Zoning evaluation
Cape & Vineyard Electric Cooperative (CVEC)
Freeman's Way Municipal Wind Project
Commerce Park Road
Brewster, Massachusetts

Dear Mr. Senie:

As requested, I am submitting this real estate impact evaluation for your consideration and use in addressing the compliance of the proposed CVEC facility with the Town of Brewster Zoning Code, as described for Special Permit approval of Wind Energy Turbines.

The approval criteria I have specifically evaluated are codified under **§179-40.2. J. (2) (a) & (b)**, as follows:

(a) The proposed WET will not have an undue adverse impact on historic resources, scenic views, natural resources, and/or residential property values;

(b) The applicant has agreed to implement all reasonable measures to mitigate the potential adverse safety, environmental, and aesthetic impacts of the WET.

Further Special Permit criteria have been evaluated pursuant to **§179-51.A.(5) (a) [2]**, as follows:

The location, type, character and size of the use/ building, or other structure in connection therewith, will be in harmony with the visual character of the neighborhood, including views and vistas and, where applicable, the historic character of the neighborhood.

Also applicable from a real estate, land use and zoning perspective are the requirements for a Special Permit described under **§179-67.E.(6)**, and all uses requiring a special permit under this Article shall meet the following standards as a condition of approval.

(6)Buildings and architectural design shall be compatible with the character and scale of the adjacent roadway and surrounding neighborhood.

Professional Opinions

My professional opinions are effective as of the current date. My evaluation and this Consulting Report have been prepared and submitted pursuant to applicable licensing laws that mandate compliance with the Uniform Standards of Professional Appraisal Practice (USPAP), and my opinions are certified accordingly.

Briefly stated, based upon my review of the proposed CVEC facility, location, the density, height, type and intensity of the proposed utility scale turbines, the proposed use does not comply with the applicable Brewster Code (Code), as it is not compatible with adjacent and nearby residential uses and, specifically, will have a significant averse effect on the market value of the neighboring residential property.

Further, the Applicant has failed to even attempt to mitigate the impact on aesthetics and values of residential properties, as could have been accomplished to some degree with the provision for an owner/developer Property Value Guarantee (PVG).

While the Brewster Code focuses on undue adverse impact criterion for residential property values, I am also aware of potential impacts on the ability to continue to use a radio transmission facility, a municipal golf course and two (2) facilities nearby that are currently used for elderly housing and care; the Pleasant Bay nursing home and the Woodlands assisted living facility, which are less than ½ mile from the nearest proposed turbine..

My specialized and unique experience with utility scale wind energy developments, as well as 30 years of real estate, land use evaluation and appraisal background has enabled and qualified me to evaluate whether the proposed CVEC facility meets the criteria described in the Brewster Code. The basis for my professional opinions are described and summarized herein.

CVEC Facility - Background

The developers for the CVEC facility seek to locate two (2) turbines of approximately 410 feet in height each (tip of blade) adjacent to single family homes, nursing/assisted living facilities, a municipal golf course, athletic fields, etc. The underlying land for the turbines is reportedly owned by the Town of Brewster, and comprises two (2) lots, (1 & 32) on Assessor's Map # 131. The site itself is zoned industrial, within the partially occupied Freeman's Way Commerce park development.

In order to better understand the character of the subject neighborhood and subject property setting therein, I have reviewed maps, photographs, the Special Permit Application prepared by Weston & Sampson dated October 18, 2010 and which has been submitted to the Brewster Planning Board Members, inclusive of the site plan photo simulations of the subject location, noise study, etc. I have also reviewed the CVEC website and documents, maps and photographs contained therein.

The issue of impact from industrial scale turbines on the property value of residential owners is the primary focus of the following property value evaluation, as property values are an objective measure of the desirable characteristics of any community.

The Brewster community, overall, and land uses nearest the subject property are also the focus of this evaluation, as the impacts from existing turbines are well documented as being present at residential homes and some impacts have been measured as distant as 2 to 3 miles from turbines.

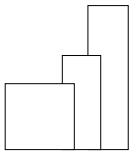
The contrast of such man made towers with natural views and the highly valued amenity derived from views is analyzed herein, with focus on ratings of the view from, or “Vista” of residential properties.

It is important to understand that high quality or natural views are an asset to real estate market values and, in particular, residential property and land. Other types of “value” can be identified and described in non-real estate terminology, but my focus as an appraiser is on the market value of property.

Similarly, detraction from such premium views can and does have a measurable adverse effect on residential property values. This is well studied in the real estate appraisal profession, and in fact by proponents of wind energy funded by the USDOE such as:

- ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY The Impact of Wind Power Projects on Residential Property Values in the United States: Ben Hoen, Ryan Wiser, et al, Environmental Energy Technologies Division December 2009. (LBNL)

This USDOE funded study is often cited by wind energy developers to claim there is no value impact from such projects, even though the ***study acknowledges that nearby properties may experience losses*** and further recommends that more study in the immediate project areas is needed. This study is useful to understanding the probable impact from the CVEC turbine facility.



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VISTA IMPAIRMENT

In the LBNL study, the authors attempt to analyze the impact of wind projects on residential property values. They also separately address the statistically measured impact on residential values from scenic vistas, or views based on ***regression analysis of over 4,700 sale transactions,*** for this component of the study***.***

As graphically depicted within the LBNL report (pg xiii) on Figure ES-2, the following observations are prima facie evidence that impairment of scenic views results in a measurable loss of property values, as follows:

- A premium Vista adds 13% of value over and above the value of an average vista.
- A poor vista results in values 21% below the base-line average vista.
- An above average vista adds 10% to the value of an average vista.
- A below average vista reflects values 8% lower than an average vista.

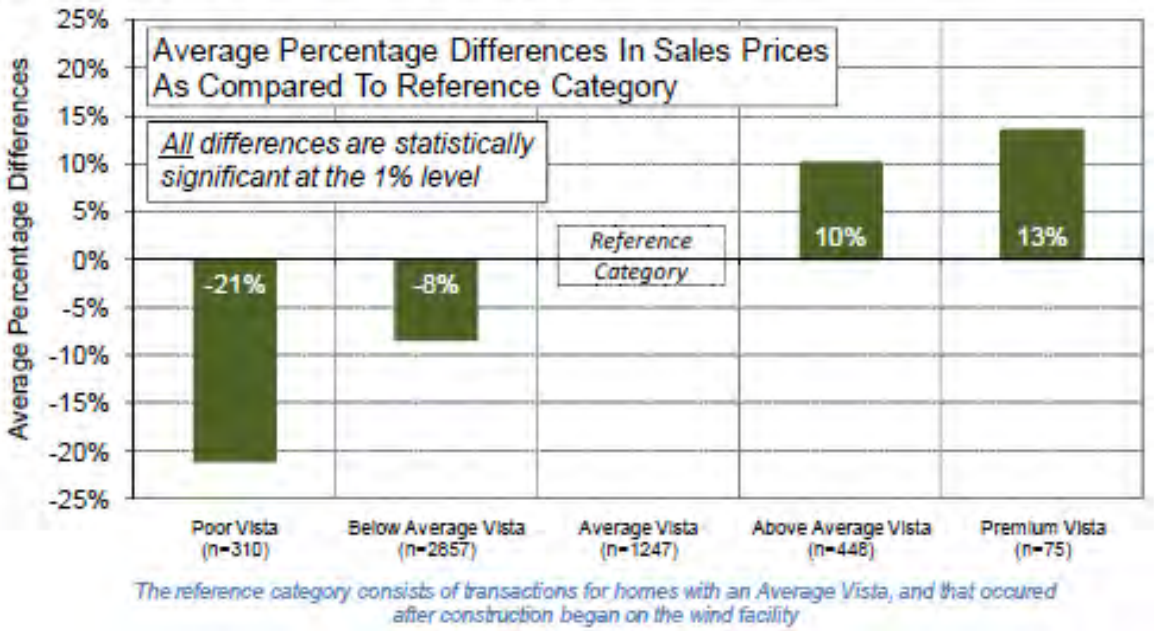
To illustrate examples of the LBNL findings as it applies to the impairment of vistas for residential property, it is first acknowledged that the vista of any given residential property is going to be rated differently before introduction of a utility scale wind energy facility which will later have a view of the facility, albeit at varied distances.

My review of photographic evidence of existing vistas in the immediate subject property location adjacent to the project area indicates similarity with premium, above average and average vistas, as defined and characterized in the LBNL report. On balance, the LBNL report provides examples of premium, above average, average, below average and poor vistas.

Less natural, industrialized vistas have inferior ratings, and the extremely close proximity of a 410 foot turbine, as represented by a distance of 1,800 feet to the nearest residence (McCann Exhibit C), and other distances to residential and senior housing/care uses of well under 1 mile, represents an extreme impairment of the existing neighborhood vista, and the character of the neighborhood that pre-exists the CVEC project.

In my opinion, below average and poor vista ratings are consistent with the impairment of vistas that will be caused by the CVEC facility itself. ***(see McCann Exhibit A)***

Figure ES-2: Base Model Results: Scenic Vista



Source: December 2009 LBNL report

Thus, in project area residential locations with a premium vista, a turbine facility downgrading the amenity to a poor or below average vista will result in a **value loss of 21% to 34%.** Similarly, residential property possessing a current average vista, if downgraded to poor or below average vista from the CVEC facility will suffer **between 8% and 21% value diminution.**

At approximately 410 feet in height, the view of the FGWP facility will be present at considerable distances that extend beyond the nearest residential property, particularly if a blinking light is required at night for aviation safety purposes.

In addition to the findings of the LBNL research report, I have also considered several peer reviewed studies published in The Appraisal Journal, that relate to value losses and impairment caused by other industrial "towers", such as cell towers, high voltage transmission lines, as well as the higher values that are derived from premium views from residential property.

Each of these studies generally confirms the findings summarized by the data reflected in LBNL Figure ES-2, and are maintained in the appraiser's work file for future reference.

NUISANCE IMPAIRMENT

For many residents, the introduction of a utility scale turbine facility will constitute a nuisance, based on the unprecedented height and the impairment of aesthetics related thereto, the blinking aviation light in the night sky, if required by the FAA, etc.

Nuisances are also created by noise from wind generators, and have been well documented by the "market" as being highly disruptive to the peaceful use and enjoyment of residential homes at levels well below the 10 dBa above ambient standard cited in the Brewster Code. In short, compliance with noise codes does NOT insure against nuisances being created by actual noise levels.

The complaints, personal accounts and factual experiences described by hundreds of individual "neighbors" to turbines comport with the technical descriptions and medical studies of sub-audible noise, also referred to as ultra-sound, infra-sound, low frequency noise, and which is not audible to the typical human ear in the normally expressed manner.

These real-life (not "modeled") nuisance descriptions are typically ignored, discounted or denied by wind developers, even though there are numerous examples of developers buying out or settling with nearby homeowners who have suffered from the same range of effects commonly known as "Wind Turbine Syndrome". These noise effects and nuisances related thereto have been documented in excess of 2 to 3 miles from the nearest turbines.

The LBNL study attempts to separately isolate the impact of nuisance on value, as depicted in the following Figure ES-1 from the LBNL study.

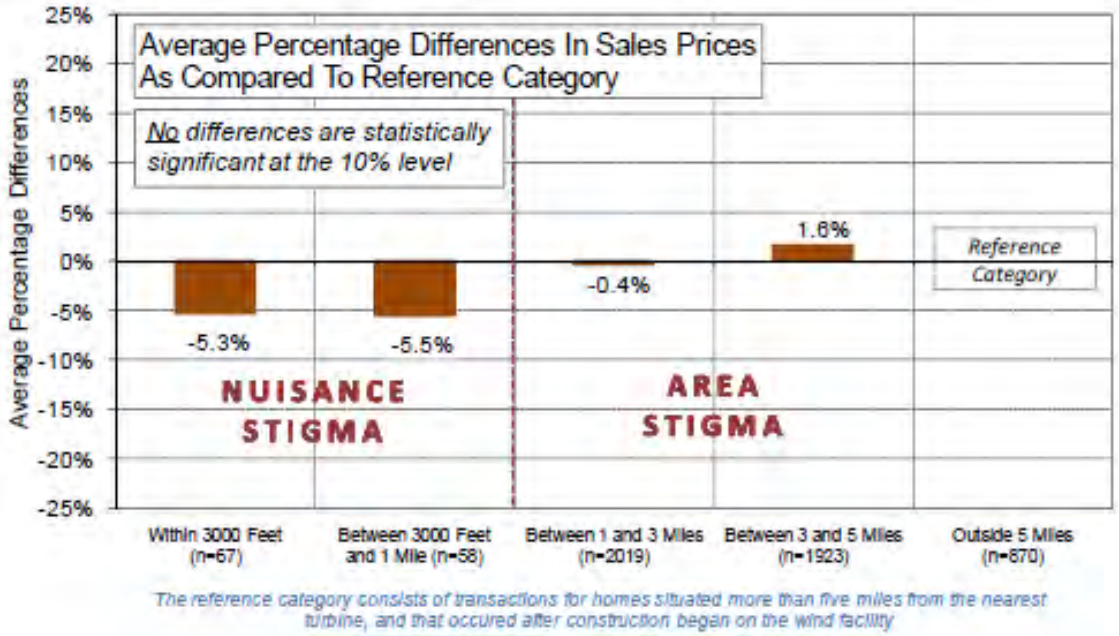
This figure separates the nuisance by distance from residential property, and clearly reveals that properties in the 3,000 feet and less, and 3,000 feet to 1-mile range **suffer value loss of 5.3% to 5.5%,** respectively.

While the LBNL report author discounts the statistical significance of their own findings, this dismissal of relevance must be understood in the context of the largely irrelevant data from greater distances having provided the baseline property characteristics in a disproportionately sized data pool or sample, and which "waters down" the statistical indications.

The LBNL report must also be understood as a study commissioned with the intent of furthering the government policy of expanding wind energy development in the United States.

Nevertheless, even exclusion of certain impacted property data, or the disproportionate inclusion of data from 5 to 10 miles distant, did not eliminate the downward indication of value resulting from proximity to a nuisance, as depicted in the following figure:

Figure ES-1: Base Model Results: Area and Nuisance Stigma

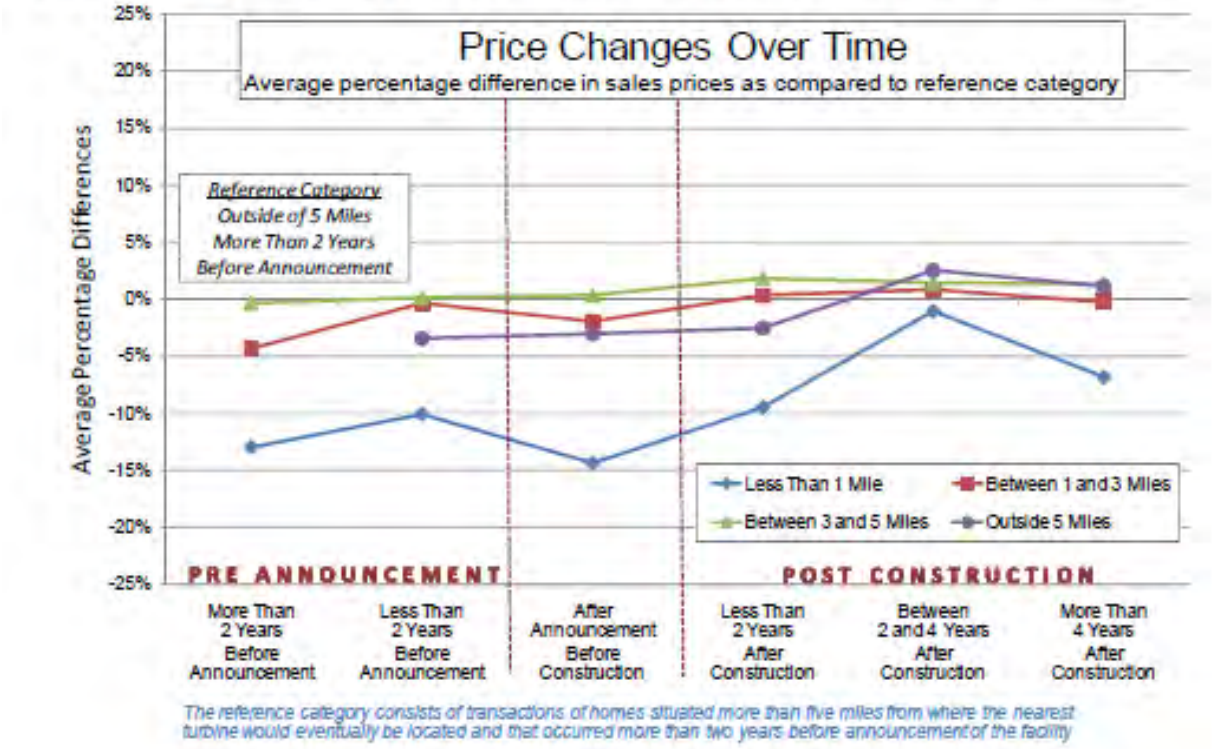


Source: December 2009 LBNL report

Pre-Construction "Constructive Notice" of Turbine Facilities

Further, the following LBNL study Figure ES-4 depicts value changes over time, at varied distance from wind turbines. The applicability of this focus of the LBNL study to the subject CVEC facility can be understood in the post-announcement but pre-construction phase of turbine projects, at which point "constructive notice" has been served on surrounding neighbors and property owners. Properties within 1-mile of such projects reflect the largest decline in value, and **confirm that a utility scale wind energy facility has measurable negative impact on property values within 1-mile**. Even the 3 to 5 mile range shows that values did not increase post-construction, when the control group of home sales outside 5 miles were increasing in value, nothing located within 5 miles indicated comparable value increases.

Figure ES - 4: Temporal Aspects Model Results: Area and Nuisance Stigma



The reference category consists of transactions of homes situated more than five miles from where the nearest turbine would eventually be located and that occurred more than two years before announcement of the facility

The LBNL study is not the only pro-wind study that refutes the claims of developers regarding property value loss, due to their utility scale wind energy projects. A recent study focuses more on the pre-construction or "constructive notice" phase of development, as characterized by the pending application for the CVEC facilities.

A separate academic study conducted by Jennifer L. Hinman, Illinois State University, WIND FARM PROXIMITY AND PROPERTY VALUES: A POOLED HEDONIC REGRESSION ANALYSIS OF PROPERTY VALUES IN CENTRAL ILLINOIS

The background of this study author is a Master's Thesis, prepared by the author in partial fulfillment of degree requirements. ISU is heavily funded by wind energy developers, the American Wind Energy Association, the USDOE and other grant programs that are decidedly "pro-wind", and which seek to refute the actual experience of many neighbors to such projects.

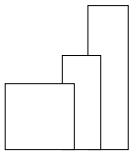
In fact, ISU newsletters disclose that "corporate partners" that include wind energy development companies have access to the renewable energy programs, include advising on research direction and the right to review any applied research developed by ISU.

An excerpt of the Hinman report is presented as follows:

This study uses 3,851 residential property transactions from January 1, 2001 through December 1, 2009 from McLean and Ford Counties, Illinois. This is the first wind farm proximity and property value study to adopt pooled hedonic regression analysis with difference-in-differences estimators. This methodology significantly improves upon many of the previous methodologies found in the wind farm proximity and property value literature. ***The estimation results provide evidence that a "location effect" exists such that before the wind farm was even approved, properties located near the eventual wind farm area were devalued in comparison to other areas****. Additionally, the results show that property value impacts vary based on the different stages of wind farm development. These stages of wind farm development roughly correspond to the different levels of risk as perceived by local residents and potential homebuyers. Some of the estimation results support the existence of "wind farm anticipation stigma theory," meaning that* ***property values may have diminished in "anticipation" of the wind farm*** *after the wind farm project was approved by the McLean County Board. Wind farm anticipation stigma is likely due to the impact associated with a fear of the unknown, a general uncertainty surrounding a proposed wind farm project regarding the aesthetic impacts on the landscape, the actual noise impacts from the wind turbines, and just how disruptive the wind farm will be*

Property Value Guarantee (PVG)

Approval of wind energy facilities have served as constructive notice of future plans for development of wind turbine projects, and property values have been shown to decline based on pre-construction anticipation of wind projects. As such, there is ample evidence to either deny such related projects within 1 to 3 miles of homes or require a PVG.



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I note the CVEC application is devoid of any such guarantee for any home or property owner, much less the Town of Brewster residents who live within 1, 2 or 3 miles from the proposed turbines.

Despite all the industry claims to the contrary, significant value impacts have in fact occurred, and have even resulted in the abandonment of homes, as well as nuisances, health problems, etc. A sampling of nuisance and health testimonials from people living near turbines is included in **McCann Exhibit D,** which contains web page and news links.

As a personal observation, in 30 years of appraising and studying real estate values, damages claims, zoning and land use issues, I have never before observed such a widespread and consistent series of similar, negative reports coming from residents living by any other type of facility. It is an observable trend in the market, both for owner-occupants and the home-buying market.

Even the principal author of the LBNL study, Ben Hoen, now recommends implementation of Property Value Guarantees (PVG's) in the context of wind energy project mitigation of impacts.

(see page 32 of linked webinar)
http://www.windpoweringamerica.gov/newengland/pdfs/2010/webinar_neweep_property_values_hoen.pdf

now at this url:
http://www.windpoweringamerica.gov/filter_detail.asp?itemid=2610&pga=ne_forum

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Property Value Risks Will Persist Unless They Are Measured, Mitigated and Managed

Manage

Manage risks in the short term for homeowners through tenable/workable measures

- Offer some combination of neighbor agreements/incentives and/or property value guarantees (e.g., Dekalb County, IL) to nearby homeowners as are economically tenable and legally workable
- Conduct follow up studies (e.g., surveys, appraisals)
- Realize that cumulative impacts may exist
- Realize that real or perceived risks may increase/decrease as more/better information become available

Nuisance can be manifest by close proximity of the CVEC facility to homes of less than 1 mile, and for other reasons. Distance includes visual impacts but that has more of an impact on marketing, and also leaves homeowners wishing to sell with the ethical dilemma of making full disclosure of known nuisances to potential buyers, or facing possible legal repercussions and financial liability for failing to make such a disclosure.

Despite the limited number of the (2) CVEC turbine developments, they will have a negative impact or "nuisance" due to the circumstances that the project and use has a dominant presence, impairs aesthetics, negatively changes the character of the neighboring residential property settings or perception thereof (single or multiple properties).

Any number of potential variable impacts has a demonstrable adverse impact on the use, enjoyment, marketability or value of the subject property neighboring use, and it creates a man-made detriment to neighboring property and results in a negative impact for any homes that "got in the way". This is exactly why adequate setbacks are important. To mitigate against adverse impacts on neighboring property.

McCann Value Impact Study

Additional sale data studied by McCann for home values in a rural Illinois location adjacent to the Mendota Hills wind turbine project in Lee County is included in **Exhibit B** of this report. Despite the booming market conditions represented by the 2003-early 2005 sale dates, the homes within 2 miles of the nearest turbine reflect an average sale price per square foot that is 25% lower than homes located outside that 2-mile perimeter.

Thus an impaired view, inadequate setback, and stigma associated with noise and health impacts and concerns, measured to project value loss from a property possessing a "premium" vista, indicates that a 13% premium could become a 21% reduction, or a net property value reduction of 34%. This is well supported by the range of property case studies of value loss for individual homes that range from 20% to 40%, and in some instances a complete loss of equity when homes are completely unmarketable, or are acquired by wind developers and re-sold for losses up to 80%, or even demolition of the otherwise livable homes.

This range of value loss for the nearest residential properties is fairly classified as significant, preventable and "undue". The probability of damages to the value of homes and other property is quantified with empirical data rather than speculation, and is clearly indicated to a high degree of professional certainty.

Further, the two property value studies cited in the CVEC website (Hoen & Hinman) were prepared by researchers who hold no appraisal licenses, designations, credentials or even any background in property sales or development. The industry-sponsored

studies have also been selectively & partially quoted by the CVEC, to the extent that it would tend to mislead the public as to the conclusions of the study authors. A brief interview with Ben Hoen, which is available on the web, is contained in **McCann Exhibit E**. This exhibit contains a printed version of the Hoen comments about his study, as well as a link to listen to the audio recording.

Conclusion

After completing my review of the subject location, it is clear that numerous homes in the Town of Brewster will be adversely impacted, and the best available evidence indicates that **value loss of 25% or more will occur to homes within approximately 2 miles of the turbines.** This impact is not expected to be uniform, and some losses may well be lower and others higher.

The close proximity of the proposed turbines cannot meet the zoning requirements stated previously. The basis for this conclusion is the failure of the project to meet certain Special Permit and other approval criteria, as follows:

- ***It will have an undue adverse impact on scenic views and residential property values.*** This is supported by both industry studies, post publication author updates, and McCann independent study of property values. The LBNL study isolates and identifies value contribution to residential property when good or premium vistas are present, and the loss of such amenity is documented as the basis for lower values.

- ***The applicant has not agreed to implement any reasonable measures to mitigate the aesthetic impacts of the WET that result in value loss.*** Property Value Guarantees are effective tools, if carefully designed to leave property owners “whole”, and even the LBNL author now recognizes the validity of a PVG.

- ***The two (2) turbine structures will NOT be in harmony with the visual character of the neighborhood, including views and vistas and, the historic character of the neighborhood.*** There is nothing built in Brewster that is the height of a 40 story building, and the turbines will become the dominant presence within at least a mile of any other land use. Views and vistas create value for property, and impairment of vistas with non-compatible, immense, spinning machines simply can not blend in to any residential area or community.

- ***The turbines architectural design will not be compatible with the character and scale of the adjacent and surrounding neighborhoods.*** Turbines are not architecturally designed but, rather, utilitarian by design. Large steel poles and the spinning (or still) blades are completely disproportionate in scale and contrary to the character of small towns and neighborhoods. Despite the denial

of wind industry spokespeople of low-frequency or sub-audible noise impacts, the fact remains that a significant number of people are highly disturbed by this type of turbine impact, which clearly demonstrates a lack of compatibility for turbines to be placed in close proximity to residential uses. The design of turbines can not avoid the noise impacts, including sub-audible, amplitude modulation noise.

The CVEC Facility, does not comply with the relevant Brewster Code, as it fails to avoid or even to minimize impact on property value, impact on the character of the neighborhood, and is highly questionable as to safety of setbacks that do not even meet manufacturer guidelines for safety zone, or the code requirement for distances safe from “ice throw”. The proximity to Route 6 is several hundred feet closer to the turbine project than the 1,300 feet minimum to prevent ice throw hazards to this public roadway.

However, the preceding range of value and value damages is considered to be reasonably reliable for the purpose of determining whether the CVEC Facility meets Code requirements as to minimizing adverse impact on property values or on adverse impact to the character of the neighborhood.

Related Issues
Other property has been identified which, in my opinion, is likely to experience significant value loss.

- A nearby radio station will reportedly experience significant impact to its broadcast capabilities, which would have a significant detrimental effect on the continued use for that purpose and its underlying value.

- The Pleasant Bay nursing home is within shadow-flicker and noise distances, and the resulting disturbance to high-risk residents is likely to cause some residents to be relocated, or even to suffer health impacts. With 135 beds and a reported approximate revenue base of $300 per day per bed, a drop in occupancy of only 10% would represent a $1.48 million per year loss of revenue, which in turn would decrease the property value and the value of the nursing home business.

- The Woodlands assisted living facility consists of 59 units that reportedly rent for $4,000 - $6,000 per month. A 10% drop in occupancy would indicate a gross revenue loss of approximately $354,000 annually, and the corresponding property value would also be impaired.

- A municipal golf course, which depends on a peaceful, serene setting, will now have visual and sometimes audible disturbances, and is likely to realize a loss of patronage from golfers who have other options and require a peaceful course.
- The Town Of Brewster’s assessed values are likely to experience justification for a significant decrease, as values and prices of residential property in Brewster

begin to decline due to the close proximity and the resulting impacts of the turbines.

- Liability issues for the Town, as owner of the project, are likely to begin if the turbines are developed, as nuisance, health and property value damage claims are litigated. The fiscal impact to the Town of Brewster could very well suffer in the long-term, despite revenue and grant benefits cited by the CVEC.

Additional documents, facts, data and studies and market trend information is retained in the appraiser's work file, in the event expert opinions expressed herein and the basis for the opinions must be refined or given in testimony in any future legal proceedings.

I reserve the right to supplement my opinions at a later date, if the need arises and/or if additional information becomes available. Further, McCann's ongoing study of wind energy projects and their impacts may result in future disclosures and market information relevant to wind energy development issues.

McCann Exhibit A

Appendix D: Vista Ratings with Photos

POOR VISTA

BELOW AVERAGE VISTA

AVERAGE VISTA

ABOVE AVERAGE VISTA

PREMIUM VISTA

Source: LBNL Appendix D, report page 120 & 121

McCann Appraisal, LLC

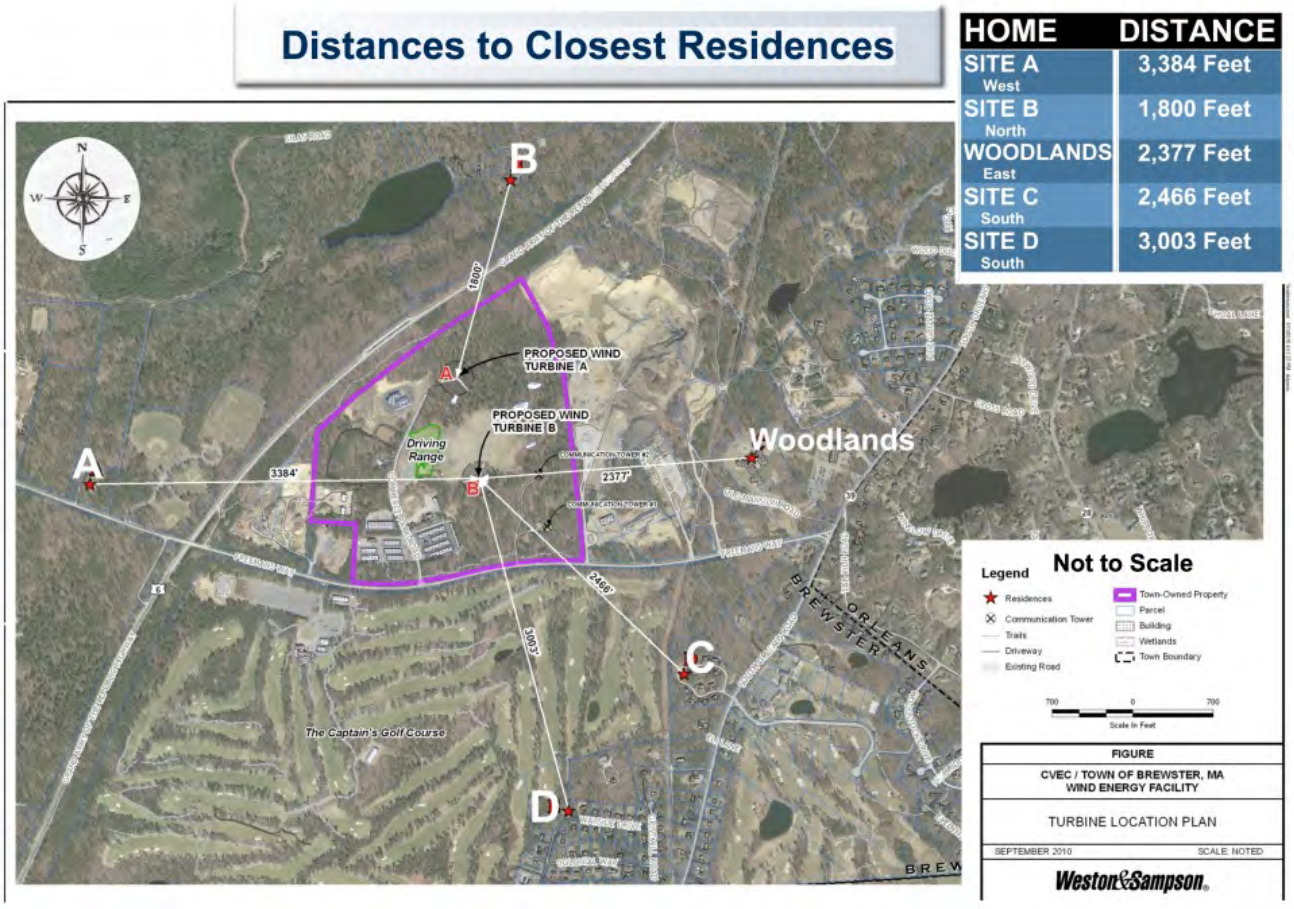
McCann Exhibit B

Mendota Hills Wind Energy Project

Sale #	Address	Sale Date	Price	Grantor	Grantee	Style	Size SF	$/SF
1	629 W. Chestnut	Oct 2003	$37,000	Estes	Lipe	1.5	1,161	$31.87
2	323 W. Chestnut	Oct 2004	$40,000	Reed	Hovious	1.5	1,425	$28.07
3	1019 Steward Rd.	May 2003	$40,000	Houle-Ward	Reyns	2	1,408	$28.41
4	91143 Paw Paw	Mar 2005	$187,000	Zaylik	Pachero	2	1,571	$119.03
5	1224 IL Rte. 251	Jun 2003	$138,000	Gittleson	Kowalski	2	1,272	$108.49
6	339 Chestnut St.	Jan 2003	$72,000	White	Flynn	2	1,684	$42.76
7	630 W. Chestnut	Sep 2003	$126,000	Eddy	Morath, Sr.	1.5	1,728	$72.92
8	427 Chestnut St.	Oct 2003	$87,000	Hesik	Rourke, Jr.	1.5	1,380	$63.04
9	138 Cherry St.	Sep 2004	$80,000	Hammond	Alexander	1.5	1,326	$60.33
10	536 W. Cherry	Oct 2004	$63,500	Johnson	Fitzpatrick	1.5	999	$63.56
11	885 Compton Rd.	Oct 2004	$68,900	Boysen	Gellings	1	480	$143.54
12	518 W. Cherry St.	Apr 2003	$87,500	Allen	Beckman	1	927	$94.39
13	222 Maple St.	Dec 2004	$150,000	Clark	Cummings	1	1,852	$80.99
14	444 W. Main St.	Mar 2005	$109,900	Miller	Michaels	1	1,402	$78.39
15	2874 Beemerville	Jul 2003	$367,000	Finkboner	DGNB TRT	1	2,201	$166.74
							Average sale price	$78.84
16	1310 Melugins Grove	Apr 2004	$179,000	Lyons	Overton	2	1,952	$91.70
17	2612 Shady Oaks Rd.	Apr 2003	$131,000	Smith	Papiech	1.5	1,208	$108.44
18	3448 Cyclone Rd.	Mar 2003	$105,900	Munyon	Pippenger	2	1,456	$72.73
19	2524 Johnson St.	Aug 2004	$61,800	Copeland	Lampson	1.5	948	$65.19
20	741 Third St.	Feb 2004	$63,500	Eckhardt	Rosales	1.5	868	$73.16
21	613 Church Rd.	May 2003	$115,000	Merkel	Parpart	1.5	1,458	$78.88
22	3435 Willow Creek	Jun 2003	$118,000	Swiatek	Brydun	2	884	$133.48
23	3021 Cottage Hill	Mar 2005	$182,000	Russ	Curtis	1.5	1,239	$146.89
24	3385 Willow Creek	Mar 2003	$180,000	McCoy	Carver	2	2,840	$63.38
25	745 Second St.	Dec 2004	$59,000	Wilson	Calderon	1.5	1,161	$50.82
26	761 4th St.	Mar 2003	$68,000	Stewart	Elsinger	1	724	$93.92
27	2774 Welland Rd.	Apr 2003	$93,000	Batha	Crumpton	1.5	1,104	$84.24
28	558 Earlville Rd.	Jan 2003	$145,000	Hodge	Ikeler	2	1,280	$113.28
29	2505 Wood St.	Aug 2004	$105,000	Janiak	Bullock	2	1,812	$57.95
30	385 Earlville Rd.	Aug 2004	$280,000	Rago	Diehl	2	2,142	$130.72
31	3095 Cyclone Rd.	Dec 2004	$169,900	Summerhill	Rainbolt	2	2,048	$82.96
32	742 Second St.	Jan 2003	$103,000	Delhotal	Stewart	2	1,876	$54.90
33	395 Angling Rd.	Mar 2005	$119,000	BMV Prop.	Herendeen	1	680	$175.00
34	2515 Wood St.	Apr 2004	$80,000	Jones	Sarver	1	912	$87.72
35	1218 Locust Rd.	Jan 2005	$169,000	Wachowski	Gembeck	1	1,040	$162.50
36	901 Melugens Grove	Aug 2003	$228,000	Kidd	Rajan	1	2,000	$114.00
37	1490 German Rd.	Aug 2004	$85,000	Firlit	Challand	2	2,144	$39.65
38	603 Ogee Rd.	Apr 2004	$285,000	Anderson	Miller	1	1,920	$148.44
39	546 Carnahan Rd.	Jan 2005	$110,000	Coley	Sarabia	1	1,296	$84.88
40	1353 County Line	Nov 2003	$185,000	Vallejo	Bozaeth	1.5	1,338	$138.27
41	2512 Johnson St.	Feb 2005	$123,000	Montavon	Sutton	2	2,232	$55.11
42	2509 Herman Rd.	Apr 2004	$142,900	Bresson	Arjes	1	1,404	$101.78
43	955 Woodlawn	Jul 2003	$265,000	Swan	LaRosa	1.5	1,918	$138.16
44	1279 Locust Rd.	Mar 2003	$270,000	Witte	olin	1	2,156	$125.23
45	648 Ogee	Nov 2003	$225,000	Fickenscher	Rojas	1	1,768	$127.26
46	1339 Woodlawn Rd.	Sep 2003	$230,000	Howell	Barnhill	1	1,701	$135.21
47	1349 Woodlawn Rd.	May 2003	$207,500	Howell	Wiskari	1	1,809	$114.70
48	711 O'Gee Rd.	Aug 2004	$185,000	Groevengoed	Carabal	1	1,352	$136.83
49	1295 Locust Rd.	May 2004	$300,000	Hagan	Lowe	1	2,672	$112.28
50	860 Paw Paw Rd.	May 2004	$185,000	Wiskur	Pogreba	1	1,148	$161.15
51	3011 Honeysuckle	Mar 2005	$355,000	Abbott	Brandt	2	3,655	$97.13
52	489 Earlville Rd.	Nov 2004	$165,000	Schlafke	Fromhertz	2	1,400	$127.86
53	2512 Shaw Rd.	Jun 2004	$153,500	Hlavin	Kapinski	2	1,638	$93.71
							Average sale price	$104.72

Sales 17 - 53 located > 2 miles from turbines	$104.72	sq ft
Sales 1 - 16 located within 2 miles of turbines	$78.84	sq ft
Difference in sale price per square foot	$25.89	sq ft
Average Value diminution within 2 miles of turbines	**25%**	

McCann Exhibit C



Source: CVEC website

McCann Appraisal, LLC

McCann Exhibit D

Author: National Wind Watch

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McCann Appraisal, LLC

McCann Exhibit E

posted: December 21, 2010 •

Ben Hoen on need for Property Value Guarantee

Author: Schneider, Clif

The following is an excerpt from a conversation I had in April 2010 with Ben Hoen, whose work with property value impacts associated with wind projects is widely referenced by developers, including those developers hoping to have wind projects approved here in Jefferson and St. Lawrence Counties. Hoen's comments below are very different from the spin suggested by Madden of BP Alternative Energy and Acciona's FEIS. Hoen indicates if developers believe turbines won't devalue neighboring property they should guarantee it, and he's right:

"You know we are very cautious about what happens close to the turbines. We really don't know what's going on there (e.g., 1,250 ft from turbines). I just spoke in Illinois about this. You might know about a Property Value Guarantee. It's a dicey situation and complicated, but I think homes that are very close, there is just too much unknown right now; that seems reasonable. I think **one of the things that often happens is that (wind) developers put our report forward and say look property values aren't affected, and that's not what we would say specifically.** On the other hand, they have little ground to stand on if they say we won't guarantee that. I think for homes that are close we have a lot more ambiguity and real issues. If we are talking about views that's one thing, if we are hearing it or shadow flicker that might be really regular, the kind of things that happen at night. …

"I'm not a lawyer and I'm not the developer, these (PVGs) are just options in the tool kit. I don't know whether it's reasonable to put together, I have looked at one, I don't know if there is a better way to write it or whether the one I read from Illinois is good or bad. They have to be thought about, they all probably have cost implications, so the developer is not going to give away the house if they were too generous; on the other hand if they are not generous enough they don't have any impact. That's just one of the tools available, there are neighbor agreements that may be more applicable whether folks nearby get compensation, if they are not a participating land owner. One of the things I've always hoped is somebody would offer one or the other and see what landowners would do."

Reported by:
Clif Schneider
April 12, 2010

Listen to the recording of Hoen's comment:

McCann Appraisal, LLC

CERTIFICATION

The undersigned, representing McCANN APPRAISAL, LLC, do hereby certify to the best of our knowledge and belief that:

FIRST: The statements of fact contained in this consulting report are true and correct.

SECOND: The reported analyses, opinions and conclusions are limited only by the reported assumptions and limiting conditions and represents the personal, impartial and unbiased professional analyses, opinions, and conclusions of the undersigned.

THIRD: We have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to any of the parties involved.

FOURTH: We have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.

FIFTH: Our engagement in this assignment was not contingent upon developing or reporting predetermined results.

SIXTH: Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.

SEVENTH: Our analysis, opinions, and conclusions were developed, and this report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice.

EIGHTH: No physical inspection was made by McCann Appraisal, LLC of the property that is the subject of this report. The undersigned utilized photographs, maps and property record card data for characterizing and understanding the character of the subject property:

NINTH: No one other than the undersigned provided significant real property appraisal assistance to the person signing this certification.

TENTH: Neither the undersigned nor McCann Appraisal, LLC has previously appraised the subject property.

IN WITNESS WHEREOF, THE UNDERSIGNED has caused these statements to be signed and attested to.

Michael S. McCann, CRA
State Certified General Real Estate Appraiser
License No.553.001252 (Expires 9/30/2011)

McCann Appraisal, LLC

PROFESSIONAL BIOGRAPHY
MICHAEL S. MCCANN, CRA

Michael S. McCann has been exclusively engaged in the real estate appraisal profession since 1980, and is the owner of McCann Appraisal, LLC.

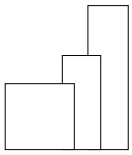
EXPERIENCE

His appraisal experience has included market value appraisals of various types of commercial, office, residential, retail, industrial and vacant property, along with a wide variety of unique or special purpose real estate, such as limestone quarries, hotels, contaminated properties, etc. He has gained a wide variety of experience in real estate zoning evaluations and property value impact studies, including analysis of utility scale wind turbine generating facilities, gas-fired electric generating plants, shopping centers, industrial facilities, limestone quarries, sanitary landfills and transfer station waste disposal facilities. He has been retained as an independent consultant to municipalities, government agencies, corporations, attorneys, developers lending institutions and private owners, and has spoken at seminars for the Appraisal Institute, the Illinois State Bar Association and Lorman Education Services on topics including the vacation of public right of ways (1986), and Property Taxation in the New Millennium (2000), Zoning and Land Use in Illinois (2005, 2006).

In addition to evaluation of eminent domain real estate acquisitions for a wide variety of property owners & condemning authorities, Mr. McCann has served as a Condemnation Commissioner (2000-2002) appointed by the United States District Court - Northern District, for the purpose of determining just compensation to property owners, under a federal condemnation matter for a natural gas pipeline project in Will County, Illinois.

EXPERT TESTIMONY

Assignments include appraisals, studies and consultation regarding real estate located in 21 states. He has qualified and testified as an expert witness in Federal Court, and for condemnation, property tax appeal and zoning matters in the Counties of Cook, Will, Boone, Lake, Madison, St. Clair, Iroquois, Fulton, McHenry, Ogle & Kendall Circuit Courts, as well as the Chicago and Cook County Zoning Boards of Appeal, the Property Tax Appeal Board (PTAB) and tax court & Commissions of Illinois, Wisconsin, and Ohio, Circuit Courts in New Jersey and Indiana, as well as zoning, planning, and land use and County Boards in Texas, Missouri, Idaho, Michigan, New Mexico and various metropolitan Chicago area locales. He has also been certified as an expert on the Uniform Standards of Professional Appraisal Practice (USPAP) by the Cook County, Illinois Circuit Court. Mr. McCann has substantial experience in large-scale condemnation and acquisition projects and project coordination at the request of various governmental agencies and departments. These include appraisals for land acquisition projects such as the Chicago White Sox Stadium project, the Southwest Transit (Orange Line) CTA rail extension to Chicago's Midway Airport, the United Center Stadium for the Chicago Bulls and Blackhawks, the minor league baseball league, Silver Cross Field stadium in Joliet, Illinois , as well as many other urban renewal, acquisition and neighborhood revitalization projects.



McCann Appraisal, LLC

REAL ESTATE EDUCATION

Specialized appraisal education includes successful completion of Real Estate Appraisal Principles, Appraisal Procedures, Residential Valuation, Capitalization Theory and Techniques Part A, Standards of Professional Practice Parts A, B and C, Case Studies in Real Estate Valuation, Highest and Best Use and Market Analysis, Advanced Income Capitalization, Subdivision Analysis and Special Purpose Properties, Eminent Domain and Condemnation, and Valuation of Detrimental Conditions in Real Estate offered by the Appraisal Institute. In addition, he has completed the Society of Real Estate Appraisers' Marketability and Market Analysis course, the Executive Enterprises - Environmental Regulation course, and a variety of continuing education real estate seminars.

DESIGNATIONS & PROFESSIONAL AFFILIATIONS

Mr. McCann is a State Certified Associate Member of the Appraisal Institute, and the National Association of Review Appraisers & Mortgage Underwriters designated him as a Certified Review Appraiser (CRA). He was elected in 2003 as a member of Lambda Alpha International, an honorary land economics society, and he served several years as a member of the Appraiser's Council of the Chicago Board of Realtors.

LICENSES

State Certified General Real Estate Appraiser in the State of Illinois (License No. 533.001252) and is current with all continuing education requirements.