Energy Facility Permitting
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Public Comments Received on the

Black Oak Wind Farm Draft Site Permit

PUC Docket No. IP6853/WS-10-1240

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In addition to the comments that follow, commenters also submitted several documents during the public comment period for the Black Oak Wind Farm Draft Site Permit. Some of these documents may be under copyright. To avoid any potential or perceived copyright infringement, the titles and locations of those documents are provided here:

American Wind Energy Organization. *Size Specifications of Common Industrial Wind Turbines.* *http://www.aweo.org/windmodels.html*

Bennington Banner. April 21, 2011. http://www.benningtonbanner.com.

Folger, Tim. "The Secret Ingredients of Everything." *National Geographic*. June 2011. http://ngm.nationalgeographic.com/2011/06/rare-earth-elements/folger-text

Glaess, Mark. "The Law of Good Intentions." *North Star Enlightener*. November, 2010, p. 3. http://northstarelectric.coop/News1110.pdf

Gunderson, Dan. "Wind power surplus blamed for spike in rural electricity costs." *MPR News*. November 23, 2010. http://minnesota.publicradio.org/display/web/2010/11/23/wind-power-electricity-rates/

Hoffer, Steven. "ERCOT Blackouts End, but Complaints are Just Getting Started." *America Online News*. February 2, 2011.http://www.aolnews.com/2011/02/02/ercot-blackouts-end-but-complaints-are-just-getting-started/

Juanita Valley Audubon Society. http://www.jvas.org

Little, David. "City utility shuts down operation of 2nd turbine." *West Central Tribune*. March 16, 2011. http://www.wctrib.com/

Nelson, Peter J. *Recommendations for Promoting Affordable and Competitive Energy Rates in Minnesota*. Center of the American Experiment. February 2011. http://www.amexp.org/sites/default/files/article_pdf/CAE_Energy%20BP%20(web).pdf

Pedersen, Eja, and Kerstin Persson Waye. "Wind turbines – low level noise sources interfering with restoration?" *Environmental Resource Letters*. Volume 3, number 1. January 11, 2008. Abstract available, http://iopscience.iop.org/1748-9326/3/1/015002 .

Peterson, Kim. "GE's Corporate Tax Bill: Zero." *MSN Money*. March 25, 2011. http://money.msn.com/top-stocks/post.aspx?post=d715c70d-f0d0-4474-8223-2949588e90f6

Pates, Mikkel. "Wind trade-offs. Aerial applicator notes 'cost' of turbine sitings." *Agweek*. Volume 25, Number 50. July 19, 2010. http://www.agweek.com/event/article/id/16783/

Sullivan, Jack. "Wind Power Promises and Predictions Gone Awry." *The Empire Page*. April 26, 2011. http://www.empirepage.com/2011/4/26/promises-and-predictions-gone-awry.

April 22, 2011

Suzanne Steinhauer
State Permit Manager
Minnesota Office of Energy Security
85 7th Place East, Suite 500
St. Paul, MN 55101-2198

Re: Black Oak Wind, LLC's Comments
In the Matter of the Site Permit Application for the Black Oak Wind Farm, a 42 MW Large Wind Energy Conversion System in Stearns County
Docket No. IP6853/WS-10-1240

Dear Ms. Steinhauer:

This letter provides additional information about the Black Oak Wind Farm in response to questions that were raised during the public information meeting held on April 7, 2011 in Sauk Centre, Minnesota.

Avian Assessments

In coordination with the U.S. Fish and Wildlife Service (US FWS) and the Minnesota Department of Natural Resources (MN DNR), the Black Oak Wind Farm is currently assessing spring migratory uses of the site, including tracking one identified eagle nest located near the project boundary. The survey design has been reviewed by the MN DNR and the US FWS, and we have continued our coordination through the survey's implementation. Black Oak anticipates completing the spring migratory surveys in June.

The Black Oak Wind Farm is committed to mitigating impacts on area birds and wildlife habitat. The protocols used for our avian assessments reflect the guidance we received from federal and state wildlife agencies and are consistent with industry best practices. We will file the results of our avian assessment in this docket after the field surveys are complete and we have consulted with the appropriate agencies regarding the survey results. Additionally, we have coordinated with a wind farm under development adjacent to the Black Oak project to ensure that our surveys are methodologically compatible and together provide a broader picture of the area.

Participating Landowners

During the public meeting, Ms. Barbara Jennissen asked us how many of our signed landowners live within the footprint. As noted previously, we have approximately 6,500 acres within the project footprint under site control or in final negotiations. Following the meeting, we also looked at where our signed landowners live in relationship to the project footprint. Our analysis shows that 15 of the 23 residences located within the footprint are participants. Of the residences not currently signed, we're actively negotiating agreements with four of them. Further, our examination of Stearns County's records shows that 82 percent of our participating landowners live inside or within 5 miles

of the project footprint. A copy of our response letter to Ms. Jennissen is included as Attachment 1.

We believe these statistics reflect not only that we have enough land area under site control to construct the 42 MW project following the conditions in the draft site permit, but also the community's support for this wind project.

Property Values

Several residents also asked how wind farms affect area property values. The most comprehensive study of property value impacts we are aware of is "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis" by Ben Hoen *et al.*, issued in December of 2009 and funded by the Office of Energy Efficiency and Renewable Energy of the U.S. Department of Energy.

The report examined the property sales of nearly 7,500 single family homes within 10 miles of 24 different wind farms across the United States. The researchers examined a number of different factors, from the view of wind turbines to the length of time those turbines had been installed, and found no correlation in the relationship between property values and the existence and proximity of wind turbines. This report can be found at: http://eetd.lbl.gov/EA/EMP/re-pubs.html.

On a local level, the Stearns County Assessor's Office conducted an informal survey of other Minnesota county assessors in counties where wind farms are present. A copy of their report is included as Attachment 2. The Stearns County Assessor's report summarizes information from each responding county regarding the total amount of wind energy production tax received and indicates that there is no evidence that the presence of wind farms has increased or decreased property values in those counties.

We appreciate this opportunity to provide additional information for consideration within the record. Please feel free to contact me with any questions.

Sincerely,

Patrick Smith
Director of Environmental Planning
(952) 988-9000

GERONIMO WIND ENERGY

April 13, 2011

Barbara Jennissen
43265 County Road 28
Sauk Centre, MN 56378

Dear Ms. Jennissen,

I hope this letter finds you well and enjoying the long-awaited spring weather. I'm writing in response to your question at the Black Oak Wind Farm Public Information Meeting held on Thursday, April 7, 2011 at the Sauk Centre City Hall, in Sauk Centre, Minnesota. At the meeting you asked: "How many signed residences are within the project footprint?" Our analysis shows that 15 of the 23 residences are signed within the project footprint. Of the residences not currently signed we're in final talks with four of them.

Our examination of Stearns County's records shows that 82% of the landowners live inside or within 5 miles of the project footprint. More details shown below:

Distance from Project	Number of Participants in the Black Oak Wind Farm
Within 5 Miles	27
Greater than 15 Miles	3
Total Participants	33

I've had the liberty of working with the farmers and homeowners alike in the project area for nearly three years and found that there's a lot of support for wind development. I sincerely want you to know we take our business very seriously and will do everything we can to ensure a successful wind farm to benefit the area.

If I can be of further help to you and your family in the future, please don't hesitate to contact me at 952.988.9000 or via email at: justin@geronimowind.com.

Sincerely,

Justin Pickar
Development Manager

CC: Suzanne Steinhauer, State Permit Manager, MN OES, suzanne.steinhauer@state.mn.us
Tricia DeBleeckere, Energy Facility Planner, MN PUC, tricia.debleeckere@state.mn.us
Karyn O'Brien, Geronimo Wind Energy, LLC, karyn@geronimowind.com

G.1.c

The Stearns County Assessor's office prepared the following report for the Board's consideration:

A Study of Wind Energy Conversions Systems in Minnesota
Prepared by the Stearns County Assessor's Office---June 1, 2010

Wind Energy Production Tax:
According to the Department of Revenue, there are more than 165 companies reporting wind energy production in 2009 compared to about 20 companies that reported production in 2002. These companies pay a wind energy production tax each year based on their tower locations and total production capacity. It is an in-lieu of personal property tax called a production tax.

Each company pays a tax on the amount of wind energy produced during the previous calendar year based upon a report submitted to the Department of Revenue by February 1st. This information and the basis of apportionment are reviewed by the Commissioner of Revenue and a tax calculated on the company's scale of production prescribed by law:

(1) A large scale system is described as a wind energy conversion system of more than 12 megawatts as measured by the nameplate capacity system or as combined with other systems;
(2) A medium scale system means a wind energy conversion system of over 2 and not more than 12 megawatts as measured by the nameplate capacity or as combined with other systems; and
(3) A small scale system is characterized as a wind energy conversion system of less than 2 megawatts but greater than .25 megawatts as measured by the nameplate capacity or as combined with other systems.

The production tax is based upon a standard fixed rate and varies according to the type and size of the wind energy conversion system. This rate is .12 cents per kilowatt hour of electricity produced by a large scale system, .036 cents per kilowatt hour of electricity produced by a medium scale system, and .012 cents per kilowatt hour of electricity produced by a small system. The fixed rate is adjusted for inflation by the Commissioner of Revenue.

The Commissioner of Revenue sends a notification to both the company and county before February 28th of the amount due. The county bills the company and collects the tax on or before May 15th and October 15th. The tax is then distributed to all taxing districts in a similar manner as the real and personal property tax with 80 percent going to the county, 20 percent to the city or township, and 0 percent going to the school district.

For taxes payable in 2010, the following summary is a list of 17 counties that receive a production tax and the approximate number of taxable towers in each county:

County	2010 Energy Production Tax Payable	# of Wind Towers

Clay	$590	3
Cottonwood	$214,241	49
Dodge	$12,236	42
Faribault	$4,817	4
Jackson	$521,894	114
Lincoln	$795,855	372
Lyon	$21,537	9
Martin	$218,598	41

County	2010 Energy Production Tax Payable	# of Wind Towers
Mower	$1,369,639	253
Murray	$1,177,405	241
Nobles	$122,453	30
Pipestone	$505,963	236
Rock	$5,084	11
Sherburne	$106	1
St. Louis	$67,506	10
Todd	$1,067	1
Watonwan	$34,201	5
Total	$5,073,192	1,422

On average, the energy production tax for a large scale system is about $5,000 per year/per tower; on a medium scale system it is around $1,500 per year/per tower; and on a small scale system the tax is approximately $500 per year/per tower.

Classification and Valuation of Wind Tower Site:
M.S. 272.02, subdivision 22 states that all real and personal property of a wind energy conversion system as defined in section 272.029, subdivision 2, is exempt from property tax except that the land on which the property is located remains taxable.

The law further states that the classification of the land shall be based on the most probable use of the property if it were not improved with a wind energy conversion system. For example, a wind tower in the middle of a corn field would properly be classified as agricultural.

In regards to the value of the land, the law allows some discretion in the valuation methodology used by the county. It says that if it is approved by the county where the property is located, the value of the land on which the wind energy conversion system is located shall be valued in the same manner as similar land that has not been improved with a wind energy conversion system. In other words, how the estimate of land value is established is the responsibility of the assessor---it may be valued as agricultural, commercial, or as another type of property. (Note: The intent of the law focuses upon the most probable use of the property prior to development as a wind tower site. In most cases, the market value will be more closely aligned to its agricultural value rather than another type of value given its use before the wind energy conversion system was located on the land).

The ensuing list provides a small sample of responses from counties contacted about their classification and valuation practices associated with a wind tower site:

County	Classification of Site	Valuation of Site
Dodge	Agricultural	1 or more acres not valued as agricultural property
Jackson	Agricultural	Acreage valued similarly to other agricultural property

County	Classification of Site	Valuation of Site
Lincoln	Waiting for Information	
Martin	Agricultural	Acreage valued similarly to other agricultural property
Mower	Agricultural	1 or more acres not valued as agricultural but similar to commercial or another property type
Murray	Waiting for Information	

The Effects of Wind Energy Development on Local Land Values:
The old cliché, "the marketplace is the final arbiter of market value", is certainly appropriate when one speaks of the effects that wind energy development has on local land values. However, the answer is not always clear given the lack of conclusive data to support the claim that wind energy towers either have a positive or negative impact on market values. Assessors from Dodge, Goodhue, Jackson, Lincoln, Martin, Mower, and Murray Counties were asked if they have seen any value changes on properties hosting a wind energy conversion system and on properties adjacent to a property with a tower located on it. Below is a summary of the responses:

County	Value Effect on Property w/Tower	Value Effect of Property Adjacent to Tower
Dodge	No Change*	No Change*
Jackson	No Change*	No Change*
Lincoln	Waiting for Information	
Martin	No Change*	No Change*

Mower	No Change*	No Change*
Murray	Waiting for Information	

*---Data to support claim is scarce.

Remarks

Sellers of land with wind towers located on them have usually retained the rights to the wind energy lease which does not appear to adversely impact the price paid per acre.

Wind energy lease information has been difficult for assessors to obtain. It is not shared with people who have requested it because of the proprietary nature of the data.

Some property owners who have land adjacent to properties hosting a wind tower have questioned their valuations, but the number and frequency of challenges are minimal and few.

There have been no positive or negative value changes made to properties with or next to a wind energy conversion system.

The collected data is insufficient to allow for a reasonable analysis of the effects of wind energy development on land values.

Studies on the Positive/Negative Effects on Property Values

With the growth of wind energy conversion systems across the country, questions have been raised and claims made about the effects that these projects have had on property values. Some studies have been undertaken by various authorities and organizations to address the monetary impact that these towers have on real estate values.

According to one study completed by the Renewable Energy Policy Project (REPP), the results suggest that wind energy development does not appear to effect property values. This study reviewed 25,000 sales inside and outside the view shed of wind farms and selected comparable areas in California, Iowa, New York, Pennsylvania, Texas, Vermont, and Wisconsin between 1998 and 2002. (Note: Website---REPP Study: The Effect of Wind Development on Local Property Values. National Wind Coordinating Committee. http://www.repp.org/articles/static/1/binaries/wind_online_final.pdf

Another study performed by the Royal Institute of Chartered Surveyors (RICS), looked at the impact that wind farms had on property values in the United Kingdom. Most of their research was on wind farms around agricultural lands. They found that about 60 percent of the respondents reported no effect on agricultural land values, but almost 30 percent reported a decrease in values and approximately 10% percent said that their farmland had increased in

value. (Note: Website---Wind Action Group. Evironmental Committee Report. http://www.greengold.org/wind/eniv.html and the Google Directory. http://www.google.com/Top/Science/Technology/Energy/Renewable/Wind/

Frequently Asked Questions

For more information on wind basics, the economy, the environment, and policy issues, a resource guide prepared by the American Wind Energy Association is available on-line. This publication can be accessed at http://www.awea.org/pubs/documents/faq2002%20-%20web.pdf

AFFIDAVIT OF SERVICE

In the Matter of the Application of Black Oak Wind, LLC
for a Site Permit for a 40 MW
Large Wind Project in Stearns County, Minnesota

MPUC Docket No. IP6853/WS-10-1240

STATE OF MINNESOTA)
) ss.
COUNTY OF HENNEPIN)

Kristen A. Swenson, of the City of Minneapolis, County of Hennepin, in the State of Minnesota, being duly sworn, says that on the 22nd day of April, 2011, she efiled with the Minnesota Public Utilities Commission the following:

1. **Post Hearing Comments; and**

2. **An Affidavit of Service.**

A copy has also been served on the service list of record.

Kristen A Swenson
Kristen A. Swenson

Subscribed and sworn to before me
on April, 2011.

Notary Public

MELONEE R HAM
NOTARY PUBLIC - MINNESOTA
MY COMMISSION EXPIRES 01/31/2015

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Julia	Anderson	Julia.Anderson@state.mn.us	Office of the Attorney General-DOC	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_10-1240_Official
Michael	Deruyter	michael.deruyter@hdrinc.com	HDR Engineering, Inc.	701 Xenia Ave S, Suite 600 Minneapolis, MN 55416	Paper Service	No	OFF_SL_10-1240_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 500 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_10-1240_Official
Burl W.	Haar	burl.haar@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_10-1240_Official
Lisa	Joyal	lisa.joyal@state.mn.us	Department of Natural Resources	500 Lafayette Road, Box 25 St. Paul, MN 55155	Electronic Service	No	OFF_SL_10-1240_Official
Stacy	Kotch	Stacy.Kotch@state.mn.us	MINNESOTA DEPARTMENT OF TRANSPORTATION	395 John Ireland Blvd. St. Paul, MN 55155	Electronic Service	No	OFF_SL_10-1240_Official
John	Lindell	agorud.ecf@state.mn.us	Office of the Attorney General-RUD	900 BRM Tower 445 Minnesota St St. Paul, MN 551012130	Electronic Service	Yes	OFF_SL_10-1240_Official
Patrick	Smith	patrick@geronimowind.com	Geronimo Wind Energy, LLC	7650 Edinborough Way, Ste 725 Edina, MN 55435	Electronic Service	No	OFF_SL_10-1240_Official

Minnesota Department of Natural Resources
500 Lafayette Road • St. Paul, MN • 55155-40_

April 22, 2011

Suzanne Steinhauer
State Permit Manager
Minnesota Division of Energy Resources
85 7th Place East, Suite 500
St. Paul, Minnesota 55101-2198

Re: Draft Site Permit for the Black Oak Wind Farm in Stearns County
[PUC Docket No. IP6853/WS-10-1240]

Dear Ms. Steinhauer:

The Minnesota Department of Natural Resources (DNR) has reviewed the Draft Site Permit for the 42 MW Black Oak Wind Farm project proposed in Stearns County, Minnesota and provides the following input. The DNR previously provided the attached comments regarding the Site Permit Application. Any updates to the comments will be included in this letter as well as comments regarding the Draft Site Permit.

The attached DNR letter dated February 10, 2011 discusses a recommendation for pre-construction surveys to assess avian use of the site. The Minnesota Department of Commerce, Division of Energy Resources (DER), DNR and the applicant met to discuss recommended survey protocol for Spring 2011 avian surveys and understand that surveys are currently underway during the migratory season. The DNR would appreciate the opportunity to review and discuss with DER and the applicant survey results when they become available.

The intent of DNR recommendations for pre-construction surveys is to use data for project planning in order to avoid natural resource impacts. The DNR concurs with the DER practice as described in the comments and recommendations dated March 1, 2011 (page 6) to recommend that studies classified as Tier III (pre-construction) by the United States Fish and Wildlife Service (USFWS) Draft Land-Based Wind Energy Guidelines be submitted prior to the final permit decision. The DNR recommends that Tier III studies are reviewed by the DER, DNR, and applicant prior to issuance of a final site permit. When submitted prior to the final permit decision, determinations can be made regarding infrastructure locations and any necessary permit requirements regarding USFWS Draft Land-Based Wind Energy Guidelines Tier IV (post-construction) surveys. Information is also provided to assist the Minnesota Public Utilities Commission (PUC) with their final permit decision.

Please also see sections of the attached DNR letter dated February 10, 2011 titled "Turbine Layout" and "Other." The DNR appreciates clarification provided regarding snow mobile trails in the comments and recommendations document for issuance of the Draft Site Permit. Clarification in updated maps of meteorological tower locations is also appreciated. Other comments in these sections should continue to be considered during the site permitting process.

Please note that an active eagle nest was reported to the DNR March 31, 2011 near the southeast portion of the project. The DNR informed the USFWS and applicant of this nest location, which was later reported as verified by the applicant with a spotting scope. The DNR encourages continued coordination with the USFWS regarding requirements of the Bald and Golden Eagle Protection Act.

Item 4.6 in the Draft Site Permit discusses wetlands. Please note that any impacts to wetlands that are not public waters would also need to be addressed by local government in accordance with the Minnesota Wetland Conservation Act.

The DNR appreciates the opportunity to review the Draft Site Permit for the Black Oak Wind Farm. Please contact me with any questions.

Sincerely,

Jamie Schrenzel

Jamie Schrenzel
Principal Planner
Environmental Review Unit
(651) 259-5115

Enclosures: 1

cc: Melissa Doperalski, DNR
Richard Davis, USFWS
Karyn O'Brien, Geronimo Wind Energy, LLC

Minnesota Department of Natural Resources
500 Lafayette Road • St. Paul, MN • 55155-40

February 10, 2011

Suzanne Steinhauer, State Permit Manager
Minnesota Department of Commerce
Office of Energy Security
Energy Facility Permitting
85 7th Place East, Suite 500
St. Paul, MN 55101-2198

Re: Black Oak Wind Farm Site Permit Application [PUC Docket Number: IP6853/WS-10-1240]

Dear Ms. Steinhauer:

The Minnesota Department of Natural Resources (DNR) has reviewed the Black Oak Wind Farm Site Permit Application and DNR staff visited the project site June 23, 2010 and January 27, 2011. The following comments are provided regarding DNR site visits and information presented in the Site Permit Application.

Wildlife Surveys

The Site Permit Application (pages 50-54) indicates that pre-construction surveys are not planned for this site based on responses to tiered analysis questions recommended by the Wind Turbine Guidelines Advisory Committee. The application (page 44) also included a discussion of the relevance of wildlife surveys conducted at the Paynesville Wind Farm site, which is located 17 miles to the southeast of the Black Oak Wind Farm Site.

After review of the Site Permit Application and attending site visits, DNR staff have considered the applicants proposal to use data from pre-construction surveys at from the Paynesville Wind Farm to assess the Black Oak Wind Farm Site and do not recommend this approach to site assessment at this time. If more data were available in Minnesota regarding the effects of wind turbines on wildlife for various habitat features, there might be a situation where detailed regional knowledge could be applied to specific sites with risk of avian fatality. However, that amount of regional understanding is currently not available in the area surrounding the Black Oak Wind Farm. It is also important to consider the substantial variation in habitats and species use among individual sites, even when located in relatively close proximity. Therefore, the DNR does not consider Paynesville Wind Farm pre-construction data in an assessment of whether pre-construction surveys are recommended for the Black Oak Wind Farm. However, comparison of data among projects in an area is encouraged for long term renewable energy development planning and may be useful as supplemental information in the record for this project.

Based on the Tier 1 and Tier 2 assessment referenced in the application and DNR assessment of the site, staff consider this site to have moderate risk for avian fatalities. The Black Oak Wind Farm site and current turbine layout avoid high quality habitats such as the Regionally Significant Ecological Area located in the southeast portion of the project, Wildlife Management Areas (WMA) and prairie. However, the surrounding area contains eighteen WMAs, thirty-four Waterfowl Production Areas (WPA), and one Scientific and Natural Area (SNA) within ten miles. There is also known migratory avian activity in the project area as described in the Site Permit Application. The Marbled Godwit (State-Listed Special Concern) and Upland Sandpiper (Species of Greatest Conservation Need), two species with courtship displays in the rotor swept zone, are also recorded near the project site. When

considering a larger landscape review, avian activity viewed particularly during the June 2010 DNR site visit, and rare species near the project area, a moderate risk of avian fatality and impact is identified for the Black Oak Wind Farm.

A pre-construction survey, including a Flight Path Analysis and concurrent point counts, is recommended in targeted areas that may pose a barrier to flight such as the center of Section 12 near the southeast portion of the project area and near the line of turbines in Section 2 in the central western portion of the project. These areas appear to present a barrier to avian flight patterns between conservation lands. The DNR is currently developing draft protocol for flight path analyses and encourages the applicant and Office of Energy Security (OES) to coordinate survey development with DNR staff.

Turbine Layout

Figures 8-12, 8-13, 8-14 included in the Site Permit Application indicate the location of grasslands within the project area. Some turbines appear to be located within grasslands, yet quite close to cropland. The DNR recommends making minor adjustments to turbine locations to avoid grassland whenever possible because, though grasslands appear to be fragmented in areas, smaller sized grassland patches in close proximity to each other can provide suitable habitat for colonization by grassland birds (Herkert 1998).

Figures included within the Site Permit Application indicate three possible turbine types and layouts. Vestas V90, GE 1.6xle, and Vestas V112 are shown in the figures section of the document. The layouts planned for the Vestas V90 and GE 1.6xle types of turbines appear to create possible flight barriers to migrating or resident birds and also include a greater number of turbines located near what appears to be a farmed ephemeral wetland in Section 12 near the southeast portion of the project. Ephemeral wetlands are often used as migratory stopover locations. The Vestas V112 layout appears to most avoid these possible impacts, with the exception of one turbine near the farmed ephemeral wetland in Section 12.

During meetings with the applicant, there was discussion of possible alternate turbine locations. The DNR encourages avoidance of sensitive habitats when considering siting for alternate turbine locations as well as planned turbine locations. For example siting near prairie and wetland habitats is not preferred. Also, alternate turbine locations should be included in future permitting review documents.

The DNR recommends appropriate avoidance of snowmobile trails or an effort to coordinate with landowners and the DNR regarding any DNR administered "Grant-in-Aid" snowmobile trails within the project area to address possible safety concerns associated with falling ice.

Other

Page 43 of the Site Permit Application discusses mitigation measures. The last line of Section 8.18.3 states that "If jurisdictional wetland impacts are proposed, then the Applicant will apply for wetland permits." Information should be provided regarding the type of impacts and which permits would be sought. If impacts are proposed to a public water wetland, a DNR Work in Public Waters Permit would be required.

The Site Permit Application states that the location of a six-acre laydown area within the project area will be identified later in the permitting process. The location of the laydown area may be relevant to a review of natural resource impacts. This location should be clarified as soon in the process as possible to facilitate public and agency reviews.

The Site Permit Application states on page two that two permanent MET towers will be on site. However, page ten seems to state that only one permanent MET tower will remain on site. The exact location of these permanent towers is also unclear.

Thank you for the opportunity to provide input regarding the Black Oak Wind Farm Project. Please contact me with any questions.

Sincerely,

Jamie Schrenzel
Principal Planner
Environmental Review Unit
(651) 259-5115

From: Barb Jennissen
To: Steinhauer, Suzanne (COMM)
Subject: Black Oak Wind Farm Docket Number IP6853/WS-10-1240
Date: Sunday, April 17, 2011 6:27:32 PM

Dear Suzanne,

The Black Oak Wind Farm site permit application should be amended to show record of a Bald Eagle nesting pair within 1 mile of proposed wind turbine. Appendix E of the site permit application under "Migratory Birds" states the existence of a Bald Eagle nest approximately 5 miles northeast of the proposed site. This section should include reference to a Bald Eagle nest approximately 0.75 miles south east of the proposed site. This Bald Eagle pair has been nesting at the site for at least 3 years.

Sand hill Cranes have also been observed mating in the same area. This information could also be added to the application.

This information was communicated to Rich Davis from the DNR for further evaluation. Mr. Davis stated that he and the biologist from Geronimo Wind would plan to visit the site. No time line was set.

We submitted this information through the eDockets website, but wanted to e-mail pictures to further document this information. Please see attached.

Sincerely,
Dave & Barb Jennissen

From: apache@web.lmic.state.mn.us
To: Steinhauer, Suzanne (COMM)
Subject: Jennissen Sun Apr 17 18:14:54 2011 IP6853/WS-10-1240
Date: Sunday, April 17, 2011 6:15:01 PM

This public comment has been sent via the form at:
www.energyfacilities.puc.state.mn.us/publicComments.html

You are receiving it because you are listed as the contact for this project.

Project Name: Black Oak Wind Farm

Docket number: IP6853/WS-10-1240

User Name: Dave & Barb Jennissen

County: Stearns County

City: Sauk Centre

Email: bdjennissen@wisper-wireless.com

Phone: 320-352-6903

Impact: The Black Oak Wind Farm site permit application should be ammended to show record of a Bald Eagle nesting pair within 1 mile of proposed wind turbine. Appendix E (Angency Correspondence) "Migratory Birds" section states existence of Bald Eagle nest approximately 5 miles northeast of proposed site. This section should include reference to Bald Eagle nest approximately 0.75 miles south east of proposed site. This Bald Eagle pair has been nesting at the site for at least 3 years.

Sandhill Cranes have also been observed mating within one mile of proposed wind turbine.

Mitigation: This information has been communicated to the DNR for evaluation.

Will forward pictures of Bald Eagle nest and location to State Permit Manager, Suzanne Steinhauer, for documenation.

Submission date: Sun Apr 17 18:14:54 2011

This information has also been entered into a centralized database for
future analysis.

For questions about the database or the functioning of this tool, contact:

Andrew Koebrick
andrew.koebrick@state.mn.us

Why are we using taxpayers money to conduct these meetings?

How many permits has the MN. Pca denied?

2

2. ~~Do your~~ turbine spacings follow industry standards-does a specialist report confirm structural integrity would not be affected by your sitings for 1.6MW,1.8MW-~~other~~ other you may add later?

3

3. If 1,~~2, or 3~~ turbines were incorrectly sited-what would be the production loss, and costs?

4

4.0 ~~8.5.1~~ Roads- federal highways- I-94 2 1/2 miles n. of project.

#in permit app

5

5.0 8.7-8.71;8.11.2,8.11.3 Public wildlife areas with in 10 mi comes to 9622.2 Acres-these are areas to protect production and for the public to enjoy-not only will that be compromised -so will the wetland integrity and ~~ground~~ surface water. What plans are implemented prior to construction? We demand a HCP(Habitat Conservation Plan) as well as an ITP (Interim Take Permit) prepared and submitted.- USFW Interim use Guidelines to Avoid and Minimize Impacts from Wind Turbines 2003- (also need web addr) #1. pre-developement include surveys done by Fed. and State agency professionals with no vested interest in prooject. and in a letter 3/26/2010 from USFW included interim guidelines- In addition to those I insist on a pre-permit issuance -DNR.USFW ,OES-and local non participants in the project area with in a 10 mi radius be included before any final recommendations are sent to MN OUC for final approval before micrositing.-The Public comment period should include all meetings the OES has with permittee and agencies-including county,state,and federal -even local.

6

6. ~~Where~~ are your receptors located? ~~How accurate are they~~? Who interprets the documents and summary of results? Who pays this company?- The integrity of these results are in conflict of interest.

7

7. ~~How~~ and when will you provide safety instructions for all non participating and participating landowners ? What is your liability for injury,death, or accidents, or damage ? Are you bonded? Provide proof.

8

8. 8.12 Recent comments from residents by the Cosmos project indicated -0- local economic gain-not so ~~much as~~ 1 person local, or even 1 load of gravel was hauled by local contractors. What can you do to assure yours would be any different?

10

10. 8.15 groundwater resources- provide mitigation when 25,000 ton concrete runoff that includes millionms of tons of re-bar-what you will do to restore this natural resource? Are you bonded to guarantee this?

11. What do you do with excess energy that might be produced? Could you explain that process?

12. Now that the MN PUC no longer rules over stray voltage-what would you do to mitigate and protect a dairy farmer who is a non participant and lives within, or near a wind farm?

13. Regarding 8.8 Public Health and Human safety? Do you understand what it means to have health related problems attributed to adverse affects of industrial wind turbines? How would you mitigate medical charges incurred by a family or person with health problems in relation to your wind turbine developement? shadow flicker,low frequency vibration,noise,vvestibular system problems, low freqency noise,rythmic modulation-??

14.(8.5.1) According to your application there would be no public safety concerns? What about a possible sever pile up on I-94-just a little over 2 mi away-an industrial wind turbine will be seen from there and it will distract people
as they strain their neck to look-boing 80 miles an hour-huge risk to public safety. What liabilities are you willing to assume? Will you even be involved in 3-5 years? Have you already sold out to an outside investor?

15. Suppose a family had noise and shadow flicker and weren't willing to take shades on the window -what would you do to insure their quality of life isn't compromised? AN ACOUSTICAL ENGINEER WITH NO ECONOMIC GAINS FROM PROJECT TO MODEL ALL

16. If 1,2,3,or 4, industrial turbines were sited incorrectly-what would be the production loss-including the efficiency of nearby turbines, and entire wind farm? According to your permit 5.1 no more than 20% of project turbines closer than the prescribed setback. Is that your prescribed setback, or is that industry standard-or model and company specific setbacks/spacings?

17. What steps and procedures will be taken to protect infrastructure relating to cell phone reception,land lines,television reception-electrical services,water and wetlands degradation-given location of proposed wind farm is in a heavily diverse habitats there could be substantial unknown cause and effect ? How can you insure this does not happen? What are the steps and protocol you will implement if issues do arise? Who is financially responsible for any costs associated with problems?

18. Do you plan to work to preserve our resources-or is your plan already in motion by gaving all the rules changed to your advantage? Which includes wetland conservation-protection of all farming resources, including birds,ducks,geese,ealgles, and hundreds ofthers. Are you familiar with the Migratory Bird Treaty Act ? What financial insurance do you have that will pay fines associated to bird and bat kills?

Demand IND AVIAN ITP HCP

19. What are your plans to prevent 32-38 % of our wildlife from leaving the area?

20. Cited literature from the MN PUC and OES state that the dB at top by narcelle could be as high as 107dB?- what is worst case scenario? and what % of the time would this affect someone living close to 1? 2? or 3? turbines-is this a singular noise, screeching-whoosh-whoosh-or how would you describe the noise?

21. Do you have anyone interested in buying any power from your planned wind farm? Who? What will be the kW hr ~~charge~~ Cost to that co?

22. Do you have any interconnection agreements-? Where is your access to the grid-and do you have that?- If so how far is it, and how big are the step up and transmission lines? What do you estimate those costs to be? and how do you expect or whom do you expect to pay for them?

23. Do you have confidentiality agreements in your wind lease/easement agreements? If you are such a true and honest company-why would you need them? Are one of the provisions in your contracts the ability to mortgage a land owner who has signed agreements? Do you base landowner payments on what level of production and efficiency?-WHAT DO YOU DO IF IT CAN'T BE REACHED AS STATED? Given 80% efficiency that would mean payments would be roughly 1/5 of what was promised

24. Does a land owner have the right to encumber or do your lease agreements remove that? including that a land owner who may experience problems would be unable to speak out for fear of lawsuits? How would you mitigate?

how do you define mitigate?

25. Have you received any noise or any other related problems with other location where you have sited wind turbines? What is the population density there? How would a person ask to see a copy of any complaints registered? What agency or department has them available for public reviewal?

26. Will non participating land owners have their property trespassed on like property owners in Paynesville did?- Are reports and problems kept in one file-or separated by location or incident?

27. The local resources here would be better suited for a biomass plant than a wind farm. A 35MW biomass plant will produce 35MW of power-where a 40-42MW wind farm will produce probably 10MW-which could not be considered consistant-wind is too variable- wind resources are marginal at best- The local resources would be used more economically,will preserve the environment without massive disturbance to infrastructure, production of power could be used locally and in and near communities. There is also hydro-which would produce triple what wind does-it needs to be allowed as a renewable.
The National Weather Service reports average wind for this area is 6.6mph average perday/per year-with a 1 in 12% chance of getting a windier day? Why would the National Weather Service publish anything but accurate readings?

28. Typically avian ,bat movement is high during late summer months-there is either some wind-or no wind-will you be required to shut turbines off to prevent slaughter of bats at certain times of the year? What would your production be then? What enforcement mechanism would you adhere to that would insure your promises would be kept? Require State & Federal Agency professionals do ALL studies with no vested interests

29. Typically if there is wind-it's at night-not at peak times,at peak times of year-therefore would your production for electrical have an end result of driving up consumer costs?

30. Total renewable energy resources in the interconnection queue is 275MW of wind resources.None of these projects have executed an interconnection agreement.
(ACCORDING TO:www.eei.org/ourIssues/ElectricityTransmission/Documents/TransprojRenew_E-M.pdf)

31. What has wind power done to rural cooperative rates in Minnesota?--Ottertail power lost 16 million dollars last year. Excel energy is asking the MN PUC for a rate increase for all of their customers? Others had these losses as well

32. If it weren't for the huge subsidies-would this project be feasible? What would your cash payment be in lieu of the PTC or ITC from the federal government? → on this project

33. Are there plans that once Getty Wind if Getty Wind gets built that their company will merge with yours? If so what would that change c-bed status to? since you are neither local-nor locally owned should that acquisition transpire?

34. If you were to go to a bank for a loan on this project which has low bankable wind-do you think it would be approved?

35. Considering the state legislature has exempted all real and personal property of wind energy systems , as well as the materials used to manufacture,install,construct,repair,and replace wind systems- and last but not least exemption from state sales tax?- What could you do on any long term basis to contribute to Mn. budget problems-rather than add to them? to reducing

36.When wind developers promise local,county governments money-what factors are used-do local governments understand they will lose govt levied money -so it doesnt generally pan out to be much if any gain?

37. Has the OES met privately with your agency developers to help you get the wording and requirements correct so that permits would get pushed thru? Would you be willing to share e-mails between your company and the OES in regard to this project?

38. What will the OES do to ensure that public participation is done-not pacification-generally trying to confuse involved citizens on project details- and including recommending illegal activities to the MN PUC? Providing access to affected individuals who have a stake in this(meaning all landowners) providing access,transparency,a shred of honesty-no meetings without non participants vested interests-provide local access for summary of all administrative offices-free access to transcripts-and local access-not reviewal at St.

Paul -or a charge of $250 .00-This is a government/developer initiated -affected landowners should not be required to pay-developers should.

39. Who will use any of the power produced from this wind farm? Will it be transmitted out of state?- How much is the production reduced by in 10 mi increments when transmitted in long distances?

40. Why should wind turbines-or any other inefficient productions be put in rural/agriculture/wildlife areas? Put them where you need them.

41. Electrical consumption has been reduced to 2007 levels,renewable mandate has been satisfied until 2016,economics don't support expansions of wind development,unemployment rate is at an all time high-wind farms "green" actually reduces employment-European studies conclude that for every "green" job created 2.2 will be lost.-this is not a US stimulus.

42. Do you believe that 849Million-might be billion-I'll verify (84%) of 2009 subsidies went overseas, are you supportive of foreign economic stimulus? Considering that 49% of your company has been strategically bought by Enel (Italian) owned company-with no records accessible about stockholders or anything else)they also have priority rights to buy the remaining 51%? How can you say you don't support foreign economies rather than your own-especially since all subsidies come from taxpayers in this nation.?

43. What assurance and guarantee do you have for property devaluation? Require bonds to protect non participants-if the industry claim is that there isn't any-then a property value guarantee shouldn't be a problem-?
Your company wouldn"t have a problem with that would they?

44.Decommissioning-Who would pick up this tab?--what procedures do you have in place-when would it be done?will industrial giants be left littered all over the landscape?What procedures and protocol do you have to ensure pre construction environment will be replaced to origin?What resources will be available? How would that be available if your company is long gone? By todays estimate decommissioning would roughly be somewhere in the 63 million range-not counting cost of living increases etc-this is no small change-local owners should not be forced to bear the brunt of poor planning and poor execution of using what resources are available-rather than wasting taxpayers money on facilities that won't do the job no matter how many of them you have-..in fact there are known factors that more base load plants would have to be built-just to provide for what wind never will be able to.Is this cost effective? Are minute energy generations worth the HUGE risks to environment and quality of life in rural Minnesota? Is it worth scarring our landscape forever?--Do we want our children, and their children to bear electrical and development costs that will only put our country further into debt? Do we support failure to more Mn. businesses and employees and job losses? Do we support such high electrical rates that businesses will be forced to migrate to other states because of rising costs of electricity that is already being attributed to wind energy coming on-line? We will not promote economic gainsor gainful employment by supporting higher electrical rates.

45.Why does the OES,and MN PUC consistantly fail to follow recommended setbacks stated in May 2009 white paper, which has only recently come under some scrutiny because the setbacks aren't large enough to protect citizens of this state.

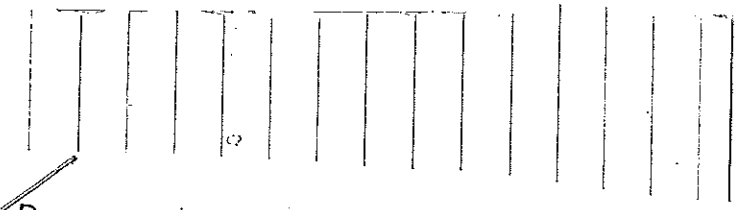
46. Texas has 9000 wind turbines-from those 9000 their production rae is 1%-and Texas is considered to be one of the windiest states. Why do you think your production would be any different? Provide documentation proving it.

47. Ice fling from wind turbines can go as far or further than 1700 ft. What liabilities are yours? Would there be any liabilities to landowners with wind agreements?-Do your contracts include mineral rights?

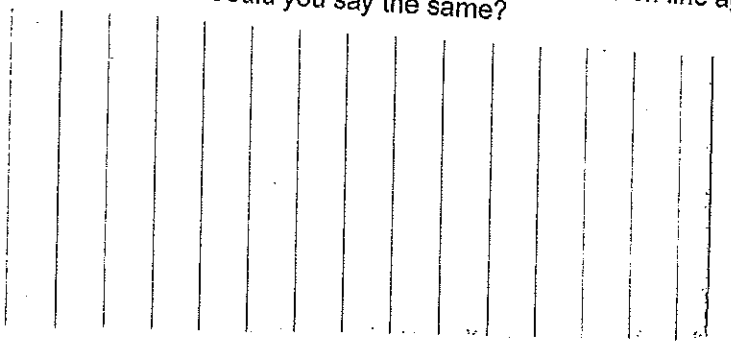
48. Given that farms have grown in size-what guarantees do you have that a farmers GPS precision system won't be compromised?

49. Initial benefits were pushed by co2 emissions-what substantial benefits would result in a facility with poor production- and co2 emissions from construction would take 8-11 years to reach pre construction levels?

50 Where have any studies been done that confirms any co2 beneficial environmental studies have been done and what results in changes if any?--prove it.



51. Denmark has recently shut off their turbines-won't be on line again til april 2011- and yes ice fling will be a problem addressed. Could you say the same?



Please entire each in it's entire document at each of the listed Websites.

*www.americanexperiment.org
MN. Policy Blueprint series - Recommendations for promoting affordable and competitive Energy Rates in Mn.

* Copy of the Law of good Intentions by: Michael Gildea, Manager MN. Rural Electric Assoc

* Copy of GE Corporate tax bill - zero MSN money

* United States Dept of Interior / USFW
* Interim USE Guidelines on Avoiding + minimizing Wildlife Impacts from Wind Turbines 2003

MBTA - MIGRATORY BIRD TREATY ACT
ESA - ENDANGERED SPECIES ACT
http://www.fws.gov/endangered/February 2009

Entire contents of U.S. Constitution Article; Bill of Rights - ARTICLE I
& entire Contents MN ~~[illegible]~~ Constitution ARTICLE I, Bill of Rights

MN constitution www.house.leg.state.MN
Highlight Article 1; Sect: 1, 8, 13

* In the matter of AWA Goodhue Wind Project
in front of ALJ Sheehy - K Rosenquist
ATTACHED

http://EPW.senate.gov/public/index.cfm
download all 44 pages to dockets

* Minnesota Dept of Health White Papers)
May 2009
entire document

Colleen Mueller
22186 Hwy 4
Paynesville, MN.
56362

New wind capacity is so dependent on this federal subsidy that installation falls off dramatically in years Congress allows tax subsidy to lapse (2000, 2002 and 2004). In 1999-2000, wind-capacity installation dropped 93 percent, with a 73 percent drop in 2001-2002, and 77 percent drop from 2003-2004.[25]

Federal taxpayer subsidy on a per unit of energy generated basis for wind and solar energy, a prime source of expected green jobs creation, is more than ten times than other sources of clean energy such as nuclear:

2007 FEDERAL TAXPAYER SUBSIDY OF RENEWABLE ENERGY GENERATION[26]

Fuel	Net Generation (BkWh)	Subsidy Value ($ in millions)	Subsidy/ Unit Generated ($/MWh)
Solar	1	$14	$24.34
Wind	31	$724	$23.37
Nuclear	794	$1,267	$1.59
Geothermal	15	$14	$0.92
Hydroelectric	258	$174	$0.67
Coal	1,946	$854	$0.44
Nat. Gas & Petrol. Liquid	919	$227	$0.25

STATE AND LOCAL GOVERNMENT TAXPAYER SUBSIDIES

While proposals for federal green jobs subsidies of $50,000 to $100,000 per job on top of multi-billion dollar federal renewable energy tax subsidies may not seem to make economic sense, State and local governments in some cases are paying even higher tax and grant subsidies per green job to attract new green job manufacturing to their locales.

18. Community Institute for Policy Heuristics Education and Research, *Green Cities, Green Jobs*, 2007.

19. Urban Agenda, *Growing Green Collar Jobs: Energy Efficiency*, 2007.

20. The White House, Mar. 10, 2009.

21. Philadelphia, PA, Feb. 27, 2009.

22. White House Middle Class Task Force, 2009.

23. Id.

24. U.S. Energy Information Administration, *Federal Financial Interventions and Subsidies in Energy Markets 2007*, April 2008.

25. Drew Thornley, Texas Public Policy Foundation, *Texas Wind Energy: Past, Present, and Future*, October 2008.

26. U.S. EIA, April 2008.

27. Good Jobs First, *High Road or Low Road? Job Quality in the New Economy*, 2009.

28. Id.

29. Ben Jacklet, "Sun, Sun, Here it Comes," *Oregon Business*, Jun. 2008.

30. Good Jobs First, 2009.

31. Jacklet, 2008.

32. http://www.solaicx.com/pages/opportunities.htm on Mar. 17, 2009.

33. Good Jobs First, 2009.

34. Energy Conversion Devices release at http://investor.shareholder.com/ovonics/releasedetail.cfm?ReleaseID=340384.

35. Good Jobs First, 2009.

36. Michael Pearson, "New Plant to Build Solar Cells," *The Atlanta Journal-Constitution*, Jun. 6, 2008.

37. Suniva release at http://www.suniva.com/documents/First%20Plant%20Grand%20Opening%20Press%20Release%20FINAL.pdf.

38. Matthew L. Wald, "Cost Works Against Alternative and Renewable Energy Sources in Time of Recession," *The New York Times*, Mar. 29, 2009.

39. Electric Power Research Institute, *Program on Technology Innovation: Integrated Generation Technology Options*, Nov. 2008.

Executive Summary

Background

In May 2007, Senator Lamar Alexander asked the Energy Information Administration (EIA) to develop an analysis of Federal energy subsidies focusing on subsidies to electricity production. Senator Alexander also specified that the analysis should be limited to subsidies provided by the Federal government, those that are energy-specific, and those that provide a financial benefit with an identifiable budget impact. Federal energy subsidies and interventions discussed in the body of this report take four principal forms:

- **Direct Expenditures**. These are Federal programs that directly affect the energy industry and for which the Federal government provides funds that ultimately result in a direct payment to producers or consumers of energy.

- **Tax Expenditures**. Tax expenditures are provisions in the Federal tax code that reduce the tax liability of firms or individuals who take specified actions that affect energy production, consumption, or conservation in ways deemed to be in the public interest.

- **Research and Development (R&D)**. Federal R&D spending focuses on a variety of goals, such as increasing U.S. energy supplies, or improving the efficiency of various energy production, transformation, and end-use technologies. R&D expenditures do not directly affect current energy production and prices, but, if successful, they could affect future production and prices.

- **Electricity programs serving targeted categories of electricity consumers in several regions of the country**. Through the Tennessee Valley Authority (TVA) and the Power Marketing Administrations (PMAs), which include the Bonneville Power Administration (BPA) and three smaller PMAs, the Federal government brings to market large amounts of electricity, stipulating that "preference in the sale of such power and energy shall be given to public bodies and cooperatives." The Federal government also indirectly supports portions of the electricity industry through loans and loan guarantees made by the U.S. Department of Agriculture's Rural Utilities Service (RUS).

With the exception of the Federal electricity programs, this report measures subsidies and support on the basis of the cost of the programs to the Federal budget provided in budget documents. Support associated with Federal electricity programs is measured by comparing the actual cost of funds made available to these entities to EIA estimates of the cost of funds that they might otherwise have incurred in the absence of Federal support.

Summary of Findings

Total Federal energy-specific subsidies and support to all forms of energy are estimated at $16.6 billion for fiscal year (FY) 2007 (Table ES1). Total energy subsidies have more than doubled in real terms (2007 dollars), increasing from an estimated $8.2 billion in FY 1999. Tax expenditures have more than tripled since 1999, rising from $3.2 billion that year to more than $10.4 billion in 2007.

The increase in energy subsidies and support since 1999 is distributed widely across all energy groups (Table ES1). Changes in the distribution of subsidies by fuel type between

Table ES5. Subsidies and Support to Electricity Production: Alternative Measures

Fuel/End Use	FY 2007 Net Generation (billion kilowatthours)	Alternative Measures of Subsidy and Support	
		FY 2007 Subsidy and Support (million 2007 dollars)	Subsidy and Support per Unit of Production (dollars/megawatthour)
Coal	1,946	854	0.44
Refined Coal	72	2,156	29.81
Natural Gas and Petroleum Liquids	919	227	0.25
Nuclear	794	1,267	1.59
Biomass (and biofuels)	40	36	0.89
Geothermal	15	14	0.92
Hydroelectric	258	174	0.67
Solar	1	14	24.34
Wind	31	724	23.37
Landfill Gas	6	8	1.37
Municipal Solid Waste	9	1	0.13
Unallocated Renewables	NM	37	NM
Renewables (subtotal)	360	1,008	2.80
Transmission and Distribution	NM	1,235	NM
Total	4,091	6,747	1.65

NOTES: Unallocated renewables include projects funded under Clean Renewable Energy Bonds and the Renewable Energy Production Incentive.

NM=Not meaningful. Totals may not equal sum of components due to independent rounding.

Sources: See Table 35

The differences between rankings of subsidies and support based on absolute amounts and amounts per megawatthour are driven by substantial differences in the amount of electricity generation across fuels. Capital-intensive, baseload generating technologies, such as coal-fired steam generators and nuclear generators, together produce about 70 percent of total net generation,[4] which tends to reduce their subsidies and support per unit of production compared to the other fuel groups (Table ES5). For the same reason, electricity subsidies for solar and wind show a relatively large subsidy per unit of production, as these groups account for less than 1 percent of total net generation in the country. It is important to recognize that the subsidies-per-megawatthour calculations are a snapshot taken at a particular point in time. Some electricity sources, such as nuclear, coal, oil, and natural gas, have received varying levels of subsidies and support in the past which may have aided them in reaching their current role in electricity production.[5] The impacts of prior subsidies, some of which may no longer be in effect, are not measured in the current analysis.

A per-unit measure of electricity production subsidies and support may provide a better indicator of its market impact than an absolute measure. For example, even though coal receives more subsidies in absolute terms than wind power, the use of wind is likely to be more dependent on the availability of subsidies than the use of coal.

[4] In fiscal year 2007, nuclear and coal accounted for 68 percent of total net generation.
[5] See Energy Information Administration, Federal *Financial Interventions and Subsidies in Energy Markets 1999: Primary Energy*, SR/OIAF/99-03 (Washington, DC, September 1999); Energy Information Administration, *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*, SR/EMEU/92-02 (Washington, DC, November 1992).

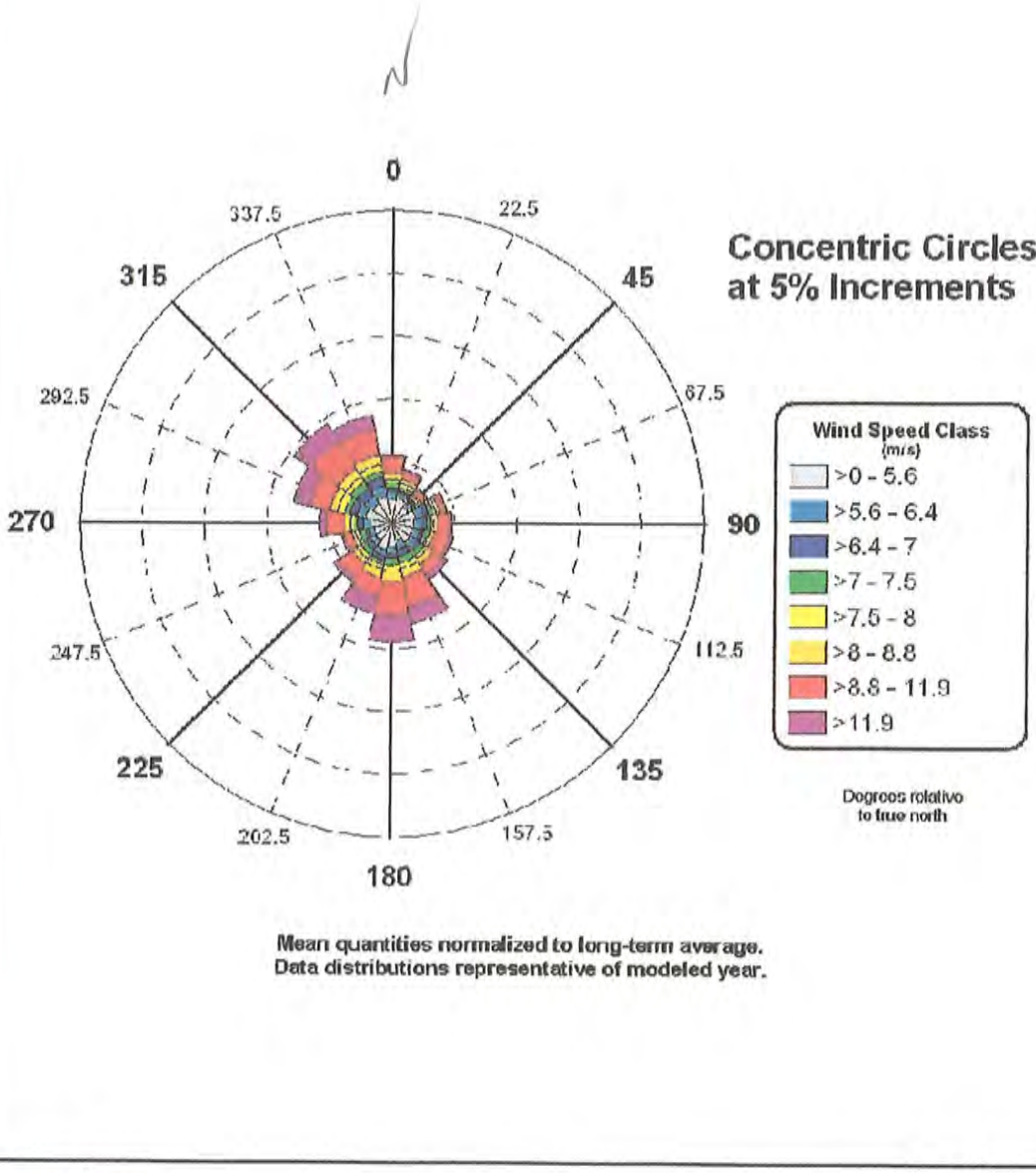


Figure 9-3
Area Energy Rose

Source: WindLogics, Inc. 2009. Black Oak, Minnesota Site Assessment Study.

Black Oak Wind Farm
Stearns County, MN

Map Document: (\\Mpls-gis-file\gistmpl\Geronimo\113816_Black_Oak\map_docs\mxd\LWECS_Site_Permit\Fig9-03_AreaEnergyRose.mxd)
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Paynesville Wind Farm CN-09-1110 WS:-10-49

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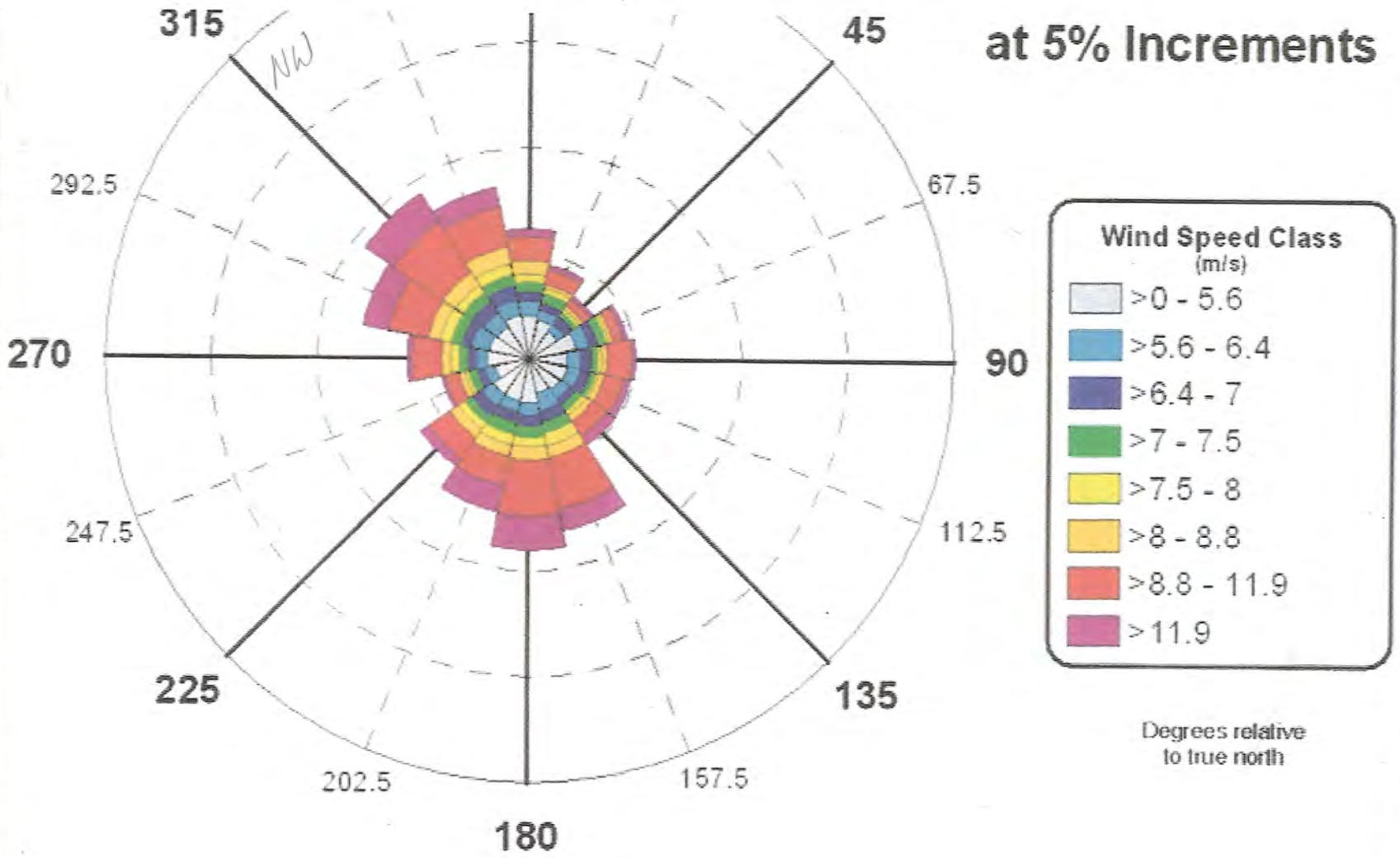


Mean quantities normalized to long-term average.
Data distributions representative of modeled year.

olication\Fig3-3_AreaEnergyRose.mxd)

Why met towers? 5

NW
S/SE

figure 3.3

In the matter of the AWA Goodhue Wind Project in front of ALJ Sheehy
Kristi Rosenquist

I live in rural Zumbrota Township, Goodhue County. In the past 15 months I have attending public meetings of the MPUC, Goodhue County Board, Planning Advisory Commission and its sub-committee on WECS ordinance. I have talk with a wide range of people by phone, email, and in person about wind energy. I read volumes of information related to wind energy from the wind industry, the government at all levels, think tanks, economists, various scientific fields, and citizen's negatively affected by existing wind projects around the world.

I conclude that the MPUC cannot agree to a PPA or issue a certificate of need or site permit for a LWECS project without violating their mission statement. Wind energy is inherently unreliable, excessively expensive and carries no benefit to tax payers, rate payers or citizens living near a wind project that would outweigh the health and safety problems associated with LWECS.

I believe the recent summary written by ALJ Eric Lipman in the matter of the MPUC 2010 Annual Review accurately reflects the situation. It reads in part:

A total of eighty-six written comments were submitted into the record. Seventy-six of the written comments were submitted by persons who had earlier participated in the Commission proceedings In the Matter of the...Goodhue Wind Project.

In the public hearings on that application, several dozen commentators testified as to their concerns about the externalities of wind farm operations, Minnesota's standards for C-BED project eligibility and the transparency of Commission's processes. Their experiences as participants in the proceedings in that docket have prompted larger and still broader suggestions for reform.

(1) the siting process is overly complex, insular and opaque – and seemingly favors the interests of energy insiders over the interests of the general public;

(2) there is a lack of uniform and accessible standards for the setbacks of wind turbines from adjacent structures and uses;

(3) there are tensions between the mandate to obtain larger shares of electric power from renewable sources of energy, and the obligation under Minn. Stat. 216E.02 to "minimize [the] adverse human and environmental impact[s]" of those energy projects;

(4) there are a number of barriers to the public's receipt of timely and accurate information on the siting of energy facilities;

(5) Commission and OES staff do not present themselves to the public as neutrals; and

(6) the standards for Community Based Energy Developments are too permissive and under-serve the affected public. With this feedback, the commentators from Goodhue County urge the Commission to revise its process so that it is clear that, in Commission decision-making, the siting preferences of individuals and communities are weighted as much as (or more than) the preferences of project applicants.

I can identify only one attempt by any agency of the State of MN to consider citizens - the MN Department of Health study "Public Health Impacts of Wind Turbines", May 22, 2009. The study was requested by the MPUC who has failed to implement key recommendations almost two years after its publication.

I conclude MN State standards for LWECS have no identifiable scientific basis and fail to protect property values, safety and health. State law states that the MPUC must consider and apply more strict standards of local governments unless there is good cause not to.

The applicant agreed to certain stricter standards so long as those standards did not pose a financial burden. I don't think the applicant agreed to the more strict County road setbacks based on science or safety, but because this posed no financial burden. Likewise, the experts and specialists hired by the applicant to provide answers to questions related to setbacks driven by considerations related to noise, flicker and other safety and health concerns did not provide evidence of good cause sufficient to override the deliberate, responsible actions of a local government body. The electrical expert testifying about stray voltage seemed unable to answer specific questions about wind turbine electrical systems and their collector systems. Likewise, he claimed to be utterly unaware of the stray voltage testing requirements for wind energy projects in our neighboring State of Wisconsin.

If built, this project would go into the most densely populated area by far of any LWECS project in the State.

The Goodhue County ordinance is reasonable and necessary.

MINNESOTA POWER

Company Background:

- Minnesota Power, a division of ALLETE, provides electricity in a 26,000 square mile electric service territory located in northeastern Minnesota. Minnesota Power supplies retail electric service to 141,000 retail customers and wholesale electric service to 16 municipalities.
- Transmission and distribution components include 8,866 circuit miles of lines and 169 substations. Minnesota Power's transmission network is interconnected with the transmission grid to promote reliability and is part of a larger regional transmission organization, MISO.
- During the period of 2001-2007, Minnesota Power invested nearly $47 million for upgrades and new infrastructure to the transmission system.

Renewable Resource Profile:

- The total connected renewable energy resource capacity is 341 MW consisting of:
  - 23 MW – Biomass, Natural Gas (Cloquet Energy Center)
  - 30 MW – Biomass, Coal (Rapids Energy Center)
  - 48 MW – Biomass, Coal, Natural Gas (Hibbard Energy Center)
  - 115 MW – Hydro (11 stations)
  - 125 MW – Wind (three wind farms added within the last five years)
- Total renewable energy resource projects in the interconnection queue is 275 MW of wind resources. None of these projects have executed an interconnection agreement.
- The following capacity factors apply to renewable resources in Minnesota Power's service area:
  - Wind = 20%
  - Hydro = 40-60%
  - Biomass = 80-86%

www.eei.org/ourissues/ElectricityTransmission/Documents/TransProjRenew_EM.pdf

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

Date: 4/18/2011

Public Comments Received by the Public Utilities Commission for week ending: 4-15-2011

Docket Number 10-1240

PC 10-1240

Rice, Robin (PUC)

From: COLLEEN MUELLER [cmueller@wildblue.net]
Sent: Sunday, April 10, 2011 2:46 AM
To: staff, cao (PUC)
Subject: Fwd: WS-10-1240 Black Oak Wind-Please enter for public comment
Attachments: subsidized green jobs no stimulus 001.jpg; glaess-good intentions gone bad 001.jpg; environment-science 001.jpg; environment-science 002.jpg; environment-science 003.jpg; environment-science 004.jpg; environment-science 005.jpg; energy-blue-print-2011.pdf; minnkota northstar co-op increases.pdf

Attachments on WS-10-1240-to be added as public comment and supporting documentation to letter. One final thought-If 849 million dollars went to overseas investors in wind-where is the US economic gain?-these wind grants are doing a great job of providng foreign stimulus-anything but US-taxpayers deserve more.-----
Forwarded message ----------
From: **COLLEEN MUELLER** <cmueller@wildblue.net>
Date: Sun, Apr 10, 2011 at 2:22 AM
Subject: WS-10-1240 Black Oak Wind-Please enter for public comment
To: consumer.puc@state.mn.us

RE: Black Oak Wind Farm:
It sure seems overly coincidental that Paynesville wind-and Black Oak Wind would be the same- no way! Why even have met towers if developer is able to just use wind map from -well who really knows where. The National
Weather Service average for Paynesville is 6.6 mph-so let's say the same is used there-the production capability is no where near 38%-more like 20%-and not taken into account wind turbines use energy in cold weather-they supposedly don't pose any threat to humans-yet they aren't to be sighted near human activity-kind of a strong contradiction.TOTALLY UNACCEPTABLE.Without access to correct wind resources it would be impossible to accurately predict what kind of energy would even be produced-higher electric rates will be a result-I have added Ottertail Power newsletter as well to add to docket. 2010 wasn't a very good year for them,especially considering they lost 16MILLION dollars which is primarily due to wind. How do you plan to keep electric bills down so it will be affordable to everyone and keep businesses in Minn. considering even more demands on their dollars. I have also attached that 2.2 jobs are lost for every"green job" job created. What kind of economic gain is that?

If windrose is any indication how this developer does business-God help us all! Since serious wildlife issues are present. The MBTA (Migratory Bird Treaty Act),ESA (Endangered Species Act) Bald and Golden Eagle Protection Act(There is a bald eagles next located within the project-which is in jeopardy -) It is only fitting under 16 U.S.C. 1531-1544) that a HPC (Habitat Protection Plan) and an ITP (Incidental Take Permit) be prepared and submitted to the Service. It is essential that under USFW Interim Use Guidelines toAvoid and Minimize Impacts from Wind Turbines 2003 be followed. 1) pre-development evaluations of potential wind farm sites to be conducted by a team of Federal and or State agency wildlife professionals with no vested interest in potential site. HDR,Inc does not fall under this category, as they are hired by the permitte, there should never be a time that an outside ,PAID ,INDEPENDENT co. could ever be considered to do an unbiased survey. The USFW and DNR need to do all wildlife studies-if they are short staffed-then perhaps the permittee should have considered that earlier. These studies also need to be done a minimum of 2 years to get a true and accurate count during spring and fall migration.Studies need to be done that the majority of days there isn't"disc corruption,compared to similar locations(each is unique in their own way-there are no 2 places exactly alike-and not compared to forested aeas when its something entirely different.)- Totally UNACCEPTABLE to have any outside firm doing those studies. Bats are most active during July and August-that is when there may-or may

not be any wind at all-yet it is known that wind turbines suck the lungs right out of bats-and how convenient was it to have disc corruption just during that time-? again-only DNR,USFW wildlife professionals with no vested interest -is mandatory -

Public Safety-I-94 is only approx 2 1/2 mi North of th is project-I can see the red blinking lights from Cosmos.MN. ,which is over 28 miles away from where I live,traffic on I-I94 will be distracted and there could be a big pileup- they already have quite a few in the winter time. Mayo One's greatest fear that there will be multiple injuries that need to receive emergency treatment and they won't be able to land- Now I ask you-how many times do you call an 800 number and get anything but a recording-not good enough-The Risks are there!!! There are only 12 by Cosmos-=there will be double that on the Black Oak project- terrible distraction and eye-sore.

Property Value Guarantee- If the wind industry claims are true, and there is supposedly no decrease in property value-then a bond or guarantee thru Lloyds of London would be a show of "good faith" that indeed they intend to make good on their claim-or pay up. Of course it needs to be bonded.

Decommissioning: Who will be left paying for this when it is no longer economically feasible? To protect Mn. taxpayers from even more burdens-the developer is already tax-exempt from absolutely everything else-security is essential to protect the interests of every Minnesotan. A bonded security of 62MILLION (not sure if that's enough) would be essential - in addition to not having to pay any taxes-the "supossed" production money is based on 100%-when actually it will be about 20% at best-that means that the $ the developer claims will come into a conmmunity will be 1/5 of what their claim is-hardly enough to go around, or measure much or any economic value .

Water: when over 25,000 ton of concrete are poured in to the ground-near 9622.2 acres of wildlife and wetlands-there will be significant impacts. You may not care about the water where you are-but it does matter and our ground water will be contaminated. This must be protected.

Health Impacts: ALJ Eric Lipman sumitted comments on theMPUC 2010 Annual Review unwillingness to site projects with safety of Mn citizens."Public Health Impacts of Wind Turbines" May 22,2009 was requested but the MPUC who has failed to implement key recommendations almost 2 years after it's publication. there are a number of barriers to the publics receipt of timely and accurate information on the siting of energy facilities, in addition Commission and OES staff do not present themselves to the public as neutrals. C-Bed are too permissive and under-serve the affected public, he urged the Commission that siting preferences of individuals and communities are weighted as much as(or more than) the preferences of project applicants.ALJLipman also stated stray voltage is an issue- and the MN State standards for LWECS have no identifiable scientific basis and fail to protect property values,safety, and health. State law states that the MPUC must consider and apply more strict standards of local governments unless there is good cause not to. Goodhue County ordinance is reasonable and necessary to protect Goodhue's citizens. Stearns County citizens deserve to be protected as well.- There are already comments that impropriety have taken place between the applicant and townships in Stearns County. Stearns County is paving the way for the developers to do whatever they want-not what the citizens of this county deserve-there has been far too "chummy relationships" and closed door meetings between county heads, and the developers-This too is unacceptable.

A company that is "farmer orientated" also knows that when a farmer goes to borrow money-that farmer is going to be required to put up collatoral. An honest and good company wouldn't want to leave a negative impression
or "take" Mn citizens without providing "good faith" bonding to protect the interests of this state.,local landowners,local governments, state, and all affected parties. There is far more at stake than what the developers have in a project-many landowners have 100's of thousands of dollars invested in their life's work-don't they deserve protection and guarantee's?

Earlier I had stated wildlife concerns;trumpeter swans migrate thru Black Oak area by the hundreds-It is very well known-they are a threatened migratory bird,bald eagles are protected (16 U.S.C. 703-712;6668-668d;MBTA;) bald eagle is federally protected,MN special concern the loggerhead shrike is Mn threatened--these avians and others require protections-a congressional investigation would be inevitable if adequate protection isn't.

Noise- an accoustical engineer-not HDR-impossible to get unbiased studies results- is mandatory to accurately model all turbines considered,topography, site locations-multiple turbines that affect a site-the various atmospheric conditions that impact turbine noisem,shadow flicker in relationship to home owners-especially non participants-what mitigation an honest co would offer landowners if trees and shades aren't acceptable. Any company that operates under "good,honest,farm orientated" would want to make "good faith" efforts to satisfy landowners and provide compensation.

Sincerely,
Colleen Mueller
22186 Hwy 4
Paynesville,MN. 56362

subsidized green jobs: www.american experiment.org

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

Date: 4/18/2011

Public Comments Received by the Public Utilities Commission for week ending: 4-15-2011

Docket Number 10-1240

Rice, Robin (PUC)

From: COLLEEN MUELLER [cmueller@wildblue.net]
Sent: Thursday, April 14, 2011 9:58 AM
To: staff, cao (PUC)
Subject: WS-10-1240
Attachments: windturbines.pdf

www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf
Please download the entire research paper on to WS-10-1240 so the public can view the health document-I see it has received an outstanding 2010 award.CMueller 22186 nHwy 4, Paynesville, MN> 56362

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

Date: 4/25/2011

Public Comments Received by the Public Utilities Commission for week ending: 4-22-2011

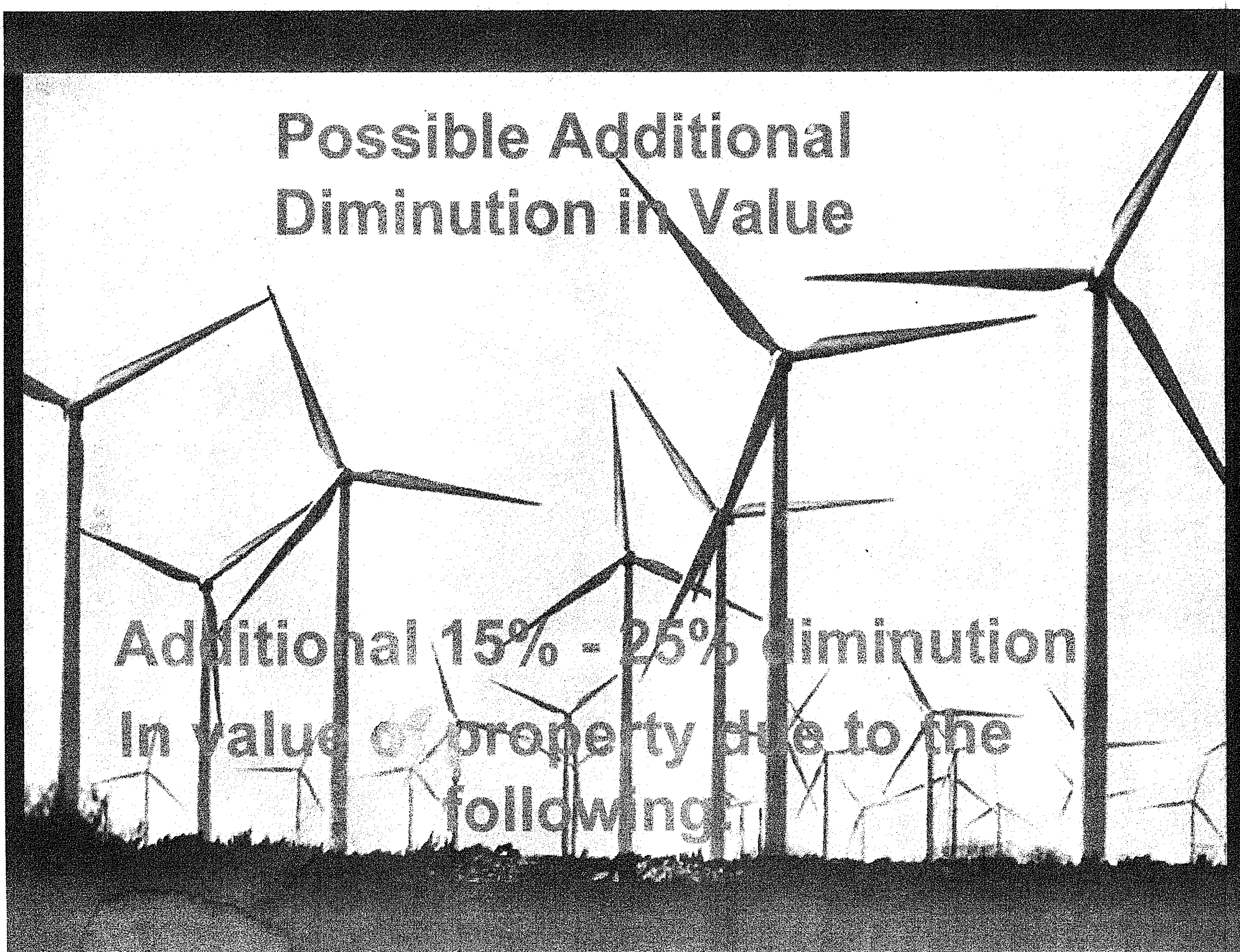
Docket Number 10-1240

WS 10-1240

Rice, Robin (PUC)

From: COLLEEN MUELLER [cmueller@wildblue.net]
Sent: Thursday, April 21, 2011 9:20 AM
To: staff, cao (PUC)
Subject: WS 10-1240
Attachments: pic-property diminuation 001 (2).zip; green jobs pg 4 am experiment 001.jpg

Please add these documents to the public record in their entirety. Thank you-Colleen Mueller http://www.benningtonbanner.com/local/ci 17090845 http://www.aol.news.com/2011/02/02/ercotblackoutends


Possible Additional
Diminution in Value
Additional 15% - 25% diminution
In value of property due to the
following:

office of energy security

85 7th Place East, Suite 500, St. Paul, MN 55101-2198
main: 651.296.4026 tty: 651.296.2860 fax: 651.297.7891
www.commerce.state.mn.us

COMMENT FORM

Proposed Black Oak Wind Farm

Docket No. IP6853/WS-10-1240

Name: Paul & Carolyn Reitsma email: _____

Street Address: 36615 Co. RD 18

City: Sauk Centre State: MN ZIP: 56378

Share your comments on the proposed Black Oak Wind Farm. **Comments must be received no later than 4:30 p.m., Friday, April 22, 2011.**

In the Black Oak proposal we are land owners of the proposed sub station. My concerns are that Geronimo Wind is saying we have agreed to sell them the land for this sub station. The truth is there has not been a company rep on my farm since I signed their lease. We have no intentions on selling any land and that was never brought up in their pre signing meetings. Top Down Here

The company keeps telling us that they are farmer friendly but then comes with a proposal running cable across my land to connect turbines on neighbors land cutting tile lines for turbines I receive no compensation for.

Please turn this form in tonight or mail to the address provided on the back. You may use additional sheets as necessary. Comments can also be emailed to: **suzanne.steinhauer@state.mn.us** with **PUC Docket No. IP6853/WS-10-1240** in the email subject line.

Signature: Paul Reitsma Date: 4-20-2011

I feel the company is applying for permit on a lot of speculation and when permit is granted will start changing things to benefit the company and will not be concerned about land owners needs.

I know I cannot stop this project but would like it noted that Black Oak Reps have not been honest and up front in obtaining land owner signatures and because of this I have no support for project.

4-20-2011

From: apache@web.lmic.state.mn.us
To: Steinhauer, Suzanne (COMM)
Subject: Thomssen Sun Apr 10 20:38:18 2011 IP6853/WS-10-1240
Date: Sunday, April 10, 2011 8:38:21 PM

This public comment has been sent via the form at:
www.energyfacilities.puc.state.mn.us/publicComments.html

You are receiving it because you are listed as the contact for this project.

Project Name: Black Oak Wind Farm

Docket number: IP6853/WS-10-1240

User Name: Will Thomssen

County: Pipestone County

City: Lake Benton

Email: willthebeast49er@yahoo.com

Phone:

Impact: Hi I am Will Thomssen, I attended the Public meeting in Sauk Center. I would like to make a comment on this permit, I live in Pipestone County where we have close to 300 hunderd wind turbines. I have never notice ficker and or noise that was to loud. I also like to commit that having wind turbines in the area has kept jobs here and local business solvent.

Thank You Will Thomssen

Mitigation:

Submission date: Sun Apr 10 20:38:18 2011

This information has also been entered into a centralized database for
future analysis.

For questions about the database or the functioning of this tool, contact:

Andrew Koebrick
andrew.koebrick@state.mn.us

Page 1 of 2
2 is a map

office of energy security

85 7th Place East, Suite 500, St. Paul, MN 55101-2198
main: 651.296.4026 tty: 651.296.2860 fax: 651.297.7891
www.commerce.state.mn.us

COMMENT FORM

Proposed Black Oak Wind Farm

Docket No. IP6853/WS-10-1240

Name: David Wiener email: _____

Street Address: 37263 Co Rd 18

City: Sauk Centre, Minn 56378 State: _____ ZIP: _____

Share your comments on the proposed Black Oak Wind Farm. **Comments must be received no later than 4:30 p.m., Friday, April 22, 2011.**

Dear Sir: etc along with Meeting 4-7-11

the maps inclosed showes where Spring bird have been Resting + migrating for as long as I lived here 62 years + I suppose before also. the blue circle in sec 12 + 1 is still used when water is high - birds leave sometimes when water drains out.

Acers signed up by participants in foot print does not fill area out lined. Fold Top Down Here

there are people in ashley + Raymond that are Nonparticipants but included in Foot print - why + whats is the reason they not out lined ashley Town Ship 26-27-35 Raymond sec 2-1 ?

please verify Geromino's sign up as they do use dicepition to get thier why. I am concerned concerned !! thank you for your time there are some participants already wishing they had NOT Signed !

Please turn this form in tonight or mail to the address provided on the back. You may use additional sheets as necessary. Comments can also be emailed to: **suzanne.steinhauer@state.mn.us** with **PUC Docket No. IP6853/WS-10-1240** in the email subject line.

Signature: David Wiener 320-352-3236 Date: 4-16-2011

loons flight path in Summer
Don't know where they all go after lines ends
Observed from Raymond township Sec 2 I live by the Co 18 semble

Attachment 1b – Vestas V90 Preliminary Layout

Eagles will Sit in My grove of trees Have be for past 27 years (aware of them)
But Not every years I see them

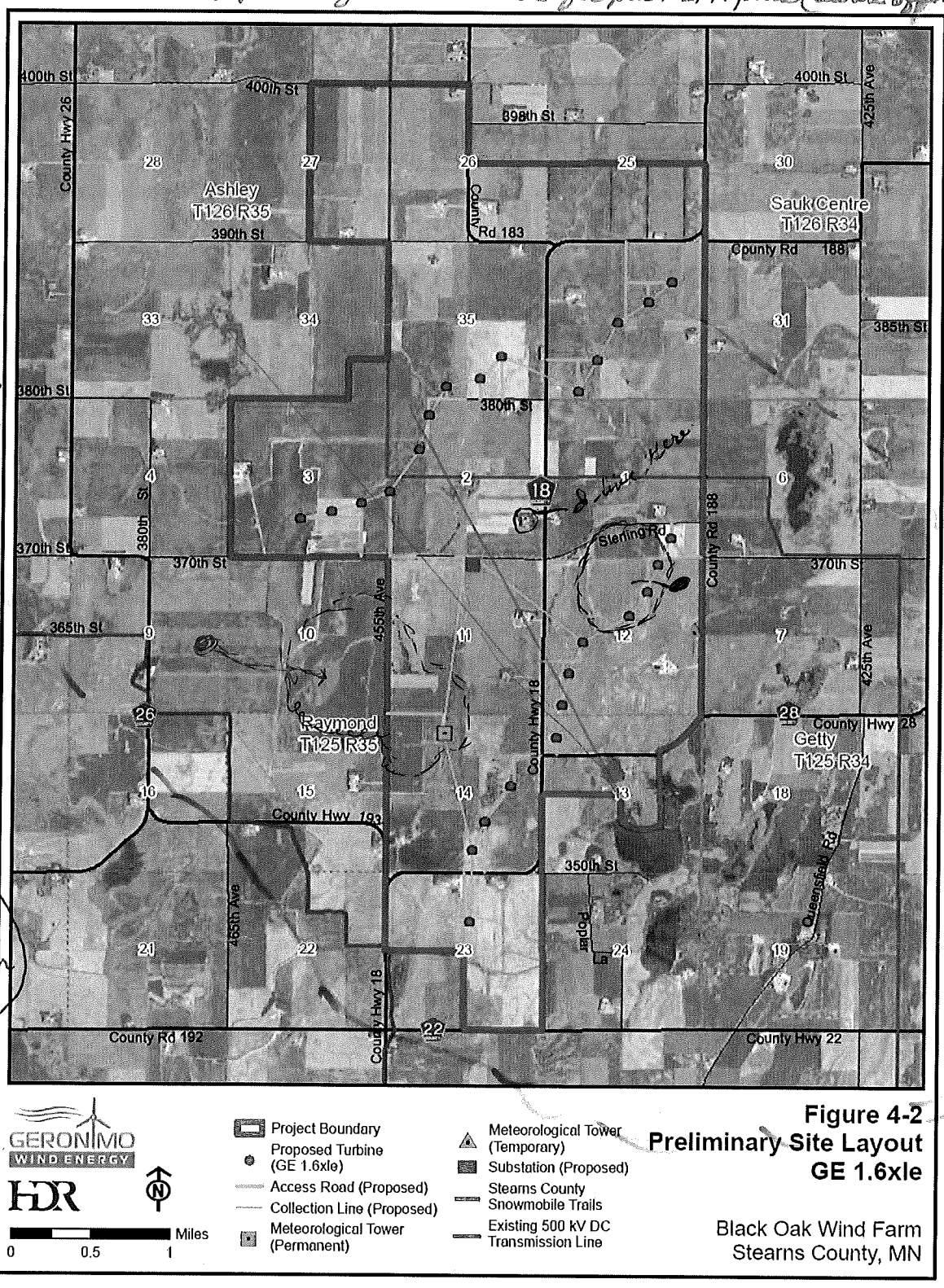


Figure 4-2
Preliminary Site Layout
GE 1.6xle

Black Oak Wind Farm
Stearns County, MN

Could find Swans + etc Bird inside the area 2011 + each year by condition of flood

Area 2011 April 2-8 where 1000+ Swans along and other many Spieces mixed

Flooded in 2011 asks anyone in this area because one could hear them 1 or more miles away

Birds in many small flood Ponds in out lined area

Don't know out side of this circled area

Blue circle is area (Most used when flooded in spring water gone in April 2011

David Wiener
Sec 2 Raymond
320-352-3236

David Wiener
37263 County Road 18
Sauk Centre, MN 56378-8102

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

Date: 5/2/2011

Public Comments Received by the Public Utilities Commission for week ending: 4-29-2011

Docket Number 10-1240

Rice, Robin (PUC)

From: Westerman Dairy [janellw@wisper-wireless.com]
Sent: Thursday, April 28, 2011 7:16 PM
To: staff, cao (PUC)
Subject: concerned about wind turbines

I'm writing in regards to the proposed wind turbines coming into our area (docket #WS10-1240). I'm very concerned that enough studies have not been done concerning environmental impact and health impact. I was recently at the meeting put on by Black Oak and their proposed wind farm in our area. Why aren't DNR or USFW professionals doing any studies on this? Black Oak has one of their own hired doing a study and that's not right. There is over 9,622 acres in or within 10 mi of the project area. We have a natural environment lake in our back yard and enjoy watching the wildlife (geese, ducks, loons, cranes, bald eagles) and are careful in our farming practices not to do anything to hurt the environment. Wildlife-acreage is taken out of our tax base-we EXPECT that DNR or USFW does their job to protect the wildlife! A Habitat Conservation Plan needs to be prepared and submitted before this project goes any further! DOE/OES needs to follow Interim Use Guidelines to minimize impacts to wildlife from wind turbines. We EXPECT that there be AT LEAST a 1/2 mile setback (a mile would be better!) from all wildlife areas and non-participating landowner's property lines.

In addition to the environment impact these wind turbines would cause, I'm also concerned about the rate increases it would cause in our electricity costs. Recent rate increases have already caused our bill to go up substantially - we cannot afford more increases. Enough is enough!
Sincerely,
Janell Westerman
Sauk Centre, MN

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

Date: June 20, 2011

Public Comments Received by the Public Utilities Commission for week ending: 6-17-11

Docket Number: 10-1240

****COMMENTS RECEIVED AFTER DEADLINE****

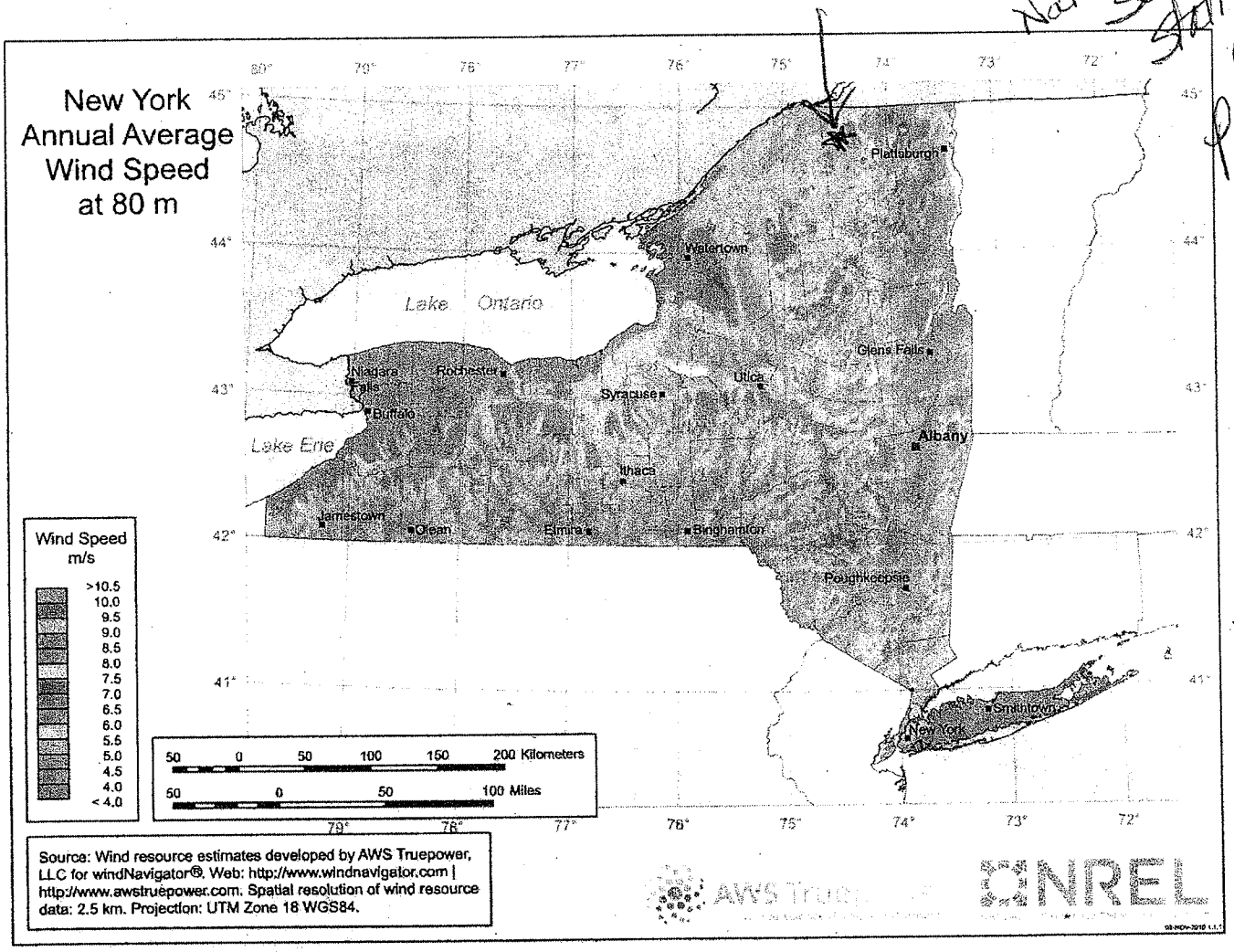
10-1240

Rice, Robin (PUC)

From: COLLEEN MUELLER <cmueller@wildblue.net>
Sent: Tuesday, June 14, 2011 12:07 AM
To: staff, cao (PUC)
Subject: WS-11-195
Attachments: 04262011wind promises 001.jpg; 04262011wind promises pg2 001.jpg; 04262011wind promises pg 3 NY 001 (2).jpg; subsidized green jobs no stimulus 001.jpg; glaess-good intentions gone bad 001.jpg; windturbines-mn dept of health.pdf

Please enter as part of public record. Wind energy production is one of the worst uses of resources. A biomass facility if it says 35MW as long as mass it put into it-it produces exactly what it claims-35MW whereas a let's say 95MW wind farm-best case scenario may produce 19MW-and given the cold winter of 2010-2011 and 5 mo. of below record temperatures-wind turbines actually use power-rather than produce-so that also affects the end results. Biomass is a more prudent use of resources the state already has-without dotting the rural populace with scars that will remain for decades to come, not only on the land, but on the people in and around, not to mention the adverse health affects that are everywhere. When does the MN. PUC consider the safety,health, morality,socioeconomical adverse affects on a region? Cracks thru the core of each and every community!. Our rural areas are being targeted because there aren't as many people to protest and to fight industrialization it would take an estimated 6 digit figure. You tell me-where and why should anyone have the come up with that kind of money when it is DOE/OES-who have masterminded this whole scheme with their legal expertise and lobbyists-most of them lobbyied wind before going to OES -each creating more work and wasting taxpayers money. The DOE/OES and MN PUC should all be fired for wasting taxpayers money. They both approve all projects and permits anyway-no use paying them a high salary when its a done deal before it even starts. No matter what anyone says-or proves-absolutely none of it is considered-no ones health, public safety, noise pollution,visual pollution-property devaluation are taken into account. Oh they say they do-, but not really-once again, it's take from the little guy and give everything and more to the big guy. MONEY TALKS-it's all bought and negotiated before the public even hears about it. Please enter the MN Dept of Health white paper 2009 as part of the public record and enter it in it's entirety. Please add other attachments as part of public record. After 3 years Chatauguay (which is in northeastern NY) they have pretty close to the same wind here-seems that NONE of the promises developers made have happened and if transmission costs were taken into account -total production would come to a whopping 10%-not even close to exaggerated estimates before project began. Is that what this project has to look forward to too?--Big lies-no truths-Subsidized green jobs from: www. americanexperiment.org.Mr. Glaess is the manager for Minnesota Rural Electric Associations. Good intentions indeed? Sincerely, Colleen Mueller 22186 Hwy 4, Paynesville, MN. 56362 I suppose this project has 6 1/2 mi to go to substation like Paynesville wind- but OES stated 4 miles- ,a lot higher cost to go 2 1/2 miles further-add that to CN-09-1110;WS -10-49 and please include on this as well.

Chateaugay N.Y. wind speed m/s 7.5-7.0 National Weather Service Statistics 6.6 for payposes



Public Health Impacts of Wind Turbines

Prepared by:
Minnesota Department of Health
Environmental Health Division

In response to a request from:
Minnesota Department of Commerce
Office of Energy Security

May 22, 2009

Table of Contents

Tables

Figures

I. Introduction

In late February 2009 the Minnesota Department of Health (MDH) received a request from the Office of Energy Security (OES) in the Minnesota Department of Commerce, for a "white paper" evaluating possible health effects associated with low frequency vibrations and sound arising from large wind energy conversion systems (LWECS). The OES noted that there was a request for a Contested Case Hearing before the Minnesota Public Utilities Commission (PUC) on the proposed Bent Tree Wind Project in Freeborn County Minnesota; further, the OES had received a long comment letter from a citizen regarding a second project proposal, the Lakeswind Wind Power Plant in Clay, Becker and Ottertail Counties, Minnesota. This same commenter also wrote to the Commissioner of MDH to ask for an evaluation of health issues related to exposure to low frequency sound energy generated by wind turbines. The OES informed MDH that a white paper would have more general application and usefulness in guiding decision-making for future wind projects than a Contested Case Hearing on a particular project. (Note: A Contested Case Hearing is an evidentiary hearing before an Administrative Law Judge, and may be ordered by regulatory authorities, in this case the PUC, in order to make a determination on disputed issues of material fact. The OES advises the PUC on need and permitting issues related to large energy facilities.)

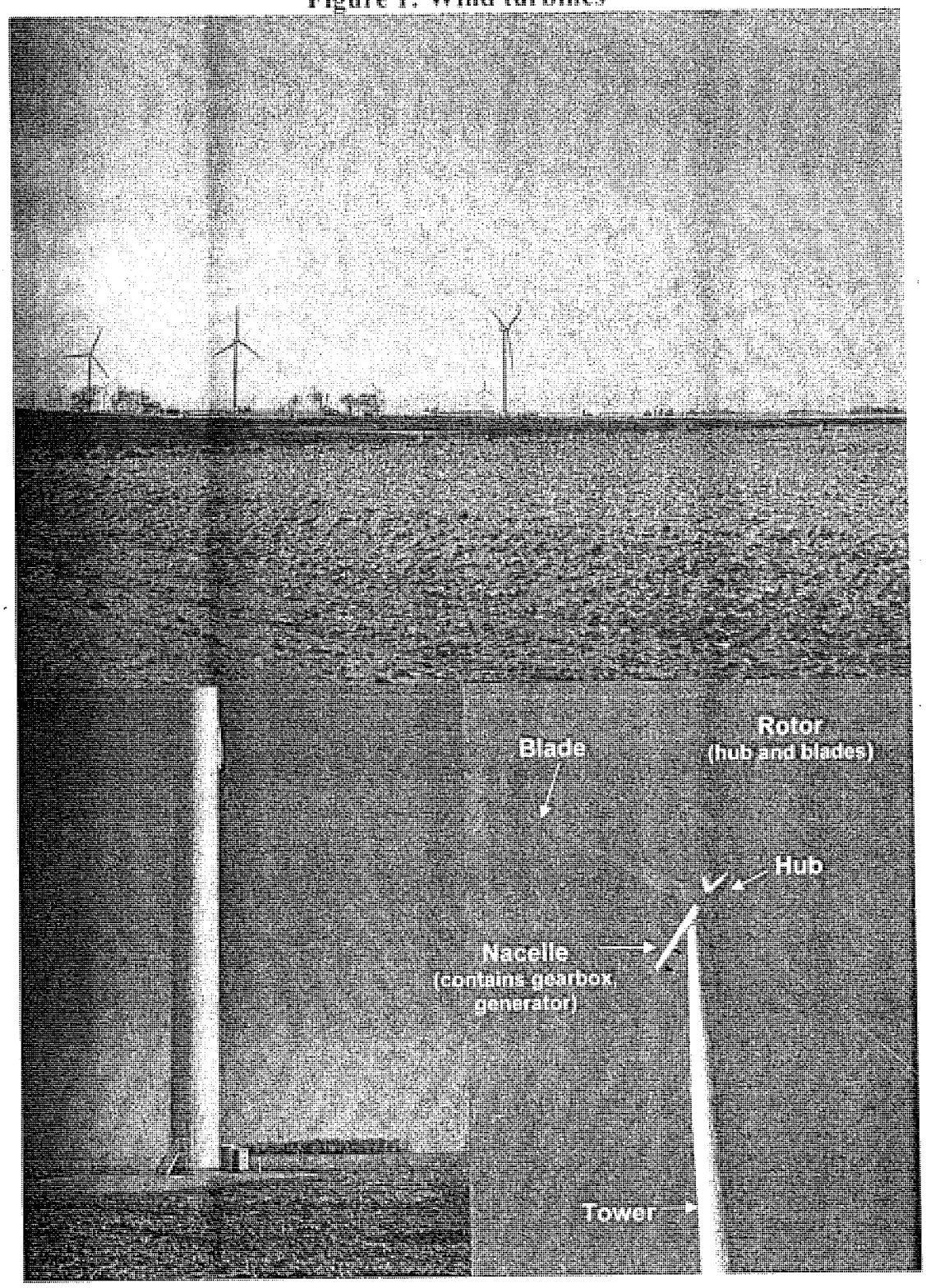
In early March 2009, MDH agreed to evaluate health impacts from wind turbine noise and low frequency vibrations. In discussion with OES, MDH also proposed to examine experiences and policies of other states and countries. MDH staff appeared at a hearing before the PUC on March 19, 2009, and explained the purpose and use of the health evaluation. The Commissioner replied to the citizen letter, affirming that MDH would perform the requested review.

A brief description of the two proposed wind power projects, and a brief discussion of health issues to be addressed in this report appear below.

A. Site Proposals

Wind turbines are huge and expensive machines requiring large capitol investment. Figure 1 shows some existing wind turbines in Minnesota. Large projects require control of extensive land area in order to optimize spacing of turbines to minimize turbulence at downwind turbines. Towers range up to 80 to 100 meters (260 to 325 feet), and blades can be up to 50 meters long (160 feet) (see Tetra Tech, 2008; WPL, 2008). Turbines are expected to be in place for 25-30 years.

Figure 1: Wind turbines



1. Bent Tree Wind Project in Freeborn County

This is a proposal by the Wisconsin Power and Light Company (WPL) for a 400 megawatt (MW) project in two phases of 200 MW each (requiring between 80 and 130 wind turbines). The cost of the first phase is estimated at $497 million. The project site area would occupy approximately 40 square miles located 4 miles north and west of the city of Albert Lea, approximately 95 miles south of Minneapolis (Figure 2) (WPL, 2008). The Project is a LWECS and a Certificate of Need (CON) from the PUC is required (*Minnesota Statutes 216B.243)*. The PUC uses the CON process to determine the basic type of facility (if any) to be constructed, the size of the facility, and when the project will be in service. The CON process involves a public hearing and preparation of an Environmental Report by the OES. The CON process generally takes a year, and is required before a facility can be permitted.

WPL is required to develop a site layout that optimizes wind resources. Accordingly, project developers are required to control areas at least 5 rotor diameters in the prevailing (north-south) wind directions (between about 1300 and 1700 feet for the 1.5 to 2.5 MW turbines under consideration for the project) and 3 rotor diameters in the crosswind (east-west) directions (between about 800 and 1000 feet). Thus, these are minimum setback distances from properties in the area for which easements have not been obtained. Further, noise rules promulgated by the Minnesota Pollution Control Agency (MPCA; *Minnesota Rules* Section 7030), specify a maximum nighttime noise in residential areas of 50 A-weighted decibels (dB(A). WPL has proposed a minimum setback of 1,000 feet from occupied structures in order to comply with the noise rule.

2. Noble Flat Hill Wind Park in Clay, Becker and Ottertail Counties

This is a LWECS proposed by Noble Flat Hill Windpark I (Noble), a subsidiary of Noble Environmental Power, based in Connecticut. The proposal is for a 201 MW project located 12 miles east of the City of Moorhead, about 230 miles northwest of Minneapolis (Figure 3) (Tetra Tech, 2008). The cost of the project is estimated to be between $382 million and $442 million. One hundred thirty-four GE 1.5 MW wind turbines are planned for an area of 11,000 acres (about 17 square miles); the site boundary encompasses approximately 20,000 acres. Setback distances of a minimum of 700 feet are planned to comply with the 50 dB(A) noise limit. However, rotor diameters will be 77 meters (250 feet). Therefore, setback distances in the prevailing wind direction of 1,300 feet are planned for properties where owners have not granted easements. Setbacks of 800 feet are planned in the crosswind direction.

Figure 2: Bent Tree Wind Project, Freeborn County

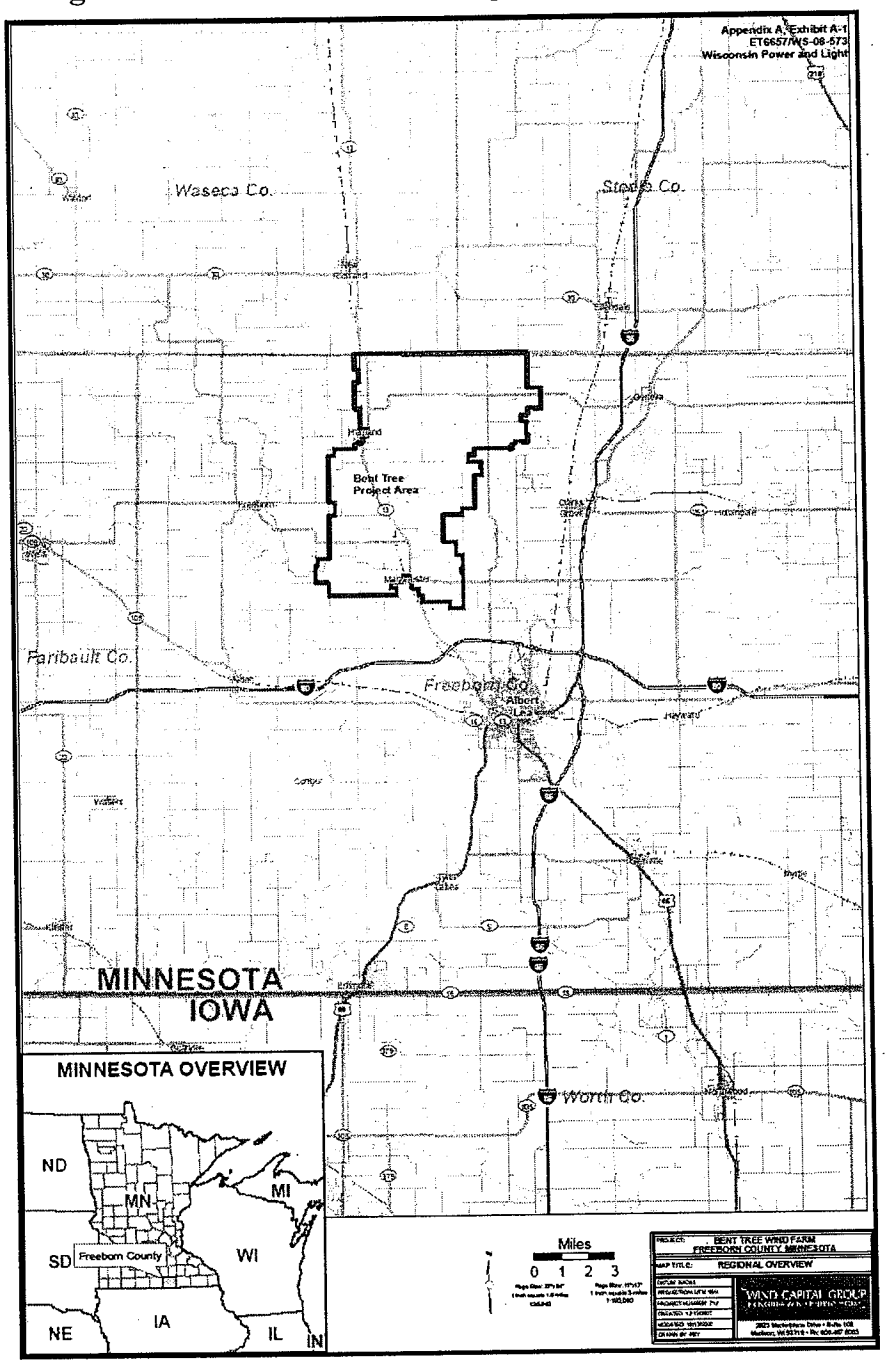
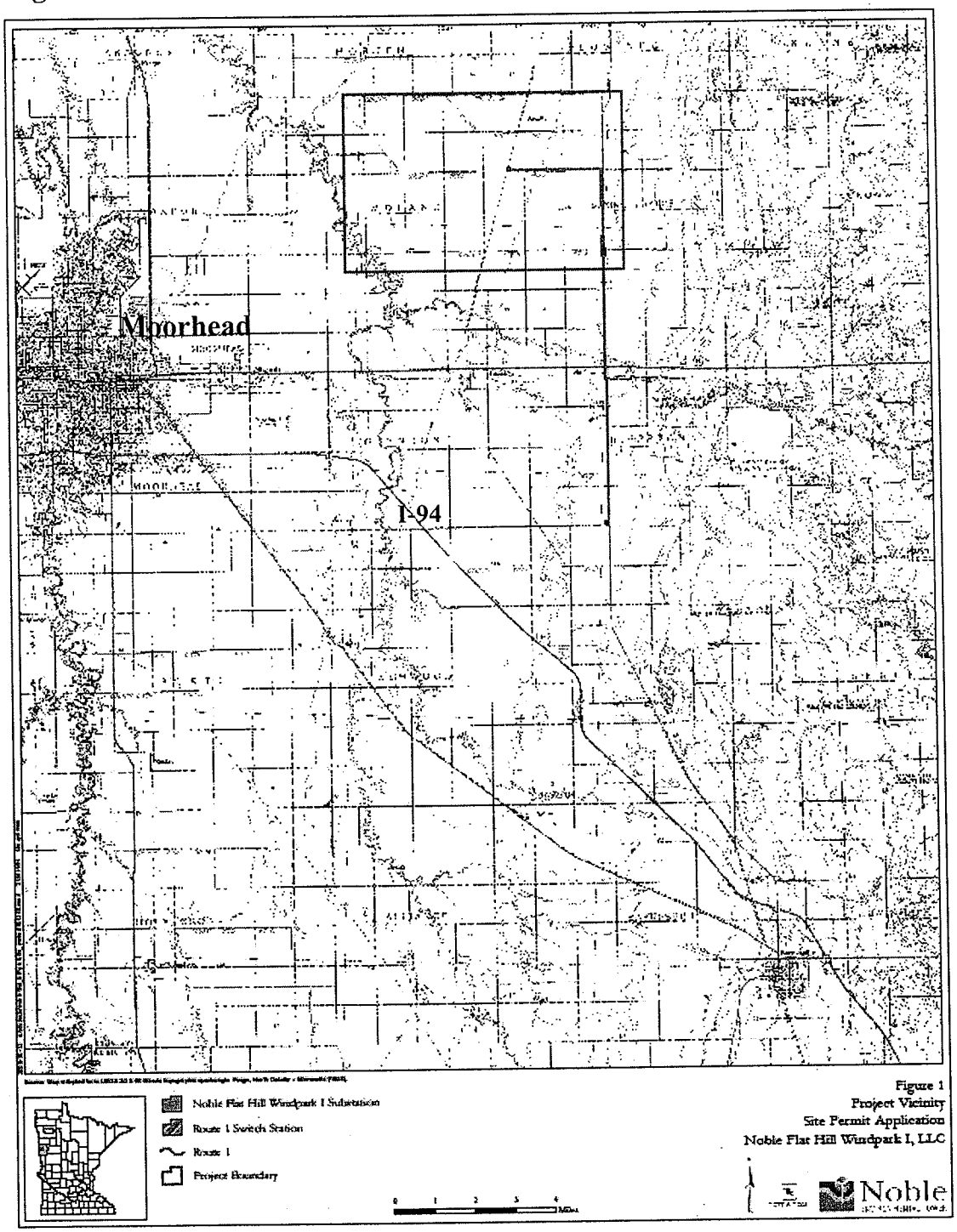


Figure 3: Noble Flat Hill Wind Park, Clay, Becker, Ottertail Counties



B. Health Issues

The National Research Council of the National Academies (NRC, 2007) has reviewed impacts of wind energy projects on human health and well-being. The NRC begins by observing that wind projects, just as other projects, create benefits and burdens, and that concern about impacts is natural when the source is near one's home. Further, the NRC notes that different people have different values and levels of sensitivity. Impacts noted by the NRC that may have the most effect on health include noise and low frequency vibration, and shadow flicker. While noise and vibration are the main focus of this paper, shadow flicker (casting of moving shadows on the ground as wind turbine blades rotate) will also be briefly discussed.

Noise originates from mechanical equipment inside the nacelles of the turbines (gears, generators, etc.) and from interaction of turbine blades with wind. Newer wind turbines generate minimal noise from mechanical equipment. The most problematic wind turbine noise is a broadband "whooshing" sound produced by interaction of turbine blades with the wind. Newer turbines have upwind rotor blades, minimizing low frequency "infrasound" (i.e., air pressure changes at frequencies below 20-100 Hz that are inaudible). However, the NRC notes that during quiet conditions at night, low frequency modulation of higher frequency sounds, such as are produced by turbine blades, is possible. The NRC also notes that effects of low frequency (infrasound) vibration (less than 20 Hz) on humans are not well understood, but have been asserted to disturb some people.

Finally, the NRC concludes that noise produced by wind turbines is generally not a major concern beyond a half mile. Issues raised by the NRC report and factors that may affect distances within which wind turbine noise may be problematic are discussed more extensively below.

II. Elementary Characteristics of Sensory Systems and Sound

A. Sensory Systems

1. Hearing

Sensory systems respond to a huge dynamic range of physical stimuli within a relatively narrow dynamic range of mechanical, chemical and/or neuronal (electrophysiological) output. Compression of the dynamic range is accomplished by systems that respond to logarithmic increases in intensity of physical stimuli with arithmetically increasing sensory responses. This general property is true for hearing, and has been recognized since at least the mid-19th century (see e.g., Woodworth and Schlosberg, 1964). "Loudness" is the sensory/perceptual correlate of the physical intensity of air pressure changes to which the electro-mechanical transducers in the ear and associated neuronal pathways are sensitive. Loudness increases as the logarithm of air pressure, and it is convenient to relate loudness to a reference air pressure (in dyne/cm^2 or pascals) in tenths of logarithmic units (decibels; dB). Further, the ear is sensitive to only a relatively narrow frequency range of air pressure changes: those between approximately 20 and 20,000 cycles per second or Herz (Hz). In fact, sensitivity varies within this range, so that the sound pressure level relative to a reference value that is audible in the middle of the range

(near 1,000 Hz) is about 4 orders of magnitude smaller than it is at 20 Hz and about 2 orders of magnitude smaller than at 20,000 Hz (Fig. 3). Accordingly, measurements of loudness in dB generally employ filters to equalize the loudness of sounds at different frequencies or "pitch." To approximate the sensitivity of the ear, A-weighted filters weigh sound pressure changes at frequencies in the mid-range more than those at higher or lower frequencies. When an A-weighted filter is used, loudness is measured in dB(A). This is explained in greater detail in Section B below.

The ear accomplishes transduction of sound through a series of complex mechanisms (Guyton, 1991). Briefly, sound waves move the eardrum (tympanic membrane), which is in turn connected to 2 small bones (ossicles) in the middle ear (the malleus and incus). A muscle connected to the malleus keeps the tympanic membrane tensed, allowing efficient transmission to the malleus of vibrations on the membrane. Ossicle muscles can also relax tension and attenuate transmission. Relaxation of muscle tension on the tympanic membrane protects the ear from very loud sounds and also masks low frequency sounds, or much background noise. The malleus and incus move a third bone (stapes). The stapes in turn applies pressure to the fluid of the cochlea, a snail-shaped structure imbedded in temporal bone. The cochlea is a complex structure, but for present purposes it is sufficient to note that pressure changes or waves of different frequencies in cochlear fluid result in bending of specialized hair cells in regions of the cochlea most sensitive to different frequencies or pitch. Hair cells are directly connected to nerve fibers in the vestibulocochlear nerve (VIII cranial nerve).

Transmission of sound can also occur directly through bone to the cochlea. This is a very inefficient means of sound transmission, unless a device (e.g. a tuning fork or hearing aid) is directly applied to bone (Guyton, 1991).

2. Vestibular System

The vestibular system reacts to changes in head and body orientation in space, and is necessary for maintenance of equilibrium and postural reflexes, for performance of rapid and intricate body movements, and for stabilizing visual images (via the vestibulo-ocular reflex) as the direction of movement changes (Guyton, 1991).

The vestibular apparatus, like the cochlea, is imbedded in temporal bone, and also like the cochlea, hair cells, bathed in vestibular gels, react to pressure changes and transmit signals to nerve fibers in the vestibulocochlear nerve. Two organs, the utricle and saccule, called otolith organs, integrate information about the orientation of the head with respect to gravity. Otoliths are tiny stone-like crystals, embedded in the gels of the utricle and saccule, that float as the head changes position within the gravitational field. This movement is translated to hair cells. Three semi-circular canals, oriented at right angles to each other, detect head rotation. Stimulation of the vestibular apparatus is not directly detected, but results in activation of motor reflexes as noted above (Guyton, 1991).

Like the cochlea, the vestibular apparatus reacts to pressure changes at a range of frequencies; optimal frequencies are lower than for hearing. These pressure changes can be caused by body movements, or by direct bone conduction (as for hearing, above) when vibration is applied directly to the temporal bone (Todd et al., 2008). These investigators

found maximal sensitivity at 100 Hz, with some sensitivity down to 12.5 Hz. The saccule, located in temporal bone just under the footplate of the stapes, is the most sound-sensitive of the vestibular organs (Halmagyi et al., 2004). It is known that brief loud clicks (90-95 dB) are detected by the vestibular system, even in deaf people. However, we do not know what the sensitivity of this system is through the entire range of sound stimuli.

While vestibular system activation is not directly felt, activation may give rise to a variety of sensations: vertigo, as the eye muscles make compensatory adjustments to rapid angular motion, and a variety of unpleasant sensations related to internal organs. In fact, the vestibular system interacts extensively with the "autonomic" nervous system, which regulates internal body organs (Balaban and Yates, 2004). Sensations and effects correlated with intense vestibular activation include nausea and vomiting and cardiac arrhythmia, blood pressure changes and breathing changes.

While these effects are induced by relatively intense stimulation, it is also true that A-weighted sound measurements attuned to auditory sensitivity, will underweight low frequencies for which the vestibular system is much more sensitive (Todd et al., 2008). Nevertheless, activation of the vestibular system *per se* obviously need not give rise to unpleasant sensations. It is not known what stimulus intensities are generally required for for autonomic activation at relatively low frequencies, and it is likely that there is considerable human variability and capacity to adapt to vestibular challenges.

B. Sound

1. Introduction

Sound is carried through air in compression waves of measurable frequency and amplitude. Sound can be tonal, predominating at a few frequencies, or it can contain a random mix of a broad range of frequencies and lack any tonal quality (white noise). Sound that is unwanted is called noise.

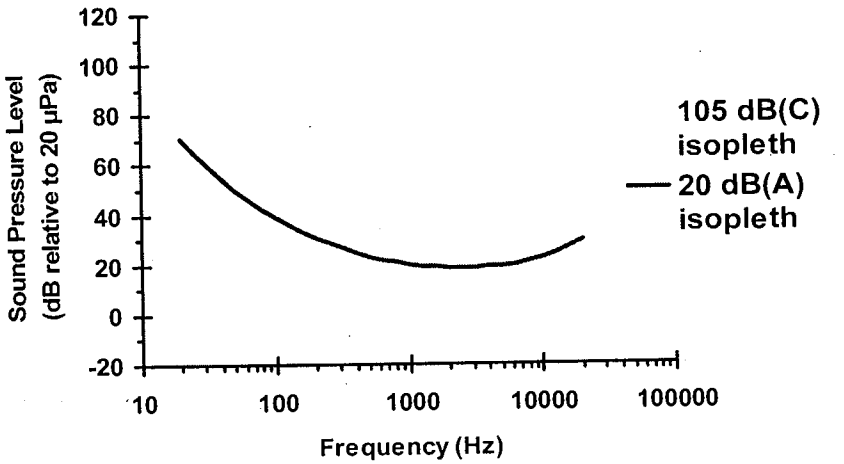
Audible Frequency Sound

Besides frequency sensitivity (between 20 and 20,000 Hz), humans are also sensitive to changes in the amplitude of the signal (compression waves) within this audible range of frequencies. Increasing amplitude, or increasing sound pressure, is perceived as increasing volume or loudness. The sound pressure level in air (SPL) is measured in micro Pascals (μPa). SPLs are typically converted in measuring instruments and reported as decibels (dB) which is a log scale, relative unit (see above). When used as the unit for sound, dBs are reported relative to a SPL of 20 μPa. Twenty μPa is used because it is the approximate threshold of human hearing sensitivity at about 1000 Hz. Decibels relative to 20 μPa are calculated from the following equation:

$$\text{Loudness (dB)} = \text{Log}\left((\text{SPL} / 20\ \mu\text{Pa})^2\right) * 10$$

Figure 4 shows the audible range of normal human hearing. Note that while the threshold sensitivity varies over the frequency range, at high SPLs sensitivity is relatively consistent over audible frequencies.

Figure 4: Audible Range of Human Hearing



Equivalence curves for different frequencies, when sound meter readings in dB are taken with A or C-weighting filters. (Adapted from EPD Hong Kong SAR, 2009)

Sub-Audible Frequency Sound

Sub-audible frequency sound is often called infrasound. It may be sensed by people, similar to audible sound, in the cochlear apparatus in the ear; it may be sensed by the vestibular system which is responsible for balance and physical equilibrium; or it may be sensed as vibration.

Resonance and modulation

Sound can be attenuated as it passes through a physical structure. However, because the wavelength of low frequency sound is very long (the wavelength of 40 Hz in air at sea level and room temperature is 8.6 meters or 28 ft), low frequencies are not effectively attenuated by walls and windows of most homes or vehicles. (For example, one can typically hear the bass, low frequency music from a neighboring car at a stoplight, but not the higher frequencies.) In fact, it is possible that there are rooms within buildings exposed to low frequency sound or noise where some frequencies may be amplified by resonance (e.g. ½ wavelength, ¼ wavelength) within the structure. In addition, low frequency sound can cause vibrations within a building at higher, more audible frequencies as well as throbbing or rumbling.

Sounds that we hear generally are a mixture of different frequencies. In most instances these frequencies are added together. However, if the source of the sound is not constant, but changes over time, the effect can be re-occurring pulses of sound or low frequency modulation of sound. This is the type of sound that occurs from a steam engine, a jack hammer, music and motor vehicle traffic. Rhythmic, low frequency pulsing of higher frequency noise (like the sound of an amplified heart beat) is one type of sound that can be caused by wind turbine blades under some conditions.

2. Human Response to Low Frequency Stimulation

There is no consensus whether sensitivity below 20 Hz is by a similar or different mechanism than sensitivity and hearing above 20 Hz (Reviewed by Møller and Pedersen, 2004). Possible mechanisms of sensation caused by low frequencies include bone conduction at the applied frequencies, as well as amplification of the base frequency and/or harmonics by the auditory apparatus (eardrum and ossicles) in the ear. Sensory thresholds are relatively continuous, suggesting (but not proving) a similar mechanism above and below 20 Hz. However, it is clear that cochlear sensitivity to infrasound (< 20 Hz) is considerably less than cochlear sensitivity to audible frequencies.

Møller and Pedersen (2004) reviewed human sensitivity at low and infrasonic frequencies. The following findings are of interest:

- When whole-body pressure-field sensitivity is compared with ear-only (earphone) sensitivity, the results are very similar. These data suggest that the threshold sensitivity for low frequency is through the ear and not vestibular.
- Some individuals have extraordinary sensitivity at low frequencies, up to 25 dB more sensitive than the presumed thresholds at some low frequencies.
- While population average sensitivity over the low frequency range is smooth, sound pressure thresholds of response for individuals do not vary smoothly but are inconsistent, with peaks and valleys or "microstructures". Therefore the sensitivity response of individuals to different low frequency stimulation may be difficult to predict.
- Studies of equal-loudness-levels demonstrate that as stimulus frequency decreases through the low frequencies, equal-loudness lines compress in the dB scale. (See Figure 4 as an example of the relatively small difference in auditory SPL range between soft and loud sound at low frequencies).
- The hearing threshold for pure tones is different than the hearing threshold for white noise at the same total sound pressure.

3. Sound Measurements

Sound measurements are taken by instruments that record sound pressure or the pressure of the compression wave in the air. Because the loudness of a sound to people is usually the primary interest in measuring sound, normalization schemes or filters have been applied to absolute measurements. dB(A) scaling of sound pressure measurements was intended to normalize readings to equal loudness over the audible range of frequencies at low loudness. For example, a 5,000 Hz (5 kHz) and 20 dB(A) tone is expected to have the same intensity or loudness as a 100 Hz, 20 dB(A) tone. However, note that the absolute sound pressures would be about 200 μPa and 2000 μPa, respectively, or about a difference of 20 dB (relative to 20 μPa), or as it is sometimes written 20 dB(linear).

Most sound is not a single tone, but is a mixture of frequencies within the audible range. A sound meter can add the total SPLs for all frequencies; in other words, the dB readings over the entire spectrum of audible sound can be added to give a single loudness metric. If sound is reported as A-weighted, or dB(A), it is a summation of the dB(A) scaled sound pressure from 20 Hz to 20 kHz.

In conjunction with the dB(A) scale, the dB(B) scale was developed to approximate equal loudness to people across audible frequencies at medium loudness, and dB(C) was developed to approximate equal-loudness for loud environments. Figure 4 shows isopleths for 20 dB(A) and 105 dB(C). While dB(A), dB(B), dB(C) were developed from empirical data at the middle frequencies, at the ends of the curves these scales were extrapolated, or sketched in, and are not based on experimental or observational data (Berglund et al., 1996). As a result, data in the low frequency range (and probably the highest audible frequencies as well) cannot be reliably interpreted using these scales. The World Health Organization (WHO, 1999) suggests that A-weighting noise that has a large low frequency component is not reliable assessment of loudness.

The source of the noise, or the noise signature, may be important in developing equal-loudness schemes at low frequencies. C-weighting has been recommended for artillery noise, but a linear, unweighted scale may be even better at predicting a reaction (Berglund et al., 1996). A linear or equal energy rating also appears to be the most effective predictor of reaction to low frequency noise in other situations, including blast noise from mining. The implication of the analysis presented by Berglund et al. (1996) is that annoyance from non-tonal noise should not be estimated from a dB(A) scale, but may be better evaluated using dB(C), or a linear non-transformed scale.

However, as will be discussed below, a number of schemes use a modified dB(A) scale to evaluate low frequency noise. These schemes differ from a typical use of the dB(A) scale by addressing a limited frequency range below 250 Hz, where auditory sensitivity is rapidly changing as a function of frequency (see Figure 4).

III. Exposures of Interest

A. Noise From Wind Turbines

1. Mechanical noise

Mechanical noise from a wind turbine is sound that originates in the generator, gearbox, yaw motors (that intermittently turn the nacelle and blades to face the wind), tower ventilation system and transformer. Generally, these sounds are controlled in newer wind turbines so that they are a fraction of the aerodynamic noise. Mechanical noise from the turbine or gearbox should only be heard above aerodynamic noise when they are not functioning properly.

2. Aerodynamic noise

Aerodynamic noise is caused by wind passing over the blade of the wind turbine. The tip of a 40-50 meter blade travels at speeds of over 140 miles per hour under normal operating conditions. As the wind passes over the moving blade, the blade interrupts the laminar flow of air, causing turbulence and noise. Current blade designs minimize the amount of turbulence and noise caused by wind, but it is not possible to eliminate turbulence or noise.

Aerodynamic noise from a wind turbine may be underestimated during planning. One source of error is that most meteorological wind speed measurements noted in wind farm literature are taken at 10 meters above the ground. Wind speed above this elevation, in

the area of the wind turbine rotor, is then calculated using established modeling relationships. In one study (van den Berg, 2004) it was determined that the wind speeds at the hub at night were up to 2.6 times higher than modeled. Subsequently, it was found that noise levels were 15 dB higher than anticipated.

Unexpectedly high aerodynamic noise can also be caused by improper blade angle or improper alignment of the rotor to the wind. These are correctable and are usually adjusted during the turbine break-in period.

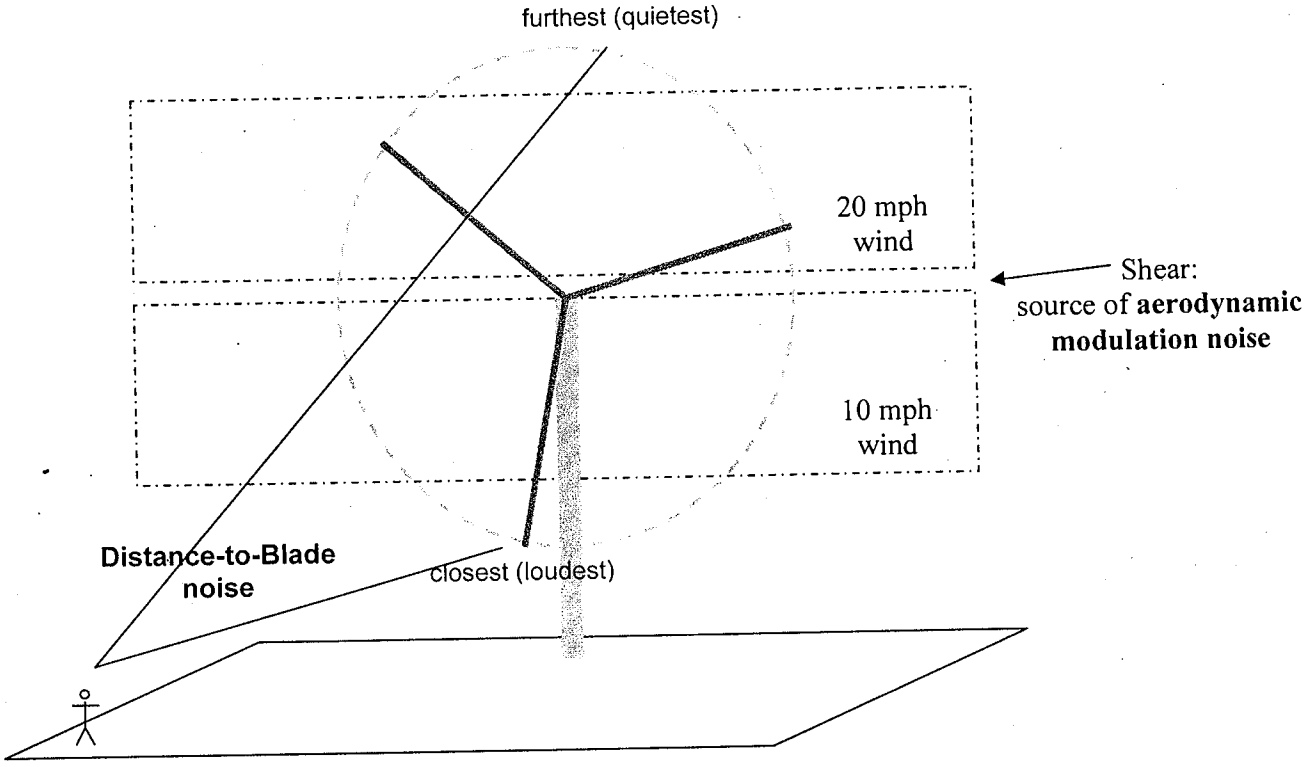
3. Modulation of aerodynamic noise

Rhythmic modulation of noise, especially low frequency noise, has been found to be more annoying than steady noise (Bradley, 1994; Holmberg et al., 1997). One form of rhythmic modulation of aerodynamic noise that can be noticeable very near to a wind turbine is a distance-to-blade effect. To a receptor on the ground in front of the wind turbine, the detected blade noise is loudest as the blade passes, and quietest when the blade is at the top of its rotation. For a modern 3-blade turbine, this distance-to-blade effect can cause a pulsing of the blade noise at about once per second (1 Hz). On the ground, about 500 feet directly downwind from the turbine, the distance-to-blade can cause a difference in sound pressure of about 2 dB between the *tip* of the blade at its farthest point and the *tip* of the blade at its nearest point (48 meter blades, 70 meter tower). Figure 5 demonstrates why the loudness of blade noise (aerodynamic noise) pulses as the distance-to-blade varies for individuals close to a turbine.

If the receptor is 500 feet from the turbine base, in line with the blade rotation or up to 60° off line, the difference in sound pressure from the *tip* of the blade at its farthest and nearest point can be about 4-5 dB, an audible difference. The tip travels faster than the rest of the blade and is closer to (and then farther away from) the receptor than other parts of the blade. As a result, noise from other parts of the blade will be modulated less than noise from the tip. Further, blade design can also affect the noise signature of a blade. The distance-to-blade effect diminishes as receptor distance increases because the relative difference in distance from the receptor to the top or to the bottom of the blade becomes smaller. Thus, moving away from the tower, distance-to-blade noise gradually appears to be more steady.

Another source of rhythmic modulation may occur if the wind through the rotor is not uniform. Blade angle, or pitch, is adjusted for different wind speeds to maximize power and to minimize noise. A blade angle that is not properly tuned to the wind speed (or wind direction) will make more noise than a properly tuned blade. Horizontal layers with different wind speeds or directions can form in the atmosphere. This wind condition is called shear. If the winds at the top and bottom of the blade rotation are different, blade noise will vary between the top and bottom of blade rotation, causing modulation of aerodynamic noise. This noise, associated with the blades passing through areas of different air-wind speeds, has been called aerodynamic modulation and is demonstrated in Figure 5.

Figure 5: Sources of noise modulation or pulsing



In some terrains and under some atmospheric conditions wind aloft, near the top of the wind turbine, can be moving faster than wind near the ground. Wind turbulence or even wakes from adjacent turbines can create non-uniform wind conditions as well. As a result of aerodynamic modulation a rhythmic noise pattern or pulsing will occur as each blade passes through areas with different wind speed. Furthermore, additional noise, or thumping, may occur as each blade passes through the transition between different wind speed (or wind direction) areas.

Wind shear caused by terrain or structures on the ground (e.g. trees, buildings) can be modeled relatively easily. Wind shear in areas of flat terrain is not as easily understood. During the daytime wind in the lower atmosphere is strongly affected by thermal convection which causes mixing of layers. Distinct layers do not easily form. However, in the nighttime the atmosphere can stabilize (vertically), and layers form. A paper by G.P. van den Berg (2008) included data from a study on wind shear at Cabauw, The Netherlands (flat terrain). Annual average wind speeds at different elevations above ground was reported. The annual average wind speed at noon was about 5.75 meters per second (m/s; approximately 12.9 miles per hour(mph)) at 20 m above ground, and about 7.6 m/s (17 mph) at 140 m. At midnight, the annual averages were about 4.3 m/s (9.6 mph) and 8.8 m/s (19.7 mph) for 20m and 140 m, respectively, above ground. The data show that while the average windspeed (between 20m and 140m) is very similar at noon and midnight at Cabauw, the windspeed difference between elevations during the day is

much less than the difference at night (1.85 m/s (4.1 mph) and 4.5 m/s (10 mph), respectively). As a result one would expect that the blade angle can be better tuned to the wind speed during the daytime. Consequently, blade noise would be greater at night.

A number of reports have included discussion of aerodynamic modulation (van den Berg, 2005; UK Department of Transport and Industry, 2006; UK Department for Business Enterprise and Regulatory Reform, 2007; van den Berg, 2008). They suggest that aerodynamic modulation is typically underestimated when noise estimates are calculated. In addition, they suggest that detailed modeling of wind, terrain, land use and structures may be used to predict whether modulation of aerodynamic noise will be a problem at a proposed wind turbine site.

4. Wind farm noise

The noise from multiple turbines similarly distant from a residence can be noticeably louder than a lone turbine simply through the addition of multiple noise sources. Under steady wind conditions noise from a wind turbine farm may be greater than noise from the nearest turbine due to synchrony between noise from more than one turbine (van den Berg, 2005). Furthermore, if the dominant frequencies (including aerodynamic modulation) of different turbines vary by small amounts, an audible beat or dissonance may be heard when wind conditions are stable.

B. Shadow Flicker

Rhythmic light flicker from the blades of a wind turbine casting intermittent shadows has been reported to be annoying in many locations (NRC, 2007; Large Wind Turbine Citizens Committee, 2008). (Note: Flashing light at frequencies around 1 Hz is too slow to trigger an epileptic response.)

Modeling conducted by the Minnesota Department of Health suggests that a receptor 300 meters perpendicular to, and in the shadow of the blades of a wind turbine, can be in the flicker shadow of the rotating blade for almost 1½ hour a day. At this distance a blade may completely obscure the sun each time it passes between the receptor and the sun. With current wind turbine designs, flicker should not be an issue at distances over 10 rotational diameters (~1000 meters or 1 km (0.6 mi) for most current wind turbines). This distance has been recommended by the Wind Energy Handbook (Burton et al., 2001) as a minimum setback distance in directions that flicker may occur, and has been noted in the Bent Tree Permit Application (WPL, 2008).

Shadow flicker is a potential issue in the mornings and evenings, when turbine noise may be masked by ambient sounds. While low frequency noise is typically an issue indoors, shadow flicker can be an issue both indoors and outdoors when the sun is low in the sky. Therefore, shadow flicker may be an issue in locations other than the home.

Ireland recommends wind turbines setbacks of at least 300 meters from a road to decrease driver distraction (Michigan State University, 2004). The NRC (2007) recommends that shadow flicker is addressed during the preliminary planning stages of a wind turbine project.

IV. Impacts of Wind Turbine Noise

A. Potential Adverse Reaction to Sound

Human sensitivity to sound, especially to low frequency sound, is variable. Individuals have different ranges of frequency sensitivity to audible sound; different thresholds for each frequency of audible sound; different vestibular sensitivities and reactions to vestibular activation; and different sensitivity to vibration.

Further, sounds, such as repetitive but low intensity noise, can evoke different responses from individuals. People will exhibit variable levels of annoyance and tolerance for different frequencies. Some people can dismiss and ignore the signal, while for others, the signal will grow and become more apparent and unpleasant over time (Moreira and Bryan, 1972; Bryan and Tempest, 1973). These reactions may have little relationship to will or intent, and more to do with previous exposure history and personality.

Stress and annoyance from noise often do not correlate with loudness. This may suggest, in some circumstances, other factors impact an individual's reaction to noise. A number of reports, cited in Staples (1997), suggest that individuals with an interest in a project and individuals who have some control over an environmental noise are less likely to find a noise annoying or stressful.

Berglund et al. (1996) reviewed reported health effects from low frequency noise. Loud noise from any source can interfere with verbal communication and possibly with the development of language skills. Noise may also impact mental health. However, there are no studies that have looked specifically at the impact of low frequency noise on communication, development of language skills and mental health. Cardiovascular and endocrine effects have been demonstrated in studies that have looked at exposures to airplane and highway noise. In addition, possible effects of noise on performance and cognition have also been investigated, but these health studies have not generally looked at impacts specifically from low frequency noise. Noise has also been shown to impact sleep and sleep patterns, and one study demonstrated impacts from low frequency noise in the range of 72 to 85 dB(A) on chronic insomnia (Nagai et al., 1989 as reported in Berglund et al., 1996).

Case studies have suggested that health can be impacted by relatively low levels of low frequency noise. But it is difficult to draw general conclusions from case studies. Feldmann and Pitten (2004)) describe a family exposed during the winter to low frequency noise from a nearby heating plant. Reported health impacts were: "indisposition, decrease in performance, sleep disturbance, headache, ear pressure, crawl parästhesy [crawling, tingling or numbness sensation on the skin] or shortness of breath."

Annoyance, unpleasant sounds, and complaints

Reported health effects from low frequency stimulation are closely associated with annoyance from audible noise. "There is no reliable evidence that infrasounds below the hearing threshold produce physiological or psychological effects" (WHO, 1999). It has not been shown whether annoyance is a symptom or an accessory in the causation of

health impacts from low frequency noise. Studies have been conducted on some aspects of low frequency noise that can cause annoyance.

Noise complaints are usually a reasonable measure of annoyance with low frequency environmental noise. Leventhall (2004) has reviewed noise complaints and offers the following conclusions:

> " The problems arose in quiet rural or suburban environments
> The noise was often close to inaudibility and heard by a minority of people
> The noise was typically audible indoors and not outdoors
> The noise was more audible at night than day
> The noise had a throb or rumble characteristic
> The main complaints came from the 55-70 years age group
> The complainants had normal hearing.
> Medical examination excluded tinnitus.
>
> " These are now recognised as classic descriptors of low frequency noise problems."

These observations are consistent with what we know about the propagation of low intensity, low frequency noise. Some people are more sensitive to low frequency noise. The difference, in dB, between soft (acceptable) and loud (annoying) noise is much less at low frequency (see Figure 4 audible range compression). Furthermore, during the daytime, and especially outdoors, annoying low frequency noise can be masked by high frequency noise.

The observation that "the noise was typically audible indoors and not outdoors" is not particularly intuitive. However, as noted in a previous section, low frequencies are not well attenuated when they pass through walls and windows. Higher frequencies (especially above 1000 Hz) can be efficiently attenuated by walls and windows. In addition, low frequency sounds may be amplified by resonance within rooms and halls of a building. Resonance is often characterized by a throbbing or a rumbling, which has also been associated with many low frequency noise complaints.

Low frequency noise, unlike higher frequency noise, can also be accompanied by shaking, vibration and rattling. In addition, throbbing and rumbling may be apparent in some low frequency noise. While these noise features may not be easily characterized, numerous studies have shown that their presence dramatically lowers tolerance for low frequency noise (Berglund et al., 1996).

As reviewed in Leventhall (2003), a study of industrial exposure to low frequency noise found that fluctuations in total noise averaged over 0.5, 1.0 and 2.0 seconds correlated with annoyance (Holmberg et al., 1997). This association was noted elsewhere and led (Broner and Leventhall, 1983) to propose a 3dB "penalty" be added to evaluations of annoyance in cases where low frequency noise fluctuated.

In another laboratory study with test subjects controlling loudness, 0.5 – 4 Hz modulation of low frequency noise was found to be more annoying than non-modulated low

frequency noise. On average test subjects found modulated noise to be similarly annoying as a constant tone 12.9 dB louder (Bradley, 1994).

B. Studies of Wind Turbine Noise Impacts on People

1. Swedish Studies

Two studies in Sweden collected information by questionnaires from 341 and 754 individuals (representing response rates of 68% and 58%, respectively), and correlated responses to calculated exposure to noise from wind farms (Pedersen and Waye, 2004; Pedersen, 2007; Pedersen and Persson, 2007). Both studies showed that the number of respondents perceiving the noise from the wind turbines increased as the calculated noise levels at their homes increased from less than 32.5 dB(A) to greater than 40 dB(A). Annoyance appeared to correlate or trend with calculated noise levels. Combining the data from the two studies, when noise measurements were greater than 40 dB(A), about 50% of the people surveyed (22 of 45 people) reported annoyance. When noise measurements were between 35 and 40 dB(A) about 24% reported annoyance (67 of 276 people). Noise annoyance was more likely in areas that were rated as quiet and in areas where turbines were visible. In one of the studies, 64% respondents who reported noise annoyance also reported sleep disturbance; 15% of respondents reported sleep disturbance without annoyance.

2. United Kingdom Study

Moorhouse et al. (UK Department for Business Enterprise and Regulatory Reform, 2007) evaluated complaints about wind farms. They found that 27 of 133 operating wind farms in the UK received formal complaints between 1991 and 2007. There were a total of 53 complainants for 16 of the sites for which good records were available. The authors of the report considered that many complaints in the early years were for generator and gearbox noise. However, subjective analyses of reports about noise ("like a train that never gets there", "distant helicopter", "thumping", "thudding", "pulsating", "thumping", "rhythmical beating", and "beating") suggested that aerodynamic modulation was the likely cause of complaints at 4 wind farms. The complaints from 8 other wind farms may have had "marginal" association with aerodynamic modulation noise.

Four wind farms that generated complaints possibly associated with aerodynamic modulation were evaluated further. These wind farms were commissioned between 1999 and 2002. Wind direction, speed and times of complaints were associated for 2 of the sites and suggested that aerodynamic modulation noise may be a problem between 7% and 25% of the time. Complaints at 2 of the farms have stopped and at one farm steps to mitigate aerodynamic modulation (operational shutdown under certain meteorological conditions) have been instituted.

3. Netherlands Study

F. van den Berg et al. (2008) conducted a postal survey of a group selected from all residents in the Netherlands within 2.5 kilometers (km) of a wind turbine. In all, 725 residents responded (37%). Respondents were exposed to sound between 24 and 54 dB(A). The percentage of respondents annoyed by sound increased from 2% at levels of 30 dB(A) or less, up to 25% at between 40 and 45 dB. Annoyance decreased above 45 dB. Most residents exposed above 45 dB(A) reported economic benefits from the

turbines. However, at greater than 45 dB(A) more respondents reported sleep interruption. Respondents tended to report more annoyance when they also noted a negative effect on landscape, and ability to see the turbines was strongly related to the probability of annoyance.

4. Case Reports

A number of un-reviewed reports have catalogued complaints of annoyance and some more severe health impacts associated with wind farms. These reports do not contain measurements of noise levels, and do not represent random samples of people living near wind turbines, so they cannot assess prevalence of complaints. They do generally show that in the people surveyed, complaints are more likely the closer people are to the turbines. The most common complaint is decreased quality of life, followed by sleep loss and headache. Complaints seem to be either from individuals with homes quite close to turbines, or individuals who live in areas subject to aerodynamic modulation and, possibly, enhanced sound propagation which can occur in hilly or mountainous terrain. In some of the cases described, people with noise complaints also mention aesthetic issues, concern for ecological effects, and shadow flicker concerns. Not all complaints are primarily about health.

Harry (2007) describes a meeting with a couple in Cornwall, U.K. who live 400 meters from a wind turbine, and complained of poor sleep, headaches, stress and anxiety. Harry subsequently investigated 42 people in various locations in the U.K. living between 300 meters and 2 kilometers (1000 feet to 1.2 miles) from the nearest wind turbine. The most frequent complaint (39 of 42 people) was that their quality of life was affected. Headaches were reported by 27 people and sleep disturbance by 28 people. Some people complained of palpitations, migraines, tinnitus, anxiety and depression. She also mentions correspondence and complaints from people in New Zealand, Australia, France, Germany, Netherlands and the U.S.

Phipps (2007) discusses a survey of 619 households living up to 10 kilometers (km; 6 miles) from wind farms in mountainous areas of New Zealand. Most respondents lived between 2 and 2.5 km from the turbines (over 350 households). Most respondents (519) said they could see the turbines from their homes, and 80% of these considered the turbines intrusive, and 73% considered them unattractive. Nine percent said they were affected by flicker. Over 50% of households located between 2 and 2.5 km and between 5 and 9.5 km reported being able to hear the turbines. In contrast, fewer people living between 3 and 4.5 km away could hear the turbines. Ninety-two households said that their quality of life was affected by turbine noise. Sixty-eight households reported sleep disturbances: 42 of the households reported occasional sleep disturbances, 21 reported frequent sleep disturbances and 5 reported sleep disturbances most of the time.

The Large Wind Turbine Citizens Committee for the Town of Union (2008) documents complaints from people living near wind turbines in Wisconsin communities and other places in the U.S. and U.K. Contained in this report is an older report prepared by the Wisconsin Public Service Corporation in 2001 in response to complaints in Lincoln County, Wisconsin. The report found essentially no exceedances of the 50 dB(A) requirement in the conditional use permit. The report did measure spectral data

accumulated over very short intervals (1 minute) in 1/3 octave bands at several sites while the wind turbines were functioning, and it is of interest that at these sites the sound pressure level at the lower frequencies (below 125 Hz) were at or near 50 dB(A).

Pierpont (2009) postulates wind turbine syndrome, consisting of a constellation of symptoms including headache, tinnitus, ear pressure, vertigo, nausea, visual blurring, tachycardia, irritability, cognitive problems and panic episodes associated with sensations of internal pulsation. She studied 38 people in 10 families living between 1000 feet and slightly under 1 mile from newer wind turbines. She proposes that the mechanism for these effects is disturbance of balance due to "discordant" stimulation of the vestibular system, along with visceral sensations, sensations of vibration in the chest and other locations in the body, and stimulation of the visual system by moving shadows. Pierpont does report that her study subjects maintain that their problems are caused by noise and vibration, and the most common symptoms reported are sleep disturbances and headache. However, 16 of the people she studied report symptoms consistent with (but not necessarily caused by) disturbance of equilibrium.

V. Noise Assessment and Regulation

1. Minnesota noise regulation

The Minnesota Noise Pollution Control Rule is accessible online at: https://www.revisor.leg.state.mn.us/rules/?id=7030 . A summary of the Minnesota Pollution Control Agency (MPCA) noise guidance can be found online at: http://www.pca.state.mn.us/programs/noise.html . The MPCA standards require A-weighting measurements of noise; background noise must be at least 10 dB lower than the noise source being measured. Different standards are specified for day and night, as well as standards that may not be exceeded for more than 10 percent of the time during any hour (L10) and 50 percent of the time during any hour (L50). Household units, including farm houses, are Classification 1 land use. The following are the Class 1 noise limits:

Table 1: Minnesota Class 1 Land Use Noise Limits

Daytime		Nighttime	
L50	L10	L50	L10
60 dB(A)	65 dB(A)	50 dB(A)	55 dB(A)

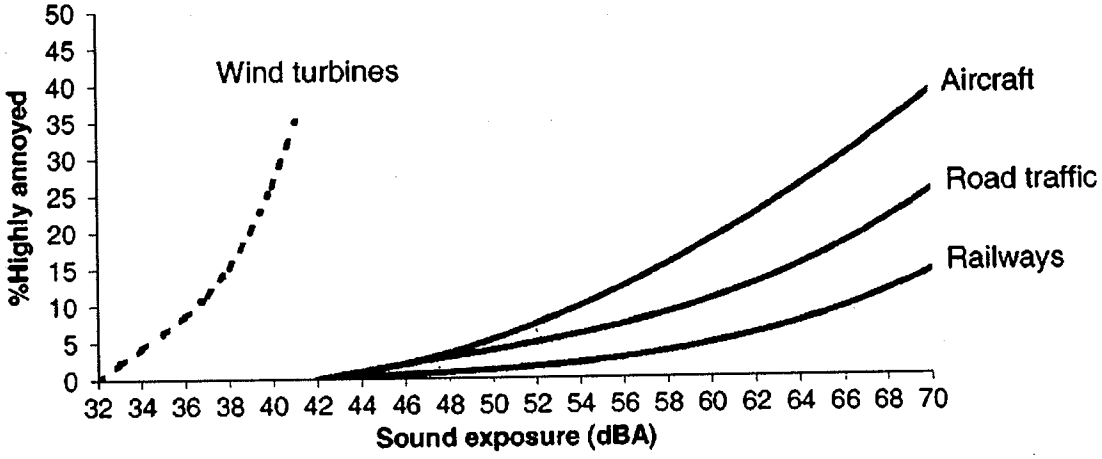
These noise limits are single number limits that rely on the measuring instrument to apply an A-weighting filter over the entire presumed audible spectrum of frequencies (20 Hz to 20 KHz) and then integrating that signal. The result is a single number that characterizes the audible spectrum noise intensity.

2. Low frequency noise assessment and regulation

Pedersen and Waye (2004) looked at the relationship between total dB(A) sound pressure and the annoyance of those who are environmentally exposed to noise from different sources. Figure 6 demonstrates the difficulty in using total dB(A) to evaluate annoyance. Note how lower noise levels (dB(A)) from wind turbines engenders annoyance similar to

much higher levels of noise exposure from aircraft, road traffic and railroads. Sound impulsiveness, low frequency noise and persistence of the noise, as well as demographic characteristics may explain some of the difference.

Figure 6: Annoyance associated with exposure to different environmental noises



Reprinted with permission from Pedersen, E. and K.P. Waye (2004). Perception and annoyance due to wind turbine noise–a dose-response relationship. The Journal of the Acoustical Society of America 116: 3460. Copyright 2004, Acoustical Society of America.

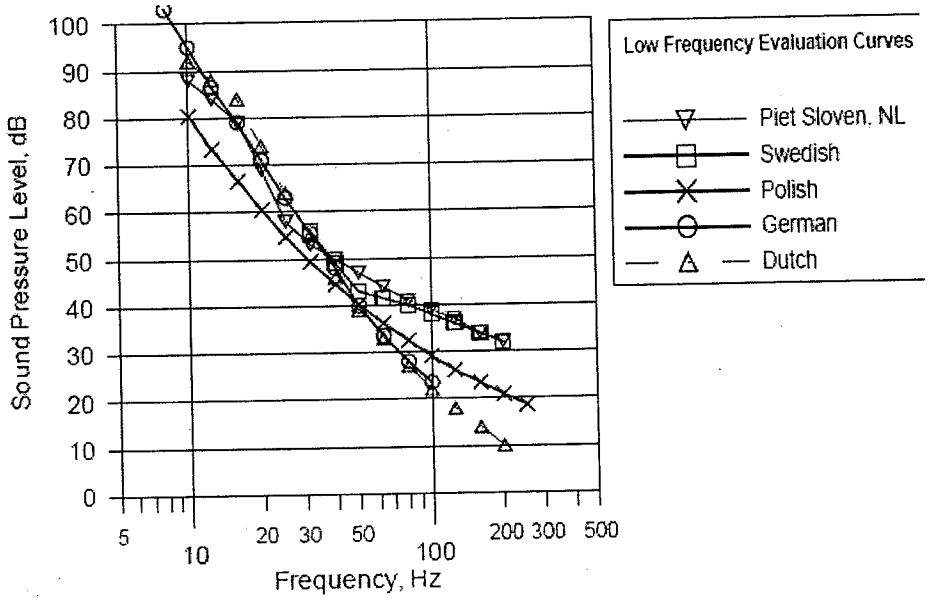
Kjellberg et al. (1997) looked at the ability of different full spectrum weighting schemes to predict annoyance caused by low frequency audio noise. They found that dB(A) is the worst predictor of annoyance of available scales. However, if 6 dB ("penalty") is added to dB(A) when dB(C) – dB(A) is greater than 15 dB, about 71% of the predictions of annoyance are correct. It is important to remember that integrated, transformed measurements of SPL (e.g. dB(A), dB(C)) do not measure frequencies below 20 Hz. While people detect stimuli below 20 Hz, as discussed in above sections, these frequencies are not measured using an A-weighted or C-weighted meter.

The World Health Organization (WHO) recommends that if dB(C) is greater than 10 dB more than dB(A), the low frequency components of the noise may be important and should be evaluated separately. In addition, WHO says "[i]t should be noted that a large proportion of low-frequency components in noise may increase considerably the adverse effects on health." (WHO, 1999)

Many governments that regulate low frequency noise look at noise within bands of frequencies instead of summing the entire spectrum. A study by Poulsen and Mortensen (Danish Environmental Protection Agency, 2002) included a summary of low frequency noise guidelines. German, Swedish, Polish, and Dutch low frequency evaluation curves were compared (see Figure 7). While there are distinctions in how the evaluation curves are described, generally, these curves are sound pressure criterion levels for 1/3 octaves from about 8 Hz to 250 Hz. Exceedance in any 1/3 octave measurement suggests that the noise may be annoying. However, note that regulations associated with low frequency

noise can be quite complex and the regulatory evaluations associated with individual curves can be somewhat different.

Figure 7: 1/3 Octave Sound Pressure Level Low frequency Noise Evaluation Curves



(Danish Environmental Protection Agency, 2002)

The Danish low frequency evaluation requires measuring noise indoors with windows closed; SPL measurements are obtained in 1/3 octave bands and transformed using the A-weighting algorithm for all frequencies between 10 and 160 Hz. These values are then summed into a single metric called $L_{pA,LF}$. A 5 dB "penalty" is added to any noise that is "impulsive". Danish regulations require that 20 dB $L_{pA,LF}$ is not exceeded during the evening and night, and that 25 dB $L_{pA,LF}$ is not exceeded during the day.

Swedish guidance recommends analyzing 1/3 octave bands between 31.5 and 200 Hz inside a home, and comparing the values to a Swedish assessment curve. The Swedish curve is equal to the United Kingdom (UK) Department of Environment, Food and Rural Affairs (DEFRA) low frequency noise criterion curve for overlapping frequencies (31.5 – 160 Hz).

The German "A-level" method sums the A-weighted equivalent levels of 1/3 octave bands that exceed the hearing threshold from 10 – 80 Hz. If the noise is not tonal, the measurements are added. The total cannot exceed 25 dB at night and 35 dB during the day. A frequency-dependent adjustment is applied if the noise is tonal.

In the Poulsen and Mortensen, Danish EPA study (2002), 18 individuals reported annoyance levels when they were exposed through earphones in a controlled environment to a wide range of low frequency environmental noises, all attenuated down to 35 dB, as depicted in Table 2. Noise was simulated as if being heard indoors, filtering out noise at

higher frequencies and effectively eliminating all frequencies above 1600 Hz. Noise levels in 1/3 octave SPLs from 8 Hz to 1600 Hz were measured and low frequencies (below 250 Hz) were used to predict annoyance using 7 different methods (Danish, German A-level, German tonal, Swedish, Polish, Sloven, and C-level). Predictions of annoyance were compared with the subjective annoyance evaluations. Correlation coefficients for these analyses ranged from 0.64 to 0.94, with the best correlation in comparison with the Danish low frequency noise evaluation methods.

As would be expected, at 35 dB nominal (full spectrum) loudness, every low frequency noise source tested exceeded all of the regulatory standards noted in the Danish EPA report. Table 2 shows the Danish and Swedish regulatory exceedances of the different 35 dB nominal (full spectrum) noise.

Table 2: 35 dB(A) (nominal, 8 Hz-20KHz) Indoor Noise from Various Outdoor Environmental Sources

	Traffic Noise	Drop Forge	Gas Turbine	Fast Ferry	Steel Factory	Generator	Cooling Compressor	Discotheque
Noise	67.6 dB(lin)	71.1 dB(lin)	78.4 dB(lin)	64.5 dB(lin)	72.7 dB(lin)	60.2 dB(lin)	60.3 dB(lin)	67.0 dB(lin)
Noise ≥ 20 Hz	35.2 dB(A)	36.6 dB(A)	35.0 dB(A)	35.1 dB(A)	33.6 dB(A)	36.2 dB(A)	36.6 dB(A)	33.6 dB(A)
	62.9 dB(C)	67.3 dB(C)	73.7 dB(C)	61.7 dB(C)	66.0 dB(C)	58.6 dB(C)	59.0 dB(C)	57.8 dB(C)
Danish Environmental Protection Agency	14.5 dB	21.5 dB *	14.8 dB	15.0 dB	13.1 dB	16.1 dB	14.0 dB	18.0 dB *
Swedish National Board of Health and Welfare	14.1 dB	19.7 dB	15.9 dB	16.8 dB	15.5 dB	18.3 dB	16.0 dB	10.0 dB

* includes 5 dB "penalty"

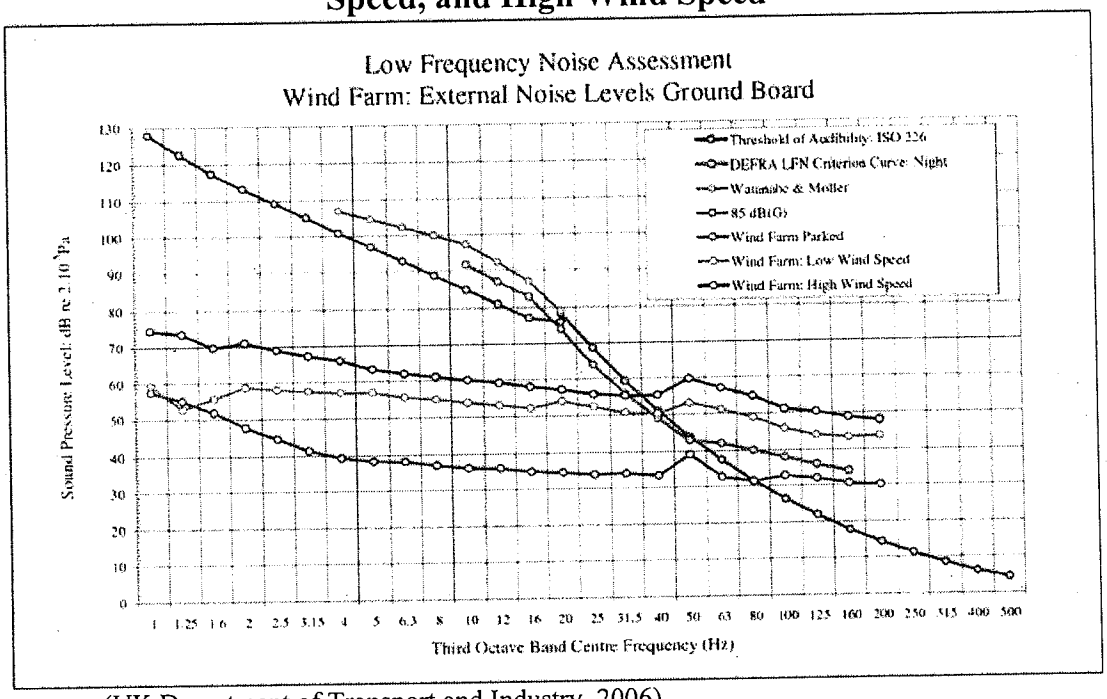
Noise adjusted to dB(lin), dB(A), dB(C) scales. Calculated exceedances of Danish and Swedish indoor criteria. (data from Danish Environmental Protection Agency, 2002)

In their noise guidance, the WHO (1999) recommends 30 dB(A) as a limit for "a good night's sleep". However, they also suggest that guidance for noise with predominating low frequencies be less than 30 dB(A).

3. Wind turbine sound measurements

Figure 8 shows examples of the SPLs at different frequencies from a representative wind turbine in the United Kingdom. Sound pressure level measurements are reported for a Nordex N-80 turbine at 200 meters (UK Department of Transport and Industry, 2006) when parked, at low wind speeds, and at high wind speeds. Figure 8 also includes, for reference, 3 sound threshold curves (ISO 226, Watanabe & Moller, 85 dB(G)) and the DEFRA Low Frequency Noise Criterion Curve (nighttime).

Figure 8: Low Frequency Noise from Wind Farm: Parked, Low Wind Speed, and High Wind Speed

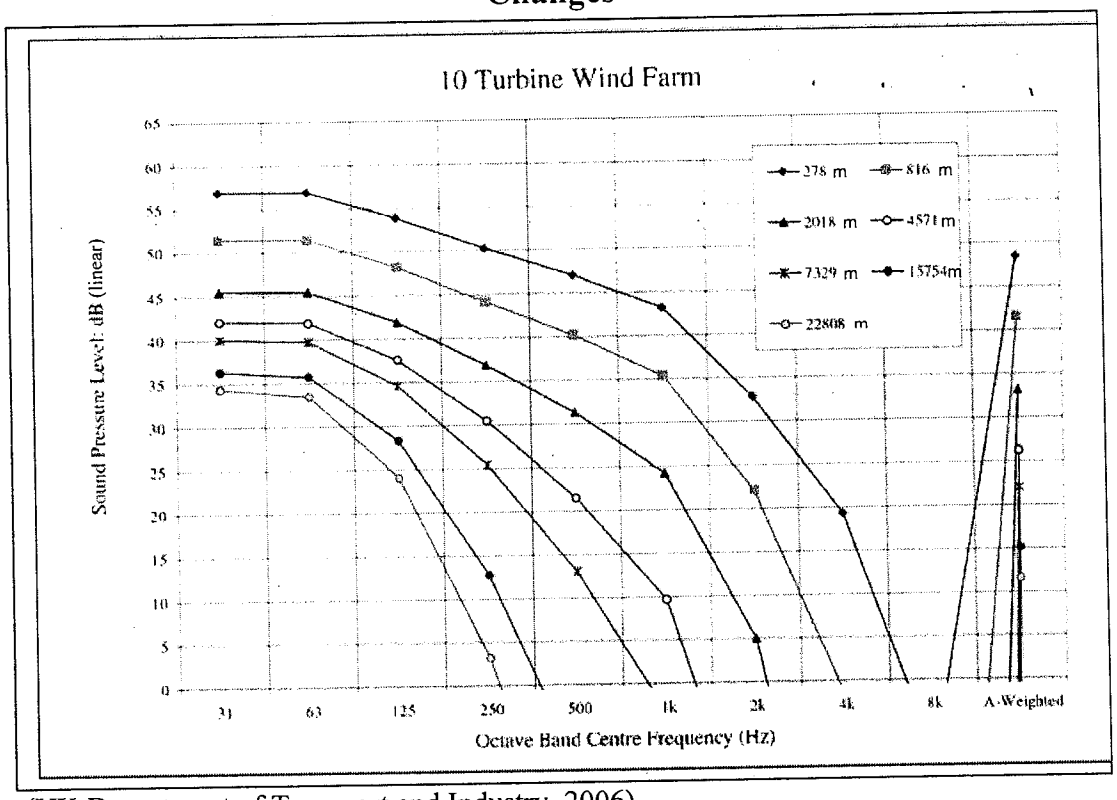


(UK Department of Transport and Industry, 2006)

In general, sound tends to propagate as if by spherical dispersion. This creates amplitude decay at a rate of about -6 dB per doubling of distance. However, low frequency noise from a wind turbine has been shown to follow more of a cylindrical decay at long distances, about -3 dB per doubling of distance in the downwind direction (Shepherd and Hubbard, 1991). This is thought to be the result of the lack of attenuation of low frequency sound waves by air and the atmospheric refraction of the low frequency sound waves over medium to long distances (Hawkins, 1987).

Figure 9 shows the calculated change in spectrum for a wind farm from 278 meters to 22,808 meters distant. As one moves away from the noise source, loudness at higher frequencies decreases more rapidly (and extinguishes faster) than at lower frequencies. Measurement of A-weighted decibels, shown at the right of the figure, obscures this finding.

Figure 9: Change in Noise Spectrum as Distance from Wind Farm Changes



(UK Department of Transport and Industry, 2006)

Thus, although noise from an upwind blade wind turbine is generally broad spectrum, without a tonal quality, high frequencies are efficiently attenuated by both the atmosphere, and by walls and windows of structures, as noted above. As a result, as one moves away from a wind turbine, the low frequency component of the noise becomes more pronounced.

Kamperman and James (2008) modeled indoor noise from outdoor wind turbine noise measurements, assuming a typical vinyl siding covered 2X4 wood frame construction. The wind turbine noise inside was calculated to be 5 dB less than the noise outside. Model data suggested that the sound of a single 2.5 MW wind turbine at 1000 feet will likely be heard in a house with the windows sealed. They note that models used for siting turbines often incorporate structure attenuation of 15dB. In addition, Kamperman and James demonstrate that sound from 10 2.5 MW turbines (acoustically) centered 2 km (1¼ mile) away and with the nearest turbine 1 mile away will only be 6.3 dB below the sound of a single turbine at 1000 feet (0.19 mile).

4. Wind turbine regulatory noise limits

Ramakrishnan (2007) has reported different noise criteria developed for wind farm planning. These criteria include common practices (if available) within each jurisdiction for estimating background SPLs, turbine SPLs, minimum setbacks and methods used to

assess impacts. Reported US wind turbine noise criteria range from: ambient + 10 dB(A) where ambient is assumed to be 26 dB(A) (Oregon); to 55 dB(A) or "background" + 5 dB(A) (Michigan). European criteria range from 35 dB(A) to 45 dB(A), at the property. US setbacks range from 1.1 times the full height of the turbine (consenting) and 5 times the hub height (non-consenting; Pennsylvania); to 350 m (consenting) and 1000 m (non-consenting; Oregon). European minimum setbacks are not noted.

VI. Conclusions

Wind turbines generate a broad spectrum of low-intensity noise. At typical setback distances higher frequencies are attenuated. In addition, walls and windows of homes attenuate high frequencies, but their effect on low frequencies is limited. Low frequency noise is primarily a problem that may affect some people in their homes, especially at night. It is not generally a problem for businesses, public buildings, or for people outdoors.

The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints. Complaints are more likely when turbines are visible or when shadow flicker occurs. Most available evidence suggests that reported health effects are related to audible low frequency noise. Complaints appear to rise with increasing outside noise levels above 35 dB(A). It has been hypothesized that direct activation of the vestibular and autonomic nervous system may be responsible for less common complaints, but evidence is scant.

The Minnesota nighttime standard of 50 dB(A) not to be exceeded more than 50% of the time in a given hour, appears to underweight penetration of low frequency noise into dwellings. Different schemes for evaluating low frequency noise, and/or lower noise standards, have been developed in a number of countries.

For some projects, wind velocity for a wind turbine project is measured at 10 m and then modeled to the height of the rotor. These models may under-predict wind speed that will be encountered when the turbine is erected. Higher wind speed will result in noise exceeding model predictions.

Low frequency noise from a wind turbine is generally not easily perceived beyond ½ mile. However, if a turbine is subject to aerodynamic modulation because of shear caused by terrain (mountains, trees, buildings) or different wind conditions through the rotor plane, turbine noise may be heard at greater distances.

Unlike low frequency noise, shadow flicker can affect individuals outdoors as well as indoors, and may be noticeable inside any building. Flicker can be eliminated by placement of wind turbines outside of the path of the sun as viewed from areas of concern, or by appropriate setbacks.

Prediction of complaint likelihood during project planning depends on: 1) good noise modeling including characterization of potential sources of aerodynamic modulation noise and characterization of nighttime wind conditions and noise; 2) shadow flicker modeling; 3) visibility of the wind turbines; and 4) interests of nearby residents and community.

VII. Recommendations

To assure informed decisions:

- Wind turbine noise estimates should include cumulative impacts (40-50 dB(A) isopleths) of all wind turbines.
- Isopleths for dB(C) - dB(A) greater than 10 dB should also be determined to evaluate the low frequency noise component.
- Potential impacts from shadow flicker and turbine visibility should be evaluated.

Any noise criteria beyond current state standards used for placement of wind turbines should reflect priorities and attitudes of the community.

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Wind Power Promises and Predictions Gone Awry

April 26th, 2011
by Jack Sullivan

The predictions and promises made by wind developers for Northern New York in 2005-2007 can now be analyzed in the light of a number of wind projects that have been in operation for 3 or more years.
I have scrutinized a number of news articles, press releases, and meeting minutes from the above period on wind power. Developer promises have come to pass in nearly none of the cases.

Most of the wind plant statistics I have quoted refer to the 106.5 MW capacity Chateaugay project. (All are verifiable). I use Chateaugay because it is in Franklin County and is the largest of the four area wind plants. The other three -- Clinton, Ellenburgh, and Altona -- have virtually identical outputs.

John Quirke of Noble Power said that local wind projects should average 30-35% of their listed capacity. In 2010, however, the Chateaugay wind plant only averaged 20.6%. The predicted value was exaggerated 58% over actual. According to Public Service Commission Report #09E-0497, if transmission losses and wind project electric use are subtracted, the wind projects only returned about 10% of their advertised capacity to consumers.

Noble's Mark Lyons said the Chateaugay project would produce enough electricity to power 33,000 homes. The actual output of 192,000 MWh in 2010 would power fewer than 18,000 homes, again a significant exaggeration over estimate. There is a huge caveat in these figures, since Chateaugay had 1,222 hours of no output (that's more than 50 days). Since this down time is unpredictable, Chateaugay can supply reliable electricity to ZERO homes. The low average value of NNY wind speeds coupled with a very high degree of variability means Northern NY is NOT suitable for economically viable nor dependable industrial wind installations.

In hyping a tentative 70 turbine project for Malone, Noble's Mark Lyons predicted it would create up to 45 jobs. This sounds like an exaggeration since the 195 turbines at Tug Hill created less than 40 jobs. The job creation aspect of wind projects is also often over-inflated. A Dept. of Energy document tells of a loan guarantee to First Wind for $117 M for a project to create 10 jobs. That's nearly $12M per job.

All of Noble's presenters claimed that wind would produce cheap electricity since the fuel is free. The reality? Chateaugay's electricity cost of $38 MWh is more than 20% higher than the cost of power from the FDR Seaway hydro plant. Maybe wind power should be touted as "not so cheap electricity". The sale of electricity in Chateaugay will not be sufficient to pay for the turbines before they are worn out!!

Chuck Hinckley said "there is no evidence of property devaluation near large wind turbines". In fact, there are a number of well done professional studies that have found significant property devaluation near wind turbines. Studies done in Texas and Wisconsin are among the best. Some local realtors avoid listing properties near turbines because they are hard to sell.

Dan Boyd, Noble's project manager, stated on several occasions that wind power could reduce our dependence on foreign oil. Any such effect is laughingly small. The entire 2010 energy production at the Chateaugay wind plant is equivalent to a mere 17 minutes of imported oil. Since oil and electricity generally serve different uses, the effect is negligible. To produce 25% of imported oils energy would take approx. ½ million turbines occupying 30+ million acres (5 Adirondack Parks). An impossible dream.

All of Noble's spokepersons claimed that free and clean windpower would combat global warming. No one mentioned the huge carbon emissions debt created when building a wind project.
An in-depth study by the internationally respected Pacific Research Institute found that a typical project must operate for 7 years at full capacity before it pays back all the emissions produced in manufacture and construction. Since our local wind plants operate at about 20% capacity, it would take 30+ years to become emission free. Not bad for machinery that the manufacturer (GE) says will last 20 yrs.

Then there's the mercury problem. Through cement use, wind projects have released enough airborne mercury to render most of the fish in the Adirondacks inedible.

Mark Lyons and Chuck Hinckley insisted that Noble would pay its fair share of taxes. Yet the PILOT agreement with Franklin County has most homeowners paying 10 times the tax rate that Noble does.

In the PILOT agreement with Clinton County IDA, Noble offered to pay a bonus of $1000/MW every time the annual capacity factor of any of their projects exceeded 35%. The problem? No NY wind project has ever exceeded a 35% annual c.f. Probably none east of the Mississippi has ever done so. Did Noble know this? If so, it was a con.

Lyons insisted that all the land around turbines could have the same use it could have had before they were installed. Not quite. If a turbine had to be sited say 1500' from a home for health and safety reasons, then future homes could be built no closer than 1500' to existing turbines. Thus, each turbine would exclude 160+ acres from home building.
Lyons and others claimed that 1&1/2 times the tower height was a safe setback from roads, trails and other areas frequented by

10-1240

Rice, Robin (PUC)

From: COLLEEN MUELLER <cmueller@wildblue.net>
Sent: Thursday, June 16, 2011 10:36 AM
To: staff, cao (PUC)
Subject: Industrial wind-
Attachments: rareearthng1 001.jpg; rareearthngpg3 001.jpg; rareearthngpg4 001.jpg

Please enter all pages as part of the public record for: CN-09-1110;WS-10-49;WS10-1240;WS11-195:IP6853,IP6866?CN-11-471 Rare Earth metals are almost all mined in China at this time How prudent is it to put all our "eggs in one basket" as it were? Is this using our resources-or some other countries and strenghtening their hold on us? Well HELLO BROWN-outs-or maybe we'll go back to kerosene and pay more for electricity we don't have-and what about the coal fired plants just to keep wind turbines running at 17-25 % - sounds a little under production for huge dollars passed on to consumers. How many coal plants have been shut down as a result of wind farms coming online? Anywhere?-NONE
The rare earth metal used in wind turbines is neodymium--the magnet in a large wind turbine may contain 500 lbs or more neodymium.Energy and military-why don't we just hand it over? Rare earth article is from National Geographic magazine June 2011 issue. Is it the intentions of the MN PUC to now change how the MN rules read and or vary the rules to allow a precedent to be set that would be an illegal interpretation of MN Statues and rules as they apply to everyone, even parts 7849.0200. Sincerely, Colleen Mueller