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22<sup>nd</sup> March 2010

Dear [REDACTED],

RE: Adelaide Wind Project

Thank you for your feedback at our Open House for the Adelaide Wind Project. You requested additional information on stray voltage and health.

Stray voltage is not a wind energy issue but is related to electricity. In Ontario, stray voltage is addressed by the Ontario Energy Board, through an amendment to the distribution system code, as of June 16, 2009 (EB-2007-0709). This amendment requires a distributor to investigate complaints from farmers regarding stray voltage and all complaints should be addressed by the local distribution company. Primary sources of on-farm stray voltage are poor/faulty wiring, poor/improper grounding, unbalanced system loads, defective equipment or voltages from telephone or gas lines.

The Adelaide Wind Farm project will be connecting to the transmission lines and not the local distribution system and the electrical collector lines will be designed to minimize any stray voltage potential. Thus it is highly unlikely that this project will increase or decrease the risk of stray voltage to consumers.

I have included a fact sheet from hydro One addressing the issue of stray voltage and outlining the process for concerned individuals.

Regarding health; I have included a recent report (Dec 2009) that was compiled by a panel of experts at the request of the Canadian and American wind energy associations to deal with challenges from anti wind groups that sound from wind turbines causes health issues. Their basic conclusions were;

- *There is no evidence that audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects."*

Montreal  
Belfast  
Oxford

- *"The ground borne vibrations are too weak to be detected by, or to affect humans."*
- *"The sounds emitted by wind turbines are not unique. There is no reason to believe based on the levels and frequencies of sound and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences"*

I hope you will find the enclosed information useful and that it goes some way to addressing your concerns. Once again thank you for your input into the Renewable Energy Approval process.

Yours Sincerely,



Mark Gallagher  
Development Manager

[REDACTED]

---

**From:** Mark Gallagher [mark.gallagher@tcir.net]  
**Sent:** Monday, March 22, 2010 12:18 PM  
**To:** [REDACTED]  
**Subject:** FW: Additional Information  
**Attachments:** Health Report.pdf; PropertyValuesConsultingReportFebruary42010.pdf; Hydro-One fact Sheet.pdf

Hi [REDACTED]

I just wanted to send some information for you to review, as you requested additional information at our Open House at the end of January on property values, health and stray voltage;

### 1. Property Values

Reports have consistently found that there is no evidence to conclude that wind farms negatively affect house prices, but most of these are from the US. A very recent study (Feb 2010) has been conducted in Ontario, in Chatham Kent where the majority of concentrated wind activity has been lately.

I have attached the full report whereby the conclusion was that there was;

*“no statistical inference to demonstrate that wind farms negatively affect rural residential market values in Chatham Kent was apparent in this analysis. Furthermore this study did not find any consistent evidence from the analyzed data that such a negative correlation exists.....the only consistency was that each evaluation methodology found that it was highly unlikely that any type of causal relationship exists between wind farms and the market values of rural residential real estate”*

### 2. Health

I have also attached a recent report (Dec 2009) that was conducted at the request of CanWEA and AWEA to address the claims that sounds from wind turbines directly affect health. A panel of experts were gathered to review the existing evidence and they concluded;

- *“There is no evidence that audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.”*
- *“The ground borne vibrations are too weak to be detected by, or to affect humans.”*
- *“The sounds emitted by wind turbines are not unique. There is no reason to believe based on the levels and frequencies of sound and the panel’s experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences”*

### 3. Stray Voltage

Stray voltage is not a wind energy issue but is related to electricity in general. In Ontario, stray voltage is addressed by the Ontario Energy Board, through an amendment to the distribution system code, as of June 16, 2009 (EB-2007-0709). This amendment requires a distributor to investigate complaints from farmers regarding stray voltage and all complaints should be addressed by the local distribution company. Primary sources of on-farm stray voltage are poor/faulty wiring, poor/improper grounding, unbalanced system loads, defective equipment or voltages from telephone or gas lines. The Adelaide Wind Farm project will be connecting to the transmission lines and not the local distribution system and the electrical collector lines will be designed to minimize any stray voltage potential. Thus it is highly unlikely that this project will increase or decrease the risk of stray voltage to consumers.

I have included some information on stray voltage from hydro one it outlines the process individuals can follow should they feel there is a potential issue.

Thank you again for your input. I hope you will find that attached information useful and that it goes some way to addressing your concerns.

Kind regards,

Mark

Mark Gallagher  
(Development Manager)

T: 514-842-1923

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# Stray Voltage



## What is Stray Voltage?

Varying amounts of low-level voltage often exist between the earth and electrically-grounded farm equipment such as metal stabling, feeders, or milk pipelines. Usually, these voltage levels present no harm to animals. However, if an animal touches a grounded metal object where these low voltages are found, a small electric current may pass through the animal. The voltage that causes this small current is known as “animal contact voltage,” “stray voltage” or “tingle voltage.”

Reported symptoms for dairy cows include:

- Reluctance to enter milking parlour
- Reduced water or feed intake
- Nervous or aggressive behaviour
- Uneven and incomplete milkout
- Increased somatic count
- Lowered milk production

These symptoms can also be the result of other non-electrical farm factors such as disease, poor nutrition, unsanitary conditions or milking equipment problems. Farmers should consider and investigate all possibilities, including stray voltage, when attempting to resolve these symptoms.

## What causes Stray Voltage?

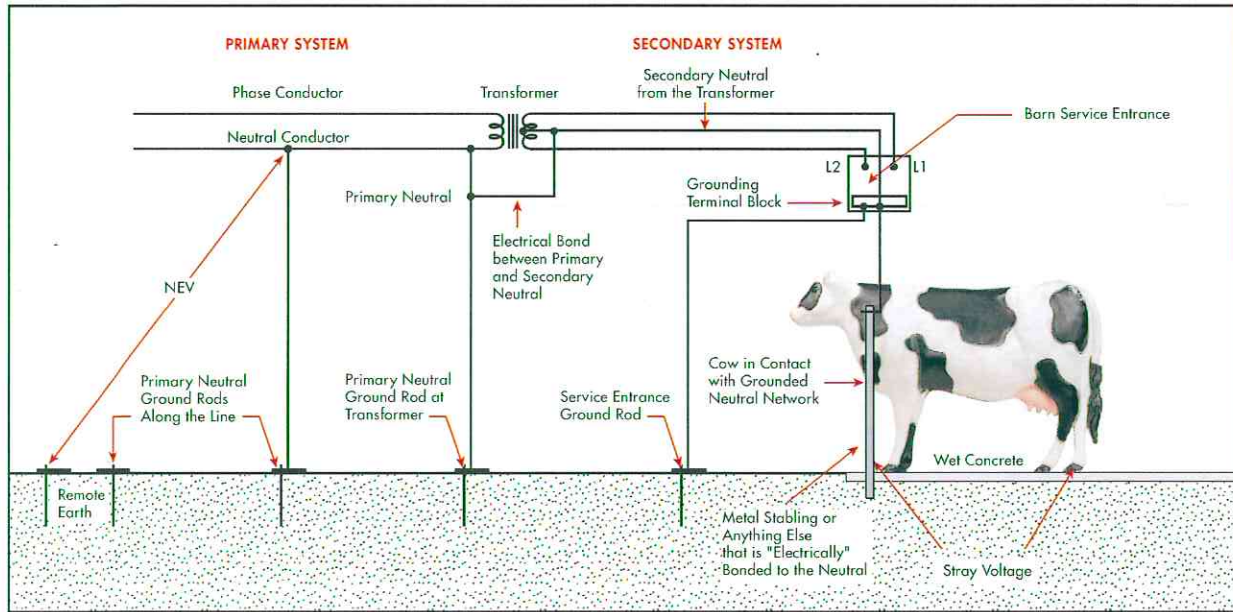
Stray voltage can be produced by a wide variety of off-farm and on-farm sources.

### Off-farm sources:

In a properly functioning electrical distribution system, some voltage will always exist between the neutral system (ground conductors) and the earth. The level of this neutral-to-earth voltage (NEV) can change on a daily or seasonal basis, depending on changes in electrical loading, environmental conditions and other factors. For safety reasons, Hydro One’s neutral system is connected to a farm’s grounding system. While this bond protects people and animals from shocks caused by faulty electrical equipment and lightning strikes, it can also result in a stray voltage equal to a fraction of the NEV appearing on grounded farm equipment, such as feeders, waterers, metal stabling, metal grates and milk pipelines.

### On-the-farm sources:

Poor or faulty farm wiring, improper grounding, unbalanced farm system loading, defective equipment or voltages from telephone lines or gas pipelines are all possible sources of stray voltage.



## If you think you have a Stray Voltage problem

Call our Customer Communications Centre at 1-888-664-9376 (Monday to Friday, 7:30 a.m. to 8 p.m.). Your local field business centre will call you within five business days to arrange an appointment.

1. **First Site Visit:** We'll meet with you at your property to perform pre-test inspections, conduct a site layout and carry out an animal contact test.
2. **Second Site Visit:** Five to ten business days after the first site visit, we will return to your property and install a farm stray voltage recording device.
3. **Third Site Visit:** Two to three business days after the second site visit, we'll remove the recording device and analyze the recorded data. We'll discuss the results of the testing with you at this time.
4. **The Ontario Energy Board (OEB) has specified that voltage levels of less than 1.0 volt to be of no concern.** If the measured threshold falls below this level, the investigation will conclude. Nevertheless, if you choose to purchase a stray voltage filter from us, we'll install it at no cost.
5. **If the stray voltage measured is above 1.0 volt,** we'll do further OEB-defined testing during a fourth site visit to determine whether corrective measures need to be taken by us.
6. **Final Site Visit:** If corrective measures were implemented by us, we'll return to your property to conduct final testing to see whether any additional corrective measures need to be taken by us.

For more information, go to [www.HydroOneNetworks.com/strayvoltage](http://www.HydroOneNetworks.com/strayvoltage)

For additional information on the effects of stray voltage on livestock, see the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website, [www.omafra.gov.on.ca/english/livestock/dairy/facts/strayvol.htm](http://www.omafra.gov.on.ca/english/livestock/dairy/facts/strayvol.htm)



# Birds, bats and wind energy.



Studies show that modern wind farms with sensitive siting have no significant adverse effect on bird populations. The wind energy industry is investing in closely monitoring this important issue and continues to work vigilantly to avoid any significant impact.

Wind energy is emission-free and can help offset the effects of climate change. Wind farms can also be developed with respect for habitats – addressing two significant threats to birds and all other forms of wildlife.



## Making way for birds and bats.

### How birds and wind turbines interrelate.

There are a few ways that wind turbines might interfere with birds – one is the potential impact to their natural habitat, another is through possible collisions with the turbines themselves. A well-sited wind farm goes a long way towards minimizing the risk to birds and brings about a natural and healthy co-existence between wind energy and avian creatures of all stripes.

A study reviewing the impact of wind farms on birds in the US, found that generally, only 2 birds per turbine per year ever die in collisions with wind turbines.<sup>1</sup>

Bear in mind that this is far less than the millions of deaths per year associated with birds crashing into buildings and windows, and the many millions of deaths associated with birds colliding with vehicles.

A real concern for birds is noted in the 2004 study in *Nature* that estimated that up to a quarter of all bird species could become extinct by 2054 due to global climate change, for which wind energy is one of the solutions.

*“It is estimated that more than 10,000 migratory birds are killed in Toronto each year between the hours of 11:00 p.m. and 5:00 a.m. in collisions with brightly lit office towers.”<sup>2</sup>*



1: see P.22. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States, August 2001

2: <http://www.defenders.org/habitat/renew/wind.html>

3: Source: <http://www.lap.org>



Climate change may result in devastating changes to breeding grounds as well as shorebird and waterfowl habitats. Migratory periods could shift out of sync with maximum food production times. These impacts are partly why Defenders of Wildlife believes that wind energy production should be expanded.<sup>3</sup>

Bats and Wind Energy Cooperative (BWEC)

Bat research is underway



Lessons learned.

Lessons were learned from one of the first major wind farm projects in North America. Established in the 1970s, Altamont Pass was problematic for birds. As turbines at Altamont are replaced, newer, fewer and bigger models take their place, making air space around the wind turbines safer for birds.

Today, the wind energy industry has put procedures in place to enhance our understanding of birds and how they interrelate with wind turbines. The modern wind farm undergoes a series of environmental assessments before being approved. In this process, the proposed site will be monitored and bird populations evaluated. What kinds of birds are on site? What are their habits, flight patterns? Do they nest in the area or simply fly through? Questions like these are answered in an effort to better understand on-site bird populations and to mitigate their potential interactions with wind turbines. Once built, further monitoring takes place to better understand the ongoing relationship between birds and the wind farm.

Watching out for wildlife.

There is an emerging concern about the impact certain wind farms might have on bat populations. As of today, bats and their interactions with wind turbines are far less understood than those of birds.

The wind energy industry has taken a proactive approach to working on this important issue. In the US, conservationists, industry officials and federal agencies are joining forces to address this, as yet, little understood relationship between bats and wind energy. In Canada, we are starting to do the same.

The wind energy industry is very interested in learning more about bats to address any potential problems.<sup>4</sup>

Bat behaviour in general, and collisions with wind turbines specifically, is largely understudied. To improve our understanding of this interaction, the Bats and Wind Energy Cooperative (BWEC) was formed in 2003.

BWEC is an alliance of Bat Conservation International, the US Fish and Wildlife Service, the American Wind Energy Association and the National Renewable Energy Laboratory of the US Department of Energy.

During the fall of 2004, BWEC researchers conducted the most detailed studies ever performed on bat fatalities at wind sites. The primary goal of this research was to improve fatality search methods and observe bat/turbine interactions. Research techniques included video and thermal imaging which provided new insights on flight, predation and roosting behaviours. This was the first time these observations were made in the rotor-swept zone of operating turbines.

This and on-going research by BWEC is rapidly advancing our understanding of bat fatalities at wind farms and is only possible with the continued support of the wind energy industry.

To review this, and other research, including the study mentioned above, please visit: <http://www.batcon.org/home/index.asp?idPage=55&idSubPage=30>

Causes of Bird Fatalities<sup>5</sup>  
Number per 10,000 Fatalities



Today's comprehensive site assessment studies and better data on migration routes have reduced bird collisions with wind turbines to levels far below other common causes of fatalities.

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CanWEA acknowledges the contribution of Natural Resources Canada.

4: [http://www.nationalwind.org/workgroups/wildlife/publications\\_catalog.pdf](http://www.nationalwind.org/workgroups/wildlife/publications_catalog.pdf)  
5: Source: A Summary and Companion of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions. Enderson, et al



## VISUAL AND SOUND

# The sights and sounds of wind.



People have a lot of questions about wind turbines and what they look and sound like. Are they really big? How much sound do they make? What will it look like when a wind farm goes up in my community?

Far from being disinterested, developers want to answer these questions and more because building wind farms that address the needs and wishes of local communities is the way to build an industry that benefits all Canadians.



photos courtesy of Vision Quest.

*“Tour of the windmills was a surprise and very informative. Great exhibit lovely place”  
From the visitor guest book in the interpretive centre of the Wind Energy Institute of Canada*

## It's not just the view – it's the vision that counts.

### The eye of the beholder.

Let's face it. There's no hiding a wind turbine. They are 30 stories tall and tend to be set in clusters. Having said that, many people find beauty and elegance in these sleek and modern structures. Many of these people are residents who live closest to wind farms.

Studies in Denmark and in other European countries where wind farms are prevalent show that proximity to the nearest turbine seems to have a surprising effect on people's attitudes. Residents who live closer than 500 meters to the nearest wind turbine tend to be even more positive about wind energy than people sited further away.<sup>1</sup>

### Designing for the future.

Developers recognize that visual impacts are a concern for the community. That's why so much effort goes into the planning stages of a wind energy project. Developers are always looking for new and innovative ways to reduce impacts and gain the consent of the community.

There are computer modelling programs that use Geographic Information Systems (GIS) technology to show residents exactly what the landscape will look like once the farm is installed. These programs provide the community with visual answers to their questions. Residents get to see the farm from different perspectives, including how it may look from the local community centre or church – or even someone's living room window.



## VISUAL AND SOUND



photo courtesy of Vision Quiet



### Wind farms and popular culture.

Where can wind turbines and wind farms be seen today? If you live near a wind farm, you can always visit. If you don't, you'd be surprised at where wind turbines are turning up. Look closely and you'll see them in TV ads, music videos and in other forms of popular culture. The wind turbine has even made it onto the 51¢ postage stamp from Canada Post!



### Noise reduction.

Are modern wind turbines noisy? The answer is no. Any mechanical device has the potential for mechanical noise – the sound that is emitted when two parts rub together. The good news is that this type of sound has virtually disappeared from today's well-engineered modern turbine.

In fact, turbines are so quiet that it's possible to carry on a normal conversation at the base.<sup>2</sup> At 300 meters from the base, the sound they make has been electronically measured and compared to a whispering voice.

Wind turbines operate under windy conditions, the harder the wind blows the faster the turbines spin. However, much of the sound from the blades is masked by the sound of the wind itself and of the accompanying sound of rustling leaves in nearby trees and shrubs.<sup>3</sup>

## CASE STUDY

### Wind Energy Institute of Canada, PEI

Site draws 60,000 visitors annually



photo courtesy of WEIC

Good science constantly helps us discover new information and unexpected results.

The Atlantic Wind Test Site was established in 1980 and by summer 2006 had evolved into the Wind Energy Institute of Canada (WEICan) – a research and testing facility for wind turbine technology. It is funded 70% by Natural Resources Canada and 30% by PEI Energy Corporation.

This site is home to the most diverse mix of wind turbine designs you'll find anywhere on the planet. Small wind turbines; large capacity turbines; giant "egg beater" vertical axis turbines – and all have generated one completely unexpected result – tourism!

The almost universal comment from the 60,000 visitors this site attracts each year is their astonishment at how quiet and how beautiful these wind turbines are.

Rave reviews don't end there. Because of the space constraints for WEICan, wind turbines are closer to local dwellings and roadways than would be permitted with present siting guidelines. Despite this, there has not been a single complaint from local residents. On the contrary, locals take great pride in 'their' wind plant and regularly hike along the access roads. To find out more about WEICan, please visit:

[www.weican.ca](http://www.weican.ca)

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Natural Resources Canada  
Ressources naturelles Canada

CanWEA acknowledges the contribution of Natural Resources Canada.

1: Andersen et al. (1997). Rapport om hvordan en dansk kommune blev selvforsynende med ren vindenergi og skabte ny indkomst til kommunens borgere, Nordvestjysk Folkecenter for Vedvarende Energi, Bishop et Proctor (1994).

2: [http://www.awea.org/pubs/factsheets/WE\\_Noise.pdf](http://www.awea.org/pubs/factsheets/WE_Noise.pdf)

3: <http://www.bwea.com/ref/noise.html>

## TURBINES AND LAND USE

# The win/win of wind energy.



photo courtesy of VeritasQuest

If wind turbines are big, wind farms are even bigger.

So how can a large wind energy project respect the lay of the land? The answer lies in how they occupy only a fraction of the land they are sited on and work in harmony with its established uses. In rural settings, farming and ranching continue undisturbed. Even in urban areas, wind farms can fit in with the local streetscape.

Wind energy fits with the way we live today. This is the unique win/win of wind. Minimal land use. No emissions. Just a clean and renewable way to produce energy that peacefully co-exists with its neighbours.

## Understanding the lay of the land.

### The small footprint of wind.

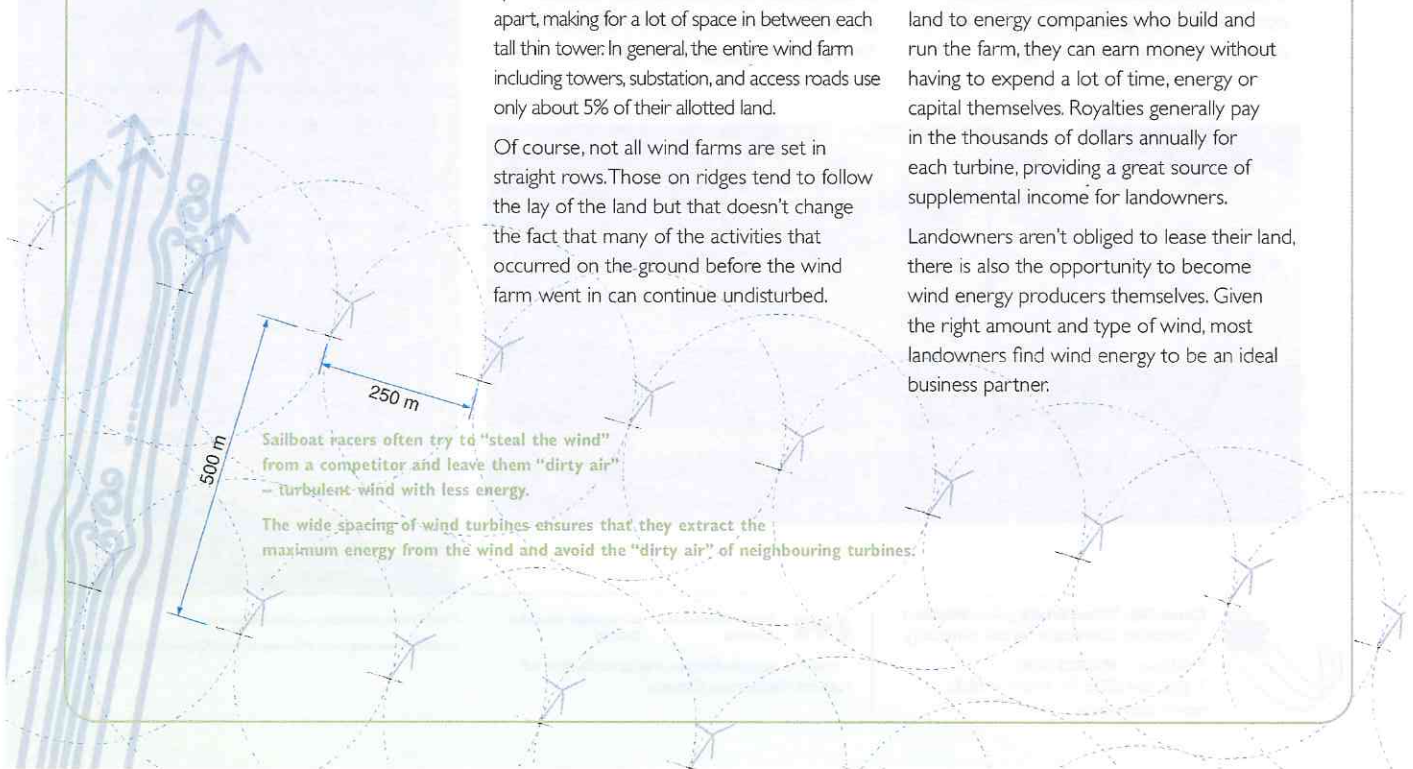
Turbines are tall – but they are also relatively slim. Generally each tower base is only 8 meters across and each turbine spaced 250 meters apart. Rows of turbines are set 1/2 kilometer apart, making for a lot of space in between each tall thin tower. In general, the entire wind farm including towers, substation, and access roads use only about 5% of their allotted land.

Of course, not all wind farms are set in straight rows. Those on ridges tend to follow the lay of the land but that doesn't change the fact that many of the activities that occurred on the ground before the wind farm went in can continue undisturbed.

### The ideal business partner.

Wind energy is a special kind of commodity because it can deliver stable financial rewards with little or no effort on the part of landowners. Since landowners lease their land to energy companies who build and run the farm, they can earn money without having to expend a lot of time, energy or capital themselves. Royalties generally pay in the thousands of dollars annually for each turbine, providing a great source of supplemental income for landowners.

Landowners aren't obliged to lease their land, there is also the opportunity to become wind energy producers themselves. Given the right amount and type of wind, most landowners find wind energy to be an ideal business partner.



## TURBINES AND LAND USE



photo courtesy of Vision Quest

## PROFILE

### John Deere Wind Energy

Wind energy investment program for farmers in USA



photo courtesy of Toronto Hydro

### Surprising sites.

Wind farms can be found throughout Canada – and in some surprising places. Head Smashed in Buffalo Jump, a World Heritage site located in southern Alberta is one such example. Several wind farms have been located within view of this Heritage Site. There is also a wind farm in downtown Toronto and one on the docks of Hamburg, Germany. Wind farms continue to surprise and delight!

### Wind farms and farming.

Rural communities are in a great position to develop wind energy. Wind farms and farming have a well-established and harmonious relationship in the US<sup>1</sup> and Europe. Farmers and ranchers in North America are fast realizing that they can use their land not only to raise cattle and grow crops but to harvest electricity from wind.

Imagine a farm or a ranch with a wind farm on it. Crops can be planted right up to the base of the turbines and harvested with the usual farm machinery, and because the presence of turbines doesn't disturb livestock, the sheep, cows and horses can continue to graze in and around the towers.

Wind farms do more than co-exist peacefully with agricultural uses of land, they help preserve what's precious to us. Because they provide an alternative income stream for farmers and ranchers, wind farms help farmers and ranchers weather the ups and downs of farming. Wind energy helps to preserve the rural way of life in Canada giving farmers, ranchers and their children the option of staying on the farm.<sup>2</sup>



John Deere has a vested interest in helping rural communities prosper. They understand the challenges faced by farmers and know wind energy can provide a new revenue stream for land owners where a good wind resource exists. To help make this revenue stream a reality, John Deere created John Deere Wind Energy (JDWE) for US farmers. Research is currently underway for a similar program in Canada.

JDWE can participate in economically viable wind energy projects in a debt and equity investor role. Typically, land owners participate as limited partners and, ultimately gain ownership of the project assets and the economic benefits.

At this time, JDWE is investing in utility-scale wind projects in the USA. This generally means projects with multiple wind turbines with a minimum capacity of 1.25 megawatts. This is generally due to the fixed cost for these projects and the ability to secure attractive power purchase agreements from utility companies or, for some projects, rural electric cooperatives or private companies. JDWE can work with developers and land owners to evaluate potential projects.

For more information on JDWE please visit: [http://www.deere.com/en\\_US/jdc/product\\_financing/wind\\_energy/about/index.html](http://www.deere.com/en_US/jdc/product_financing/wind_energy/about/index.html)



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CanWEA acknowledges the contribution of Natural Resources Canada.

1: <http://www.rurdev.usda.gov/rbs/farmbill/index.html>

2: <http://www.ontario-sea.org/Community/Wind/Community/Wind.html>

# **Wind Turbine Sound and Health Effects**

## **An Expert Panel Review**

### *Executive Summary*

Prepared by (in alphabetical order):

**W. David Colby, M.D.**

**Robert Dobie, M.D.**

**Geoff Leventhall, Ph.D.**

**David M. Lipscomb, Ph.D.**

**Robert J. McCunney, M.D.**

**Michael T. Seilo, Ph.D.**

**Bo Søndergaard, M.Sc.**

Prepared for:

**American Wind Energy Association**

and

**Canadian Wind Energy Association**

December 2009

# Executive Summary

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People have been harnessing the power of the wind for more than 5,000 years. Initially used widely for farm irrigation and millworks, today's modern wind turbines produce electricity in more than 70 countries. As of the end of 2008, there were approximately 120,800 megawatts of wind energy capacity installed around the world (Global Wind Energy Council, 2009).

Wind energy enjoys considerable public support, but it also has its detractors, who have publicized their concerns that the sounds emitted from wind turbines cause adverse health consequences.

In response to those concerns, the American and Canadian Wind Energy Associations (AWEA and CanWEA) established a scientific advisory panel in early 2009 to conduct a review of current literature available on the issue of perceived health effects of wind turbines. This multidisciplinary panel is comprised of medical doctors, audiologists, and acoustical professionals from the United States, Canada, Denmark, and the United Kingdom. The objective of the panel was to provide an authoritative reference document for legislators, regulators, and anyone who wants to make sense of the conflicting information about wind turbine sound.

The panel undertook extensive review, analysis, and discussion of the large body of peer-reviewed literature on sound and health effects in general, and on sound produced by wind turbines. Each panel member contributed a unique expertise in audiology, acoustics, otolaryngology, occupational/ environmental medicine, or public health. With a diversity of perspectives represented, the panel assessed the plausible biological effects of exposure to wind turbine sound.

Following review, analysis, and discussion of current knowledge, the panel reached consensus on the following conclusions:

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
- The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel's experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

## SECTION 5

# Conclusions

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Many countries have turned to wind energy as a key strategy to generate power in an environmentally clean manner. Wind energy enjoys considerable public support, but it has its detractors, who have publicized their concerns that the sounds emitted from wind turbines cause adverse health consequences.

The objective of the panel was to develop an authoritative reference document for the use of legislators, regulators, and citizens simply wanting to make sense of the conflicting information about wind turbine sound. To this end, the panel undertook extensive review, analysis, and discussion of the peer-reviewed literature on wind turbine sound and possible health effects. The varied professional backgrounds of panel members (audiology, acoustics, otolaryngology, occupational and environmental medicine, and public health) were highly advantageous in creating a diversity of informed perspectives. Participants were able to examine issues surrounding health effects and discuss plausible biological effects with considerable combined expertise.

Following review, analysis, and discussion, the panel reached agreement on three key points:

- There is nothing unique about the sounds and vibrations emitted by wind turbines.
- The body of accumulated knowledge about sound and health is substantial.
- The body of accumulated knowledge provides no evidence that the audible or subaudible sounds emitted by wind turbines have any direct adverse physiological effects.

The panel appreciated the complexities involved in the varied human reactions to sound, particularly sounds that modulate in intensity or frequency. Most complaints about wind turbine sound relate to the aerodynamic sound component (the swish sound) produced by the turbine blades. The sound levels are similar to the ambient noise levels in urban environments. A small minority of those exposed report annoyance and stress associated with noise perception.

This report summarizes a number of physical and psychological variables that may influence adverse reactions. In particular, the panel considered “wind turbine syndrome” and vibroacoustic disease, which have been claimed as causes of adverse health effects. The evidence indicates that “wind turbine syndrome” is based on misinterpretation of physiologic data and that the features of the so-called syndrome are merely a subset of annoyance reactions. The evidence for vibroacoustic disease (tissue inflammation and fibrosis associated with sound exposure) is extremely dubious at levels of sound associated with wind turbines.

The panel also considered the quality of epidemiologic evidence required to prove harm. In epidemiology, initial case reports and uncontrolled observations of disease associations

need to be confirmed through controlled studies with case-control or cohort methodology before they can be accepted as reflective of casual connections between wind turbine sound and health effects. In the area of wind turbine health effects, no case-control or cohort studies have been conducted as of this date. Accordingly, allegations of adverse health effects from wind turbines are as yet unproven. Panel members agree that the number and uncontrolled nature of existing case reports of adverse health effects alleged to be associated with wind turbines are insufficient to advocate for funding further studies.

In conclusion:

1. Sound from wind turbines does not pose a risk of hearing loss or any other adverse health effect in humans.
2. Subaudible, low frequency sound and infrasound from wind turbines do not present a risk to human health.
3. Some people may be annoyed at the presence of sound from wind turbines. Annoyance is not a pathological entity.
4. A major cause of concern about wind turbine sound is its fluctuating nature. Some may find this sound annoying, a reaction that depends primarily on personal characteristics as opposed to the intensity of the sound level.