Submission to

Canadian Senate Standing Committee on Energy, the Environment and Natural Resources

The Social & Economic Impact of Rural Wind Farms Related to Canada's Energy Future

Submission by:

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Submitted to:

All Canadian Senators

Dear Senators of the Canadian Senate:

Thank you for the opportunity to present information to you regarding Canada's Energy Future. My presentation is based on the Social & Economic Impact of Rural Wind Farms. I have found that often a study such as yours will use information from other areas to learn the impacts on society and economics from elsewhere. The intent of this submission is to provide you an overview of my first-hand experience with wind farms in North America (Ontario principally) and Europe.

My name is Bill Palmer. Our family is developing TRI-LEA-EM, an environmental gathering place to serve youth and church groups in Bruce County, in the Province of Ontario, in Canada. For over 10 years, the TRI-LEA-EM gathering facility has been a demonstration of sustainable resources. Electricity is supplied by solar panels and a well-insulated passive solar building design minimizes heating or cooling needs. The use of renewable energy sources with appropriate placement is justified, but inappropriate placement can do harm to people, and if economic factors are not correctly considered, society will suffer.

We originally considered a small wind turbine for energy supply at TRI-LEA-EM. When it came time to purchase the turbine, I contacted a person selling a used machine. Why was he selling it? He answered in two parts:

1. The owner now had utility supplied hydraulic electric power, and the wind-generated power was just too expensive - (the economics impact).
2. Neighbours half a mile down the road (over 800 metres) complained about the noise from the turbine when it operated - (the social impact).

I stored this information away in my head and ordered solar panels. In my presentation, I will separate my comments into the issues of Social Impact and Economic Impact, although where necessary, the interaction between the two issues will be discussed.

<u>The Social Impact of Wind Turbines</u>

About 6 years ago, it was announced that the largest wind turbine development in Canada to date would be built in our municipality. The 121 industrial sized turbines would be safe, have zero emissions (no noise) and be a financial boon to the community, the developer said. Many landowners signed leases to put turbines on their property without further investigation. Neighbours asked me, "Aren't you going to sign up?" I replied that when someone offers me "free" money, alarm bells ring. As I tried to clarify some points, answers were not to be found, and more questions were raised. I commenced to study the issues in depth.

My engineering career in the natural resources sector of Canada with Noranda Mines, and in the electrical generation sector with Ontario Hydro, Ontario Power

Generation and Bruce Power gave experience in the fields of system design and operation, training others, accident analysis, and public safety. My engineering education is from the University of Toronto with specialized courses from MIT (the Massachusetts Institute of Technology) in the areas of safety and risk assessment. I have been a practicing Professional Engineer in Ontario for over 37 years. When I applied these skills to the study of wind turbines being installed the results were unsettling. They showed turbines in Ontario were being placed too closely to roadways or the edges of leased lots for safety. The risk calculations being performed by the wind turbine industry[1] were flawed. I identified this problem to the Ontario Ministry of the Environment, but no action ensued. Independently, Hydro One Networks (the operator of the electricity transmission system in Ontario) determined that wind turbines should be set back over 500 metres from their 500 kV transmission lines[2]. However, CanWEA, the Canadian Wind Energy Association (industry advocacy association) states that wind turbines need be set back from roads and lot lines no more than the blade length plus 10 metres (50 metres to 65 metres)[3]. The provincial Ministry of the Environment chose to establish setbacks to roads, railways, and lot lines in accordance with the CanWEA position, rather than considering a proper risk assessment. The public is not being protected. Letters to the Ministry of the Environment brought no effective response. The Provincial government was intent on an ideology driven position of promoting wind and solar energy, and simply refused to acknowledge adverse impacts, which were dismissed by literature studies conducted by consultants with links to the industry.

The actual performance of wind turbines in Ontario shows a blade failure rate four times higher than seen earlier in Europe as identified in Appendix 1 to this report. Published research by the US Department of Energy shows a higher blade failure rate had been predicted for tall wind turbines with large rotor diameters during conditions of high wind shear, as proven to exist in Ontario. These facts identify that the issue of public safety needs to be addressed by adequate setbacks. This had also been previously identified in letters to the Minister of Energy and the Minister of the Environment without resolution.

As a Professional Engineer, I am obliged “to report a situation that an engineer believes may endanger the safety or welfare of the public.” It obliged me to give formal notice to the legislators and regulators in Ontario that undue risk to public safety was being posed by wind turbines at present setbacks. I stated bluntly that the consequence of ignoring this is increased risk of public injury or death.

Then, using experience from studying the root cause of incidents, my attention turned to the noise emissions from wind turbines. Research in Europe had

[1] M.P. LeBlanc, Garrad Hassan, “Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario”, prepared 31 May 2007, for David Timm, CanWEA

[2] Letter, Enza Cancilla, Hydro One Networks Inc. to William Palmer, November 3, 2008

[3] Canadian Wind Energy Association Position on Setbacks for Large-Scale Wind Turbines in Rural Areas (MOE Class 3) in Ontario, September 28, 2007

determined that changes in the wind profile caused an increase in annoyance from wind turbines at night[4]. This was identified to the Ontario Ministry of the Environment (MOE), along with evidence proving this was happening in Ontario. I expected that the MOE would investigate and take corrective action. Instead, the MOE Senior Noise Engineer refused to take action, noting that my evidence was not published. This confirmed my first indications that the Ministry of the Environment was not protecting citizens. Then, when the MOE approved the certificate of approval for the Enbridge Ontario Wind Development, and subsequent developments, they did not follow their own wind turbine noise guidelines that were to be based on ISO code 9613-2, but allowed a non-standard calculation technique to increase the sound level at homes.

I presented a paper[5] identifying the issue at the Second International Wind Turbine Noise Meeting, in France in 2007, to show the evidence gathered in Ontario. Delegates were supportive, and when shown the Enbridge Ontario Wind Development plans, they observed, “You are going to have problems.” This paper was cited[6] by the Ministry of Housing of the Netherlands as a basis for changing their regulations from a ramped series of values depending on wind speed to a limit independent of wind speed, with more restrictive values at nighttime. After that conference and a further workshop, the MOE revised their wind turbine noise guideline to state that the summer nighttime average wind shear needed to be used to correctly calculate the noise emissions for wind turbines. Yet, when the MOE issued the certificate of approval for the Harrow Wind Development months later, they failed to apply this guideline, and there is no transparency in the basis for the assumed wind shear values used. No test data is provided, and in some cases very low values of wind shear are assumed. Further, when revising the wind turbine noise guidelines, the Ontario MOE refused to apply the penalty for cyclic noise demanded by MOE requirement NPC-104, which calls for a 5 dBA penalty to be applied if a sound is EITHER tonal OR cyclical. The MOE refused to comply with their own requirement and said that unless the noise from wind turbines was BOTH tonal AND cyclical, no penalty would be applied. The MOE are consistently not applying their own rules.

It is informative that the MOE Senior Noise Engineer stated publicly at a MOE workshop that he was “proud to have approved the Ontario wind turbine developments”, and that “people will get acclimatized to the noise.” Ontario allows wind turbines to produce 51 dBA of noise at a residence, while in

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[4] G.P. van den Berg “Effects of the wind profile at night on wind turbine sound”, Journal of Sound and Vibration, vol 277 (4-5), pp 955 – 970 (2004).

[5] Palmer, “Uncloaking the Nature of Wind Turbines – Using the Science of Meteorology” Proceedings of the 2nd International Meeting on Wind Turbine Noise, Lyons, France, 2007.

[6] RIVM Rapport 680300007/2009 Evaluatie Nieuwe Normstelling Windturbinegeluid,(in Dutch) *Evaluating new norms for windturbine noise - Influence of various limits on exposure, annoyance and potential development sites.*

Germany; a limit of 35 dBA is applied. This is an important difference (as every 6 dB of difference is the same as halving the distance from turbines to a home.)

A significant flaw in the Ontario Renewable Energy Approval Regulations (O. Reg. 359/09) is that it delegates the responsibility to develop setbacks for wind turbines to the Ministry of the Environment. At a MOE technical expert workshop held to collect information related to wind turbines setbacks, Mr. Kevin Perry, Director of the MOE Program Development Branch stated, "the goal is to make it possible for these technologies (wind turbines and solar panels) to be installed." A second MOE spokesperson noted, "the intent is not to create rules and requirements," adding "there is no time to debate requirements." At this workshop, MOE staff refused to permit a presentation on the health effects from wind turbines.

You will undoubtedly hear from citizens, who have suffered from noise and / or other emissions from wind turbines. You will undoubtedly hear that an evidence based epidemiological health assessment is required to determine the actual impact on public health before setbacks can be determined.

I have been trying to use my technical background to bring further explanation and understanding to the source of the problems faced by people. While my training and experience may not permit me to determine medically why people are suffering, I am able to determine what has changed in their environment, as changes are usually the source of new problems that arise.

In 2009, I presented a second paper[7] at the 3rd International Meeting on Wind Turbine Noise, to try to help understand the issue of the cyclic noise that wind turbines produce, since it is well recognized that the cyclical noise from wind turbines are their characteristic signature, and as recognized by the Ontario Ministry of the Environment guideline, NPC-104, the existence of a cyclic noise increases the impact from noise. The paper concluded,

> *The anecdotal evidence that wind turbines are more annoying at night, and that the "Whoosh" is more pronounced at night cannot be fully explained by the normal power law, the logarithmic change in velocity with height, by Doppler effects, or by the creation of sound towards the outer limits of the turbine blade on downward motion.*
>
> *The explanation of the cyclic nature of the "Whoosh Whoosh Whoosh" can be found in the cyclical change of the sound level that occurs, particularly at night, as a stable atmosphere is created. The stable atmosphere creates the greatest change in the summed angle of attack considering the contribution of each blade taken together, as is heard by an observer.*

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[7] Palmer, "A New Explanation for Wind Turbine Whoosh – Wind Shear" Proceedings of the 3rd International Meeting on Wind Turbine Noise, Aalborg, Denmark, 2009

> *This paper has shown that this condition of a stable atmosphere occurs on the majority of nights in Ontario (and likely occurs elsewhere with a similar frequency, as climatic conditions do not observe political boundaries). … The existence of this condition as shown in this report reinforces the need to apply a penalty to the average sound received from wind turbines at night because the cyclic "Whoosh" produced during stable atmospheres makes them particularly noticeable and annoying, compared to other noise sources.*

In the absence of responsible action by the Ontario government or the industry, ongoing personal research has continued to try to bring further understanding to the changes occurring at the homes of citizens influenced by the placement of wind turbines nearby. Review of data collected by the acoustical consultant for an existing Ontario wind farm shows that the sound levels actually observed by the consultant shows the sound level exceeds that which was predicted to occur in the Environmental Noise Assessment used by the same consultant to justify the issuance of a "Certificate of Approval" by the Ministry of the Environment on 50% of the nights at midnight. In fact, on 25% of the nights, the observed sound level exceeded the predicted value by over 3 dB. This is understood to be a change that is readily noticeable. This information[8] was presented to the Ontario Ministry of the Environment, but no response has been received.

Now, a further paper[9] has been accepted for presentation to the 4th International Meeting on Wind Turbine Noise, in Rome Italy, in April 2011. While all the details of this paper cannot be given before presentation, the paper concludes:

> *A repeatable manner of assessing the frequency spectrum of the sound experienced by people living in homes at distances approved by regulators for predicted sound levels of 40 dBA or less shows that the sound levels at octaves below 1000 Hz are consistently 15 to 20 dB higher than at a home in a similar environment distant by 5000 metres from wind turbines.*
>
> *Sound levels at homes near turbines for any ground level wind speed at all octaves below 1000 Hz are shown to be greater than the sound level experienced at a home distant from wind turbines when the wind there exceeds a Beaufort Force 5 wind.*
>
> *Research by others (notably A.N. Salt) notes that low frequency sound, which might be emitted by wind turbines, needs further study. This work*

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[8] Palmer, "Review of Enbridge Ontario Wind Power Compliance With Ministry of the Environment Certificate of Approval (Air) Noise" presented to the Ontario Ministry of the Environment, 2011

[9] Palmer, "Evidence Based Study of Noise Impacting Annoyance", accepted for presentation to the 4th International Meeting on Wind Turbine Noise, Rome, Italy, 2011

confirms the presence of low frequency sound (below 200 Hz) at homes near wind turbines.

The Economic Impact of Wind Turbines

Up to now, the material discussed in this report has focused on the social impact of wind turbines. I will briefly now turn to the second issue of study, the economic impact of wind turbines, basing my comments on Ontario experience.

Typically in Ontario the seasonal electrical demand are as follows:

- winter, a base load of about 16,000 MW at night, and 22,000 MW in the daytime,
- summer, a base load of about 15,000 MW at night and perhaps 26,000 MW in the daytime (air conditioning load is now places larger demand on the electrical system than heating load in Ontario), and
- spring and fall, a baseload of perhaps 12,000 MW a night and 18,000 MW in the daytime (when both heating and air conditioning demands are least).

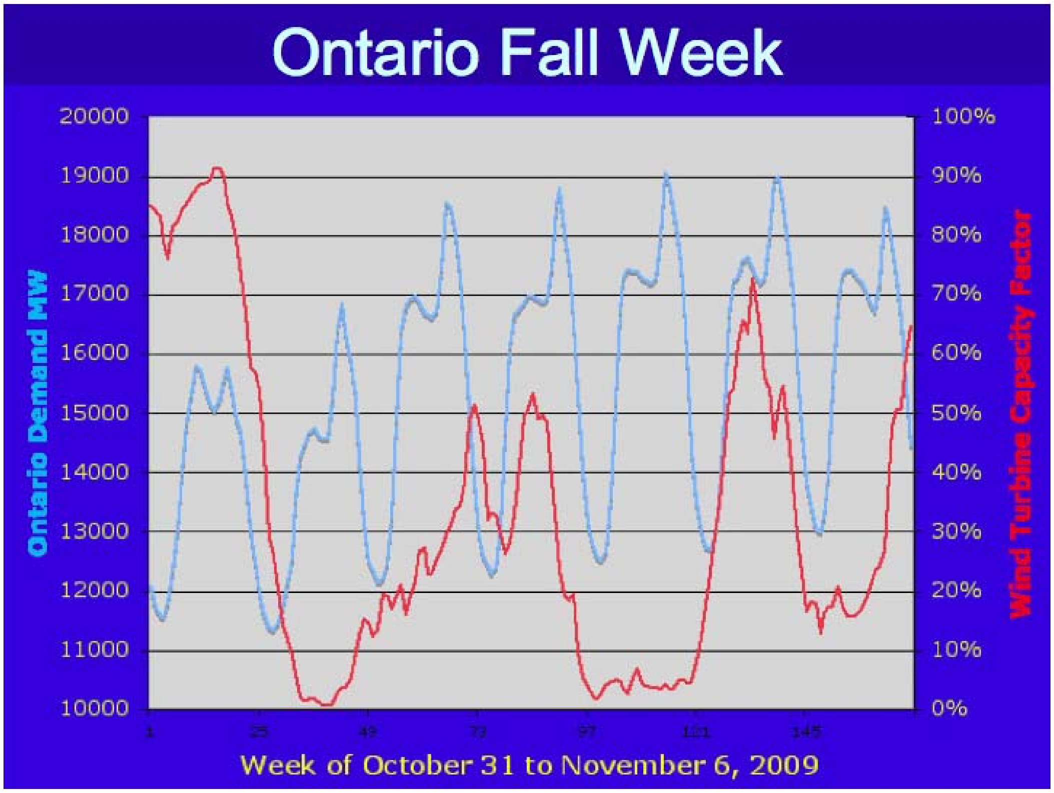
In Ontario, the electrical load demands are met as follows, with rates approximately as noted here. Actually the rates are not simply described as Ontario supposedly has an “open market” yet most suppliers have fixed price guarantees, and there are many additional costs that are embedded in the prices for energy, particularly transmission costs, which are greater for distributed sources of generation such as wind turbines than localized sources.

- about 10,000 MW of nuclear electric generation supplies base load. Nuclear generation has relatively little maneuverability, preferring to stay at a constant output. Nuclear baseload is paid about $50 per MWh.
- hydraulic electric generation supplies up to about 7,000 MW (perhaps 4,000 MW available for base load, and an additional 3,000 MW available intermittently for peaking) Hydraulic generation is the most maneuverable in output. Hydraulic baseload is paid about $40 a MWh.
- coal fired electric generation has supplied up to about 8,000 MW in the past mostly for peaking in the daytime, but in recent years this has been replaced with natural gas fired generation, to reduce the coal capability to about 3,000 MW. Coal generation is maneuverable once above about 5% in output. The current government plan is to shut down and deregister all coal-fired generators by 2014, although some may have to continue to operate as synchronous condensers for voltage support, supplying reactive power. Coal generation is paid “spot market prices” of perhaps $40 to $75 per MWh.
- natural gas electric generation has a capability of about 9,000 MW, of which some 5,000 MW is combined cycle plants, which need to be maintained above about 50% in output to be maneuverable. The Natural gas capability is targeted to increase to about 11,000 MW over the next few years, to enable the shut down of the coal-fired generation. Natural

gas generators generally have fixed contracts, at confidential rates, but they are typically about $100 per MWh.

- wind turbines exist with a nameplate capability of about 1400 MW, with a government plan to increase this to about 10,000 MW over the next 10 years. Wind turbines are paid a variety of rates although current installations are at Feed In Tariff rates of $135 per MWh for land based turbines and $190 per MWh for water based turbines, to which the federal government has been adding an “Eco-Action” adder of about $10 per MWh.
- solar photovoltaic plants exist with about 120 MW of nameplate capability and some 2000 MW of additional nameplate capability planned. Solar plants are paid Feed in Tariff rates ranging from $480 per MWh to $803 per MWh, plus the federal Eco-Action adder.

Although the published Ontario plans are to maintain the nuclear baseload generating capability at about 10,000 MW, the actual long term case has not been carefully considered, as when some 10,000 MW of wind turbines are available, in order to stabilize the electrical system, it will be necessary to maintain much of the natural gas generators on line, and since they are mostly combined cycle generators, that means that they will be operating at about 5000 MW to be able to load to 10,000 MW, along with the addition of perhaps an additional 2,000 MW of simple cycle natural gas generators that can rapidly load to be able to accommodate the regular drops in wind turbine output from high output to low output over short periods. A sample curve of wind turbine output superimposed on the electrical demand curves on the next page shows that even with widely spaced wind turbines the entire system can drop in output rapidly.



What this means is that having a large wind turbine complement, that will require the back up of a large natural gas fired complement, means that there will be no place left in the Ontario system for the nuclear electric generator baseload, that has kept the price low and stable for the last 40 years in Ontario. The system will replace nuclear with intermittent wind, and it's back up natural gas, each of which have firm prices some 3 times higher than the nuclear price, which will have serious economic impact on the Ontario electricity process, and as a "knock-on" on Ontario manufacturing, as well as on consumer costs. Fuel poverty crosses from an economic issue to a social issue, in particular as energy demands must be met, and as more disposable income goes to pay for fuel, less is available for health care, and healthy eating habits. Fruits and vegetables are replaced by Macaroni and Cheese!

The economic impact gets even muddier, since the provincial legislation ensures that wind turbines do not pay property taxes based on their replacement value but on a very low assessment. For example, a 2.5 MW turbine, with an installation value of perhaps $5,000,000 is taxed on the basis of having a value of only $100,000. This means that very low property taxes accrue to the municipalities where the turbines are located, and if homeowners make a successful submission to have their taxes reduced by showing that their home value has been reduced by the installation of nearly wind turbines, then the municipal tax base may actually erode.

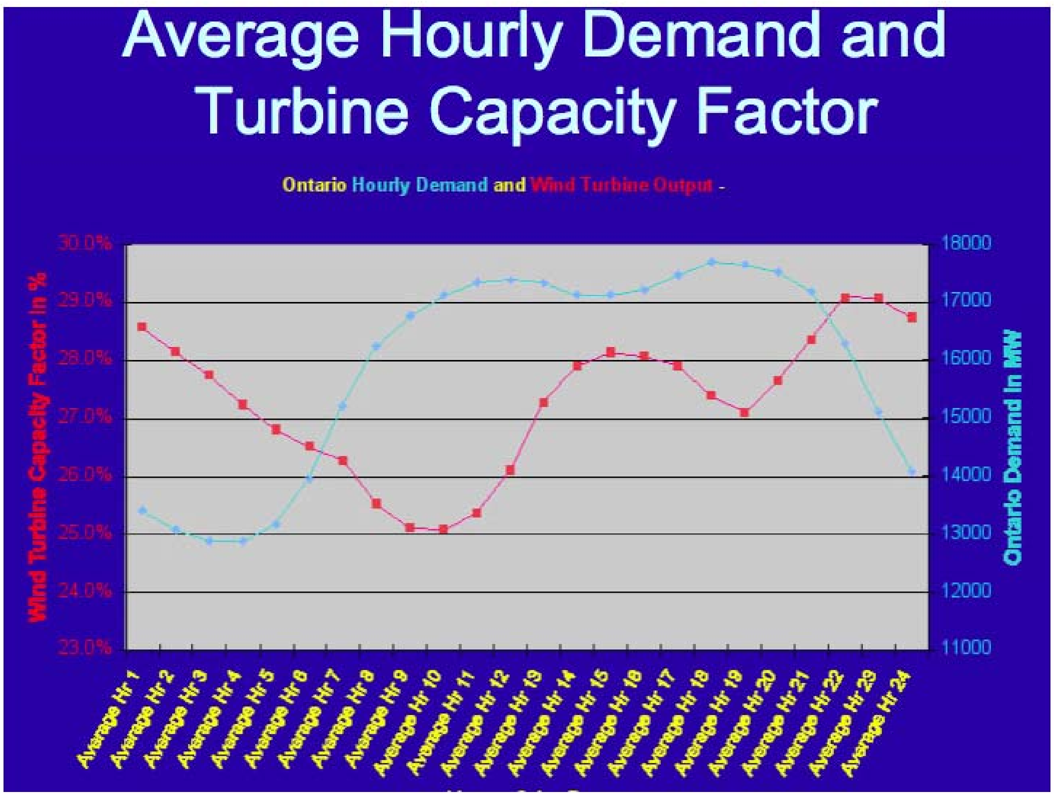
Even muddier, since wind turbines can be depreciated at a high rate over a period of some 4 years, this ensures that the wind turbine operators will pay very little if any income tax on the income from their operation for the first 4 years. In Ontario, no new large wind turbine installation has been owned by the same owner for a period of greater than 4 years. Before the time that the depreciation limit is reached, every wind farm has been “flipped” to a new owner (in some cases just a different division within the same company) but which effectively restarts the depreciation clock. The economic impact on society of having wind turbine generators paid high fixed prices for all energy produced, whether needed or not, being charged property taxes based on an artificially low assessment, and then being allowed to depreciate the resource over a short time period to enable paying very little income taxes puts all the benefit into the hands of the developers and puts a high toll on the citizens. The economic impact on the province is expected to be severe.

A further complication is that wind turbines in Ontario make a very poor fit to the provincial electricity needs. The largest Ontario electricity demand occurs in the summertime, when air conditioning load is highest. In the summer of 2010, for 100 days of the summer, the aggregate of Ontario wind turbines had a capacity factor of 5% or lower for periods of 5 hours or greater on 40% of the days – the time it was most needed. In fact, over the year, wind turbines in Ontario produce best at night, when the electricity demand is lowest, and poorest in the daytime, when the demand is highest, as shown on the chart on the next page.

A common fallacy is that the additional energy produced when not needed can be stored. In Ontario advertisements from the government and Ontario Power Authority often speak of using plug in electric cars in the future to level the generation to load fit. It is clear than no one is seriously doing the simple math to find out if this is possible. In reality, the need is to store energy from spring or fall into the summer or winter. The magnitude of such a battery bank is pretty hard to imagine. For simplicity, assume that 10,000 MW of wind turbines running at 80% capacity factor want to store energy from 8 hours (64 MWh or 64,000,000 kWh) overnight to be used in the next day. To store that electricity, one looks at the storage capacity of known electrical assist cars available or planned today.

- Honda Civic Hybrid – battery capacity of 1 kWh, so would need 64,000,000 cars
- Toyota Prius Hybrid – battery capacity of 1.5 kWh, so would need 43,000,000 cars
- Toyota Prius Plug in – (not yet available) battery capacity of 5.2 kWh, range of about 10 km on battery, would need 12,000,000 cars
- Chevy Volt – (soon to be available) battery capacity of 16 kWh, range of about 30 km on battery, would need 4,000,000 cars
- Nissan Leaf – (all electric plug in) battery capacity of 24 kWh, expected range of 100 km, would need 2,700,000 cars.

Note also that the battery for an all-electric car has a weight of about 200 kg and the battery alone is expected to cost some $20,000, and to have a life expectancy of 6 to 8 years. The problem is that Ontario; with a population of about 12,000,000 people, has roughly 6,700,000 cars and light duty trucks. Most vehicles are larger than the Nissan Leaf, and while some are driven more than 100 km in a day, most are not, and the battery would not be depleted to be able to accept full charge. Besides, if the intent were to plug the car in the next day to supply electricity back into the system, then the drivers would not be able to drive home! No one has really done the sums to determine that the number of plug in cars, all to be driven to completely deplete their battery every day, to see what impact this would have on society or economics.



Conclusion

Wind can be a contributor to electric supply, but hopefully the Senate will look carefully at the experience from Ontario, to ensure that setbacks are appropriate to protect citizens. It is not happening here. In general terms this would need safety setbacks of 500 + metres to any roadway, or location where a citizen is not excluded from being (their own property or example), and a noise setback of 2000 + metres from any home, or location where citizens get restorative rest.

It is chilling to observe the denial of respect being shown in Ontario to citizens harmed by the effects from wind turbines and to professionals showing factual evidence of problems. Statements by the Premier and the Minister of Energy and Infrastructure of the Province of Ontario that the intent of the Green Energy Act was to ensure "NIMBYs will never again stop the development of wind turbines in Ontario" is a denial of hope, and instead brings despair. In fact, nearly every person in Ontario, and all of Canada, believes that our actions as citizens and government should not harm another. Ontario Regulations and government response makes a mockery of this fundamental premise of society. I would hope that in your deliberations, you might learn from Ontario, and not make the same mistakes.

In your hearings you will hear from presenters who believe that wind turbines are necessary to "save the world." However, ask carefully if have they shown evidence of the environmental gains to be realized, or have they lived with the impacts of wind turbines near their homes? In fact wind turbines are destroying the environment where people live when placed too near to homes. Unless you choose to publicly state that all those who have suffered adverse effects are liars, you must ensure the protection of people.

Before you listen to economic claims that "storage" is simple to solve the problems of energy being produced when it is not needed, please pause to do the simple sums, as done in the review, to show that the case is not as clear as claimed.

Thank you for the opportunity to provide input to this important decision. If any of the information I have noted in passing needs further explanation, or if you would like copies of any of the referenced material, please do not hesitate to ask.

With respect,

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<u>Appendix 1</u>
Known Industrial Size Turbine Failures – Resulting in Blades on the Ground
Jan2008 to Dec 2009 (24 month period)

List Compiled From Public Records

- Dec. 2009, all blades are removed from 25 Gamesa 2 MW turbines in the Kumeyaay Wind Project due to damage. Photos show one-third to one-half of some blades lost. California USA (counted as only 1 failure due to lack of detail.)
- Dec 2009, 1.5 MW GE wind turbine in New York State (Fenner Wind Farm) collapses after loss of power. Cause under investigation. USA.
- Nov 2009, 2.1 MW Suzlon wind turbine at Siif Energies Praia Formosa development "exploded" loosing a blade, Brazil.
- Nov 2009, 1.5 MW turbine at Acciona – Aibar Wind Development, nacelle, blades, and top third of prototype concrete tower collapse, Spain.
- Nov 2009, Vestas V47 turbine failure one blade lands on path used by hikers, (Falkenberg) Sweden.
- Nov 2009, Wincon turbine in Denmark (Esbjerg) – defective axle causes all blades of 40 m high turbine to come loose, one hit a power transformer – article notes that since 2000, Denmark has had 27 incidents of wind turbines loosing blades,
- Oct 2009, Vestas V90 turbine failure, braking fails in winds of 30 metres/sec, Sweden.
- Sept 2009, blade failure, second in 15 months, 56 m turbine, Sheffield U, UK.
- July 2009, GE 1.5 MW turbine looses blade after lightning strike, Montana, USA.
- Jul 2009, Vestas V80 turbine looses blade after lightning strike, broken blade parts travel 150 metres, Germany.
- Jun 2009, GE 1.5 MW turbine blade failure following lightning strike, MO, USA.
- May 2009, Wind turbine blade falls off and onto highway A6, Lelystad, the Netherlands.
- May 2009, Vestas turbine overspeeds and collapses, North Palm Springs, CA, USA.
- April 2009, wind turbine failure, and collapse, CA, USA.
- Mar 2009, GE 1.5 MW turbine blade failure in Illinois, USA.
- Mar 2009, GE 1.5 MW turbine collapses at Noble Environmental NY State site when blades spin out of control, USA.
- Feb 2009, turbine collapses at Waverly Idaho when under construction as blades spin out of control, USA.

- Jan 2009, Enercon turbine looses one 20 m blade (bolt failure) and second blade damaged, UK.
- Dec 2008, Vestas V90 turbine blade damage - pieces travel to home 490 m away, PEI, Canada
- Oct 2008, 42 m long blade breaks off turbine, Illinois, US.
- Oct 2008, turbine blade contacts tower, buckles it, collapses VT, US.
- Jun 2008, blade failure, 2 months after in service, 56 m turbine, Sheffield U, UK.
- May 2008, blade failure Vestas V47 turbine - full 23 m long blade broke off, passes over road, the Netherlands.
- May 2008, Suzlon turbine fire, blades come off in fire. Minn, USA.
- Apr 2008, 2 turbines each loose 37 m long blades in storm, Japan.
- Mar 2008, 10-metre section breaks off wind turbine blade, flies 200 metres, Italy.
- Mar 2008, Lagerway turbine collapse, the Netherlands.
- Feb 2008, Vestas turbine looses blade - travels 100 m, Denmark.
- Feb 2008, (another) Vestas turbine blades contact tower, tower collapses, blade pieces travel up to 500 m Denmark.
- Feb 2008, Nordex turbine blade failure Norway.
- Feb 2008, Vestas turbine looses blade, travels 40 metres – Sweden.
- Feb 2008, turbine collapse, Island of Texel, Northern the Netherlands.
- Jan 2008, GE 1.5 MW blade failure in winter storm - Prince Wind Farm, ON, Canada.
- Jan 2008, Vestas turbine collapses, Cumbria, UK.

This list does not tabulate turbine fires in the same period, unless they resulted in blades falling to the ground. Tabulated fault data shows at least 15 wind turbine fires have occurred in the same period, which can result in falling burning fiberglass and oils.
The 35+ known blade failures that resulted in blades on the ground occurred over a world wind turbine experience exposure of about 160,000 wind turbine years of experience. It is noted that many countries with numerous wind turbines do not report turbine failures, such as India or China. However, even assuming this list constitutes all failures, it is a failure rate of 219 x 10-6 failures per turbine year of operation.

Ontario has seen two incidents in about 1225 turbine years of operation where portions of a wind turbine blade have fallen to the ground. One on a GE turbine the Port Burwell Wind Farm reported by A Channel News in April 2007, and the second also on a GE turbine at Prince Wind Farm reported by the Sault Star in January 2008. There was also one blade failure at a wind turbine at Belwood, ON, in Sept 2006 where a failed 600-pound blade traveled 100 metres, which is not counted in these failure figures. 2 failures in Ontario’s total 1225 turbine years of experience is a failure rate of 1600 x 10-6 failures per turbine year, considerably higher than the world average.

Appendix 2: Wind Turbine Blade Failures

Blades Can Fail

This turbine has been inoperable for more than three weeks

Terry Mancini For The Sault Star

"Mike Crawley, president and CEO of AIM PowerGen, said the wind turbine performed just as it was designed to do when hit." "The blade took a direct hit from lightening and buckled, but did not separate from the rest of the turbine."

Looking at the pictures from
A Channel News
Monday April 30, 2007

Does "the blade" mean only the exterior coating, and not include any of the heavy structural material inside the gel-coat?

Prince Wind Farm - Jan 08

Port Burwell - Apr 07

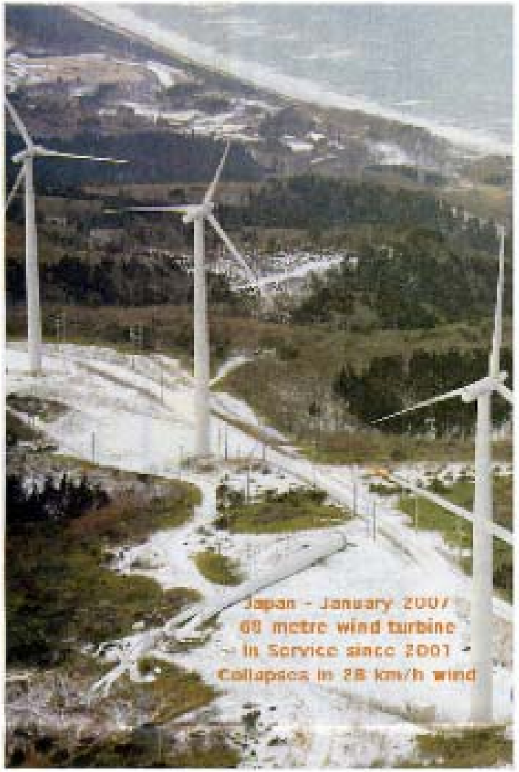
Denmark - Feb. 2008 - parts of wind turbine blades travel 500 metres from tower in turbine accident. Ontario turbines have a blade failure rate 4 x as great as seen in European study - possibly as taller, and more severe weather.

Appendix 2: Wind Turbine Blade Failures

Public Safety Risk - Towers Can Collapse

Oklahoma USA

Japan Jan 2008



Oregon USA

Aug 2007

Appendix 2: Wind Turbine Blade Failures

When considering wind turbine blade failures, it is important to understand the size of these devices that are nominally well up in the air, where they look small. The photo above is a blade for a Vestas V-82 turbine, with an 82-metre rotor diameter. The GE 2.5 XL turbines typically being used today shown on the right, will have 24% larger blades with their 100-metre rotor diameter. Comparing the blade to the size of the men with it helps to understand the threat that even a small part of the turbine blade poses to human health if it falls.