

## **The Green Energy Act – Wind Energy Generation**

**John Harrison, Member of Coalition to Protect Amherst Island**

### **Introduction**

Ontario has an Environmental Protection Act. In principle, it is the responsibility of the Ministry of the Environment to implement this protection. In fact, this Ministry has been negligent in so doing with regard to the siting of wind turbines. Not only are the regulations too lenient, it does not even apply its regulations properly, does not check the proponent's Environmental Noise Impact Assessments thoroughly and when there are obvious problems does not shut down the offending wind energy systems: Amaranth and Ripley are the most obvious examples. World-wide, health authorities are recommending setbacks from residences of about 1.5 km. As noted below, Ontario allows setbacks less than one third of this distance. Until this Green Energy Act, it has been possible for municipalities to take on the role of protecting its constituents and many did so. This is now being taken away from local government. The most serious concern is that of setbacks. Other concerns will be dealt with below.

### **Setbacks**

The purpose of setbacks is to protect people from noise, shadow and flicker, visual intrusion, blade throw and ice throw. The dominant complaints concern annoyance and consequent health problems from noise, and a variety of health problems arising from dirty electricity and stray voltage. The dirty electricity and stray voltage problem is an engineering issue which some developers seem remarkably reluctant to address. The noise problem is a matter of having rational regulation, as well as having MOE enforce its regulations.

Under current Ontario regulations, the noise guidelines correspond to setbacks of about 400 metres from a single turbine and about 650 metres from a group of 3 equidistant turbines. First, it is clear that the need is for setbacks based upon predicted noise because developers typically cluster turbines. Secondly, these setbacks are not nearly large enough.

The insufficiency of the allowed setbacks arises from several deficiencies in the MOE guidelines:

### Cyclic Noise

Wind turbine noise is periodic in the blade passage frequency, about 1 Hz. Nobody that I know denies this. It is clear from figure V.4 of Dr. van den Berg's thesis<sup>1</sup>. It is clearly stated in the Salford report published by the British Wind Energy Association<sup>2</sup>. It is clear from the acoustic data presented by Brian Howe at the Technical Workshop on Renewable Energy Technologies (Workshop) held on March 11<sup>th</sup> in Toronto. The MOE in "Noise Guidelines for Wind Farms (October, 2008)", the clarification document, acknowledges that turbine noise is cyclic. We see: "variation in wind turbine sound level"; "swishing sound"; "temporal characteristic". There is a general Ontario noise guideline NPC-104. This guideline is quite general. Until October 2008, MOE neglected

to enforce this regulation. In the clarification document, we read that NPC-104 does not apply to wind turbines; yet nowhere in NPC-104 does it say to what cyclic noises the regulation does and does not apply. **In this respect, the clarification document is indefensible and needs immediate revision.** I note that under section 5.4.4 of its draft wind turbine noise regulations, New Zealand is introducing a 5 dBA penalty for amplitude modulation<sup>3</sup>.

### Intrusion

Wind turbine noise causes far more annoyance than industrial or road noise at the same 40 dBA level. The paper by Pedersen & Persson Waye<sup>4</sup> makes clear that at the noise level corresponding to the Ontario regulation for a residence, 50% of people are suffering annoyance. Note that this was not a laboratory study; this was a field study conducted in the neighbourhood of a wind generating development. This compares with 2 - 4% annoyance for industrial/traffic noise at the same level<sup>5</sup>.

Rural Ontario is very quiet, probably below 25 dBA at night. This means that the guidelines are allowing a 15 dBA intrusion above background and, given the annoying characteristic of turbine noise, this is too much. There is no need to allow this large an intrusion. For instance, Germany with a population density 20 times larger than our own has a night-time noise limit of 35 dBA. As is well known, Germany has a well-developed wind energy generation system, supplying 6.4% of its electrical energy. In another instance, New Zealand, in section 5.3.1 of its draft regulations, is introducing a secondary noise limit of 35 dBA for evening and night-time in low background environments. **Ontario needs to reduce the noise limit to 35 dBA in rural regions.**

### Masking Noise

The clarification document went some way towards coming to terms with the myth of masking noise. The initial idea was that wind blowing through vegetation will mask the noise from the turbine, allowing a higher noise limit in high winds. This idea has become unsustainable in view of very many measurements that show, for much of night-time, the wind speed at ground level is significantly lower than the wind speed at the height of the blades; the turbine makes its noise but there is no masking noise. As things now stand, the developer must justify the use of masking noise with measurements of wind speed gradient. However, these measurements may not necessarily be available to the public for scrutiny.

### Uncertainty

No prediction of noise is going to be 100% correct. The turbine manufacturer quotes uncertainty in its specifications. The algorithm used to predict noise at a residence, ISO-9613, has uncertainty. This is clearly stated in the code. Together these amount to 4 dBA. The wind industry ignores this uncertainty and MOE does not enforce it. **This allowance for uncertainty needs to be incorporated into the regulations.**

### Result

With the lower intrusion level, the penalty for the very real amplitude modulation and acknowledgement that there is uncertainty in the predictions, the setback is pushed out to

1250 metres from a single turbine and 1400 metres from a cluster of 3. This is now approaching the setbacks recommended by a variety of health authorities.

**Although these numbers are given by way of illustration, it is emphasized that setbacks need to be based upon a 35 dBA noise limit with associated penalties for uncertainty in the noise prediction determination, for tonal contribution in the case of transformers and for periodic or cyclic contribution in the case of turbines. One fixed setback will not suit a variety of layouts and topographies.**

### **References**

- 1) G. P. van den Berg, The Sound of High Winds, Thesis, University of Groningen (2006).
- 2) A. Moorehouse et al., Research into Aerodynamic Modulation of Wind Turbine Noise, [www.bwea.com/pdf/0707%](http://www.bwea.com/pdf/0707%) (2007).
- 3) New Zealand Standards; Draft DZ6808 v2.5
- 4) E. Petersen and K. Persson Waye, J. Acoustical Society of America, 116, 3460-3470, (2004).
- 5) H. M. E. Miedema and H. Vos, J. Acoustical Society of America, 116, 334 – 343 (2004).

### **Other Concerns**

A municipal official plan will include many other matters involved in the siting of a wind energy generating system. Many of these matters are unique to the municipality. It is absurd for the province to think that it can plan for something as large and as intrusive as a wind development without local input. The following are a minimum set of matters that must be considered.

- a) Shadow and flicker.
- b) Setbacks for ice and blade throw.
- c) Protection of lands designated for protection in municipal official plans.
- d) Site control during construction.
- e) Upgrading of roads.
- f) Protection of agricultural lands, woodlands, wildlife, cultural and archaeological sites.
- g) Acknowledgement of important bird areas (IBA).
- h) Bonds for decommissioning.
- i) Dispute resolution mechanisms.
- j) Visual impact.

I do believe that the provincial government has not realized the implications of taking on the responsibility for renewable energy projects in rural Ontario and on present evidence is incapable of doing so.

### **Economics**

These are tough times for the well-being of Ontarians. We are told that 50,000 jobs will be created. Let us look at that. If 2000MW of renewable energy is to be established over the next 3 years, that could correspond to 1000 modern wind turbines. After

construction, there could be 5 maintenance jobs for a 100 turbine project. So, we get 50 jobs. About 100 construction jobs are involved in putting up a 100 turbine project which takes about 1 year. So over the 3-year period with 350 turbines going up per year, we have another 350 jobs. Over 3 years then there are 400 jobs. The government numbers are just pie in the sky! Those 1000 turbines are all manufactured in Denmark, Germany or the USA and cost about US\$2M each. Therefore of the total cost to develop 2000MW, \$2B (\$2,000,000,000!) goes straight out of Ontario. This is a disgrace.

John Harrison ([harrisjp@physics.queensu.ca](mailto:harrisjp@physics.queensu.ca))  
8850, Second Concession Road,  
Stella, ON K0H 2S0

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**Credentials:**

**Career:** PhD (Leeds, 1964); Post-doctoral Fellow (Cornell 1964 – 67, Sussex 1967 – 69); Faculty at Queen’s University (1969 – 2002); presently retired.

**Research:** Low temperature physics with extensive work on the propagation of phonons (very high frequency sound waves) in solids, liquid helium and porous solids and the reflection of phonons at liquid/solid interfaces.

**Teaching:** Various, including classical and quantum mechanics to all years and advanced laboratory techniques to 4<sup>th</sup> year Arts and Science and Applied Science (Engineering) students; also, introductory physics to Life Science students, including heat, light and sound.

**Other:** Many national and international committees, including several for the series of international conferences on phonon physics; Co-Editor and then Editor of the (International) Journal of Low Temperature Physics (1978 – 1992); also, a 2-year term as an Associate Editor of the Canadian Journal of Physics; 3-year term as a member of a grant selection committee for the Natural Sciences and Engineering Research Council; 3-year term as a member of the Polanyi Prize Committee for the Ontario Council for Graduate Studies.

**Wind Turbine Noise:** Presentations made to community groups; Member of the Ministry of the Environment Stakeholder Focus Group on Wind Turbine Noise Regulations; Talk given at the International World Wind Energy Conference held in June 2008 in Kingston, Ontario and paper accepted for the conference proceedings; Invitation to present a talk and paper on wind turbine noise at the annual conference of the Canadian Acoustics Association in October 2009.