AWS Truewind

255 Fuller Road, Suite 274
Albany, NY 12203

# TRANSMITTAL

**Date: March 6, 2006**
**To: Vicki Colello, NYSERDA**
**Re: Wind Energy and Electromagnetic Interference**

AWS Truewind is pleased to provide you with the following information regarding wind energy and the potential for Electromagnetic Interference (EMI).

*Overview of Issue*
Generally, any large structure, whether stationary or moving, in the vicinity of a receiver or transmitter of electromagnetic signals may interfere with those signals and degrade the performance of the transmitter/receiver system under certain conditions. When sited between a radio, television or microwave transmitter or receiver, wind turbines, like most vertical structures, can sometimes reflect portions of the electromagnetic radiation in such a way that the reflected wave interferes with the original signal arriving at the receiver.

*General Occurrences of Issue*
For electromagnetic interference generated by a wind turbine to disturb a signal, the following conditions must exist[i]:

1. A transmission signal must be present
2. The wind system must modify the radio signal
3. A radio receiver must be present in the volume affected by the wind system
4. The radio receiver must be susceptible to the modified signal

Field experience, analytical modeling and EMI experiments conducted in the United States (Sengputa and Senior, 1994) and Europe (Chignell, 1986) indicate the following effects of wind turbine EMI on various forms of radio transmission:

- *Television Interference* – The majority of concerns regarding wind turbines and electromagnetic interference is related to television service. This type of interference is generally characterized by video distortion (i.e., jittering of picture that's synchronized with the wind turbine blade rotation). A significant amount of work on this issue has been carried out in the United States and Europe to quantify this effect. Lastly it's worth noting that digital and most satellite television services are not susceptible to this issue.

- *FM Radio Interference* – EMI effects on FM broadcast have only been observed in laboratory simulations and appear in the form of a background 'hiss' superimposed upon the FM sound. The research conducted in this area concluded that the effects of wind turbine EMI on FM reception was negligible except possibly within a few tens of meters from the turbine.

- *Interference to aircraft navigation and landing systems* – The effects on VOR (VHF omnidirectional ranging) and LORAN (a long range version of VOR) systems have been studied via analytical models. Results from the VOR studies indicate that a stopped wind turbine may produce errors in the navigational information produced by the VOR. When the wind turbine is operating, however, the potential interference effects are significantly reduced. Existing Federal Aviation Authority (FAA) rules prevent a structure the size of a typical utility-scale wind turbine from being erected within 1 km of a VOR station.

- *Interference to microwave links* – Analytical work has indicated that electromagnetic interference effects tend to smear out the modulation used in typical microwave transmission systems. In Europe, experimental work has produced reports of major interference problems with microwave links. As such, wind developers routinely consult with experts within the communications industry (e.g., Comsearch) to avoid conflicts with microwave links.

- *Interference with cellular phones* – Since cellular radio is designed to operate in a mobile environment, it should be comparatively insensitive to EMI effects from wind turbines.

- *Interference with satellite services* – Satellite services using a geostationary orbit are not likely to be affected because of the elevation angle in most latitudes and the antenna gain.

In closing, when developing wind projects, developers often retain a communication systems consultant to ensure that the design of the proposed wind project does not interfere with any local communication systems.

For more information on this issue, the following resources may be consulted:

*Web Sites*

American Wind Energy Association
http://www.awea.org/pubs/factsheets/050629_Myths_vs_Facts_Fact_Sheet.pdf
http://www.awea.org/faq/sagrillo/ms_telint_0304.html

British Wind Energy Association
http://www.bwea.com/aviation/index.html

Australian Wind Energy Association – Cut sheet addressing EMI
http://www.auswea.com.au/WIDP/assets/10Electromagnetic.pdf

UK Department of Trade and Industry – Facts About Wind Energy
http://www.dti.gov.uk/renewables/renew_3.5.1.5.htm

Comsearch – Independent Consultant Specializing in EMI issues
http://www.comsearch.com/newsletter/archiveWP/WirelessPulseNov02.html#case

*Publications*

Chignell, R. J. (1986) Electromagnetic Interference from Wind Energy Conversion Systems – Preliminary Information, *Proc. European Wind Energy Conference '86. 563-586*

Manwell, J.F. McGowan, J.G., Rodgers, A.L. Wind Energy Explained: Theory, Design and Application. University of Massachusetts, Amherst, USA 2002

Senguptra, D.L. Senior, T.B.A. (1994) Electromagnetic Interference from Wind Turbines, Chapter 9 in Wind Turbine Technology, ed. S. A. Spera, ASME, New York.

Senior, T.B.A., Sengupta, D.L., (1983) Large Wind Turbine Handbook: Television Interference Assessment, *Solar Energy Research Institute Report SERI/STR –215-1881, NTIS*

[i] Wind Energy Explained