WIND INSTALLATION AND THE ENVIRONMENT

Vladimir A. Dobrovolski
Director, Wind Energy Department of Moscow Aviation Institute (MAI), Director, Molinos Co. Ltd., Moscow, Russia

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Summary

There are a lot of claims concerning the hazardous impact of wind installations, however they seem to be exaggerated. This Article is analyzing all the possible impacts of wind mills upon the environment, namely influence of noises in various frequency ranges, electromagnetic interference with radio and TV communications, debauching of the landscape, influence upon flora and fauna. On the other hand impact of environmental factors upon the wind mill equipment is described.

1. Introduction

One of the advantages of wind turbine generating systems (WTGS) installations is their relative environmentally friendliness. They don't contribute to carbon dioxide (CO_2) or other greenhouse gases emissions, don't produce soil or water pollutants.

The expansion of wind-powered generation can help reduce the risk of global warming. On good windy sites, where plenty of wind can be expected, wind turbines are competitive with fossil-fueled or nuclear power plants.

Possible environmental draw backs of wind turbine usage can include impacts on bird and animal habitat, behavior, and survival rates; noise; television interference; impacts on aesthetics; safety; and effects on vegetation.

Wind farms cover considerable areas of countryside and although they occupy only a tiny fraction of the land (only 1 or 2 %), their presence will be noticeable over the whole area. If they produce noise, they may be heard and if they interfere with radio or television reception, there will be objections. They will certainly be visible at quite a distance and the public will need reassurance about many other matters: no one wants to be hit by a flying wind turbine blade.

The identified environmental impediments to the use of WECS are as follows:

- Noise;
- Electromagnetic interference;
- Land use;
- Aesthetics;
- Biophysical.

2. Acoustics

Like any mechanical system, including those that generate electricity, wind turbines are producing noise when they operate. The sound of the wind moving over the wind turbine blades, called aerodynamic noise, can be heard. In addition, the mechanical components of wind turbines generate sound.

The international Standard defines the procedures to be used in the measurement, analysis and reporting of acoustic emissions of WTGS. Instrumentation and calibration requirements are specified to ensure accuracy and consistency of acoustic and non-acoustic measurements. Non-acoustic measurements required to define the atmospheric conditions relevant to determining the acoustic emissions are also specified. All parameters to be measured and reported are identified, as are the data processing methods required to obtain these parameters.

A wind turbine generator may produce noise with both pulse like (thumping) and broadband (swishing) characteristics. The low frequency infrasound (below 16 Hz frequency) tends to be the most annoying because it dominates other sounds and can cause structures such as houses to shake.

Infrasound may adversely affect the human respiratory system and cause discomfort or nausea at pressure levels above 100 decibels sound-pressure level (dB-SPL), but is generally believed not to produce any damaging effects below a level of 120 dB-SPL.

In the case of large downwind system infrasound is generated by sudden blade deflection, which occurs in the tower shadow. But the results of the infrasound tests indicated that in the most cases the peak sound was no more then 75 dB-SPL, which is well below the discomfort level of 100 dB-SPL.

The audible sound generated by a WTGS is typically attributed to the interaction of the various components and structural resonance. The primary concern was that sound in the frequency range of 16 Hz to 20 kHz might affect the human auditory and nervous system if the loudness levels are sufficiently high. The effects of wind turbine noise on

the listener may be modified by factors such as the background noise level, location of the listener (indoors versus outdoors), and the presence of any perceptible house vibrations induced by the noise. Any noise from a wind turbine tends to be masked by the noise of the wind itself, and, of course, the machines do not run when there is no wind.

Sound-intensity testing was also conducted on a Darrieus WTGS (see *General Characteristics and Meteorology of Wind* in EOLSS On-Line, 2002), which represents a different basic configuration. The results of the Darrieus studies indicate that the sound level at a short distance from the turbine was indistinguishable from the background noise.

Engineers have reduced aerodynamic noise in recent years by design changes such as decreasing the thickness of the trailing edge of the blades and by orienting the blades upwind of the tower. The sound from wind rushing through towers can also be lessened through design changes.

Based on the results of the tests conducted, the audible sound generated by either small or large WTGS should not present a significant environmental impact. In all tests sound levels recorded were within tolerable limits even at places relatively close to the WTGS.

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Biographical Sketch

Professor Vladimir A. Dobrovolski, Ph.D. was born in Moscow, Russia in 1936. He graduated from Moscow Aviation Institute in 1960 and Ph. D. Degree in 1968.

1960-1963 - test engineer, the USSR Civil Aviation

1963-1970 - researcher, Thermodynamics department of Moscow Aviation Institute

1970-1973 - head of department, Central Aerohydrodinamics Institute

1973-1977 - adviser, International Civil Aviation Organization (Montreal, Canada)

1977 - head of department, Moscow Aviation Institute. His present position is a director of Wind Energy Department of Moscow Aviation Institute and director, Molinos Co. Ltd. Main activities: Development and production of small scale wind mills.