

A Summary of Understanding the Evidence: Wind Turbine Noise

A report by the Council of Canadian Academies' Expert Panel on Wind Turbine Noise and Human Health, 2015

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Understanding the Evidence: Wind Turbine Noise² was published in 2015 by the Council of Canadian Academies' Expert Panel on Wind Turbine Noise and Human Health, in response to a request from the Government of Canada for an assessment of the relationships between wind turbine sound and health effects. The authors researched the available scientific literature, web sites, and case law on this topic. Based on that review, the report attempts to summarize the current state of knowledge of wind turbine noise. The report's authors focused on "causal relationships" between noise and health effects. A causal relationship is one in which one event is caused by another event.

Key Findings from the Report

- Some humans exposed to wind turbines find the noise from turbines to be annoying.
- It is possible that wind turbine noise may disturb sleep, but the evidence is not conclusive.
- Wind turbine noise does not cause hearing loss.
- There is no direct relationship between wind turbine noise and stress.
- Other health effects, such as cardiovascular disease and diabetes, cannot be linked directly to wind turbine noise, based on the available evidence.
- Current technological developments have reduced sound emissions but further progress may be more elusive as the size of turbines increases in order to generate more power.
- Community engagement in proposed wind projects developments helps promote the acceptance of turbines.

¹ This summary, prepared by the Clean Energy States Alliance (CESA), was not reviewed by the report's authors.

² Council of Canadian Academies Expert Panel on Wind Turbine Noise and Human Health, 2015. *Understanding the Evidence: Wind Turbine Noise* (Ottawa: Council of Canadian Academies, 2015), <http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/wind-turbine-noise/windturbinenoisefullreporten.pdf>.

Discussion

The report defined the acoustic elements of sound such as frequency, amplitude, and pressure. Most wind turbine sound is caused by air moving over turbine blades. Sound may also be generated from the turbine's mechanical components. Turbine sounds occur over a broad range of frequencies.

The sound measurement protocol used in the study focused on sounds within the range of human hearing, however, the exact relationships between sound and health effects will not be fully understood until the low and very high frequencies from turbines, which cannot be heard by humans, are investigated as thoroughly as sounds in the audible range.

The study defined wind turbine "noise" broadly, comprised of both "sound" as a measurable acoustic signal and "noise," something the listener considers to be annoying. Direct exposure to wind turbine noise can cause annoyance. The study notes that the visual appearance of a turbine and attitudes toward turbines may also be factors in this perception. Annoyance is the only health condition with enough evidence to conclude that it has a causal relationship to turbine noise.

Sleep may be disturbed directly by wind turbine noise or indirectly by annoyance caused by the noise. It's not clear how much disruption results from direct causes and how much from indirect causes. Without more studies and evidence, a clear relationship cannot be established. Other characteristics of sound, such as frequency components and amplitude modulation, may also affect sleep.

Hearing loss is not caused by wind turbine noise when the noise emitted from the turbine is within regulated limits and setbacks. There is adequate research showing that noise from other sources in the same sound range as wind turbines do not cause hearing loss.

People who live in noisy environments, such as cities, often feel stress as a result of noise. However, it is not clear if stress is caused directly by the noise itself, or indirectly by annoyance from the noise. Studies have not concluded that there is a strong relationship between turbine noise and stress. The relationship between stress and turbine noise remains inadequate.

The report's authors examined other health conditions which might be caused or aggravated by wind turbine noise. These included cardiovascular disease and diabetes. Stress and sleep disturbance may influence these conditions indirectly, but there is no evidence of a direct relationship with wind turbine noise.

Improvements in engineering technology may ameliorate health concerns and annoyance factors. For example, the relationship between blade angles and power production are being examined to determine the position that will optimize power while reducing emitted sounds. Design changes to the trailing edge of the turbine blade may also help reduce noise levels.

Cutting back on power generation, known as curtailment, reduces sound and can be beneficial under certain meteorological conditions.

Members of the public are more likely to have a favorable view of a nearby wind project if they are informed of it early on in the development process and they have an opportunity to provide input. Studies have shown that residents who view wind projects unfavorably are more likely to be annoyed by the project than those with favorable attitudes.

Conclusion

The report concluded that much still remains unknown about the relationship between wind turbine noise and its effects on human health. Without more and better evidence, it is impossible to fully describe and evaluate the nature of these relationships.

About the Report and Its Authors

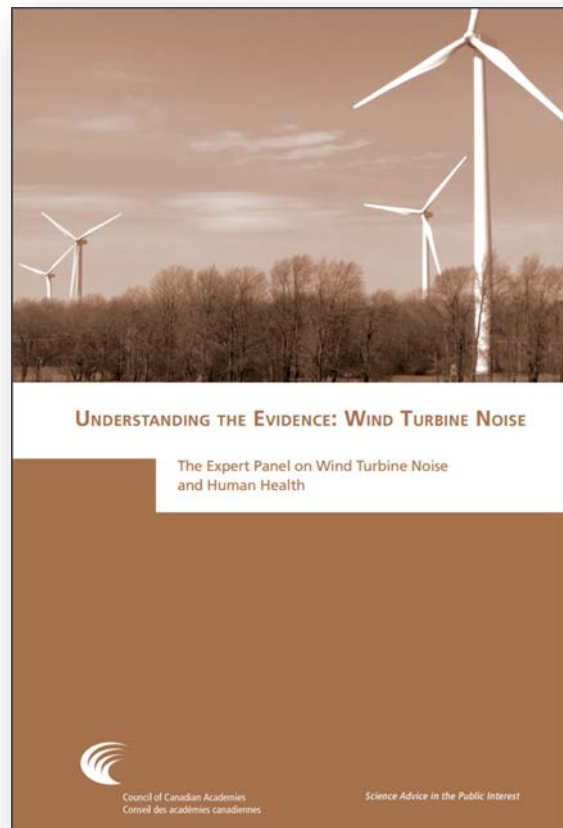
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The report was produced by 10 experts chosen for their knowledge of engineering and medical science. It was reviewed for its objectivity and quality by individuals with diverse backgrounds and proficiency.

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This paper is part of a series by the Northeast Wind Resource Center, a project managed by Clean Energy Group and CESA, to provide accessible, concise summaries of technical studies related to land-based wind in the Northeast.

If you have suggestions for studies that should be summarized, please send your suggestions to LBWStaff@northeastwindcenter.org.