

Alice Ly
EK132 MC
Professor Grace
November 28, 2012

Noise and Shadow Flickers from Wind Turbines: Are There Health Effects?

In order to live in today's society, people need resources to power the energy they use. One of the most eco-friendly approaches is to use wind turbines to generate electricity. However, there are many proposed adverse effects from wind turbines. Noise and shadow flickers produced by wind turbines are two major elements associated with possible health problems. While individuals have stated many different health effects from noise (for example, an increase in psychological distress and physiological stress), the leading possible health impact is caused by sleep disturbance. There is not enough evidence to prove that shadow flickers can lead to health problems; however, possible health impacts of shadow flicker can be kept at a minimum if the turbines are placed at an adequate distance from residences and operated at hours when shadows are not intense. Noise control, on the other hand, is more challenging. More measures are being taken to minimize the noise generated from wind turbines, such as adaptive approaches and blade modifications. Ultimately, there is no way to completely eliminate the existence of noise from a wind turbine; the only approach is to place them far away from residences. Thus, more research is needed to not only determine whether or not wind turbines really cause health problems, but also to minimize the aspects of it that some consider unhealthy.

Noise is the dominant source of complaint from wind turbines. Many have stated that there are health effects associated with noise. In a letter to Senator Doug Cameron, Dr. Sarah Laurie, a CEO from the Waubra Foundation, stated that there have been serious health symptoms caused by wind turbines, such as acute vestibular dysfunctions and disorders, acute sympathetic nervous system stimulation, combined psychological and physiological stress, and tissue damage (Laurie)⁷. She derives her claims from Dr. Pierpont's research on low frequency noise exposure, various articles on noise, stress, and sleep deprivation, and wind turbine research from National Wind Watch. Her sources show that stress, sleep deprivation, and noise do cause health problems, but there are no articles that can reliably prove wind turbines as instigators. McEwen, one of her sources, studied the cause and effects of stress, but never directly states wind turbines as one of the causes of stress⁸.

There is little significant evidence that wind turbines actually cause these health effects. It is concluded in "Infrasound and Low Frequency Noise from Wind Turbines: Exposure and Health Effects" that "there is no evidence that infrasound at these levels contributes to perceived annoyance or other health effects" (Bolin, et al.)². Three research studies were conducted to measure noise annoyance, and overall, about 6% of the participants were very annoyed by noise levels from 35-40dB. This percentage is about the same as research conducted on annoyance due to traffic noise. Out of all the participants, no health problems were mentioned. In addition, Bolin also disclaims Dr. Pierpont's study on health problems caused by wind turbines. "The study has several limitations, which makes the conclusion unjustified. For example, the lack of acoustic measurements, no comparison group of people with no or low wind exposure and no investigation of the subjects prior to the wind turbines were constructed (prior health status was estimated retrospectively)" (Bolin, et al.)². Dr. Pierpont's study consists of 38 participants, which is too small of a sample to make an established claim.

There are people that have posted videos online showing shadow flicker and intense noise from wind turbines. However, Phil Bloomstein's video showed only small snippets of various places in and outside of the house. It never stated for how long the shadow flickers occurred, and when. The video showed sunshine that was not bright, indicating that the sun was most likely behind the wind turbine, which would cause shadow flickers, but not for long. It was possible that he filmed it "just a little after the sunrise and just a little before the sunset" (Katsaprakakis)⁶. "According to the Hellenic legislation, the minimum distance between a wind park and a settlement is 500 m." (Katsaprakakis)⁶. The wind turbine in the Bloomstein's video was 1,000 feet away from residences⁴. Therefore, it more than fulfills Hellenic legislation. The Nation Wind Watch website also claimed that the noise level at Bloomstein's house was approximately 50dB, but the videos were not available for viewing. Larry Wunsch's video also showed shadow flicker in the same situations. The noise in his video seemed loud, but it was clear that he was really close to the wind turbines in the video⁹, which means that the sound level is not the same near his house, invalidating his noise claims.

Although there isn't enough evidence to prove that noise and shadow flicker from wind turbines contribute to health problems, there have been many different approaches to minimize these aspects. Firstly, adaptive approaches like speed and pitch modifications, which reduce noise, have been considered, although reduction in noise also means a reduction in the power generated⁵. However, "despite the loss in power, the main advantage of wind turbines with optimized operating conditions is that the acoustically affected areas are much smaller, allowing more wind turbines to be built in a specified area" (Jianu, et al.)⁵. In addition to that, there have been blade modifications that can reduce noise but not power. "By breaking down the noise sources it can be seen that the maximum noise contribution occurs within the trailing edge" (Jianu, et al.)⁵. Thus, there have been many different studies to minimize noise through this aspect. One way is to replace existing airfoils with acoustically enhanced airfoils. The noise was found to be reduced by about 1-3 dB⁵. Another way is to place a row of polypropylene fibers on the trailing edge, which would be aligned with trailing edge flow, and the study showed that a noise reduction from 2 to 10 dB was seen⁵.

Overall, many studies have either concluded that noise and shadow flicker from wind turbines do not effect health, or that there is not enough evidence to support the claim that they cause health problems. In the "Wind Turbine Health Impact Study: Report of Independent Expert Panel," it is concluded that there is limited scientific and epidemiologic evidence that either noise or shadow flicker contributes to health problems. In "Impact of Wind Turbine Sound on Annoyance, Self-reported Sleep Disturbance and Psychological Distress," it is concluded that "no direct effects of wind turbine noise on sleep disturbance or psychological stress has been demonstrated, which means that residents, who do not hear the sound, or do not feel disturbed, are not adversely affected" (Bakker, et al.)¹. However, even though there have been no direct health affects, advances have still been made in noise reduction, including adaptive approaches and blade modifications. But these approaches can only go so far as to reducing noise without sacrificing power. In the end, one still has to be sacrificed. The problem is, which one is more worth it?

Sources:

1. Bakker, R.H., E. Pedersen, G.P. van den Berg, R.E. Stewart, W. Lok, and J. Bouma. "Impact of Wind Turbine Sound on Annoyance, Self-reported Sleep Disturbance and Psychological Distress." *Science of the Total Environment* 425 May 2012: 42-51. *Compendex*. Web. 28 Nov. 2012.
2. Bolin, Karl, Gösta Bluhm, Gabriella Eriksson, and Mats E. Nilsson. "Infrasound and Low Frequency Noise from Wind Turbines: Exposure and Health Effects." *Environmental Research Letters* 6.3 July-Sept. 2011: 035103-09. *Inspec*. Web. 25 Nov. 2012.
3. Ellenbogen, Jeffrey M., et al. "Wind Turbine Health Impact Study: Report of Independent Expert Panel." January 2012. Massachusetts Department of Environmental Protection Massachusetts Department of Public Health. Web. 26 Nov. 2012. <http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf>.
4. *Freedom Windmills Shadow Flicker*. Prod. Phil Bloomstein. *Wind-watch.org*. National Wind Watch. Web. 26 Nov. 2012. <<http://www.wind-watch.org/video-freedom-maine.php>>.
5. Jianu, Ofelia, Marc A. Rosen, and Greg Naterer. "Noise Pollution Prevention in Wind Turbines: Status and Recent Advances." *Sustainability* 4.6 June 2012: 1104-17. *Inspec*. Web. 26 Nov. 2012.
6. Katsaprakakis, Dimitris Al. "A Review of the Environmental and Human Impacts from Wind Parks: A Case Study for the Prefecture of Lasithi, Crete." *Renewable and Sustainable Energy Reviews* 16.5 June 2012: 2850-63. *Compendex*. Web. 26 Nov. 2012.
7. Laurie, Sarah. "List of Symptoms and Medical Problems." Letter to Doug Cameron. 22 Nov. 2012. *wind-watch.org*. National Wind Watch. Web. 26 Nov. 2012. <<http://docs.wind-watch.org/Laurie-List-of-symptoms.pdf>>
8. McEwen, Bruce. "Protective and Damaging Effects of Stress Mediators" *New England Journal of Medicine* 338 1998: 171 – 179. Web. 28 Nov. 2012. <<http://www.nejm.org/doi/full/10.1056/NEJM199801153380307>>.
9. *Wind Turbine Shadow Flicker and Noise, Byron Wisconsin*. Prod. Larry Wunsch. *Wind-watch.org*. National Wind Watch. Web. 26 Nov. 2012. <<http://www.wind-watch.org/video-wisconsin.php>>.