

Wind Turbines & Infrasound: What the latest research says

“At night the wind turbines cause a low pitched thumping [i.e., infrasonic] sound superimposed on a broadband ‘noisy’ sound, the ‘thumps’ occurring at the rate at which blades pass a turbine tower.... The number and severity of noise complaints near the wind park are at least in part explained by the two main findings of this study: actual sound levels are considerably higher than predicted, and wind turbines can produce sound with an impulsive character.”

-- Professor Frits G.P. van den Berg, University of Groningen, the Netherlands, November 2004 (see excerpts from research articles, below)

“A second effect that adds to the sound annoyance is that the sound has an impulsive character. The primary factor for this is the well-known swishing sound caused by the pressure fluctuation when a wing [turbine propeller] passes the turbine mast [turbine tower]. For a single turbine, these 1 – 2 dB [decibel] broad band sound pressure fluctuations would not classify as impulsive. When several turbines operate nearly synchronously the pulses, however, may occur in phase: two equal pulses give a doubling in pulse height (+3 dB), three a tripling (+5 dB). Several low magnitude pulse trains thus cause sound with an unexpected, relatively strong impulsive character whenever they synchronize. The sound then resembles distant pile driving or, as a resident said: ‘an endless train.’”

— taken from Frits G.P. van den Berg, “Wind Turbines at Night: Acoustical Practice and Sound Research,” *Science Shop for Physics*, University of Groningen, the Netherlands, pp. 2-3. Contact g.p.van.den.berg@phys.rug.nl. For a copy of this article, go to http://www.scoutmoor.com/News_and_Docs/Turbines_at_night.pdf.

“There is a distinct audible difference between the night and daytime wind turbine sound at some distance from the turbines. On a summer’s day in a moderate or even strong wind the turbines may only be heard within a few hundred metres and one might wonder why residents should complain of the sound produced by the wind park. However, on quiet nights the wind park can be heard at distances of up to several kilometres [one or more miles] when the turbines rotate at high speed. On these nights, certainly at distances between 500 and 1000m [one-third to two-thirds of a mile] from the wind park, one can hear a low pitched thumping sound with a repetition rate of about once a second (coinciding with the frequency of blades passing a turbine mast), not unlike distant pile driving, superimposed on a constant broadband ‘noisy’ sound. A resident living at 1.5km [nearly a mile] from the wind park describes the sound as ‘an endless train.’ In daytime these pulses are not clearly audible and the sound is less intrusive or even inaudible (especially in strong winds because of the then high ambient sound level). In the wind park the turbines are audible for most of the (day and night) time, but the thumping is not evident, although a ‘swishing’ sound—a regular variation in sound level caused by the pressure variation when a blade passes a turbine mast—is readily discernible. Sometimes a rumbling sound can be heard, but it is difficult to assign it, by ear, to a specific turbine or to assess its direction” (*p. 3).

“At night the sound from the wind park contains repetitive pulses, unlike the sound in daytime. According to the long-term auditory observation of residents, this pulse-like character, or ‘thumping,’ is more pronounced and more annoying at high turbine rotational speed” (*p. 13).

“Pedersen et al. ... have investigated the annoyance around wind turbines in the south of Sweden.... They found highly annoyed residents at (calculated) sound levels as low as 32.5–35 dB [decibels] (A). This study shows that tall wind turbines may in fact be up to 18 dB noisier than the calculated values suggest. A further increase in annoyance may be expected because of the pulse-like character of the wind turbine noise, especially at high rotational speeds” (*p. 14).

“Measured sound ... levels at 400m [nearly a third of a mile] from the nearest wind turbine almost perfectly match ... sound levels calculated from measured emission levels near the turbines.... There is, however, a growing discrepancy with distance: at distances of 1–2km [up to 1.25 miles] the calculated level may underestimate the measured level by 3 dB. This is most probably a consequence of the fact that the actual (night-time) atmospheric sound transmission is not adequately modeled in the sound transmission model. At night the turbines cause a low pitched thumping sound superimposed on a broadband ‘noisy’ sound, the ‘thumps’ occurring at the rate at which blades pass a turbine tower. It appears that the characteristic, but usually small, ‘swishing’ pulses that can be heard at the rate at which blades pass a turbine tower, coincide because turbines operate nearly synchronously. Two coinciding pulse trains thus give a 3 dB higher pulse level, three a 5 dB higher pulse level. The measured pulse levels and frequencies agree with values expected from nearly synchronous pulse trains generated by a small number of wind turbines. The number and severity of noise complaints near the wind park are at least in part explained by the two main findings of this study: actual sound levels are considerably higher than predicted, and wind turbines can produce sound with an impulsive character. The relatively high wind speeds at turbine hub height at night also have a distinct advantage: the electric power output is higher than predicted and benefits the operator of the wind turbine” (*p. 15).

— taken from G.P. van den Berg, “Effects of the Wind Profile at Night on Wind Turbine Sound,” *Journal of Sound and Vibration* (November 2004) 277:955-970. Contact g.p.van.den.berg@phys.rug.nl. For a pre-publication copy of this article, go to <http://www.nowap.co.uk/docs/windnoise.pdf> (pagination of quoted text, above, is taken from the pre-publication ms.).