

Noise from wind turbines

As many of you may know, the wind energy industry relies on research and reports from bodies and consultants who are, predominantly, supportive of wind farms. Below is such a report from The Danish Wind Industry Association which we have asked an independent expert to review. Please read both the report and the response as we are convinced that onshore wind energy developers try very hard to disguise the truth about the transmission of noise from turbines.

The report from the Danish Wind Industry Association

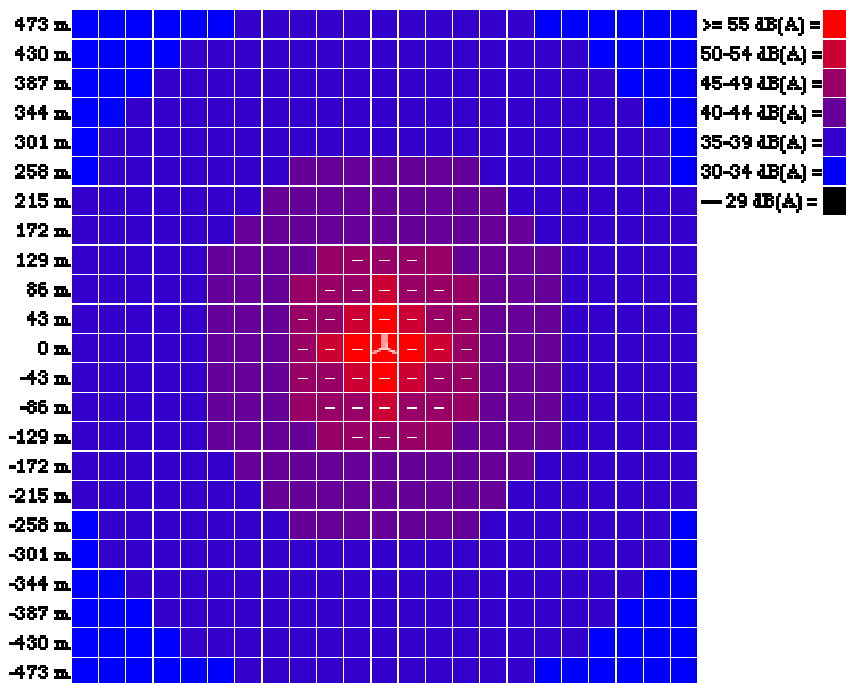
Sound from Wind Turbines - *Noise is a Minor Problem Today*

It is interesting to note that the sound emission levels for all new Danish turbine designs tend to cluster around the same values. This seems to indicate that the gains due to new designs of e.g. quieter rotor blade tips are spent in slightly increasing the tip speed (the wind speed measured at the tip of the rotor blade), and thus increasing the energy output from the machines.

It thus appears that noise is not a major problem for the industry given the distance to the closest neighbours (usually a minimum distance of about 7 rotor diameters or 300 m = 1000 ft. is observed).

The concepts of sound perception and measurement are not widely known in the public, but they are fairly easy to understand, once you get to grips with it. You can actually do the calculations yourself in a moment.

Planning Wind Turbine Installation in Regard to Sound



Fortunately, it is usually reasonably easy to predict the sound effect from wind turbines in advance. On one of the following pages you may even try for yourself, using the Sound Map Calculator, which was used to draw the picture.

Each square measures 43 by 43 metres, corresponding to one rotor diameter. The bright red areas are the areas with high sound intensity, above 55 dB(A). The dashed areas indicate areas with sound levels above 45 dB(A), which will normally not be used for housing etc. (We get to the explanation of the sound level and dB(A) in a moment).

As you can see, the zone affected by sound extends only a few rotor diameters' distance from the machine.

Background Noise: Masking Noise Drowns out Turbine Noise

No landscape is ever completely quiet. Birds and human activities emit sound, and at wind speeds around 4-7 m/s and up the noise from the wind in leaves, shrubs, trees, masts etc. will gradually mask (drown out) any potential sound from e.g. wind turbines.

This makes it extremely difficult to measure sound from wind turbines accurately. At wind speeds around 8 m/s and above, it generally becomes a quite abstruse issue to discuss sound emissions from modern wind turbines, since background noise will generally mask any turbine noise completely.

The Influence of the Surroundings on Sound Propagation

Sound reflection or absorption from terrain and building surfaces may make the sound picture different in different locations. Generally, very little sound is heard upwind of wind turbines. The wind rose is therefore important to chart the potential dispersion of sound in different directions.

Human Perception of Sound and Noise

Most people find it pleasant listen to the sound of waves at the seashore, and quite a few of us are annoyed with the noise from the neighbour's radio, even though the actual sound level may be far lower.

Apart from the question of your neighbour's taste in music, there is obviously a difference in terms of information content. Sea waves emit random "white" noise, while you neighbour's radio has some systematic content which your brain cannot avoid discerning and analysing. If you generally dislike your neighbour you will no doubt be even more annoyed with the noise. Sound experts for lack of a better definition define "noise" as "unwanted sound".

Since the distinction between noise and sound is a highly psychological phenomenon, it is not easy to make a simple and universally satisfactory modelling of sound phenomena. In fact, a recent study done by the Danish research institute DK Teknik seems to indicate that people's perception of noise from wind turbines is governed more by their attitude to the source of the noise, rather than the actual noise itself.

Our independent expert's response

The report above is flawed in many respects in that it oversimplifies the calculation of noise attenuation from wind turbines. Having looked at the Sound Calculator used, it uses the rated sound level of the turbine and simply uses the basic principle of attenuation of sound waves from a point source. It assumes that the noise level of the turbine only consists of the manufacturer's rated level & doesn't appear to take into account secondary noise generated by e.g. the blade passing the tower ('blade swish').

A Dutch researcher, G P Van den Berg has done some research on this phenomenon and has highlighted significant effects from this at distances up to nearly 2km from the towers.

The comments about background noise are also wrong. It is a fallacy that background noise will always mask turbine noise. With increasing wind speeds, it is true that things like noise from rustling trees will increase, but there are two factors to consider;

- trees and other ambient background sources tend to emit a range of frequencies around 1kHz which means they tend to be like the white noise (i.e. waves on the beach) that the author describes, *however*, the frequency of the modulated blade swish as reported by Van den Berg is lower and also impulsive (i.e. it has a rhythmic thumping nature as the blades pass the tower) and this is quite different in character to background noise, making it more noticeable and irritating (like the thumping of a neighbours stereo he mentions!)
- when winds are calm, background noise levels are lower, but methods used to predict noise are seriously flawed because of the assumption that wind speeds measured at a height of 10m (as required by the ETSU standard, for example) are representative of wind speeds at the greater heights of modern wind turbines. This means that at ground level, trees may not be moving much at all, but at the hub height the wind speed may be significantly greater, allowing the blades to turn and concomitant noise generation.

Additionally, lower frequency noise has more sound energy and therefore are attenuated less easily over distance than higher frequencies. This means they travel greater distances from the tower and also have more penetrating properties, i.e. they are quite capable of passing through good quality double glazing and so closing a window does not stop the sound! All this is based on one tower operating. Multiple towers will obviously generate a combined effect in terms of dB(A) and also may cause a phenomenon known as 'standing waves' where at certain geographical locations, the noise is amplified due to the interaction of sound waves coming from multiple sources of the same type & frequency.

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