Is Noise Protection necessary for Wind Energy Plants?

Till Biedermann

Motivation

- Wind energy plants are often criticized for producing noise
- Low frequency components are of particular interest, as they supposedly have negative health effects
- By using different measurement techniques, airborne noise as well as structure borne noise were investigated
- Ideally the noise components should be identified and attributed to their sources in the plant

Noise Production

Aerodynamic noise:
- The flow at the blades creates broadband noise around 1 kHz
- Unsteady oncoming flow and the resulting lift forces lead to pulsed low frequency fluctuations

Machine noise
- The generator accounts for constant frequency components
- Cooling/ventilation
- Auxiliary actuation / Yaw system

Selection of results

- All measurements presented here were taken at the base of the tower
- For the most part, the geophone provided the clearest results

Figure 5: This frequency spectrum shows the blade passing frequency
- Frequency corresponds to approximations made during the measurements (counting of passing blades)

Figure 6 shows a constant frequency component, caused by the gear drive
- Furthermore an unsteady component caused by fluctuating vortex shedding frequencies is clearly visible

Figure 7: A narrow band spectrum of the lower frequency range shows high amplitudes for low frequencies
- Geophone measurements show a loud component around 16 Hz whenever the yaw system is active

Conclusions from the results

- Constant frequency components are generated by vibrating solid parts
- Aerodynamic effects cause unsteady frequency components
- A distinct consideration of airborne sound and structure borne sound is necessary for a thorough prediction and investigation of a plant’s noise emission
- Especially the hollow tower can behave like a loudspeaker when excited by certain frequencies
- Low frequency components created by machine parts can travel great distances through the ground and possibly excite other structures
- Generally a well designed wind energy plant will not cause any problems, notable resonance phenomena are a rare occurrence

Literature