Research Paper Engineering

Feasibility of Using Solar Noise Barrier for the Reduction of Noise

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ABSTRACT

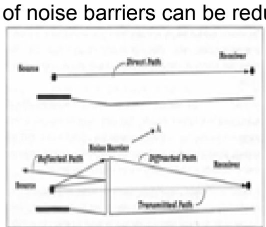
Wind farms are becoming increasingly popular in the world in an effort to increase the production of green energy. As with any infrastructural development, wind farms must consider potential environmental impacts prior to construction and post construction. One particular issue that must be examined is the emission of noise from the development. The noise level of all types of turbines are taken into consideration. The feasibility is than checked if a solar noise barrier is installed. The pros and cons are taken into consideration to validate whether the installing a solar noise barrier will be helpful.

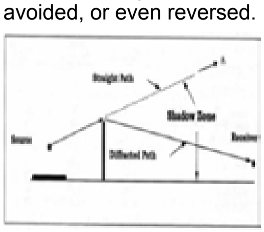
Keywords :

INTRODUCTION

Solar noise barriers: Many factors need to be considered in the detailed design of solar noise barriers. First of all, barriers must be acoustically adequate. They must reduce the noise as identified in the EIA and NIA studies. A proper design of noise barriers would need due considerations from both acoustic and non-acoustic aspects. Acoustical design considerations include barrier material, barrier locations, dimensions and shapes. However, they are not the only requirements leading to proper design of noise barriers.

A second set of design considerations, collectively labeled as non-acoustical design considerations, is equally important. As is often the case, the solution of one problem (in this case noise), may cause other problems such as unsafe conditions, visual blight, maintenance difficulties, lack of maintenance access due to improper barrier design and air pollution in the case of full enclosures or deck over. With proper attention to maintainability, structural integrity, safety, aesthetics, and other non-acoustical factors, these potential negative effects of noise barriers can be reduced, avoided, or even reversed.





Wind noise: Wind turbines generate two types of noise: aerodynamic and mechanical. A turbine's sound

Power is the combined power of both. Aerodynamic noise is generated by the blades passing through the air. The power of aerodynamic noise is related to the ratio of the blade tip speed to wind speed. Table shows how the sound power of two small wind turbines vary with wind speed.

Table 4. Sound Power of Small Wind Turbines[1]

Make and Model	Turbine Size	Wind Speed (meters/second)	Estimated Sound Power
Southwest Windpower	900 W	5 m/s	83.8 dB(A)
Whisper H400		10 m/s	91 dB(A)
Bergey Excel BW03	10 kW	5 m/s	87.2 dB(A)
		7 m/s	96.1 dB(A)
		10 m/s	105.4 dB(A)

Depending on the turbine model and the wind speed, the aerodynamic noise may seem like buzzing, whooshing, pulsing, and even sizzling. Turbines with their blades downwind of the tower are known to cause a thumping sound as each blade passes the tower. Most noise radiates perpendicular to the blades' rotation. However, since turbines rotate to face the wind, they may radiate noise in different directions each day. The noise from two or more turbines may combine to create an oscillating or thumping "wa-wa" effect.

Wind turbines generate broadband noise containing frequency components from 20 – 3,600 Hz. The frequency composition varies with wind speed, blade pitch, and blade speed. Some turbines produce noise with a higher percentage of low frequency components at low wind speeds than at high wind speeds. Table 5 lists the sound power for some common utility scale turbines.

Table 5. Sound Power of Utility Scale Wind Turbines

Make and Model	Turbine Size	Sound Power
Vestas V80	1.8 MW	98 – 109 dB(A)
Enercon E70	2 MW	102 dB(A)
Enercon E112	4.5 MW	107 dB(A)

Wind Speed	Noise Limit, dB(A)	
	Dwellings (Countryside)	Dwellings (Noise Sensitive Land Use)
8 m/s	44	39
6 m/s	42	37

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Utility scale turbines must generate electricity that is compatible with grid transmission. To meet this requirement, turbines are programmed to keep the blades rotating at as constant a speed as possible. To compensate for minor wind speed changes, they adjust the pitch of the blades into the wind.

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These adjustments change the sound power levels and frequency components of the noise.

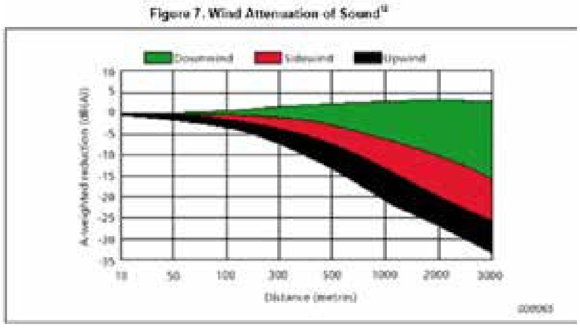
Germany

No specific wind turbine noise guidance is available so the following generic limits apply.

Land Use	Noise Limit, dB L_{Aeq}	
	06:00-22:00	22:00-06:00
Industrial	70	70
Commercial	65	50
Mixed	60	45
Mostly Residential	55	40
Residential	50	35

Wind direction: Wind direction also has an influence on sound propagation. Within 900 ft. of a sound source, the wind direction does not seem to influence the sound. But after about 900 ft., the wind direction becomes a major factor in sound propagation. Downwind (meaning the wind is moving from the noise source towards the receiver) of the source, sound volume will increase for a time before decreasing. Upwind (the wind is moving from the receiver to the noise source), sound volumes decrease very quickly.

Figure 7. Wind Attenuation of Sound[u]



Results and Discussion

Length (m)	Height (m)	Area (m2)	Azimuth (°)	Pitch (°)	Number of Pv panels (max)	kWp	kWh per annum
730	3	2190	South	35	1719	310	252,500
				Total	1719	310	252,500

We consider a wind farm where we build solar noise barrier to reduce the noise as well as generate energy from the solar panels. Length of the solar noise barrier built is 730m with a height of 3m. The area covered is 2190m^2. The azimuth angle is tilted towards south and the angle of tilt is equal to the latitude of the place to get the maximum sunlight and power from the solar panels. The number of panels required is 1719 panels. The power output from the panels is 310 KW. The KWh per annum is 252,500. The noise level is reduced also by an average of 5 to 10 decibels.

CONCLUSION

By installing solar noise barriers in a wind farm we can reduce noise from wind turbines and preventing from the receiver. The solar panels also provide power in addition to the wind power. So hybridization improves the power output even though initial cost is high. It serves as a dual purpose of reducing the wind noise turbine and also giving extra power output from solar panels, so this is feasible approach which can be implemented.

REFERENCES

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