



## **Comparison of Noise Pollution in Windmills with other power generating stations like hydro and thermal power plants**

**S.Sundaram**, Associate Professor in Physics, Thiruvalluvar College, Papanasam, Vickramasingapuram, Tirunelveli - 627425

### **Abstract**

Sound is a form of energy and is produced by any vibrating body. The sound intensity level is measured in decibels. Windmill is a device which converts the kinetic energy of the wind to mechanical energy and then into electrical energy. In Tamilnadu, the wind prone areas are on the Western side affluenced by the Westernghat. The noise produced by windmill fall into two categories. The first type is a mechanical noise from the gear box, generating equipment and the linkages and the second type of aerodynamic in nature produced by the movement of turbine blades. Noise is considered to be one of the dimensions of pollution which leads to degradation of the environment. The noise levels were measured along different directions at various distances from the mill. These observations were repeated for different heights. The noise level varies with capacity of generation, wind velocity, shadowing features, barriers. The noise level also varies with different directions and height. The noise produced by the windmill is compared with the noise produced by the hydro power and steam power plant. The noise level is low when compared with the other power generating stations.

**Key words:** Windmill, noise, hydro power plant, thermal power plant

### **Introduction:**

Energy is an important input for development. The coal and oil deposits are to exhaust one day. The energy crisis has shown that for sustainable development in energy sector, we must conserve the non renewable sources and also replace them by non-polluting renewable energy.

In Tamilnadu, the wind prone areas are on the western side affluenced by the westernghat. The following three on the western-ghats cause heavy wind flow because of the tunnelling effect.

1. Palghat gap in Coimbatore district.
2. Shencottah gap in Tirunelveli district.
3. Aralvoimozhi gap in Kanyakumari district.

Environmental concern about wind energy involves such factors as the risk of accidents, noise, interference with telecommunications and the possibility of local climatic alterations.

The noise produced by the windmill falls into two categories. The first type is a mechanical noise and the second type produced by the movement of turbine blades.

Due to the emergence of population, we need more energy. The noise produced by the windmill is compared with the noise produced by the hydro power and steam power plant.

### **Methods and measurements of noise level in windmills**

The largest installation of wind turbines in the country has so far taken place at Muppandal, with an aggregate of capacity of 150 MW. This represents one of the largest concentration of wind farm capacity at a single location. For the study of noise level in windmills, twenty-one windmills belong to various private sectors like Ramco, Dalmia, etc. For each of the windmills the noise levels were measured along  $0^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $150^\circ$  and  $180^\circ$  at distances of 10metres, 20metres, and 30metres. These observations were repeated at 50cm, 100cm, 150cm and 165cm height from the ground.

To measure the noise level at different heights, a wooden pole of length nearly 9metres with holes drilled at equal distances nearly of 1metre, the diameter of the hole being sufficient to hold the microphone of the sound level meter is used. The measurement was done with the help of two more persons. The noise produced by the windmill depends upon (i). Tip speed of the blade. (ii). Length of the blade. (iii). Density of air. (iv) Wind velocity and the direction of wind.. (v). The capacity of the windmill. (vi) Height between the point and the rotor. It also depends upon the directions of observations.

Comparison of Noise Pollution in Windmills with other power generating stations like hydro and thermal power plants

**For 640 MW Capacity of a Thermal plant, the noise levels are as follows**

Sl. No.	Different Sound Proofing	Noise levels in dB for different equipment		
		Turbo alternator	ID & FD	Power Transformer
1.	Without sound proofing	127	139	110
2.	With moderate proofing	112	109	102
3.	With medium proofing	102	99	--
4.	With intensive proofing	97	94	97

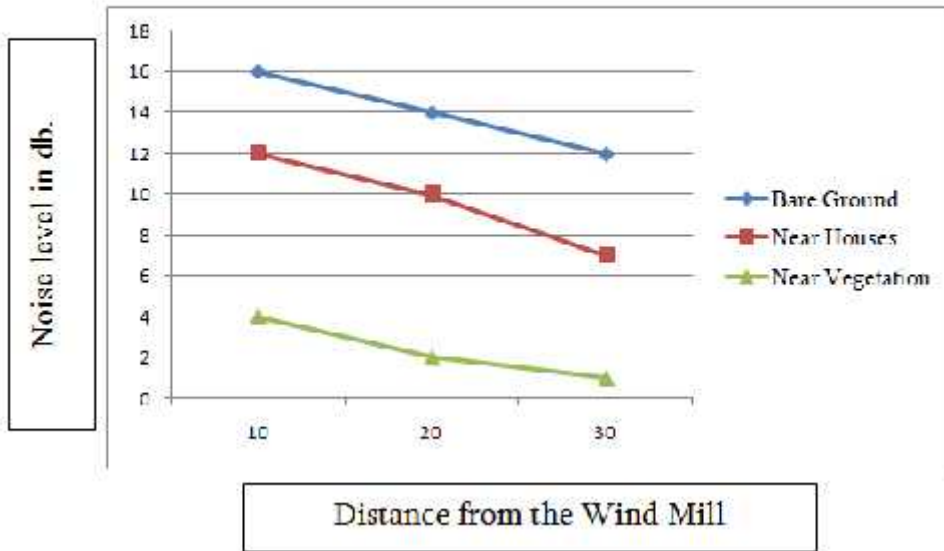
(Ref: Arora)

**Table showing the noise levels at different locations at different heights for different distances from the windmill for different directions**

Distance from the Windmill in Metres	Noise Level with Different Locations for Different Heights in cm												Angle
	Bare Ground				Near Houses				Near Vegetation				
	50	100	150	165	50	100	150	165	50	100	150	165	
Bottom	24	28	30	32	8	16	18	20	04	08	12	16	0°
10	14	16	18	20	06	14	17	18	04	12	16	16	
20	12	14	18	20	10	14	17	17	08	12	16	16	
30	04	08	12	14	--	--	--	12	--	--	--	--	
10	12	14	17	19	08	10	14	14	04	08	12	12	60°
20	08	12	15	16	06	08	14	14	04	06	12	12	
30	06	10	12	12	04	07	12	14	03	05	10	12	
10	10	12	16	18	04	04	12	12	02	02	04	04	90°
20	05	08	14	14	04	04	10	10	02	02	02	02	
30	04	07	12	12	--	02	07	08	0	01	01	02	
10	10	16	20	24	06	08	10	10	02	04	06	06	150°
20	08	12	14	15	04	05	09	09	02	03	06	06	
30	06	08	12	13	02	02	06	06	0	0	04	04	
10	08	12	18	18	06	10	14	14	03	06	08	08	180°
20	06	10	15	15	04	08	12	13	02	02	04	04	
30	05	08	13	14	03	06	10	10	0	0	02	04	

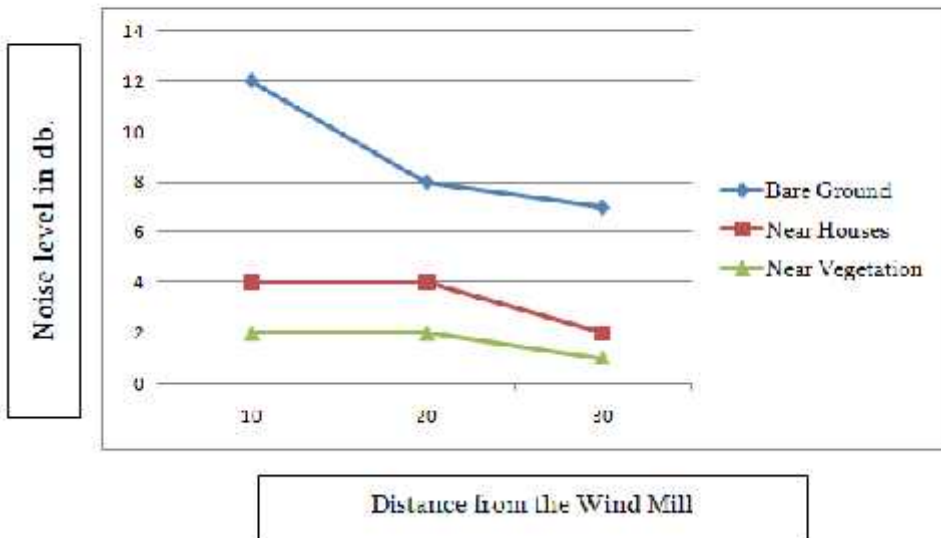
Variation of Noise Level With Barriers

HEIGHT 150 Cm ANGLE 90°



Variation of Noise Level with Barriers

HEIGHT 100 Cm ANGLE 90°



## Comparison of Noise Pollution in Windmills with other power generating stations like hydro and thermal power plants

### **Analysis and Conclusion**

The machines used in hydel plants are generally run at 300 to 400 RPM. In hydro power station, the kinetic energy of the water is converted into mechanical energy in the water turbine, further utilised to run the electric generator. The generated units and exciters are located on the ground floor. Fast moving water passing through the prime mover produce noise, high in the substructure and slightly reduced level in the superstructure. In Papanasam lower power station, 4 units of 7 MW each are there. Nearly thirty workers are in the power house. The noise level in the substructure is about 130 dB and in the super structure is about 100 dB. Ear plugs are given to the works and for management purposes they do not use the ear plugs. The workers are exposed to high noise for more than 8 hours.

The main sources of noise in a power plant are turbo alternators, fans and power transformers. The simple proofing system consists of adequate insulation of the turbine body and piping, with a dash pot on the air inlet to the fans. A moderate treatment includes a complete casing for turbo alternator. An intensive treatment includes building around the turbine group and fans and complete sound proofing of the transformers and switch gears. In Tuticorin thermal power plant, there are five units of 210 MW capacity each. Even though intensive treatments remade to control the noise, the workers are exposed of high noise level. During the time of steam release, the noise heard over a long distance with high intensity.

Many thermal power stations use coal for the production of steam. A thermal power plant of 400 Mw capacity requires 5000 to 6000 tons of coal per day. According to the survey of the environment, by Hindu, for every megawatt of a thermal plant, about one acre of land is required for disposal of ash generated, the material generated accumulating to a height of eight to ten meters. The first order impact of coal based thermal plant manifested by acid rain, increased suspended particle matter in air, despoiling of land, choking of the drainage systems etc are amenable. About 1/3 of the world's CO<sub>2</sub> emission is from power plants which leads to Global warming.

The impacts caused by the construction of dams include changes in the microclimate, loss of vegetal cover. Most important social consequence of big dams has been the displacement of millions of tribals from their home land and their eventual influx into urban areas, almost as refugees. In Sardar Sarovar project, over 75000 will be evicted. (Ref: P.D.Sharma)

The cost of generation of electricity by thermal plant varies from Rs.1.75 – 2.25 /Kwh. According to Tuticorin Thermal plant official statistics, the cost of generation is Rs.1.54 /Kwh. in 1995-95. The capital costs of hydro plant is considerably more than thermal plant. Power generation by the hydroplant is only dependent on the quantity of water available which in turn depends on the natural phenomenon of rain. The dry year is more serious for hydroelectric project. Eventhough the cost of generation of electricity by windmill is high compared with the thermal and hydro power plants, the environmental degradation is high in thermal and hydro power stations. The energy pay back period of a wind turbine is about one year in its life span of 20 years. So, for 19 years it is producer of electricity. A wind farm of capacity 600 MWh/year, saves 250 tonnes of coal per year and avoids 800 tonnes of CO<sub>2</sub> per year. To quote an example with unassailable data, the windfarm commissioned in 1994 on the island of Fahmaren epitomizes involves 34 machines of 500 kw each, spread over an area of 220 acres to cater to the needs of Island's residents and tourism industry at a total cost of Dm 40 million. It avoids the emission of (i). 319,500 Kgs of SO<sub>2</sub>. (ii). 1,261,000 Kgs of nitrogen compounds. (iii), 50,130,000 Kgs of CO<sub>2</sub> (iv). 8,100 Kgs of dust and (v) 40,500 Kgs of CO.

Moreover, due to the continuous depletion of conventional energy sources, man has reached a stage when natural resources could not be exploited further and development will have to be achieved without destruction of the environment. Countries all over the world have been forced to concentrate over tapping the vast potential of non conventional energy sources. It was found that the noise produced via windmill at a distance of 100m is 45 dB which is less than a car passing at 40 mph at 100m [55dB}. So, wind is an important source of renewable energy, with less noise pollution.

Comparison of Noise Pollution in Windmills with other  
power generating stations like hydro and thermal power plants

**Reference :**

1. A Text Book of Sound – By M.Subramaniam & Brijlal,  
Vikas publishing house Pvt. Ltd 1974.
2. Windpower Development  
Proceedings of National Symposium organized by Tamil Nadu  
Energy Development, Agency, October – 3 – 4, 1990.
3. Pollution Control Hand Book 1986  
By AV.Bridge Water & C.J.Mumford.