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LIGHTNING OF HIGHWAY USING WIND POWER MILL

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Abstract- *According to the present scenario of power generation sector the most of the plant depends on the fossil fuels for the production of energy which leads to the emission of harmful gases like chloro-Fluoro carbons, Carbon-dioxide, Nitrogen-oxide etc. due to which the environment is getting effected so to overcome these several problems the use of renewable resources should be taken into existence. The objective of our work is we are using wind energy which is a good renewable source of energy for the production of electrical energy by using highway wind mill for lightning purpose. Highways can provide a good amount of wind which is required for driving the wind turbines. This energy is unused. Extensive research on wind turbine has been done to determine the average velocity of the wind which is required for energy generation. The wind energy is considered as the well-known growing clean energy source however having no effects on the environment. The wind mill is placed at the divider of the highway therefore air flow from either sides of the highway will be considered in the working process. Therefore the streetlights on the dividers will be fitted with these wind turbines. Additionally, since the wind s will fluctuate, a storage system (battery) for the power generated will be designed to maintain a constant source of power. , the turbine can be used as an unlimited power source for streetlights and other domestic use. For this work we are taking "Vertical Axis Wind Turbine". Different types of wind turbines such are horizontal axis and vertical axis wind turbines are mostly used for energy extraction. Horizontal axis mainly used in huge scale applications and thus its implementation is generally a concern due to enormous installment setup and initial cost; whereas vertical axis wind turbines are used in medium sized residential spaces or smaller ruler areas. Each vehicle on the highway provides an intermittent and uncontrolled source of wind power. Therefore, the proper design and functioning of the other parts like Shaft, Flange, Bearings etc. have the same important. The various results have been taken in order to make this project successful by applying the various engineering methods.*

Keywords- *Renewable energy, Vertical axis wind Turbine, Wind Energy, Lightning of Highway and Wind Turbine Model validation.*

I. INTRODUCTION

It is well known that non-conventional energy resources these are the sources of energy which are abundant on our earth but we have a doubt why we call this as non-conventional energy sources because they are also going to be depleted at the end of our planet therefore why not to call them as omnivore sources of energy but left it will call as people calls so there are many renewable energy sources like wind energy, air energy and solar energy etc. The development and modification of wind turbines has made a significant contribution to power generation and technological advancement throughout history. and global concern about pollution and environmental damage arising due to high use of fossil fuels, wind turbines begin to lead an ever-increasing role during the next century and beyond Through the next several decades, renewable energy technologies, the use of these energy sources are improving performance and cost and growing as an important renewable energy source with almost no Environmental effects, economic and social values, will grow increasingly competitive with Traditional energy technologies, so that in coming middle of the 21st century, renewable Energy, in its various forms, should be providing half of the world's energy needs. "The cost of wind-generated electric power has reduced substantially. Since 2003, according to some sources, the price in the various countries is now lower than the cost of fuel-generated electric power. In 2006, wind energy cost one-fifth as much as it did in the late 1990s, and Wind power is growing quickly, at about 39%, up from 24% growth in 2002. Wind power is the fastest growing form of electricity energy on the percentage basis. Wind energy conversion systems convert the power of the wind to rotational shaft power and to electricity by coupling a generator to the system. Wind "turbines" is wind electric power unit system and is used throughout the world. Commercial wind turbines range from a few hundred watts to about 20 kilowatts for domestic applications. Units designed for grid connection are available in the range of 20 kilowatts to over one megawatt. Where annual average wind speeds exceed about 3 meters per second, residential and village-scale wind turbines can provide electricity at costs Here people are using air flow generated by vehicle running on highway in both side of roads. The cross-air flow helps to rotate wind mill blades in single direction. The shaft of generator is attaché with dynamo and produce electricity which is store in battery and used for the lightning of street light.

1.1 Objective

Our main objective is to build a wind mill in such a way that by using it on the highways the required amount of electricity should be generated and further it can be used for the lightning purpose at the highway which can lead to an energy saving .Due to this many companies will move towards manufacturing of such wind mill which will reduce cost of wind mill. Thus it will reduce cost of the power produced by the wind turbine. While working on this work desired results were found by taking various speeds of the air and revolution of the pulley

2. LITERATURE REVIEW

The knowledge of availability of required components and their working is essential for implementation of the project. This chapter provides information about the wind mill theory and types which is important for designing of wind mill.
Vertical-axis wind turbines are a type of wind turbine where the main shaft runs vertically. It works somewhat like a classical water wheel in which water arrives at a right sq. pipe to the rotational axis (shaft) of the water wheel. Vertical-axis wind turbines are divided into two major categories: Durries turbines and Savonious turbines. Savonious **Turbine** invented in Finland, the Savonious turbine is S-shaped if viewed from above. This drag-type VAWT turns relatively slowly, but can produce a high torque.

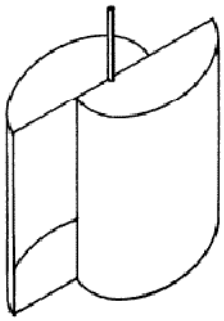

Fig.1 S-type wind turbine

Which is an extended version of an anemometer (wind speed measuring tool)? VAWTs can offer up to 15% efficiency and they work equally well no matter which direction the wind is coming from.

2.1 SETUP AND CALCULATION

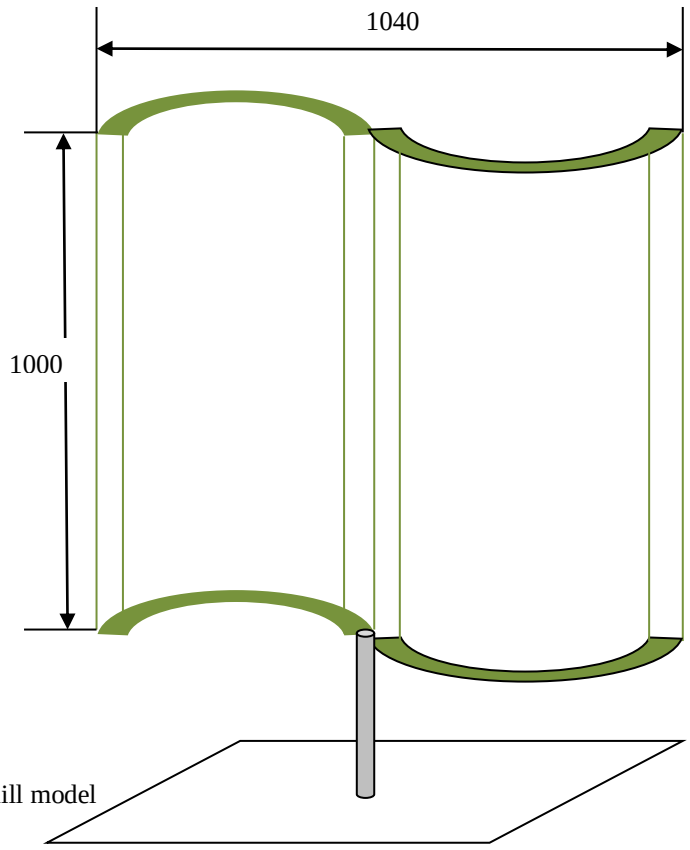

Fig -2 Highway wind mill model

Power capacity

Calculation of Energy and Power

Force = mass X acceleration

$F = ma$

Energy = Work = Force X Distance

Power = P = W / time

Power = Torque (Q) x Rotational Speed (Ω)

Kinetic Energy in the Wind

Kinetic Energy = Work = $\frac{1}{2}MV^2$

Where:

M= mass of the moving object

V = velocity of the moving object

Mass of the moving air

M = density (ρ) x volume (Area x distance)

$= \rho \times A \times d$

$= (kg/m^3)\ (m^2)\ (m)$

$= kg$

$= 1 \times 0.196 \times 0.5$

$= 0.098$ kg

Power of the Wind

Power $= Work / t$

$= Kinetic\ Energy / t$

$= \frac{1}{2}MV^2 / t$

$= \frac{1}{2}(\rho \times A \times d)\ V^2/t$

$= \frac{1}{2}\rho AV^2\ (d/t)$

(d/t = Distance/time = velocity)

$= \frac{1}{2}\rho AV^3$

Power of the Wind $= \frac{1}{2}\rho AV^3$

V = 5 meters (m) per second (s) m/s

$\rho = 1.2\ kg/m^3$

Power of the Wind $= \frac{1}{2}\rho AV^3$

Units $= (kg/m^3) \times (m^2) \times (m$

$= (kg\text{-}m)/s^2 \times m/s$

Given Data:

Power (P) required …….. 10W

Velocity of wind (U)…… 5 m/sec

Coefficient of power (Cp)…… 0.154

Tip Speed Ratio (TSR)…… 0.70(constant for vertical axis wind mill)

Density of air at sea level (ρ)……..…….. $1.2\ kg/m^3$

Viscosity of air (μ)…… 10-5 kg/m-s

Length of blade = 1000 mm

Width of blade = 520 mm

Number of blade = 3 no's

Diameter of turbine = 1040 mm

Material = GI sheet

Weight of blade = 5.5 kg

P = 0.5 X density X A X Cp X V ^{3}

P = 0.5 x (1 x 1.04) x 1.2 x0.154 x 5^3

P = 12.012 watt.

3 RESULTS

The various observations have been recorded during the day and night time due to the fluctuations in the speed of the air which is necessary for the rotation of the wind mill accordingly we have taken several readings by taking our model to the highway and we have recorded the various speeds of the air, rotation speed of the shaft and output voltage which are as follows: -

SR no.	Wind speed m/s	Speed of shaft rpm	Voltage V
1	1 to 1.5	82 to 90	3.2
2	1.5 to 2.5	109 to 121	3.9
3	2.5 to 3.5	189 to 201	4.8
4	3.5 to 4.5	271 to 320	6.2
5	4.5 to 5.5	328 to 353	8.8
6	5.5 to 6.5	390 to 396	9.2
7	6.5 to 7	400 to 409	12

Table -1 Readings.

4. CONCLUSION

During working on this project, we came to know about the various renewable sources of energy and their importance in power production in the world. We came to know that importance of the power through wind mills. In future, further development in the direction of wind energy will make the power cheaper. India stands fifth in rank of power produced by wind energy. Building of this project has helped us to develop good amount of confidence as we were able to tackle very interesting problems like,confidence,team work, leadership.

By using this model the desired results were obtained and it can be used further in future for the production of electricity which is required for the lightning of highways.

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