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Vertical Axis Wind Mills

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ABSTRACT

Now a day the requirement of electricity is much higher than its generation, hence the main the objective of our project is to produce electricity in low cost with no effect on environment. The Electricity is Produce by using the force of air created by the moving vehicle in highways. A considerable amount of wind energy is produced due to the pressure difference created by the moving vehicles on the highways. This wind energy can be used for the production of electrical energy with the help of vertical axis wind turbines This is a new unique method of power generation in low cost. We use arrangement vertical axis blade for power generation called as turbine for power generation. These turbines install on middle on highway so that the wind from both sides of the median will proceed tangentially in opposite direction on both sides of the turbine thereby increasing effective wind speed acting on the turbine. The wind power harnessed through this method can be used for street lighting, traffic signal lighting, toll gates etc. Working method is in following steps, Capturing of wind induced by moving vehicles. Routing the induced wind in the direction of the wind turbine. Converting the energy of the wind into Mechanical energy by using wind turbine. Converting that Mechanical energy into electrical energy by using a generating device.

I.INTRODUCTION

Renewable energy is generally electricity supplied from sources, such as wind power, solar power, geothermal energy, hydropower and various forms of biomass. These sources have been coined renewable due to their continuous replenishment and availability for use over and over again. The popularity of renewable energy has experienced a significant upsurge in recent times due to the exhaustion of conventional power generation methods and increasing realization of its adverse effects on the environment. This popularity has been bolstered by cutting edge research and ground breaking technology that has been introduced so far to aid in the effective tapping of these natural resources and it is estimated that renewable sources might contribute about 20% – 50% to energy consumption in the latter part of the 21st century. Facts from the World Wind Energy Association estimates that by 2010, 160GW of wind power capacity is expected to be installed worldwide which implies an anticipated net growth rate of more than 21% per year.

Although wind has been harnessed for centuries, it has only emerged as a major part of our energy solution quite recently. Before the 21st century, wind was primarily used to pump water from wells and to grind grain, but over the last twenty years the cost of wind energy has dropped by more than 80 percent, turning it into the most affordable form of clean energy. Recent advances have allowed for sophisticated wind technologies, which previously sat in the mind of thoughtful engineers and inventers, to be developed into cost-effective, reliable solutions.

The Power of Wind

As mentioned earlier the effective functioning of a wind turbine is dictated by the wind availability in an area and if the amount of power it has is sufficient enough to keep the blades in constant rotation. The wind power increases as a function of the cube of the velocity of the wind and this power is calculable with respect to the area in which the wind is present as well as the wind velocity. When wind is blowing the energy available is kinetic due to the motion of the wind so the power of the wind is related to the kinetic energy.

Types of Wind Turbines

Many types of turbines exist today and their designs are usually inclined towards one of the two categories: horizontal-axis wind turbines (HAWTs) and vertical-axis wind turbines (VAWTs). As the name pertains, each turbine is distinguished by the orientation of their rotor shafts. The former is the more conventional and common type everyone has come to know, while the latter due to its seldom usage and exploitation, is quiet unpopular. The HAWTs usually consist of two or three propeller-like blades attached to a horizontal and mounted on bearings the top of a support tower.

Overview

Renewable energy is generally electricity supplied from sources, such as wind power, solar power, geothermal energy, hydropower and other various forms. The renewable energy is also considered as an alternative energy to be utilized instead of fossil fuels, which is inflating the cost of fossil fuel. And, Global warming will continue unless dependence on fossil is reduced, so the wind energy could be having a key role in reducing greenhouse gas emissions. In the past, the kinetic energy of the wind energy was harnessed by windmill to perform mechanical work. Vertical axis wind turbines (VAWTs) are a type of wind turbine where the main rotor shaft is positioned in vertical coordinate. The advantages are that generators and gearboxes can be placed close to the ground, and that VAWTs do not need to be pointed into the wind. The main benefit of VAWT is that it can generate power in all directions of wind flow.

Problem statement

As world population and standards of living increase there is an ever growing demand for energy. This increase in energy creates significant demand for energy created by fossil fuels, which the world has a limited amount of

and carbon emissions can lead to global warming. The fears of diminishing natural resources and concern of significant climate change as a result of the burning of fossil fuels has created great worldwide interest in clean renewable energy that can meet the electrical demands of the world. One common strategy is to use wind turbines that generate electricity from wind.

Objective of the project

The main objective is to utilize the maximum amount of wind energy from the automobiles running on the highways.

The unused and considerable amount of wind is used to drive the vertical axis wind turbine, which will use the kinetic energy of the wind to produce the electrical energy.

In corporation of more renewable energy to the power system.

Design of a new method of generation of electricity using the wind energy generated by the moving vehicles on the highways.

Development Stand-alone system for providing the power to the highways.

To design and develop a comprehensive working model of a Vertical axis wind turbine.

Future scope

In this project we are going to design and develop the working model of a cup type of vertical axis wind turbine for the power generation from wind energy. We are going to design the blades for drag force. The power generation will be demonstrated with the help of stepper motor in place of dynamo.

II.LITERATURE REVIEW

Niranjana S. J.[1 In the present work, vertical axis wind turbine (VAWT) is designed and fabricated as per the specification, the VAWT blades are designed with aerofoil shape, with less weight and more stiffness, the assembled VAWT is mounted on the highways of a divider, so that the air velocity obtained from the moving vehicle is sufficient enough to cut the turbine blades, VAWT is a special purpose wind mill, they are designed in such a way that the vehicle moving on both the sides of highway are capable to cut the blades of VAWT, the blades are connected to the shaft intern connected to the generator, it generates the power, the power developed by the VAWT is stored in battery, the power is used for some useful application. In this project a small capacity model is developed is tested in the laboratory the result obtained for a velocity of 25 m/sec the power may come up to 1W. It is also working with the low speed wind at 4m/sec to 35 m/sec.

Mani R, Ajith Kumar M, Akash Sharma S, Janarthanan S, Jayakumar R [2], This Paper includes number of literature works on wall vertical axis wind turbine for generation of electricity on highways have been reported. power generation using VAWT is an eco-friendly method and power produced here is almost a continuous one. Design of the frame is also a very important factor, as light frame may lead to instability in high wind condition. Also there is a problem of vibration which may lead to excessive lateral loading. Number of blades can be

reduced to two and the experimentation can be carried out for smaller application. By using the dimensionless numbers various calculations can be carried out. Shaft material is also an important factor, composite materials could be used and the analysis can be carried out. Shape of the blades can be changed to helical shape and the speed of rotation of the shaft can be noted with the current method.

P. D Abd. Aziz A. K. R Mohamad, F.Z Hamidon, N. Mohamad, N. Salleh and N. Mohd Yunus[3], This paper presents the simulation study on the airfoil based on the vertical axis wind turbine (VAWT) for low wind speed application ranging 2 to 8 meter per seconds. The main advantage VAWT compared to the horizontal axis wind turbine (HAWT) is the ability to capture wind from any direction. Therefore, the yaw system is not required to turn the rotor towards the wind direction. Furthermore, the noise level produced during the rotation making it suitable to be installed on residential and urban environment. However, the major drawbacks of VAWT over HAWT are less efficient due to drag and turbulent force that the blade produces and low starting torque. The aim of this study is to develop a VAWT design equipped with the advantages mentioned and to overcome the VAWT drawbacks.

Schematic diagram of Vertical Axis Wind Mills setup

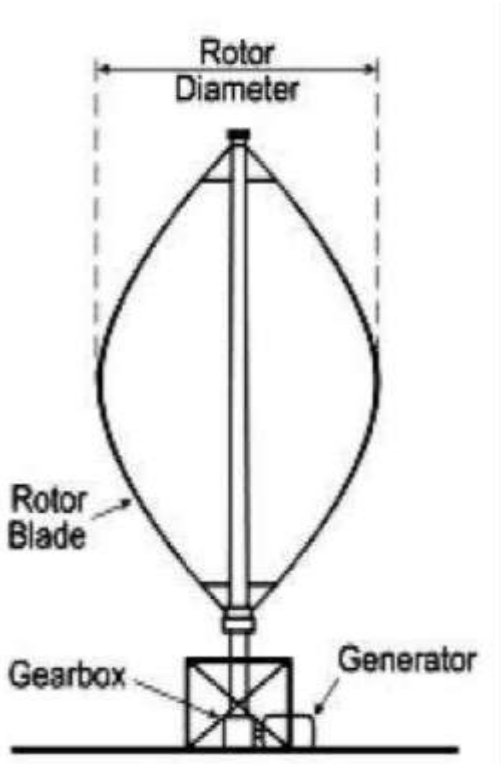

Figure.1. Vertical Axis Wind Mills setup

3D model of setup

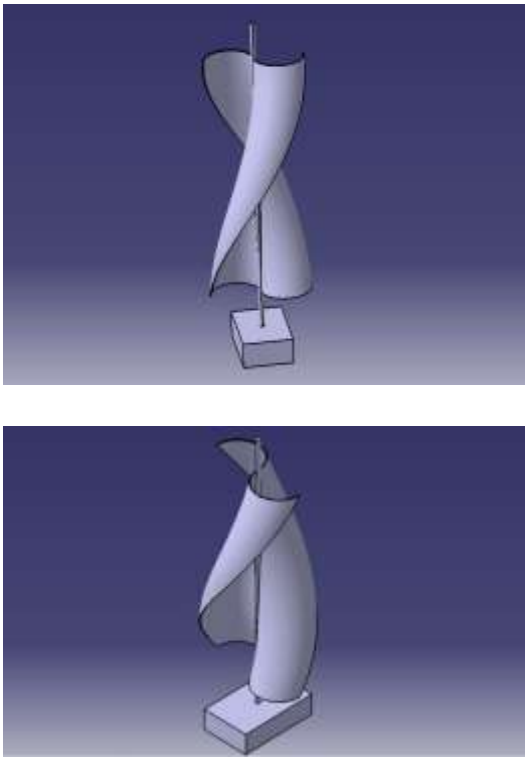

Figure.2. Catia model Vertical Axis Wind Mills setup

Components Used

COMPONENTS	MATERIAL USED
CHANNELS	MILD STEEL
ANGLES	MILD STEEL
SHAFT	MILD STEEL
BLADES	MILD STEEL
PULLEY	MILD STEEL
BEARINGS	STAINLESS STEEL

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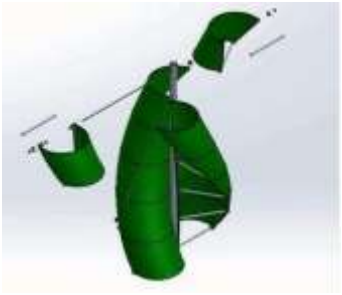
III.ROTOR BLADES

The design of the individual blades also affects the overall design of the rotor. Rotor blades take the energy out of the wind; they capture the wind and convert its kinetic energy into the rotation of the hub. The arc angle was selected based on the pervious study mentioned in chapter 2.2, which recommended an angle of 160°

SHAFT

The shaft is the part that gets turned by the turbine blades. It in turn is connected to the generator within the main housing. A solid works tools have been used in designing the blades and the shaft as shown in the below



Stepper Motor

A stepper motor or step motor or stepping motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

Calculation

The wind mill works on the principle of converting kinetic energy of the wind to mechanical energy. The kinetic energy of any particle is equal to one half its mass times the square of its velocity, or ½ mv^2.

K.E=½ mv^2. …….. (1)

K.E = kinetic energy

m = mass

v = velocity,

M is equal to its Volume multiplied by its density of air

M = AV …….. (2)

Substituting equ(2) in equ(1)

We get,.

K E = ½ □ AV.V^2

K E = ½ □ AV^3 watts

□ = density of air (1.225 kg/m^3)

A = □ D^2 /4 (Sq. m)

D = diameter of the blade

A = □*(1.22)^2 /4

A = 1.16Sq.m

Available wind power

Pa = **(½ □ □ D^2 V^3)/4**

P = 1/8 □ □ D^2 V^3 watt

TRAIL 1

FOR VELOCITY 4.5m/s

Pa = (½ □ □ D^2 V^3)/4

Pa = (½*1.225*□*1.22^2*4.5^3)/4

Pa = 65.244watt

TRAIL 2

FOR VELOCITY 5.5m/s

Pa = (½ □ □ D^2 V^3)/4

Pa = (½*1.225*□*1.22^2*5.5^3)/4

Pa = 119.12watt

COST ESTIMATION

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

PURPOSE OF COST ESTIMATION

1. To determine the selling price of a product for a quotation or contract so as to ensure a reasonable profit to the company.
2. Check the quotation supplied by vendors.
3. Determine the most economical process or material to manufacture the product.
4. To determine standards of production performance that may be used to control the cost.

SAFETY PRECAUTIONS

The following points should be considered for the safe operation of machine and to avoid accidents:-

All the parts of the machine should be checked to be in perfect alignment.

All the nuts and bolts should be perfectly tightened.

The operating switch should be located at convenient distance from the operator so as to control the machine easily.

The inspection and maintenance of the machine should be done from time to time.

Advantages:

1. The energy create is environmental pollution free and does not cause any damage to environment.
2. Till now the energy which is waste can be utilized in developmental work.
3. Installation and maintenance charge is not much high.
4. There is no damage to birds and animals.
5. Can be used to produce energy free electricity.

IV.CONCLUSIONS

The prototype vertical axis wind turbine has been designed to withstand wind speeds up to 60 miles per hour. All the turbine blades have the hollowed out hook section as proposed. From existing extruded aluminium profiles available on the market now, the one that had the best weight and strength characteristics was selected. Based on these criteria, the prototype met the criteria laid out in the project statement.

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