DESIGN AND FABRICATION OF MINI WIND MILL POWER GENERATOR

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Abstract: *The objective of this project is to generate electricity with vertical axis wind turbine. Increasing demand for energy has lead to search for efficient source of energy .Most of the places in India have a wind speed of less than 5.32 m/s. So a vertical axis wind turbine will be the best choice for places with low wind speed. Renewable energy source of power is high on demand due to the need of tackling of environmental pollution .By the end of 2020 nearly 12% of global energy source will be by WIND ENERGY. It is very useful for market today. It is more cost effective and efficient than the normal wind mills .It can rotate along the direction of wind so it is multi-directional .It is economic and pollution free , so we can harvest electricity in a greener way.*

Keywords: *Renewable energy, Efficient, Multi-directional*

1. INTRODUCTION:

Generation of power in an economic and greener way has always been an great challenge for the modern society. Generation of power with coal and other sources are never economical and pollution free. They cause a huge damage to the environment. One of the best sources of energy that can apply the concept of sustainability is renewable energy such as sun, wind, and rivers. The positive point of wind energy is that unlike solar energy that only used with sunlight, wind turbine can be useful all the 24 hours all the year. Another way of sustainability is that we should use in utilizing this renewable energy efficiently, and environmentally friendly. This, in turn will eliminate the environment hazard and improve Indian health and life style. Streets, public place, schools, and public facilities are consider as having good wind energy consumers, these consumers should be value to wind from time to time. The idea of this project is to convert this wind by using Vertical Axis Wind Turbines (VAWT) to a useful energy by using it as a power source that can serve these consumers. The objective of this our project is gaining power from wind. Therefore, this project is green source of energy and has no effect on the life of environment. Another objective of this project to learn about wind energy and different ways of convert it to a useful power. A vertical axis wind turbine is used to generate electricity. The kinetic energy of the wind is converted into electrical energy**.** Efficiency can be increased by using vertical axis wind turbine, in comparison to a normal wind mill. It need not oriented into the direction of the wind. For the power generation it is dependant only on the wind velocity.

2. MATERIALS:

TABLE 1.1

Specification of the wind turbine

BLADE DIMENSIONS	SHAFT DIMENSIONS
Height-1000mm	Length-1300mm
Width-370mm	Diameter-20mm

TABLE 1.2

S.NO	MATERIAL	QTY
1	Blades	2
2	Shaft	1
3	Bearing	1
4	Spur gear	2
5	Generator	1
6	Wire	As per required

Blades

Materials that are naturally used for the rotor blades in wind turbines are mild steel plate. Which is light weight where The acknowledged density of mild steel is 7.85 g/cm^3 (0.284 lbs/in^3). Depending on the alloy elements added to manufacture specifications this can vary between 7.75 and 8.05g/cm^3. Then the Thicknesses available range from 3mm and sizes range from 2000 x 1000mm. The blade is manufactured at the size of length upto1000mm and width is 370mm. The blade was design in Twisted Savonius method. This Twisted Savonius is a modified savonius method with is one of the Subtypes of the vertical axis design.

Shaft

A **shaft** is a rotating machine element, usually circular in cross section, which is used to transmit power from one part to another, or from a machine which produces power to a machine which absorbs power.

Shaft designing the shaft of blades it should be appropriately fitted to the blade. The shaft should be as possible as less in thickness & light in weight for the blade, the shaft used is very thin in size are all properly fitted. So no problem of while working, it is made up is having very light weight. Length of shaft & diameter are 1300mm & 20mm respectively. And at the top and bottom ends mild steel.

Bearing

A **bearing** is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. There are different type of bearing, each Bearings are classified broadly according to the type of operation. In here ball bearing is used The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. The Bearing has diameter of 20mm. Bearing are generally provided for supporting the shaft and smooth operation of shaft. Greece is used for bearing maintenance

Spur gears

Spur gears or *straight-cut gears* are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Though the teeth are not straight-sided , the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears mesh together correctly only if fitted to parallel shafts. Here the two spur gear used with different size. The gear use to increase speed of the rotation to improve output power.

Generator

Generator that converts mechanical energy to electrical energy in the form of alternating current. The generator also refers as a alternator which is used to produce current. An alternator that uses a permanent magnet for its magnetic field is called a magneto. Alternators in power stations driven by steam turbines are called turbo-alternators. Large 50 or 60 Hz three phase alternators in power plants generate most of the world's electric power, which is distributed by electric power grids.

3. METHOD:

The method applied in this project can be divided into 4 different phases. There are design of blades, component selection, assembly and testing.

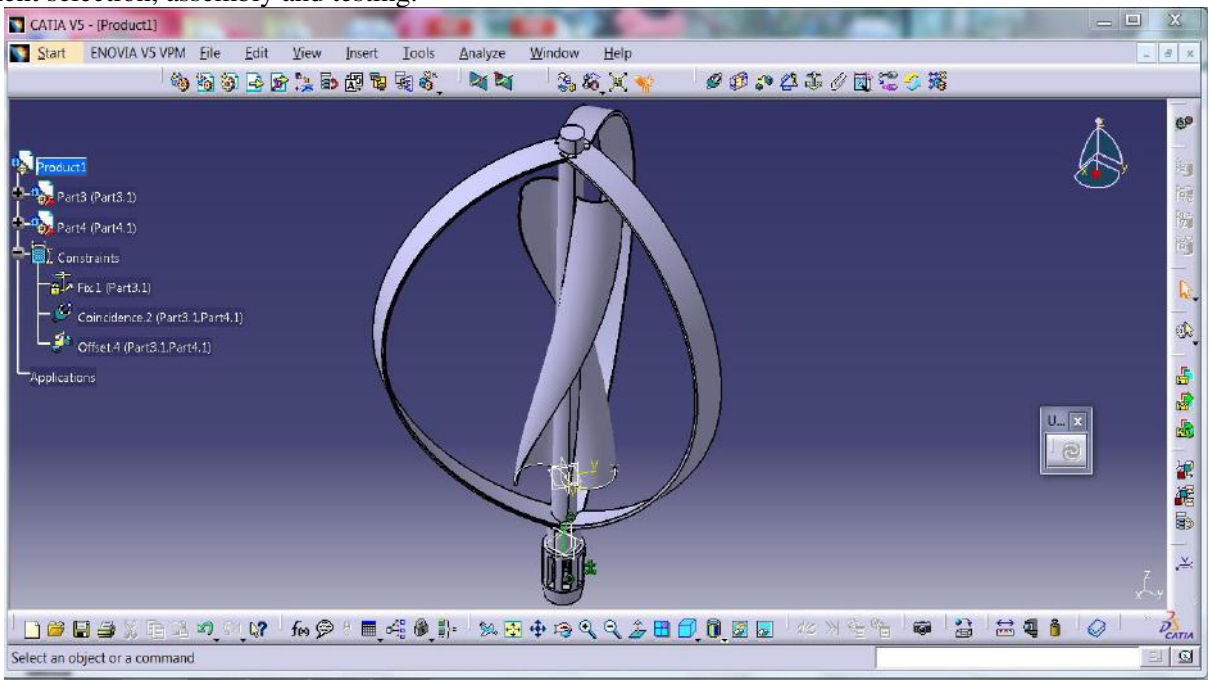

FIGURE 1.1

4.1Design:

Design of blade Wind turbine blades have on aero foil – type cross section and a variable pitch. While designing the size of blade it is must to know the weight and cost of blades in the project Three blade with vertical shaft are used, it has a height & width of 1000mm & 370mm respectively. The angle between two blades is 600. So if one Blade moves other blades comes in the position of first blade, so the speed is increase. And the overall design is done in catia.

4.2Component selections

The components are used in this are shaft, bearing, generator, gears, which are specify Selected. Design of Bearing For the smooth operation of Shaft, bearing mechanism is used. To have very less friction loss the two ends of shaft are pivoted into the same dimension bearing. The Bearing has diameter of 20mm. Bearing are generally provided for supporting the shaft and smooth operation of shaft. Greece is used for bearing maintenance.

Shaft designing the shaft of blades it should be properly fixed to the blade. The shaft should be as possible as less in thickness & light in weight for the blade, the shaft used is very thin in size are all properly fitted. So no problem of slip & fraction is created, it is made up is having very light weight. Length of shaft & diameter are 1300mm & 20mm respectively. And at the top and bottom ends mild steel. And other components are selected as per the requirement.

4.3Assembly

The components of the full-scale VAWT are assembly from Base with is made by iron and Shaft was mounted on base along with Bearings, then gear are fixed in the one end of the shaft and another gear is fixed with alternator the two gears are meshed and battery are connected to alternator for power supply and then the blades are fixed in the shaft and each parts are weld or fixed as per the design.

4.4Testing

After the assembly is done the VAWT is testing and verifying the working process. Then output power generated by wind generator is measured by using multi meter.

4. DISCUSSION:

Use of non-renewable energy sources and pollution causing sources for the generation of power is the main cause of depletion of important energy sources and the pollution of the environment. This is the main cause of discomfort to the humans. By the usage of Vertical axis wind turbine, we can harvest power without harming environment because it is pollution free and it is a green energy. It is the simplest way and efficient way of converting wind energy into electrical energy.

5. CALCULATION:

The average natural wind speed in India to be 5.3m/s. Density of air 1.225kg/m^3.Turbine 1.2m diameter and 1.0m in height. The power of the wind is given by,

$Pw= ½ \rho A u^3$

Where

Pw - power of the wind (W)

ρ - Air density (kg/m3)

A - Area of a segment of the wind being considered (m^3)

U - Undisturbed wind speed (m/s)

A= D lb

Where

A- Swept area (m2)

D-diameter of the turbine (m)

Lb- length of the turbine Blades (m)

A= (1.2) * (1.0)=1.2m2

Pw=1/2 * (1.225) * (1.2) * $(5.32)^3$=110.66watt

Wind velocity (m/s)	**Output power(W)** (Theoretical)	**Output power (W)** (Experimental)
4m/s	47.04	38.33watt
5.5m/s	117.2watt	96.92watt
6m/s	156.03watt	118.13watt

6. WORKING PRINCIPLE:

- The energy of the winds rotates two or three blades around a rotor.
- When the wind moves the fan, kinetic energy is created.
- The rotor is connected to a shaft and the shaft is coupled with multiple gear.
- The gears increase rotation of the rotor from 18 revolutions to 1800 revolutions per minute.
- Then the main shaft is connected to a Motor.
- The kinetic energy uses magnets spinning within coil and convert kinetic energy to electrical energy inside the motor.

7. ANALYSIS:

- Vertical axis wind mill can even start rotating at a low wind speed of 4 m/s.
- It does not create much stress on support structure.
- Wind energy can be popularized for domestic use.
- Efficiency of the vertical axis wind mill is higher than the normal wind mill.
- The direction of the wind is no problem as vertical axis wind mill is not dependent on direction of wind.
- It is environment friendly.
- Low maintenance cost.

8. RESULT:

- Can be used even in extreme weather conditions.
- It is definitely an eco-friendly product.
- Cleaner way to create electricity.
- High efficient at low cost.

9. CONCLUSION:

The primary aspire of this project is to bring a eco-friendly product with can be used in house, parks, apartments etc., In this product many specific empirical studies have been carried out and we have tried to improve the efficiency of vertical axis turbine further. Our main focus was increasing efficiency and making it more reliable and durable. We made all the blades to work simultaneously for higher efficiency. We have tried to reduce noise pollution and reduce the vibration bearing wear to increase the efficiency. With the assumption of placing the turbine in a location with moderate wind availability with optimized blade parameters and design specifications, high power generation is achieved with vertical axis wind turbine and can be serving as energy generation unit for remote areas.

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