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# Design and Performance Study of Hybrid Solar Wind Turbine for Generation of Electricity

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**ABSTRACT**

**This project dwells on the implementation of an alternate configuration of a wind turbine for power generation purposes. A vertical axis wind turbine (VAWT) is introduced technology to optimize the performance. The system utilize solar energy with wind energy simultaneously to overcome the problem of traditional wind turbine or solar panel. The wind turbine is expected to bring wind power technology to the next level. Furthermore, the system can be suited in use for rural and urban areas of low wind speed regions. The selection of materials in the design of wind turbine system will be discussed. A model of hybrid solar-wind turbine is built to perform several tests such as starting wind speed, rotational speed at constant wind speed, and time taken to stop rotation completely. The results obtained will be compared with the model of conventional wind turbine. The present day methods are not sufficient to keep pace with ever increasing demand. The recent severe energy crisis has forced to think & develop the power generation by renewable sources (mainly solar and wind).**

**Key words: - Vertical Axis Wind Turbine(VAWT), Renewable Sources, Solar Panel**

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## I. INTRODUCTION

Wind power is the conversion of wind energy into a useful form of energy using wind turbines. A wind turbine is a machine that converts the kinetic energy of the wind into mechanical energy. Wind turbine is a device that utilizes wind energy to generate mechanical or electrical power. There are two types of wind turbines: Horizontal Axis Wind Turbine (HAWT) and Vertical Axis Wind Turbine (VAWT). HAWTs are the most commonly known types of wind turbines which operate parallel to the direction of the wind whereas VAWTs rotors operate perpendicular to the direction of wind and are very unpopular.

A typical photovoltaic system is made of 36 individual 100 cm² silicon photovoltaic cells and auxiliary devices which are lead-acid batteries with a typical voltage of 5 V. This system has the capacity of producing more than 12V during cloudy days and can charge a 12 V battery.

## II. DIFFERENT COMPONENTS

### A. Solar Plate

The solar plate is the main components of model that harvest solar energy from sun rays. The basic specification of the solar plate is 5V and 3 Amp. It is mounted on top of the model as shown in Fig. 1

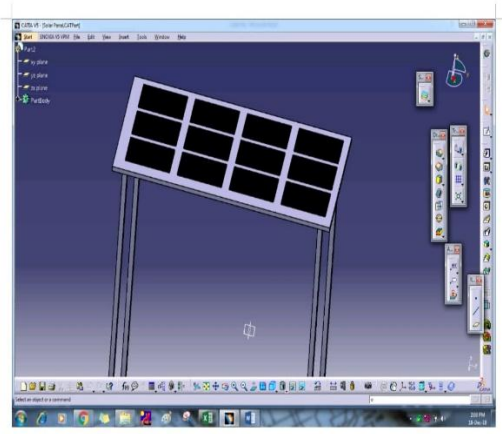

Fig. 1 Solar Plate.

 

### B. Turbine Rotor

Vertical axis wind turbines are different from traditional wind turbines in that their main axis is perpendicular to the ground. Their configuration makes them ideal for both rural and urban settings and offers the owner an opportunity to offset the rising cost of electricity and to preserve the environment. Besides, they do not need the complicated head mechanisms of conventional horizontal axis turbines. VAWTs are not affected by the direction of the wind which is useful in areas where the wind changes direction frequently or quickly. Fig. 2

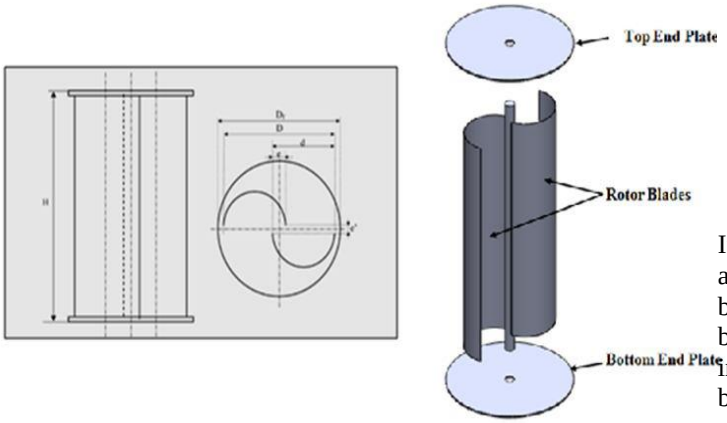


Fig. 2 Turbine Rootor

### C. Dynamo

For generation of electricity from the designed our vertical axis wind turbine, we chose a Bicycle dynamo which has the capacity to light a bulb of 6V. A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter.

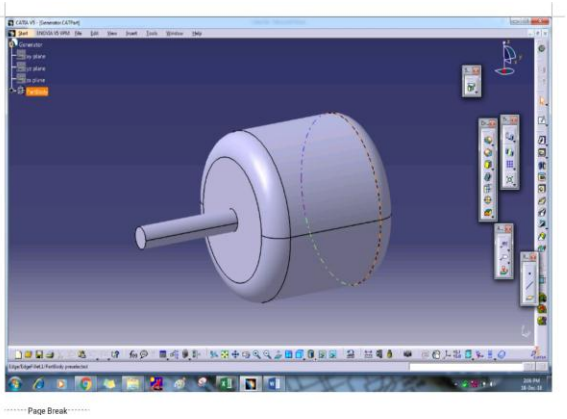

Fig. 3 Dynamo

### D. Shaft of Turbine

Shafts form the important elements of machines. They are the elements that support rotating parts like gears and pulleys and in turn are themselves supported by bearings resting in the rigid machine housings. The shafts perform the function of transmitting power from one rotating member to another supported by it or connected to it. Thus, they are subjected to torque due to power transmission and bending moment due to reactions on the members that are supported by them. Shafts are to be distinguished from axles which also support rotating members but do not transmit power.

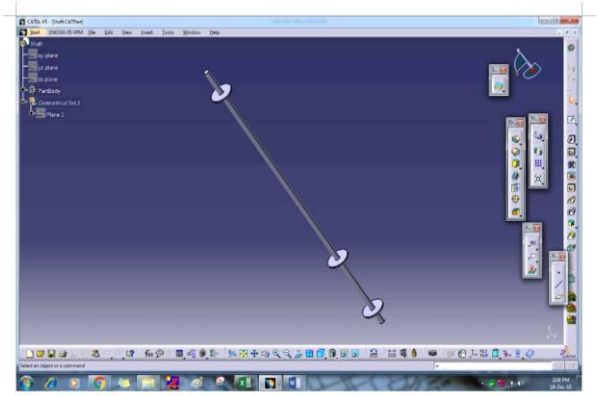

Fig 4. Shaft of Turbine.

### E. Blade of Turbine

In the project two blades with vertical shaft are used, it has a height & width of 30 cm & 30 cm respectively. The angle between two blades is 180. So if one Blade moves other blades comes in the position of first blade, so the speed is increases. Although the turbine was designed with a set of blades for each of the two tiers, for simplicity and low cost, a single Shape was used in the prototype in only a single tier. It was created using MS Sheet, Diameter buckets. The buckets were cut into 2" half cylinder ribs and attached to the Mild steel frame.

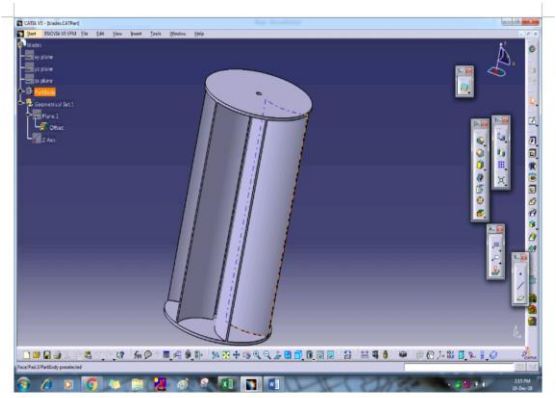

Fig 5. Blade of turbine

## III. WORKING PRINCIPLE

The basic working principle of a wind turbine is: When air moves quickly, in the form of wind, and their kinetic energy is captured by the turbine blades. The blades start to rotate and spin a shaft that leads from the hub of the rotor to a generator and produce electricity. In general, they are two types of wind turbine according to the axis they are rotating about. Horizontal axis wind turbine (HAWT) is the type of wind turbine which has a main rotor shaft and electrical generator at the top of tower and pointed to the direction of wind. Most of them possess a gear box which turns the slow rotation of turbine blades into faster rotation that is more suitable to drive an electrical generator. As for the Vertical axis wind turbine (VAWT) consists of generator and gearbox which are placed at the ground and thus there is no need for a tower to support them as in HAWT. The main rotor shaft is arranged vertically to allow

 

the turbine blades rotate without facing to the direction of the wind. In VAWT system, the generator and gearbox is placed on the ground rather than on the top. There is no need of the support from a tower make it more accessible for maintenance.

Also, to get an idea of inner arrangement a sectional view of the machine is shown in Fig. 8. The inner cross section of the main body holds the lead screw in order to carry the raw material from the hopper to the pockets.

## IV. CONCLUSION

Over all, the vertical axis wind turbine was a success. The rotors that were designed harnessed enough air to rotate the stator at low and high wind speeds while keeping the centre of mass closer to the base yielding stability. The wind turbine rotors which allowed for a smooth rotation with negligible friction. The home for the hybrid solar vertical axis wind turbine would be in residential areas. Here it can be mounted to a roof and be very efficient and practical. A home owner would be able to extract free clean energy thus experiencing a reduction in their utility cost and also contribute to the "Green Energy" awareness that is increasingly gaining popularity.If the magnets were pulled in closer to one another, the magnetic field density would be much greater allowing for more power to be induced into the coils. If a more heavy duty material was used in future design then it would allow for more precision in magnet placement. In terms of large scale power production, vertical axis wind turbines have not been known to be suitable for these applications. In terms of large scale power production, vertical axis wind turbines have not been known to be suitable for these applications.

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