Design and Fabrication of Savonius Wind Turbine

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I. INTRODUCTION

Now a day, the electricity is generated from conventional energy sources. These sources will be at the end of the scale. For save this sources, we will be must use the renewable energy sources. The wind energy is the one of the big energy source of renewable energy sources. The wind mill are used the wind power for produce the electricity. Wind is the form of solar energy. Wind is created from the atmosphere of the sun causing areas of uneven heating. In conjunction with the uneven heating of the sun, rotation of the earth and the rockiness of the earth's surface winds are formed. This wind energy strikes on the blade of turbine which rotate the turbine. This rotation of turbine shaft rotates the shaft of generator which is coupled together. The mechanical energy of wind is converted into the electrical energy. For reducing the friction between the bearing and shaft we are use the magnetic levitation. Magnetic Levitation are suspended the shaft in air without contact with steady side part of wind mill. This totally neglects the Friction between the shaft of rotor and the stator assembly. Vertical axis wind turbine is the best option for the acquired the wind energy from all the direction. Vertical axis wind turbine has not required any yaw mechanism. It is simple in construction. The Savonius turbine is to be used for this vertical axis wind turbine. The Savonius wind turbine is rotated at the low speed wind turbine is rotated at the low speed wind, due to the minimization of friction between shaft and stator the total wind speed of turbine observed passes to the generator. This turbine is worked at the low wind speed. This turbine gives the maximum power than any other wind mill. We are created the design of Savonius turbine

II. LITERATURE REVIEW

A review on the performance of Savonius wind turbines was carried out by surveying various journal papers. Joao Vicente et al., studied and published a paper on “Renewable and sustainable energy, an overview” and revealed that the performance of Savonius wind turbines are powerful turbine in the production of energy sector. And also stated that this type of turbine is unusual and its application for obtaining useful energy from air stream is an alternative to the use of conventional wind turbines. Simple construction, high start-up and full operation moment, wind acceptance from any direction, low noise and angular velocity in operation, reducing wear on moving parts, are some advantages of using this type of machine.

Another author Ian Ross, Aaron Altman et.al. published in his journal entitled “Journal of Wind Engineering and Industrial Aerodynamics”,523-538, 2011, An investigation on wind turbine is done and on wake and solid blockage effects of vertical axis wind turbines (VAWTs) in closed test-section wind tunnel testing is described. Static wall pressures have been used to derive velocity increments along wind tunnel test section which in turn are applied to provide evidence of wake interference characteristics of rotating bodies interacting within this spatially restricted domain. Vertical-axis wind turbines present a unique aerodynamic obstruction in wind tunnel testing, whose blockage effects have not yet extensively investigated.

Following observation are collected by referring more than ten journal papers and only two journals are mentioned here,. The findings are as described below.

Most commonly, very large, horizontal-axis turbines are constructed in fleets that are connected to national level electrical grid systems. More recently, there has been a desire for more local, small-scale power production that can be used to power very specific pieces of equipment or buildings. Some of the small-scale turbines are designed differently from their larger counterparts—they are driven by drag forces rather than by lift. Drag-driven turbines are typically called Savonius turbines. This paper, which presents a historical perspective on Savonius turbines, will illustrate their potential for providing local power. Finally, we will discuss recent developments in analysis methods which intend to optimize Savonius turbines for powering cellular communication towers in developing parts of the world Despite having a low efficiency, its design simplicity, low cost, easy installation, good starting ability, relatively low operating speed, and independency to wind direction are its main rewards. This paper attempts to give an overview of the various augmentation techniques used in Savonius rotor over the last four decades.

In view of this, the present paper, attempt is made to design and fabricate a new model of savinous wind turbine which suites for the Indian road conditions and can also be used as model in education institution.

III. OBJECTIVE

The main objective of our project is to use the maximum amount of wind energy. The unused considerable amount of pressurized air used to drive the vertical axis wind turbine from which the kinetic energy of turbine is converted into electrical energy. The main aim of this paper is to reduce the pollution produced by burning of fossil fuel. The generated energy by VAWT and solar system are stored in a battery and this stored energy which can be used street lighting.

IV. METHEDOLOGY

The savonius wind turbine is used to convert the kinetic energy into mechanical energy. The light weight blade materials (mica sheet) are used for making the vertical axis wind turbine. The height of blade is 0.8 meter and width of blade is 0.33 meter. The whole turbine is assembling with collar and blades which is fitted by nut bolts. To achieve the unidirectional motion of the turbine the blades are bended by 200 angle curve shape and shaft of the turbine connected to the shaft of generation.

V. COMPONENTS AND DESCRIPTION

The main components are

1 Turbine blades

2 DC generator

3 Shafts

4 Battery

5. Inverter

5.1 PRODUCT DESCRIPTION

Blade weight (mica sheet) = 2.5kg

Shaft weight= 1.5 kg

Width of blade= 13 inch= 0.33 meter

Area = diameter * height =0.68 * 1.09 = Area = 0.7412 m^2

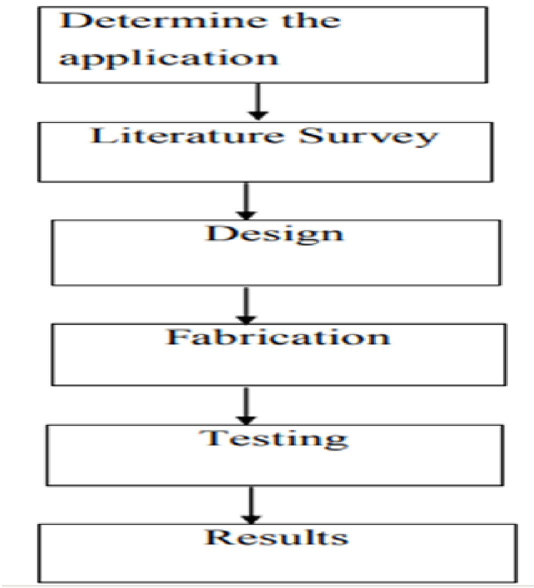


Figure: 1 Methodology flow chart

5.2 DC GENERATOR

VOLT: 12V TYPE: PMDC

RPM: 100 RPM

BALL BEARINGS SIZE: 20 X 45 X 12 MM

MATERIAL: STEEL 6.3

BATTERY Material: Lead-Acid Free maintenance Battery

Output Voltage: 12 V D.C

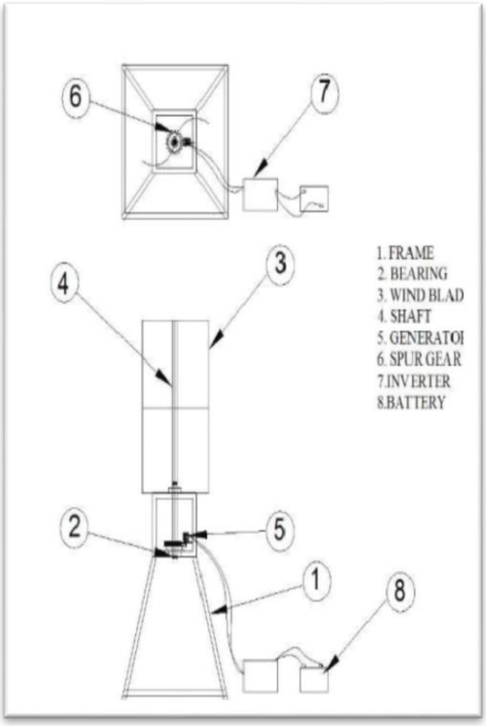
Output Power: 7.2 Ampere-Hours

VI. DESIGN PARAMETERS

- Diameter of blades (d) =150 mm
- Gap (e) = 0.15xd = 0.15x150 = 22.5mm
- Rotor diameter (D) = d+d-e =150+150-22.5 =277.5mm
- Rotor height (h) = 1000mm
- Thickness of blades (t) = 2mm
- Assume Tip Speed Ratio (TSR) = 6 Velocity of air = 5m/s Density of air = 1.2 kg/m3
- Velocity of blade = TSR x Velocity of air = 6x5 = 30 m/s
- Swept area (A) = πxDxh = 3.142x0.2775x1 = 0.871 m3
- Co-efficient of power (CP) = π/8 x h x D x V3 = 0.36 x 1 x 0.2275 x 53 = 12.48 W
- Angular velocity (ω) = (N x π)/30 = (450 x π) / 30 = 47.12 rad/sec
- Torque = P/ ω = 12.48 /47.12 = 0.26 Nm

VII. WORKING PRINCIPLE

In our project, both the rotor and the stator are made to rotate in the opposite direction so that be induced which results in the higher power generation compared to the normal method. The outer hub is coupled with the rotor that is connected to the frame with the help of the bearings. We use the spur gear to run the wind mill. Outer rotor coupled with gear arrangements with shaft. The two bearings are fixed at the bottom of the rotor shaft. The generator can be used to store the energy whenever the rotation of blades. When the rotors are rotated by wind energy, when the blades are to produce the power then stored in generator. The rate of power production is higher than the conventional type wind turbines. The generated energy can be stored by the inverter and the battery for the future purpose.



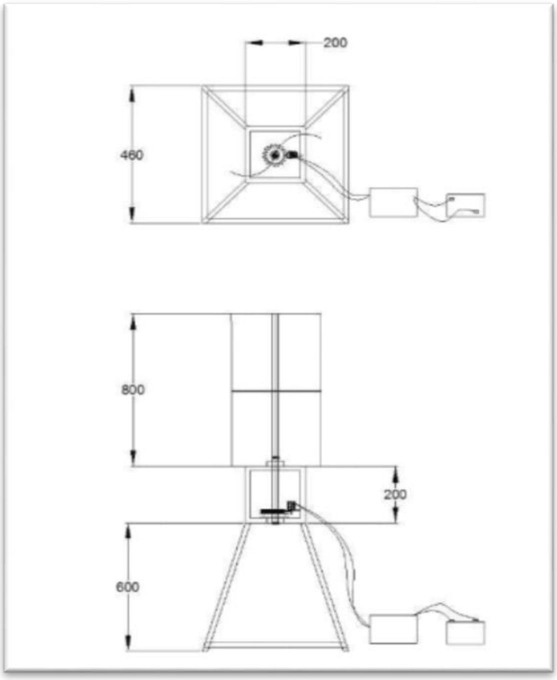


Figure 2: Savonious Wind Turbine

8. CONCLUSION

A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informational different levels of hierarchy. This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We are proud that we have completed the work with the limited time successfully. The "savonius wind turbine" is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus we have developed a "savonius wind turbine". By using more techniques, they can be modified and developed according to the applications.

ANNEXURE

Figure 3: Fabricated Model

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