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Vertical Axis Wind Turbine

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Abstract –

The key components of a vertical-axis wind turbine (VAWT) are located at the base of the turbine, with the primary rotor shaft aligned transversely to the wind. Because of this arrangement, maintenance and repairs are made easier because the generator and gearbox are located close to the ground. The parts of a vertical axis wind turbine include the blade, shaft, bearing, frame, and blade support. In short, the rotor rotates because of the dynamic pressure exerted by the wind on the blades. Concurrently, the opposing side of the blades encounters aerodynamic hindrance, occasionally referred to as "drag." We experience something similar when we run or cycle: airflow is constantly working against us.

Key Words: Turbine, Dynamic pressure, Rotar resistance, Shaft.

1.INTRODUCTION

The goal of this project is to develop and build a wind turbine that uses vertical axis wind turbines (VAWT) to transform wind energy into useful electricity. Kenya's current electricity consumption is much more than its average. The focus of such end ever thought to be on exploring alternate energy sources in light of the rising demand. Using renewable energy sources such as rivers, wind, and the sun is one of the best methods to apply the concept of sustainability to the production of energy. The benefit of wind energy is that wind turbines can be used 365 days a year, round the clock, unlike solar energy, which can only be used in the presence of sunshine. Another definition of sustainability is the best possible use of renewable energy sources while yet being environmentally friendly. Consequently,

2.OVERVIEW OF THE PROJECT

In this project, Vertical Axis Wind Turbines (VAWT) will be used to design and build a wind turbine that can transform wind energy into useful energy. Kenya currently uses a lot more electricity than it does on average. Given the growing demand, that effort ought to be focused on exploring alternate energy sources.

One of the best ways to use the concept of sustainability in energy production is to employ renewable power sources, such as the sun, wind, and rivers. Wind turbines can be utilized 365 days a year, 24 hours a day, which is an advantage over solar energy, which can only be used in the presence of sunshine. Another concept of sustainability concerns the most efficient use of renewable energy sources while upholding environmental integrity.

• Oil uses a lot of water, which leads to water pollution and thermal discharge. It also adds to air pollution and greenhouse gas emissions. Solid waste and hazardous sludge are produced by oil.

• Oil extraction and refining have an adverse effect on the environment.

• Oil transportation poses environmental hazards.

•One non-renewable source of electricity is oil. These negative consequences on the environment force us to give renewable energy sources, which reduce environmental risks while enhancing lifestyle and health, careful consideration.

One important energy source is wind power. The concept of wind energy is the conversion of kinetic energy to mechanical energy. Blades turned by this energy turn generators, which produce electricity. Wind power is a good fit for our project. This project's goal is to use the Vertical Axis to produce power from wind.

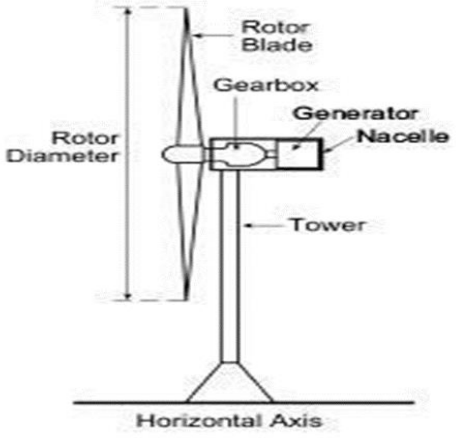

Fig -2.1Figure

Wind turbines with a vertical axis (VAWTs). The most common kind of turbine used by homeowners to turn their houses into renewable energy sources is the VAWT. VAWT is used less frequently than Horizontal Axis Wind Turbines. This is because VAWT is less effective than HAWT in terms of power plant generator efficiency. However, VAWT works better at smaller scales, as those seen in homes, parks, and businesses. Vertical axis turbines can be powered by wind from either direction; in fact, certain types of turbines can capture wind from both above and below. Vertical axis wind turbines are thought to be appropriate for sites with variable wind conditions or when the turbine cannot be positioned high due to their versatility.

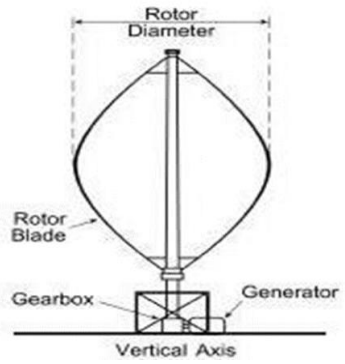

Fig -2.2: Figure

3.WORKING PRINCIPLE OF VAWTS

Savonius Wind Turbines: The Turbine of Resistance The Savonius wind turbine's operation principle. The Resistance Runner's Path Savonius wind turbines are essentially designed like fusilli pasta or DNA due to the helix-shaped blades that surround the vertical shaft. The wide, solid blade wind-receiving area of a Savonius wind turbine is one of its most crucial features. When Savonius wind turbines are in operation, their rotors are propelled by a flow resistance mechanism. In short, the rotor rotates because of the dynamic pressure exerted by the wind on the blades. The other side of the blades encounters aerodynamic resistance, or "drag," concurrently. Because the air is always pushing against us whether we run or cycle, this is comparable to how we feel.

a) Darrieus: The Man Who Lifts Up: Traditional The long, curving wings of Darrieus turbines, which bear the name of their French inventor, Georges Darrieus, are coupled to the top and bottom of the rotor shaft. Occasionally, they are called the "egg-beater." Another type of Darrieus turbine is characterized by three straight wings that are joined to the shaft in a parallel manner to form a "H" shape. Lift is the aerodynamic force that causes Darrieus to rotate. As the wind blows around the building, it creates a suction on the front side of the turbine, which rotates the wings. Because of the way their wings are made, they experience less drag than Savonius turbines. Once rotation commences, Darrieus wind turbines have the capacity to accelerate to a speed greater than the wind. Wind is created when the earth heats unevenly due to sun radiation. Wind is created when pressure changes in the atmosphere are brought on by this uneven heating. The wind can then be harnessed using a wind turbine. When wind drives a turbine's blades, a generator fixed to the shaft's axis produces electricity that may be fed into the grid and used in residences. (windies.gov, 2012) Wind turbines are an environmentally friendly way to generate electricity, but they also have a lot of negative aspects. One problem is that wind farms need a lot of land to provide adequate energy for towns and neighbourhoods, and they are quite expensive to develop and install.

b) Power Density Wind speed and power can be significantly influenced by geographic considerations. Understanding these facts is crucial before putting in a wind turbine. A simple calculation to calculate the average power generated by wind is: Equation 1 emphasizes the importance of wind speed in power generation since power generation rises proportionately as wind climbs to the third power. Wind turbines can be positioned to generate electricity in the most efficient locations bycalculatingthepowerdensity.

c)The wind speed The height of the turbine rotor is an additional important factor. One of the primary causes of wind turbine expenses is the increase in wind speed with turbine altitude, which boosts the generator's power production. The equation that represents the power model

4. POTENTIAL RANGE:

The Indian offshore wind power industry is predicted to expand quickly through 2027, with yearly installations estimated to go from 1.8 GW in 2022 to 2.8 GW starting in 2023, 3.7 GW in 2024, and, in the base scenario, five gigawatts in 2025. Between 2023 and 2027, there is a potential for 21.1 GW of wind installations in India.

5. ADVANTAGES:

Advantages of VAWT:

1) Compared to HAWT, it generates less noise and vibration.
2) Since the motion of the wings is perpendicular to the wind speed, no particular orientation or swing control system is needed.
3) It can produce power in lower wind conditions. Making Use of VAWT Street lighting becomes self-sufficient as they depend less on the grid.

6. CONCLUSIONS

It is observed that, this is a very good efficiency when compared to a horizontal axis wind turbine, which has an efficiency of 35%. With their many designs, the VAWTs currently on the market have an efficiency of 17%. It is nevertheless possible to see the production of practical energy out of thin air, despite the apparent low efficiency. Our high dead weight was one of the causes of our low efficiency. These wind turbines have the major advantage of being able to operate at lower heights than horizontal axis wind turbines, which enables them to be installed on individual homes for particular uses.

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