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Review Paper on Magnetically Leviated Vertical Axis Wind Turbine

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A B S T R A C T

The vertical axis concept for the wind turbine that will be used as part of this project's power generation. It has the feature of being fully supported and rotating around a vertical axis. This axis runs vertically through the centre of the wind sails, allowing for a different type of rotational support than the standard ball bearing system. This support is known as maglev, and it is based on magnetic levitation. Magnetic levitation is a phenomenon that is based on the repulsion properties of permanent magnets. Maglev is a method of suspending an object using only magnetic fields for support. Magnetic pressure is used to counteract the effects of gravitational and other accelerations. The primary advantage of a maglev wind turbine is the use of magnets for blead levitation rather than ball bearings. Maglev provides a near frictionless replacement for ball bearings that requires little to no maintenance. So, to reduce friction and increase efficiency, use magnetic levitation.

Keywords:Maglev, Vertical Axis Wind Turbine, Vertical Type, Renewable energy, Energy generation.

1. INTRODUCTION

Non-conventional energy is electricity produced from renewable sources such as wind power, solar power, geothermal energy, hydropower, and various forms of biomass. Because of their constant replenishment and availability for use over and over, these sources have been dubbed renewable. Due to the exhaustion of traditional power generation techniques, renewable energy has seen a significant increase in popularity in recent years. Wind power in India has a potential of 20,000 MW. Wind power accounts for nearly 9.87 percent of India's total installed capacity. Wind energy is usually produced in India's southern states. For human development to thrive, we will eventually need to seek for renewable or nearly inexhaustible sources of energy. Renewable energy is generated electricity from renewable sources such as wind, solar, geothermal, hydropower, and various kinds of biomass. Due to the exhaustion of conventional power generation methods, the popularity of renewable energy has skyrocketed in recent years. Exploration of renewable energy sources is the only way to reduce our reliance on fossil fuels. Wind energy is one of the fastest growing renewable energy sources, growing at a rate of 30 percent per year on average. A wind turbine is a device that converts the kinetic energy of the wind into electrical energy. Wind turbine blades turn at a constant velocity of 13 to 20 revolutions per minute, depending on technology, whereas the velocity of the rotor varies in relation to the velocity of the wind to achieve greater efficiency. This project introduces the structure and concept of the proposed magnetic levitation wind turbine for better wind energy utilization. Maglev Wind Turbine has no mechanical contact, no friction, and so on, reducing damping in the magnetic levitation wind turbine, enabling the wind turbine to start up with low-speed wind and work with breeze. With magnetic levitation, the Maglev vertical axis wind turbine (VAWT), which was first unveiled at the Wind Power Asia exhibition in Beijing, is expected to take wind power technology to the next level. Magnetic Levitation (Maglev) is being used in a turbine system to improve efficiency. If the efficiency of a wind turbine is increased, more power can be generated, reducing the need for expensive, polluting power generators. Because one of the most common complaints about wind turbines is the noise they make, this is a significant advantage over other turbine designs.

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2. LITERATURE REVIEW

Mr. SharangdharDehadrai, et al. [1] presented a paper titled, 'Study on Magnetic Levitation for Vertical Axis Wind Turbine and Low Wind Speed'. This paper presents the design component aspects of a Magnetically levitated Vertical Axis Wind Turbine and to report the result analysis using a modified magnetic circuit. The modified magnetic circuit generator reported and tested with the built-in MAGLEV-VAWT. The position of the blades to derive maximum velocity is analyzed. The degree of impact at angle of 300 is found to have the highest lift coefficient. The system is investigated with and without the maglev structure.

D. A. Nikam, et al. [2] presented a paper titled, 'Literature review on design and development of vertical axis wind turbine blade. This review work focuses on various stages for design and development of optimized vertical axis wind turbine which will studies various parameters such as general wind energy scenario, different available energy extraction methods, design and aerodynamic performance analysis of vertical axis wind turbines. Project work will include Optimization of design parameters of vertical axis turbine blades considering different parameters such as geometry orientation in assembly.

Mayur Patel, et al. [3] presented a paper titled, 'Design, Analysis & Fabrication of Maglev Vertical Axis Wind Turbine'. This paper presents magnetic pressure is used to counteract the effects of the gravitational and any other accelerations. The principal advantage of a maglev windmill from a conventional one is, as the rotor is floating in the air due to levitation, mechanical friction is totally eliminated. That makes the rotation possible in very low wind speeds, which is the new direction to improve the performance of wind turbines. In this project work, magnetically levitated (maglev) wind turbines are designed and developed. The choice for the model is to showcase its efficiency in varying wind conditions as compared to the traditional horizontal axis wind turbine and contribute to its steady growing popularity for the purpose of mass utilization in the near future as a reliable source of power generation.

Nirav Patel, et al. [8] presented a paper titled, 'Design and Performance Analysis of a Magnetically Levitated Vertical Axis Wind Turbine Based Axial Flux PM Generator'. This paper presents an innovative concept to design of a magnetically levitated axial flux permanent magnet generator used in vertical axis wind turbine (VAWT). Conventional PM axial flux generator's efficiency needs to be improved by reducing frictional losses. This novel design incorporates magnetic levitation concept using rare earth permanent magnets between dual rotors to reduce the losses research demonstrated a simple way to enable a darrieus VAWT to be self-starting and achieve higher efficiencies. Historically VAWTs cost more to operate and maintain than Horizontal Axis Wind Turbine. A counter rotating wind turbine with a freely rotating generator can produce higher amounts of power than common wind generators. The wind turbine rotors and Stator levitated properly using permanent magnets which allowed for a smooth rotation with negligible friction. At moderate wind speeds the power output of the generator satisfied the specifications needed to supply the LED load. The project as an overall system we found that it functioned properly but there feel limited the amount of power it could output.

3. MAGLEV VAWT

The phenomenon operates on the repulsion characteristics of permanent magnets which is known as maglev. Using a pair of permanent magnets like neodymium magnets and substantial support magnetic levitation can easily be experienced. By placing these two magnets on top of each other with like polarities facing each other, the magnetic repulsion will be strong enough to keep both magnets at a distance away from each other and which can be seen in Figure 1. The force created as a result of this repulsion can be used for suspension purposes and is strong enough to balance the weight of an object depending on the threshold of the magnets.

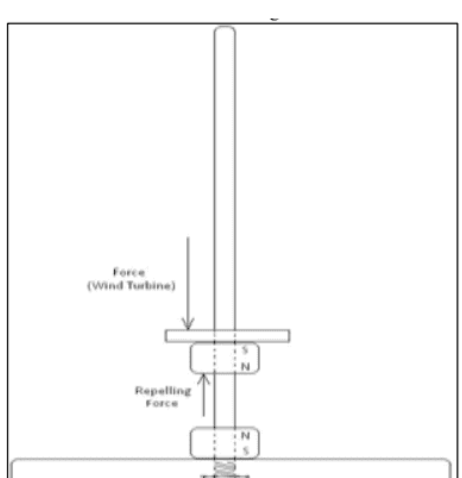

Figure 1: -Basic Magnet Placement

4. PROBLEM STATEMENT

The fast-growing demand for wind energy has led to a wide variety of wind turbine designs. A specific contemporary type is the vertical-axis wind turbine (VAWT), where the rotor shaft is oriented vertically and the generator and gearbox are placed at the base of the turbine. Compared with horizontal-axis wind turbines, VAWTs are generally considered more capable of handling highly turbulent, gusty wind conditions and rapidly changing wind directions. Since these conditions are commonly encountered in urban environments, this type of wind turbine can play a vital role in urban wind energy. On the downside, however, VAWTs are up to now generally less efficient and can be more prone to fatigue.

5. PROPOSED WORK

Voltage generated from Maglev wind turbine can be increased by increasing the number of turns of the coil in proportion with magnetic lines of force obtained from the permanent magnet. Therefore, greater thickness of the permanent magnets should be used while fabricating the axial flux generator. The Maglev windmill can be designed for using in a moderate scale power generation ranging from 400 Watts to 1 kW. Also, it is suitable for integrating with the hybrid power generation units consisting of solar and other natural resources.

6. CONCLUSION

VAWT provide an economically viable energy solution for both rural and urban areas. The blade design, such as height and diameter, is critical for turbine performance and energy extraction. Magnetic levitation has a bright future in wind power generation. Maglev wind turbines will require less wind velocity to start up and will perform better at lower wind speeds. Furthermore, it is clear from various literature reviews, journal papers, and articles that maglev VAWT is frictionless, less noisy, and more efficient.

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