A Review Paper on Vertical Axis Wind Turbine

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Abstract— Magnetic levitation is a method by which a body is suspended without any support with the help of strong magnetic field. The high energy produced by magnetic field is used to overcome the effects of gravity. In maglev windmills the rotor is suspended in air by means of maglev Due to this the mechanical friction is totally eliminated. The efficiency of maglev windmills is 1000 times the efficiency of the conventional windmill. Due to presence two types of blades the windmill is capable of generating power even at a low air velocity of About 1.5 m/s.

Key words: Vertical Axis Wind Turbine

I. INTRODUCTION

The latest renewable sources like solar energy, wind energy are very helpful in the cost cutting of the electricity bills of the families. From street lighting to apartments, renewable energy sources are starting to bring consistent power to the areas world-wide. Magnetic wind turbine is an ideal solution for the very big in size with the massive blades traditional turbines.

With the use of magnetic levitation technique in the vertical axis wind turbine which means there will be less moving parts, less maintenance, smaller in size and the important thing is that this blades will require less wind to start its working. With the less moving part another advantage is that there will be less friction.

The compact design of the vertical axis wind turbine makes it ideal for home use.

The magnet levitation is frictionless process which allows only small breeze of wind to turn it on and start producing power. The magnetic wind turbine has very small footprint.

WIND POWER The wind is the byproduct of the solar energy. The surface of the earth heats and cools unevenly, which creates the atmospheric pressure zones that makes air flow from high pressure to low pressure areas. Approximately 2% of the sun's energy reaching the earth is converted in to the wind energy.

The kinematic energy in the wind is a promising source of the renewable energy with significant potential in many parts of the world.

A. Wind turbines

Wind turbines are machines that generate electricity from the kinetic energy of the wind.

1) Classification of Wind Turbines

1) Horizontal wind turbines
2) Vertical axis wind turbine
3) Based on the location
4) Aerial wind turbine (not in practice)
5) Ducted rotor

B. Horizontal Axis Wind Turbine

The rotor blades of the main shaft is on the horizontal hub. The direction of wind is parallel to the axis of the rotation of rotor blades. The horizontal hub is connected to the gearbox and generator which are located inside the nacelle houses the electrical components are mounted at the top of the tower. There is a supporting tower to withstand the rotor and nacelle as well as wind kinetic energy. The horizontal wind turbine usually consists of two or three propeller like blades attached to a horizontal and mounted on the bearings at the top of the supporting tower.

1) Advantages of Horizontal Axis Wind Turbine

- Blades are to the side of the turbine's centre of gravity which helps stability
- The turbine collects the maximum amount of wind energy by allowing the angle of attack to be remotely adjusted.
- Most of them are self-starting.

2) Disadvantages of Horizontal Axis Wind Turbine

- It has difficulties operating near the ground.
- The tall towers and long blades are hard to transport from one place to another and they need a special installation procedure

C. Vertical Axis Wind Turbine

With the vertical axis wind turbine the concept behind the operation is similar to that of the horizontal designs. The major difference is the orientation of the rotors and generators which are all vertically arranged and usually on a shaft for support and stability. Their design makes it possible for them to utilize the wind power from every direction unlike the horizontal wind turbine that depends upon lift forces from the wind similar the lift off concept of an aeroplane.

Fig. 1.0:

1) Advantages of Vertical Axis Wind Turbine

- Since the components are placed nearer to the ground it has an easier access to maintenance
- Smaller cost of production, installation, and transport.

- Turbines do not needed to be pointed towards the wind in order to be effective.
- Blades spin at low velocity, thus there is less chance of bird injury.

With the world population increasing yearly and the resource of the non-conventional fuels decreasing very fast, it is very important to invest in the renewable resources. And also our use of fossil fuel is leading cause of the so many environmental issues. After consumption of the fossil fuel the by-product of it the carbon dioxide which the leading cause of the global warming. Based on the REN21'S 2017 report, renewable energy resources contributed 23.7 % to the human's global energy consumption in 2017-18. There are only few types of energy which do not produce carbon dioxide. These are nuclear power plants and renewable energy sources such as wind, solar, and hydro power plants. Renewable resources are the cleanest of all the options of generating the power cause there is no by-product's which can harm the environment or human beings. Other options like nuclear power plant produces nuclear waste which takes more than 100 years to disposed properly.

II. LITERATURE REVIEW

1) Pravesh K. Sahara, Tanveer A. Hussain, Sangita N. Kakde, Sujata R. Ingle, Ambikaprasad O. Chaubey, the objective of this paper is to write a review on all the parameters important for designing of Maglev Vertical axis wing turbine. Disc type Neodymium magnets are considered which are developed rapidly and applied widely due to their perfect characteristics. The author concluded that the design of the blades and rotors are capable enough to rotate at low wind speed and give the output. The magnets are levitated properly while working which gives smooth rotation and hence there is negligible friction.
2) Chinnu Sara Thomas, Dhanya Varghese, Jayalakshmi S, Sonu SavyThomas George, Rini Varghese P, the aim of this project work is to design a Vertical axis magnetic levitated wing turbine as an alternative for conventional wind turbine. Author has considered Two ring type neodymium (Nd-Fe-B) magnets of grade N52 of outer diameter 28 mm, inner diameter 10 mm and thickness 12.5 mm are placed at the shaft, by which the required levitation between the rotor and the base is obtained. The Experimental result shows that maglev wind turbine rotate at minimum wind energy of 1.45m/s as compared to conventional turbine which required 4.475m/s.
3) Vishal D Dhareppagol, Maheshwari M Konagutti, the objective of this thesis work is to design and implement a magnetically levitated vertical axis wind turbine system that has the ability to operate in both low and high (1.5m/s to 40m/s) wind spee Conditions. The no of blades used for this turbine is 6 which are placed such that the angle between two adjacent blades is 60 degree. Each blade is fixed between the two discs with 30degree deviated. The length to diameter ratio is kept as 1 for better performance of turbine. Producing 20% more energy than a conventional turbine, at the same time decreasing operational costs by 50% over the traditional wind turbine
4) Shubham Patil, Pratik Kumbhar, Oslaniya Siddhartha, Patil Rohit, C.S.Wagle, the objective is to compare the experimental testing of the Vertical wind turbine with bearing and magnetic assistance at the supports. Neodymium magnet with dimensions 15*8*3mm having capacity to repel 9.81 force can be used for levitation between stator and rotor to maintain air gap. The Magnetic bearing will produce 29.7% more RPM than conventional Design. The experimental Results shows that the Magnetic Vertical Axis Wind Turbine has lower starting speed and the arrangement of magnets so proposed assists the turbine in lowering the starting speed.
5) Andrea Alaimo, Antonio Esposito, Antonio Messineo, Calogero Orlando and Davide Tumino, the Objective of the paper is to analyze the complex and unsteady aerodynamic flow associated with wind turbine functioning, using computational fluid dynamics an attractive and powerful method. The applicative goal of this study is the comparison of the performance between a straight blade vertical axis wind turbine and a helical blade one. Analyses are carried outthrough the use of computational fluid dynamic ANSYSR Fluent software, solving the Reynolds averaged Naiver–Stokes (RANS) equations.
6) Rosario Nobile, Maria Vahdati, Janet F .Barlow, Anthony Mewburn-Crook, a 2D computational investigation of an augmented wind turbine is proposed and analysed in this project work. Three parameters are carefully investigated: mesh resolution; turbulence model; and time step size. It appears that the mesh resolution and the turbulence model affect result accuracy, while the time step size examined, for the unsteady nature of the flow, has small impact on the numerical results. It is found that the power and torque coefficients of the augmented wind turbine are independent of the incident wind speed considered.
7) A.Y. Qasim,R. Usubamatov , Z. M. Zain and Ghulam Abdul Quadir, work designs the rotor wind turbine, which uses more effectively for the wind energy and depends on the acting area of the vanes. The frame design consists of three movable vanes to reduce the negative torque of the frame that rotates contrary to the wind. The wind tunnel is used to measure the power coefficient, torque coefficient and angular velocity.

III. CONCLUSION

It is hoped that they may be constructed used high-strength, low- weight materials for deployment in more developed nations and settings or with very low tech local materials and local skills in less developed countries.

The MAGLEV wind turbine designed is ideal to be located on top of a bridge or bridges to generate electricity, powered by wind.

The elevated altitude gives it an advantage for more wind opportunity. With the idea on top of a bridge, it will power up street lights and or commercial use. In most cities, bridges are a faster route for everyday commute and in need of constant lighting makes this an efficient way to produce natural energy.

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