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Design, Analysis & Development of (Prototype) Vertical Axis Wind Mill

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ABSTRACT

A vertical axis wind turbine (VAWT) is to convert wind power into the useful form of energy by turbine blade. The Vertical axis wind turbines are effective than horizontal axis wind turbines as they require less space than horizontal blades and the turbines does not need to be pointed in direction of the wind for effective output. This is useful in a site where the wind direction is highly variable. The Maglev 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 wind speeds in most of Asian zone is much lower, especially in the cities. 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 wind power). This system can also be implementing on the highway and rooftop of buildings. In this project study of alternate configuration of wind turbine for power generation purpose.

Keywords: Vertical axis wind turbine, Maglev wind turbine, Renewable energy sources, Wind power.

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I. INTRODUCTION

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. 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. If the mechanical energy is used directly by machinery such as, a pump or a grindstone, the machine is usually called a wind mill. If the mechanical energy is converted to electricity, the machine is called a wind generator or a wind turbine. Vertical axis wind turbines have the main rotor shaft arranged vertically. The main advantage offered by this type of arrangement is that the turbine does not need to be pointed in the direction of the wind to be effective. This is useful in a site where the wind direction is highly variable. Since the shaft is vertical, the gear box and the generator can be placed near the International Journal of Infinite Innovations in Technology ground so that the tower does not need to support it and is hence, more accessible for maintenance.

They are difficult to mount on towers and hence, they are installed near the base, like a building rooftop. Since they are located closer to the ground than horizontal wind machines, the arrangement can take an advantage of the natural constructions and surrounding buildings to funnel the air and increase the wind velocity. The main disadvantage of the vertical axis wind machines is that the stresses in each blade change sign twice during each complete cycle. This reversal of stresses increases the likelihood of blade failure by fatigue. The objective of the present work is to study the characteristics of a specific type of vertical axis wind machine, namely, the Savonius rotor. The following section gives an introduction to this rotor and the definitions of the performance characteristics associated with it..Nowadays, we will ultimately need to search for

renewable or virtually inexhaustible energy for the human development to continue. Renewable energy is generally electricity supplied from sources, such as wind power, solar power, geothermal energy, hydropower and various forms of biomass. These sources have been coined renewable due to their continuous replenishment and availability for use over and over again.

II. OBJECTIVE

The objective of this project is to design and build a vertical-axis wind turbine to generate electric power. The vertical turbine has the advantage of being deployable in urban or other crowded zones, whereas horizontal-axis turbines require a large footprint due to the space needed for safe spinning of the blades.

III. EQUATIONS

For a main shaft which is a power generator, power is given as,

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$P = FxV$ ---------- (1)

Force acting on shaft is given by,

$F = mxg$ ----------(2)

The resultant moment on a given shaft is given as,

$MR = (M^2+T^2)^{1/2}$ ----------(3)

Also we know that shaft diameter is given as,

$d = [(MRx16)/ (\pi x\tau)]^{1/3}$ ----------(4)

IV. FIGURE AND TABLE

Fig.1 Prototype of vertical axis wind mill

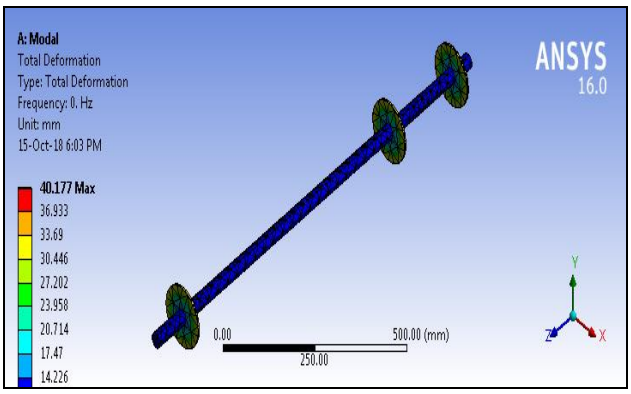

Fig.2 Total deformation of shaft

Tables-

Sr. No.	Parts	Material
1	Shaft	Mild steel
2	Blade	Mild steel
4	Bearing	Steel
5	Rod	Mild steel
6	Dyanamometer	

Table no.1 Components list

Sr. No.	Air Velocity(In m/s)	Speed in RPM of Turbine Blades	Electricity Generate in Volt (V)
1	1	12	0.50v
2	2	30	2v
3	2	30	2v
4	3	40	3v
5	4	55	4 v

Table no.2 Observation table

V. CONCLUSION

A wind turbine is a machine that converts the wind kinetic energy into electricity. The major components of a wind turbine are: the rotor, the gearbox, the generator, the control and protection system, the tower and the foundation. Wind turbines are classified into two types of category: horizontal axis wind turbine and vertical axis wind turbine. The major advantage for a HAWT is the high efficiency it has; the disadvantage is the maintenance and repair at high altitude. The advantage of a VAWT is that the wind can come from any direction; the disadvantage is the height limitations.

Aerodynamically, the wind turns the rotor blades of the HAWT because of the pressure differential between the top and the bottom of the airfoil. For the VAWT, it is the drag that acts on the blades and turns the rotor blades. Today, wind power is economically competitive compared to traditional energy because the cost of wind turbines is getting cheaper because of technology advancement and government incentives. It also creates jobs and generates extra personal and tax income. Wind energy is also a

renewable and pollution-free energy which can help us reduce the emissions of greenhouse gases. I believe that wind energy can become an important asset to solve climate change and global warming issues in the future.

REFRENCES

[1] Micha Premkumar, Mohan ,Sarlathan Shivamani, "Design and Analysis of a Permanent Magnetic Bearing for Vertical Axis Small Wind Turbine", ScienceDirect, 4 March 2018, pp. 291-298.

[2] Kung-Yen Lee, Shao-Hua Tsao, Chieh-Wen Tzeng, Huei-Jeng Lin, "Influence of the vertical wind and wind direction on the power output of a small vertical-axis wind turbine installed on the rooftop of a building", Applied Energy, 19 August 2017, pp. 0306-2619.

[3] Wenlong Tian, Zhaoyong Mao, Xinyu An, Baoshou Zhang, Haibing Wen, "Numerical study of energy recovery from the wakes of moving vehicles on highways by using a vertical axis wind turbine", Applied Energy, 30 July 2017, pp. 31366.

[4] Andrea Arena, Walter Lacarbonara, "On the stability of magnetically levitated rotating rings", ScienceDirect, 5 July 2017, pp. 286-295.

[5] Lidia Lombardi, Barbara Mendecka, Ennio Carnevale, Wojciech Stanek, "Environmental impacts of electricity production of micro wind turbines with vertical axis", Renewable Energy, 3 July 2017, pp. 30622-5.

