

Traffic Signal Controller Using Magnetic Levitation Wind Turbine

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ABSTRACT: Since a decade the demand for electricity is increasing at alarming rate and the demand for power is running ahead of supply. 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 project dwells on the implementation of an alternate configuration of a wind turbine for power generation purposes. Regenedyne (magnetic levitation) has apparently moved to prototype stage. The floating blades spin with little resistance, and the power output is increased. They also can spin in light breezes. This provides efficient frictionless Power Generation with less maintenance, compared to Horizontal Axis Wind Turbine (HAWT). The aim of this major qualifying project 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 speed conditions. Hence this technology provides an extreme efficient, versatile and elegant method of producing power from wind with nearly zero pollution. Our choice for this 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. Hence the main objective of this project is to harness wind energy in more efficient way with frictionless magnetic levitated operation.

KEYWORDS: wind energy; maglev wind turbine; neodymium permanent magnet; vertical and horizontal configurations.

I. INTRODUCTION

Renewable energy resources are the natural resource which can replenish with the passage of time. Renewable resources are a part of earth's natural environment and the largest components of its ecosphere. Examples of renewable energy resources are; solar energy, wind energy, tidal energy, geothermal energy, biomass etc. Renewable energy is used for producing electricity, direct heating, cooling and direct cooking purposes. Among all other renewable energy resources global electric power produced from the wind energy is largest and it is about 2.9 % in 2013. India is the sixth largest country in the world with 27 GW of renewable power capacity and only the wind energy is having 80 % of this renewable power capacity. Wind energy is the best alternative source of energy for India and therefore its utilization for the power generation shall increase in near future. However the conversion efficiency of wind energy to electrical energy from the available conventional wind turbines is less than 30 % and the minimum wind velocity required to run these turbines is 5.5 m/s (20 km/h). Therefore increasing the efficiency of the wind turbines is the present need. Wind turbine is a device which converts the kinetic energy of moving air into mechanical energy that can be either used directly to run the machine or to run the generator to produce electricity. However by reducing the contact friction of the rotor at its supports by providing the contact free frictionless magnetic bearings is the new direction to improve the performance of wind turbines.

II. METHODOLOGY

Designed and fabricated magnetically levitated wind turbines are shown in Fig.1. Rare earth neodymium permanent magnets are used to construct the radial and axial bearings. These bearings are used to support the wind turbine's shaft. Power generation unit is fitted to the turbine shaft. Performance of these designs is compared with the conventional wind turbines supported on frictional contact ball bearings. Starting wind velocity, rotational speed at constant wind velocity, time taken to stop rotation and electric power generated at constant wind velocity are considered as the performance measures. Regenedyne Maglev Wind Power Generation (RMWPG) is the advanced method of harnessing the kinetic energy of wind. The word Regenedyne means generation by renewable source (wind) and in this type of generation the spinning turbine floats on the magnetic cushion, just as the high-speed train floats above the rail track hence the name *REGENEDYNE MAGLEV WIND POWER GENERATION*. The Maglev wind turbine design is a vast departure from conventional propeller designs. Its main advantages are that it uses frictionless bearings and a magnetic levitation design and it does not need the vast spaces required by more conventional wind turbines. It also requires little if any maintenance. The Maglev wind turbine was first unveiled at the Wind Power Asia exhibition in Beijing 2007. The unique operating principle behind this design is through magnetic levitation. Magnetic levitation is supposedly an extremely efficient system for wind energy. The vertically oriented blades of the wind turbine are suspended in the air replacing any need for ball bearings.

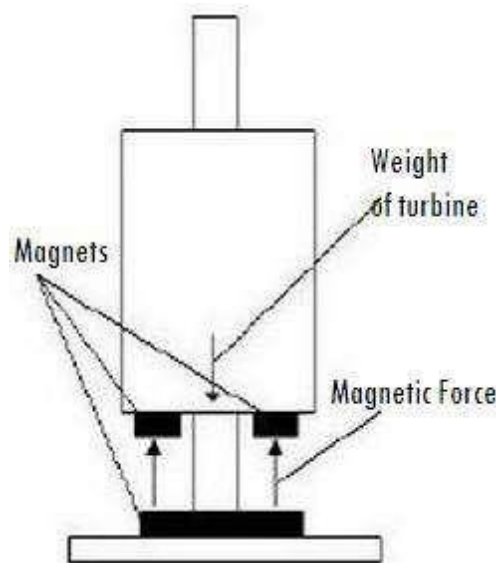


Fig.1: Maglev Turbine concept.

III. WORKING MODEL OF MAGLEV WIND TURBINE

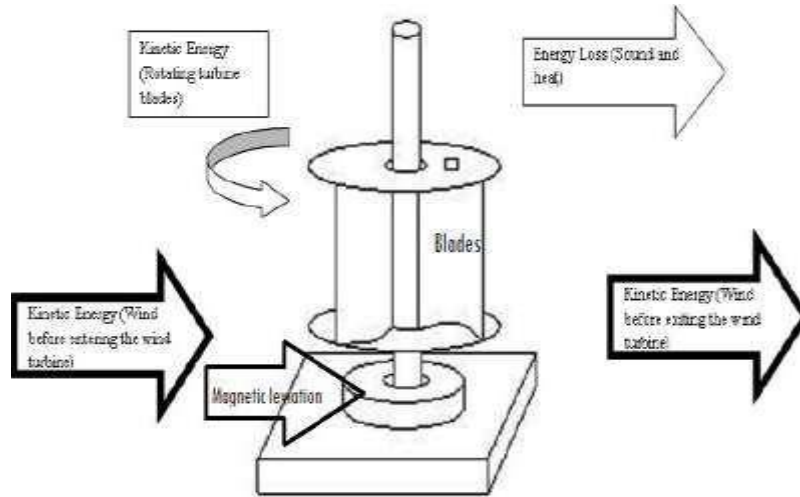


Fig.2: Working model of maglev wind turbine

IV. DESIGN AND CONSTRUCTION

There are several parameters involved in the design of an efficient yet economical wind turbine. Generally and efficient design of the blade is known to maximize the lift and minimize the drag on the blade.

I. Diameter of the Rotor:

Since the power generated is directly proportional to the square of the diameter of the rotor, it becomes a valuable parameter. It's basically determined by the relation between the optimum power required to be generated and the mean wind speed of the area.

Power generated, $P = \eta_e \eta_m C_p P_0 = 1/2 \eta_e \eta_m C_p \rho V^3 = 1/8 \eta_e \eta_m C_p \rho D^2 V^3$ (5.1.1)

Where, η_e = efficiency of electrical generation η_m = efficiency of mechanical transmission

In the absence of concrete data, the following empirical formulae can be used.

$P = 0.15 V^3 D^2$, for slow rotors

$P = 0.20 V^3 D^2$, for faster rotors.

The below figures shows the design of turbine model

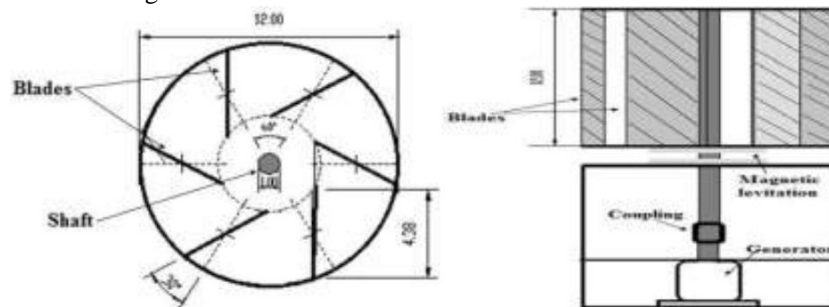


Fig.3: Front view of Turbine setup (dimensions in inch).

Choice of number of blades. The choice of the number of blades of a wind rotor is critical to its construction as well as operation. Greater number of blades is known to create turbulence in the system, and a lesser number wouldn't be capable enough to capture the optimum amount of wind energy. Hence the number of blades should be determined by both these constraints. The no of blades used for this turbine is 6 which are placed such that the angle between two adjacent blades is 60°. Each blade is fixed between the two discs with 300° deviation as shown in above fig 5.1.1. When blades are placed with the deviation of 300 to 450 the area of blades facing the wind will be more and help the turbine to rotate faster. The length to diameter ratio is kept as 1 for better performance of turbine. The whole turbine assembly is placed on the magnetic levitation as shown in figure.

V. DEVELOPMENTS IN MWT

Construction began on the world's largest production site for maglev wind turbines in central China on November 5, 2007. Zhongke Hengyuan Energy Technology has invested 400 million yuan in building this facility, which will produce maglev wind turbines with capacities ranging from 400 to 5,000 Watts. In the US, Arizona-based MagLev Wind Turbine Technologies will be manufacturing these turbines. Headed by long-time renewable energy researcher Ed Mazur, the company claims that it will be able to deliver clean power for less than one cent per kilowatt hour with this new technology. Equatorial region countries –less wind speed (Malaysia, Singapore..) Small Maglev Wind Turbine generate power at wind speed of 1.5m/s.

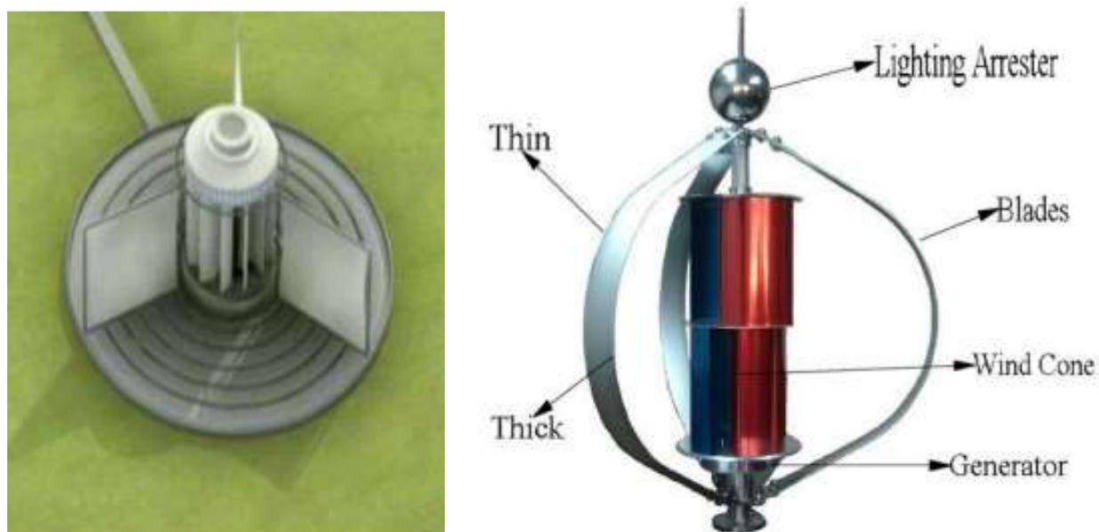


Fig.4: Wind turbine models.(multi blades & tri blade)

VI. CONCLUSION

Magnetic Suspension Wind Power Generators, represent a very promising future for wind power generation. A single large Maglev turbine can output more than conventional horizontal wind turbines. The rotor that is designed harness enough air to rotate the stator at low and high wind speeds while keeping the center of mass closer to the base yielding stability due to the effect of magnetic levitation. The efficiency of turbine is increased by replacing the bearings by magnets, the magnetic levitation helps the turbine to spin at much faster rate as it will eliminate the stress on the shaft of the turbine. The major components are placed at ground level. We can say the maglev turbine can power more output

International Journal of Innovative Research in Science, Engineering and Technology

An ISO 3297: 2007 Certified Organization

Volume 7, Special Issue 7, June 2018

**One Day National Conference on "Recent Trends in Mechanical Engineering & Applied Sciences 2018"
(RTME & AS-2018)"**

17th May 2018

Organized by

Department of Mechanical Engineering and Applied Science, Sri Krishna Institute of Technology, Bangalore, India

with high efficiency conversion compared to traditional wind turbine. The system will provide electricity at a rate lower than coal and nuclear. Thus we believe this technology has the capacity to completely displace current technology in use for wind farm.

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