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A Review on Design and Fabrication of Maglev Windmill

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ABSTRACT - Maglev is an innovative vertical axis turbine concept. Construction began on alarge production site for Maglev wind turbines in central China, in November 2007. According to a press release, ZhongkeHengyuan 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 kW.Using magnetic levitation, the blades of the turbine are suspended on an air cushion, and the energy extracted by linear generators with minimal friction

I. INTRODUCTION:

Electricity can be generated in many ways. In each case, a fuel is used to turn a turbine, which drives a generator, which feeds the grid. The turbines are designed to suit the particular fuel characteristics. Wind generated electricity is no different: The wind is the fuel, which drives the turbine, which generates electricity. But unlike fossil fuels it is free and clean.

Fig .no. 1

The politics and economics of wind energy have played an important role in the development of the industry and contributed to its present success, but the engineering is still pivotal. As the wind industry has become better established, the central place of engineering has become overshadowed by other issues, but this is a tribute to the success of engineers and their turbines. Part I addresses the key engineering issues:

- The wind – its characteristics and reliability – how it can be measured, quantified and harnessed;
- The turbines – their past achievements and future challenges, covering a range of sizes larger than most other technologies: from 50 W to 5 MW and beyond;
- The wind farms – an assembly of individual turbines into wind power stations or wind farms; their optimisation and development; and
- Going offshore – the promise of a very large resource, but with major new technical challenges.

Part I provides a historical overview of turbine development, describes the present status and considers future challenges. This is a remarkable story, which started in the 19th century and accelerated over the last two decades of the 20th, on a course very similar to the early days of aeronautics. The story is far from finished, but it has certainly started with a vengeance.

Wind must be treated with great respect. The wind speed on a site has a very powerful effect on the economics of a wind farm and wind provides both the fuel to generate electricity and, potentially, loads that can destroy the turbines. This part describes how it can be quantified, harnessed and put to work in an economic and predictable

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manner. The long and short-term behaviour of the wind is described. The latter can be successfully forecasted to allow wind energy to participate in electricity markets.

The enormous offshore wind resource offers great potential, but with major engineering challenges, especially regarding reliability, installation and access.

In short, Part I explores how this new, vibrant and rapidly expanding industry exploits one of nature's most copious sources of energy – the wind.

In selecting the vertical axis concept for the wind turbine that is implemented as the power generation portion of this project, certain uniqueness corresponded to it that did not pertain to the other wind turbine designs. The characteristic that set this wind generator apart from the others is that it is fully supported and rotates about a vertical axis. This axis is vertically oriented through the center of the wind sails, which allows for a different type of rotational support rather than the conventional ball bearing system found in horizontal wind turbines. This support is called maglev, which is based on magnetic levitation. Maglev offers a near frictionless substitute for ball bearings with little to no maintenance. The four different classes are Alnico, Ceramic, Samarium Cobalt and Neodymium Iron Boron also known Nd- Fe-B. NdFe-B is the most recent addition to this commercial list of materials and at room temperature exhibits the highest properties of all of the magnetic materials. It can be seen in the B-H graph shown in Figure 5.1 that Nd-Fe-B has a very attractive magnetic characteristic, which offers high flux density operation and the ability to resist demagnetization. This attribute will be very important because the load that will be levitated will be heavy and rotating high speeds, which will exhibit a large downward force on the axis[3] . The next factor that needs to be considered is the shape and size of the magnet which is directly related to the placement of the magnets. It seems that levitation would be most effective directly on the central axis line where, under an evenly distributed load, the wind turbine center of mass will be found as seen in Figure 5.2. This figure shows a basic rendition of how the maglev will be integrated into the designAlso known as maglev, this phenomenon operates on the repulsion characteristics of permanent magnets. This technology has been predominantly utilized in the rail industry in the Far East to provide very fast and reliable transportation on maglev trains and with on-going research its popularity is increasingly attaining new heights. 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. 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. In this project, we expect to implement this technology form the purpose of achieving vertical orientation with our rotors as well as the axial flux generator.

II. LITERATURE REVIEW:

1) R. F. Post[1] filed a Patent on Magnetic Levitation System which stated that Repelling Magnetic forces are produced by the interaction of flux- conc. Magnetic field (produced by permanent magnets or electromagnets) with an inductively loaded closed electric circuit. When one such element moves with respect to the other, a current is induced in the circuit. This current then interacts back on the field to produce a repelling force.
2) S. Mashyal and Dr. T. R. Anil designed a portable highway wind turbine, which is to be contributing towards the global trend in wind energy production in a feasible way. Wind turbines are traditionally employed in rural areas; the main goal the work is to design a wind turbine that can be used in cities. In particular, the turbines will use the wind draft created by vehicles on the highway to generate electricity. The idea is to offset the amount of pollution created by burning fossil fuels by introducing a potential source of clean energy. As the automobiles moves from highways/expressways, there is a creation of pressure column on both the sides of the road. This pressure column is created due to imbalance of high pressure/low pressure energy band created by the automobiles. Due to this pressure band wind flow and create pressure thrust. The pressure thrust is sufficient to generate electricity through designed wind turbine.
3) G.P. Ramesh and C.V. Arvind] studied that Due to Vertical Axis Wind Turbine low power generation capabilities, the Vertical Axis Wind Turbine is highly conducive for standalone applications. The operational range limits the power generating capability in wind turbines and is highly influenced through the blade shape and angle of attack. Recently maglev

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concept is introduced to increase the velocity of rotational mass and thereby the power generation capability. A maglev design incorporated with the optimized wind turbine is presented in this work. Initial investigation on three different wind profiles and the suitable airfoil provide the degree of impact at angle of 30° to have the highest lift coefficient for the chosen airfoil structure.

4) A.P Diaz, G. J Pajaro and K. U Salas stated that Although vertical axis turbines have long existed, it was not until the beginning of the twentieth century when the Darrieus (1921) and Savonius rotors (1924) appeared; the two most used models nowadays. Savonius rotor was invented by the Finnish engineer Sigurd J Savonius with two half cylinders basic design that rotate around an axis. In this research, four different models of Savonius rotor blades are analyzed, as well as the traditional rotor and He found the best Power Coefficient (Cp) and the best torque coefficient (Cm) for different models. In order to achieve the objective, a CFD computational model was used, with 3D simulations in transient regime. A computational domain was defined as a function of the minimal longitude in the system, and meshing is performed after a mesh size independency analysis. The results show that helical Savonius rotor performs the best in the analyzed operation conditions and improves in ~20% above the other configurations. In addition, 3-blade rotor presents the lowest performance of all the models with a power coefficient Cp of 0.073.

5) Y. Hongxing, Z.Wei, L.[5]Chengzhi recommended an optimal design model for designing hybrid solar–wind systems employing battery banks for calculating the system optimum configurations and ensuring that the annualized cost of the systems is minimized while satisfying the custom required loss of power supply probability (LPSP). The five decision variables included in the optimization process are the PV module number, PV module slope angle, wind turbine number, wind turbine installation height and battery capacity. The proposed method has been applied to design a hybrid system to supply power for a telecommunication relay station along south-east coast of China. The research and project monitoring results of the hybrid project were reported, good complementary characteristics between the solar and wind energy were found, and the hybrid system turned out to be able to perform very well as expected throughout the year with the battery over-discharge situations seldom occurred

6) W Kim and D. L. [6] Trumper presented a high-precision magnetic levitation (maglev)stage for photolithography in semiconductor manufacturing. This stage is the world's first maglev stage that provides fine six-degree-of-freedom motion controls and realizes large (50 mm 350 mm) planar motions with only a single magnetically levitated moving part. The key element of this stage is a linear motor capable of providing forces in both suspension and translation without contact. The advantage of such a stage is that the mechanical design is far simpler than competing conventional approaches and, thus, promises faster dynamic response and higher mechanical reliability. The stage operates with a positioning noise as low as 5 nm rms in x and y, and acceleration capabilities in excess of 1 g (10 m/s2). They demonstrate the utility of this stage for next-generation photolithography or in other high precision motion control applications.

III. METHODOLOGY:-

Wind turbine transforms kinetic energy into power. The process begins when wind contacts with turbine blades and transforms kinetic energy to power. The main shaft rotates as well as creating mechanism. Main shaft is connected to the gear box which rotates parallel shaft at about 30 times the rate of main shaft. In generator magnets are arrange surrounding a coil. The shaft connects to the magnet assembly spinning it around the stationary coil of wire and creating voltage in wire.

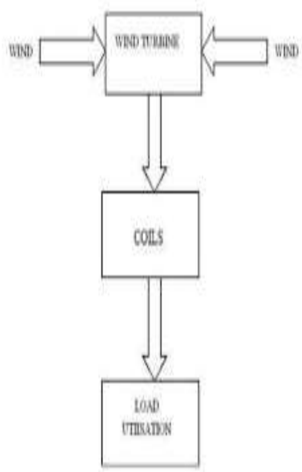

Fig. 2 - flow chart

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