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Hybrid Power Generation Using Maglev Turbine

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***Abstract*— Nowadays the demand for electricity is increasing and traditional power generations sources has not able to complete this demand. This paper presented different configuration of wind turbine for power generation. Power is generated using an axial flux generator with use of permanent magnets, set of coils and solar cell. A mini model of maglev turbine has made to perform the work of the turbine and this turbine is connected with the solar cells to generate power generation. The aim of this work is to design and implement a magnetically levitated wind turbine system that has the ability to operate in all mediums wind speed conditions and solar energy. Maglev turbine has several advantages over conventional wind turbine and has certain applications. Hence the efficient use of wind power and solar power is possible using this model to generate high power generation.**

Index Terms—Solar Energy, Magnetic Levitation, Maglev Wind Turbine .

I. INTRODUCTION

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 [1]. Renewable energy sources such as wind, solar and biomass, etc. are very much important to people living [2, 3, 4] The popularity of renewable energy has experienced a significant upsurge in recent times due to the exhaustion of conventional power generation methods and increasing realization of its adverse effects on the environment [6,7] .Combining latest Maglev technology with PV (Solar) panels gives the best solution for generation of electricity against conventional sources. Wind power is utilized by human being for a longer time period and so that technology related to it is highly advanced.

Maglev turbines are an ideal solution to the traditional wind turbine, which need very high structures to allow room for their massive blades. Using Maglev technology in VAWT's (Vertical Axis Wind Turbine) means less moving parts, less maintenance, smaller profile and most importantly, very little wind start working due to the lack of friction [5]. The reality is that demonstrated maglev designs have efficiencies comparable to competitive technology and can be both less expensive and more efficient. The main aim is to design and implement a magnetically levitated wind turbine for generation of electricity with more efficiency. From the literature review, it is found that to working principal of the wind turbines most of the work is carried out on the following principals [7, 8, 9]

A. Wind Power

Wind is known as another form of solar energy because of its result of uneven heating of the atmosphere by the sun. Wind energy is the energy which is extracted from the wind. The winds relevant to applications of wind turbines are local winds and planetary winds. The second one is most available. Wind power available in the atmosphere is much greater than current world energy consumption. The locations of these winds are generally along sea shore, mountain, valleys and open plains.

B. Solar Energy

Solar energy is that energy which gets by the radiation of the sun. Solar energy is present on the earth continuously and in the abundant manner. Solar energy is freely available. It doesn't produce any gases that mean it is pollution free. It is affordable in cost. It has low maintenance cost. The only problem with the solar system, it cannot produce energy in bad weather condition. But it has greater efficiency than other energy sources. It only needs initial investment. It has a long life span and has lower emission.

C. Magnetic Levitation

The basic working of maglev turbine is based on the magnetic levitation principle. The magnetic levitation principle is stated that one subject is suspended over another subject with no support other than the magnetic field magnetic pressure is used to counter out the effect of

gravitational force; this principle is also based on the properties of magnets. Those properties are given below;

1. Same pole repulse with from each other,
2. Different poles are attracted towards each other.

Fig.1. Magnetic levitation

D. Maglev Wind Turbine

There are different types of turbine which are horizontal axis turbine and vertical axis turbine. The maglev turbine is the vertical axis turbine and which is the best option of turbine against the other type of turbine. This turbine is the most efficient than other turbine which reduce the friction and increases the efficiency and increases the efficiency of turbine. Arrangement of this turbine in such way that when the wind is comes in any direction then turbine will be rotates. This turbine rotates up to minimum velocity 1.3 m/s.

Fig.2. Maglev turbine

E. Selection of magnet

There are few materials available in the nature that having a tendency to attract or repulse each other that type of material is called as magnet or ferromagnetic material. In magnet there are two poles north and south in which the likes or same pole is repulse and unlike or different pole attract. The physical field between the two poles is called as magnetic field and its intensity and direction find the force of attraction and force of repulsion between the two magnets. While selecting the magnet considering some of the properties of magnet like shape, size and understanding the characteristics of magnetic material and these entire factors is very useful while designing the maglev turbine.

II. FABRICATION

Fabrication of the work is carried out with following way:

A. Neodymium Magnet

In a maglev turbine neodymium type of magnet is used. The permanent neodymium magnet made from alloy of neodymium, iron and boron to from the Nd2Fe14B Tetragonal crystalline structure. They are silver in color. The grade of this magnet depends on the maximum energy produce by the magnet. Neodymium magnets are ten times stronger than other magnet.

B. Magnet placement

The ring type of two neodymium magnet of having an inner diameter 20mm and outer diameter 40mm are placed at the middle of the shaft in between stator and rotor. These two magnets are used to produce levitation between stator and rotor. Also, the base magnets having thickness 6mm and diameter 20mm, which are placed on the rotor. These base magnets are used for production of flux that is utilized by power generation system.

Fig.3. Magnet placement

C. Coil arrangement

The four coils can be arranged on the stator or base plate which can be made up plywood. Each coil having 3050 turns of copper wire. The angular distance between the two magnets is 45 degrees equal to the distance between two coils. The coils are arranged on the periphery of stator exactly in line to arranged disc magnet.

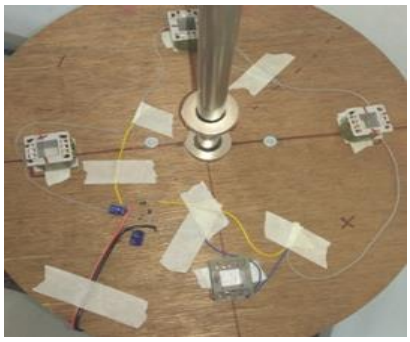

Fig.4. Coil arrangement

D. CONNECTION OF THE COIL

There are four coils used for connection, also two capacitor and two diodes are used in this connection. Out of four coils two coils has taken and negative terminal of both the coils is connected to each other as shown in figure. Similarly from remaining two coils positive terminals of both coils are connected together. Remaining positive and negative terminal is connected in series. Now common positive and negative terminal are connected to positive and

negative terminal of a capacitor after diode respectively. Diodes are used to prevent reverse flow of current.

E. TURBINE BLADES

We use aluminum sheet for manufacturing of turbine blades. We bend the sheet manually. The design for the blade design is taken from the papers. Attachment of blades to the turbine is done with the help of screw joint. Tightening is done manually.

F. DC - AC CNVERTOR

Normally alternating current has been used to power supply. The AC is used because is voltage is easily stepped up or stepped down using a transformer, DC voltage cannot be altered using this type of equipment. Transformer operates due to change in the magnetic field in which change in magnetic flux induces current. DC cannot be providing changing magnetic field therefore AC can be used. The concept of DC-AC conversion emerged after the development fast switching transistors.by varying the duty cycle of the pulse that is apply to gate of the transistor for switching, these convertors can bulk the voltage as if where a DC transformer. When accurate feedback is applied to this type of circuit, the convertor will not only transform a supply voltage to the desired output but also maintain given a varying input

III. SPECIFICATIONS

Some components are used for the making for the mini model of turbine such as the plates, Base plate and solar panel. The specification of these main components of turbine as follows:

Central hole of base plate = 20 mm

A. SOLAR PANEL

Rated Power- 3W
Open Circuit Voltage-10.8V
Short Circuit Current- 0.39A
Voltage at max power- 8.80 V
Current and max power- 0.35 A
Maximum System voltage- 600V

B. PLATES

Diameter of the plates = 400mm
Central hole of the plate = 20mm
Height of lower half turbine blade = 250mm
Height of upper half turbine blade = 250mm

C. BASE PLATE

Diameter of base plate = 600 mm

IV. CALCULATIONS

As mentioned earlier the effective functioning of a wind turbine is dictated by the wind availability in an area and if the amount of power it has is sufficient enough to keep the blades in constant rotation. The wind power increases as a function of the cube of the velocity of the wind and this power is calculable with respect to the area in which the wind is present as well as the wind velocity. When wind is blowing the energy available is kinetic due to the motion of the wind so the power of the wind is related to the kinetic energy. We know,

$$\text{Kinetic Energy} = (MV2)/2 \quad (1)$$

The volume of air passing in unit time through an area A, with speed V is AV and its mass M is equal to the Volume V multiplied by its density ρ so:

$$M = \rho AV \quad (2)$$

Substituting the value of M in equation above we get:

$$\text{Kinetic Energy} = 1/2\ (\rho AV)\ V2$$

$$\text{Kinetic Energy} = 1/2\ \rho AV3 \quad (3)$$

To convert the energy to kilowatts, a non-dimensional proportionality constant k is introduced where,

$$K = 2.14\times10^{-3}$$

Therefore,

$$\text{Power in KW } (P) = 2.14\rho AV3\times10^{-3}$$

Where,

Air Density (ρ) = 1.2/(2.33x 10-3) (Kg/m3)/(slugs/f3)
Area (A) = Area swept by the blades of the turbine.
Velocity (V) = wind speed in m/s

in the above equation, the power being generated can be calculated, however one should note that it is not possible to convert all the power of the wind into power for generation.

V. CONCLUSION

From this concept the magnetic levitation turbine is very useful in renewable energy as an energy generation source. The following conclusions are concluded by this work

- Non-polluted, less noisy, simple construction.
- Hybridization of solar and maglev gives continuity in energy generation in any season.
- Reduction in heavy construction, starting, maintenance.
- Better output.
- A home owner would be able to extract free clean energy thus experiencing a reduction in their utility cost and also contribute to the "Green Energy" awareness that is increasingly gaining popularity.

VI. It is suitable for integrating with the hybrid power generation units consisting of solar and other natural resources.

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