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Design and Development of Magnetic Levitation based Vertical Axis Wind Turbine for hybrid Power Generation

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ABSTRACT : *To overcome the increasing energy development demand and its cost application of renewable energy is must. Renewable energy is generally electricity supplied from source, such as wind power, solar power, geothermal energy, hydropower and various forms of biomass. These source have been coined renewable due to continues replenishment and availability for use over and over again. Stand-alone wind energy and stand-alone solar energy having some drawbacks such as unpredictable weather result into unpredictable output. Hence, to overcome this stand-alone energy system the installation of hybrid system is necessary. The key feature of this new concept is the arrangement of multiple savonius vertical axis wind turbine into the structure. A photovoltaic Panel is integrated to contribute to power generation. The energy is collected by power conversion equipment along with a storage device which ensures the lighting also during windless nights. The main application of this project is the stand-alone street lighting, but also a grid connected option is feasible. This project presents Design, development and application of hybrid wind solar energy system.*

Keywords: *Wind-solar, hybrid, VAWT, Savonius, Street lighting*

I. INTRODUCTION

Solar-wind Hybrid System comprises of solar panel and small wind turbine generator to generate electricity. It work in small capacities typically in the range of 1 kW to 10 kW for the solar panel and wind turbine combined system. Renewable energy is generally electricity supplied from source, such as wind power, solar power, geothermal energy, hydropower and various forms of biomass. These source have been coined renewable due to their continues replenishment and availability for use over and over again. The popularity of renewable energy has experienced a significant upsurge in recent times due to the exhaustion of conventional power generation method and increasing realization of its adverse effect on the environment. This popularity has been bolstered by cutting edge research and ground breaking technology that has been introduced so far to aid in the effective tapping of this natural resource and it is estimated that renewable sources might contribute about 20% - 50% to energy consumption in the latter part of the 21st century. Facts from the World Wind Energy Association estimates that by 2010, 160GW of wind power capacity is expected to be installed worldwide which implies an anticipated net growth rate of more than 21% per year.

In this hybrid system the Magnetic Levitation Based Savonius vertical Axis Wind turbine is installed with photovoltaic cell for the power generation and with help of magnetic Flux the intensity of load is reduced. The VAWT consist of rotary blades arranged vertically the load of the rotor shaft and blades is supported by two bearings at top and bottom and to reduce the intensity of the load with the help of permanent magnet on the principle of magnetic flux. The LED lamp is used to test the demonstration. The system is dual type in summer season the wind rate is low then the solar energy generate power. In Rainy season wind is fast but the solar energy is low the wind will contribute the power generation.

1.1 Problem Statement

The Electric Power Generation is the basic need of human being there are lots of method to generate electricity but, that are not efficient and gives low amount of power at high cost and for conventionally used horizontal axis wind turbine drawbacks.

The solution for this problem is to overcome the demanding and developing energy need and to sustain energy requirements. The hybrid system consists of Solar-wind Power generation with the help of permanent magnet and the principle of it at very low cost.

1.2 Solar-wind hybrid power system

Hybrid Wind-solar system for the rural exchanges can make an ideal alternative in areas where wind velocity of 5-6 m/s is available. Solar Wind Power generations are clear and non-polluting. Also, they complement each other. During the period of bright sunlight the solar energy is utilized for charging the batteries, creating enough energy reserved to be drawn during night, while the wind turbine produces most of the energy during monsoon when solar power generation is minimum. Thus, the hybrid combination uses the best of both means and can provide quality, stable power supply for sustainable development in rural areas. 9 | p a g e DOT committee on renewable energy 2008 2.3.2 these systems are specifically designed to draw 48 volts DC power output from the solar cell/ Wind turbines and combine them to charge the storage batteries. The system does require availability of diesel generator, though for much reduced no. of hour's operation. It is also designed to give priority to solar and wind power so that operations of generators can be minimized to the extent possible.

II. WORKING OF SOLAR-WIND HYBRID POWER SYSTEM

To better understand the working of solar-wind hybrid system, we must know the working of solar energy system and wind energy system. Solar power system can be defined as the system that uses solar energy for power generation with solar panels. The block diagram of solar wind hybrid system is shown in fig. in which the solar panels and wind turbine are used for power generation. Solar energy is one of the major renewable energy sources that can be used for different applications, such as solar power generation, solar water heaters, solar calculators, solar chargers, and solar lamps and so on.

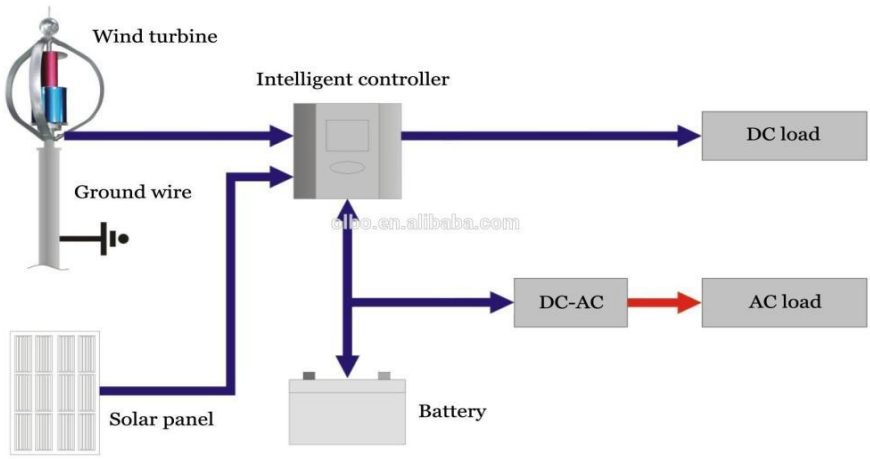

Figure 1. Schematic diagram of solar-wind hybrid power system

2.1 INDENTATIONS AND EQUATIONS

When wind is blowing the energy available is kinetic due to motion of wind so the power of wind is related to kinetic energy. We know, kinetic energy = **1/2 mv**^{2}, When designing a generator it is important to have a firm grasp of the basic laws that govern its performance. In order to induce a voltage in a wire a nearby changing magnetic field must exist. The voltage induced not only depends on the magnitude of the field density but also on the coil area .The relationship between the area and field density is known as flux(ϕ) 5.1.The in which this flux varies in time depends on the generator design .The axial flux generator uses the changing magnetic flux to produce a voltage. The voltage produced by each coil can be calculated using Faradays law of induction:

$$V = -N(d^{\phi}/dt)$$

2.2 Magnet Selection

Some factor need to be assessed in choosing the permanent magnet selection that would be best to implement the maglev portion of the design. Understanding the characteristics of magnet material and the different assortment of size, shapes and material is critical. there are four classes of commercialized magnets used today which are based on their material composition each having their own magnetic properties the four different classes are Alnico, Ceramic, Samarium Cobalt and neodymium Iron Boron also known Nd-Fe-B. Nd-Fe-B is the most rent addition to this commercial list of materials and at room temperature exhibits the highest properties of all of the magnetic materials.

2.3 Figures and tables

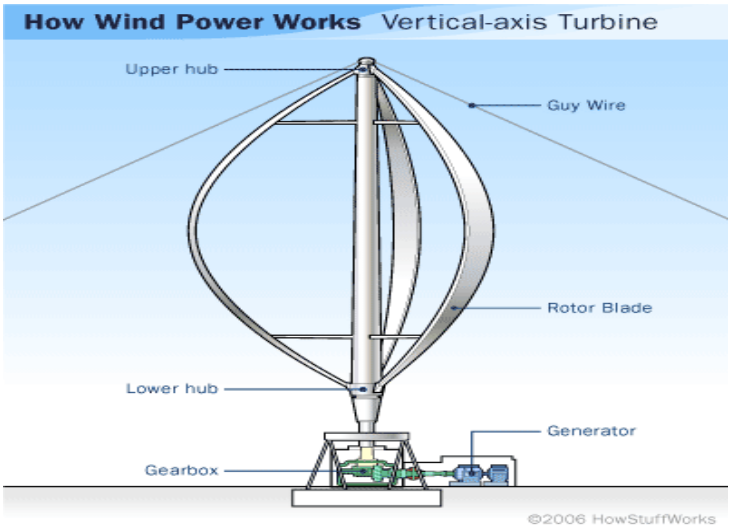

Figure 2. Vertical Axis Wind Turbine

BH(max)	B_1 (max)	Hc	$D_0 = D_m$	D_1	H
42 MGOe	13200 gauss	11K 0e	1.5 inches	0.75 inches	0.75 Inches

Table 1. Permanent Magnet Specification

Rotor diameter	21mm
Weight	5 Kg
Start up wind	7 mph (3m/s)
Voltage	12 volt
Output	6-8 Watt
Total height	5.5 ft
Pulley ratio	1:4
Belt Length	2 ft
Alternator	1/3 HP
Material of shaft	M/S
Battery capacity	12 volt to 24 volt

Table 2. Specification

2.4 Advantages

1. Ensure continues power supply.

2. System can be used at remote location where transmission lines are not available.

3. It reduces the size of large energy storage (Battery) needed individually for solar power system and wind power system.

4. Fuel Saving is upto 50% and lowers atmospheric contamination.

5. Saving in maintenance and silent system

6. Connection to the other power supplies (Wind turbines, Solar panels etc.)

7. The major advantage of the system is that it meets the basic power requirements of non-electrified remote areas, where grid power has not yet reached.

8. The power generated from both wind and solar components is stored in a battery bank for use whenever required. A hybrid renewable energy system utilizes two or more energy production methods, usually solar and wind power.

9. The major advantage of solar / wind hybrid system is that when solar and wind power productions are used together, the reliability of the system is enhanced.

10. It can run 24 hours in a day. Any season it can run efficiently compare with solar energy.

11. Installation is very easy and not requires any external source. And non-polluting process.

III. CONCLUSION

Over all, the magnetically levitated vertical axis wind turbine was a success. The rotor that were designed harnessed enough air to rotate the stator at low and high wind speeds while keeping the center of mass closer to the base yielding stability. The wind turbine rotor and stator levitated properly using permanent magnets which allowed for a smooth rotation with negligible friction. At moderate wind speeds the load. Lastly the SEPIC circuit operated efficiently & to the specifications that were slated at the beginning of the circuit design.
Electricity shortage problem is the major problem that we face in our day-to-day life. Electricity is one of the needed parts of human being. So, there is need of new technology to solving this problem. This proper deal with the study and practical information of battery charging from wind energy. That technology which gives us to solve the shortage of electricity problem efficiently.

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