Asian Journal of Electrical Sciences
ISSN: 2249-6297 (P) Vol.8, No.S1, 2019, pp.15-18

DOI: https://doi.org/10.51983/ajes-2019.8.S1.2315

Replenishing Water Source for Wildlife Using Hybrid Energy Sources

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(Received 12 February 2019; Revised 28 February 2019; Accepted 20 March 2019; Available online 27 March 2019)

***Abstract* - This Paper presents the hybrid model of solar and wind turbine system for the power generation.The hybrid system can be used in forest area and in the remote area also which is unable to connect to the grid and its use can be extended to city streets lights also. It can also be operated as a standalone PV and wind models. The hybrid model is designed using MATLAB Simulink.**
***Keywords:* PV Panel, Maglev Wind Turbine**

I. INTRODUCTION

In the initial stage of power energy system development, the electricity is supplied to the users in a type of bulk electric transmission system. Due to the technology of power system is improved, the traditional type of power system operating pattern seems to occur some weak points in the field of flexibleness and securities. Besides that, fossil fuel price is fluctuating due to the global economic and limited resource; it is found that producing electricity with conventional fossil fuel will lead to the environment pollution [1]. In order to overcome all these issues, the hybrid solar wind turbine system based on renewable energy such as solar and wind is considered as the alternative method to produce and supply electricity power energy to the forest. A hybrid energy system is defined as the component combination of two or more types of power generation system. For our project, solar energy system is integrated with wind turbine system to form a hybrid renewable energy system. Since the power output of these renewable energy is ultimately depends on climatic conditions such as temperature, solar irradiance, wind speed and etc., the instability of the system output is compensated by adding a suitable energy storage system to the hybrid energy system.

The power autonomy is greatly relied on the perfect balance exist between power demand and generated power. The benefits of utilizing renewable energy sources such as hybrid solar wind turbinesystems are increased the reliability of the hybrid energy system because it is based on more than one electricity generation source. Besides that, it is a free from the pollution and environmentally friendly system, since it does not use any fossil fuel to drive the generator. The solar energy also becomes one of the most Promising alternatives for conventional energy sources and has been increasingly used to generate electric power from sunshine.Moreover, the hybrid solar wind energy system is suitable to use in forest areas with inaccessible to utility grid.

II.BLOCK DIAGRAM

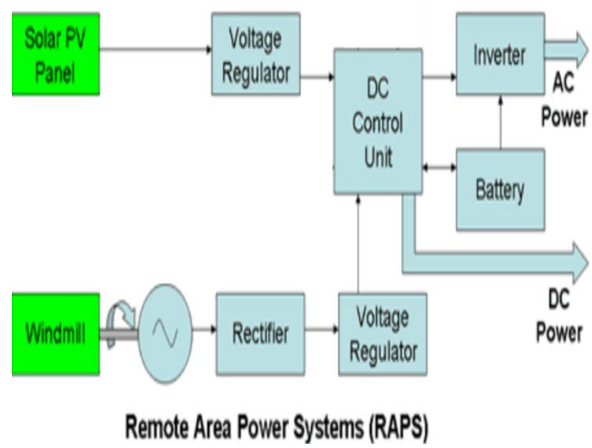

Fig. 1 Block diagram of Proposed System

Here the functional block diagram shows the hybrid wind solar energy system. The power generated from wind mill is of AC voltage which is converted through AC-DC rectifier. The both the output of the solar PV panel and windmill is given to the voltage regulator. The voltage regulator is a system designed to maintain constant voltage level automatically. The output of the voltage regulator is given to the DC control unit. The DC control unit controls the proper output voltage which is required to the battery source. Then the power is given to the battery, the battery stores the electrical energy. This direct DC energy is used for the required applications. Inverter is provided to convert the DC power to AC and it is used as supply to the system.

III. SOLAR PV PANEL

A. Mathematical Modeling of Solar PV Panel

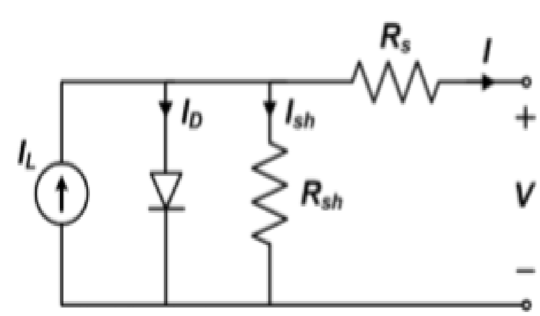

Fig. 2 Equivalent circuit of Solar cell

In the above circuit,
R_s represents series resistance of PN junction cell
R_{sh} represents shunt resistance which is inversely in relation with leakage current to ground.
I_D and I_{sh} represents shunt resistance which is inverse in relation to leakage current to the ground.

$$I = I_{ph} - (I_d + I_{sh})$$

According to this analysis, the solar PV panel is simulated with the help of MATLAB Simulink.

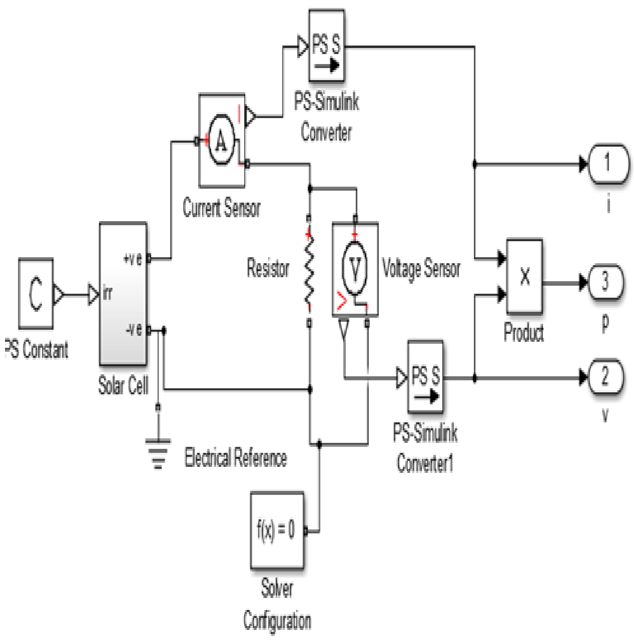

Fig. 3 Solar Cell simulation

The Solar Cell is connected in a series and Parallel combination, to build a DC voltage of 12V. This voltage can also be stored in a battery [2]. This Voltage is the input for an inverter from which the alternating voltage can be tapped.

The output of the PV panel is shown below.

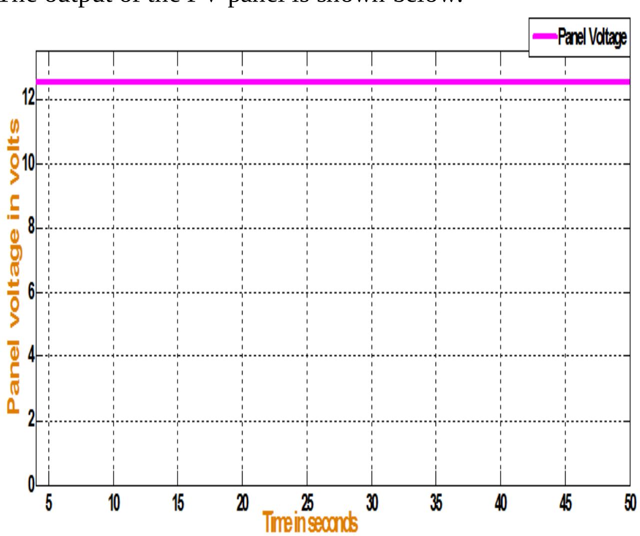

Fig. 4 Panel Voltage

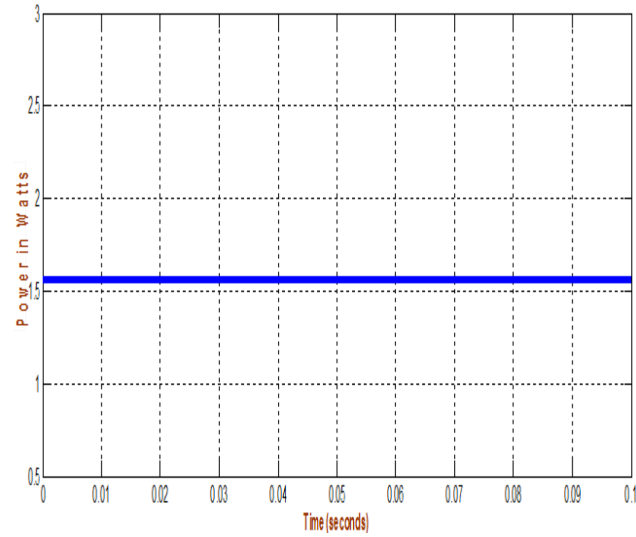

Fig. 5 Power from solar panel

IV.MAGLEV WIND TURBINE

A. Modeling of Maglev Wind Turbine: Wind is considered as one of the renewable energies as solar because of its origination from difference in heating of atmosphere by sun. The winds relevant to applications of wind turbines are local winds and planetary winds. The second one is most available. The wind force may be very strong. During the ancient period, human harnessed this force for important usage like the propulsion of ships using sails before the invention of the engines, in windmills for grinding grain or pumping water for cause of irrigation. At the beginning of the twentieth century concept of electricity found its use and windmills got converted into wind turbines with the rotor coupled to an electric generator. Electricity generated from the wind does not produce Carbon Dioxide emissions and therefore does not contribute to the greenhouse effect.

B. Power from Wind Turbine: The power rises as the cube of the wind velocity and depends on the area in which wind and wind velocity is flowing.When wind is in motion the energy produced is kinetic energy.

$$\text{Kinetic energy} = \frac{1}{2}MV^2$$

Where V is the volume flowing in unit time in area A then wind speed is VA and mass M is taken as

$$M = \rho AV$$
$$\text{Kinetic Energy} = \frac{1}{2}\rho AV^3$$

Where
Air density(ρ)=1.225 kg/m^3
Area (A) = Swept Area of turbine blades
Velocity (V) = wind speed in m/s

*C. Generator:*The generator converts mechanical energy of the shaft into electrical energy output. While designing the axial flux generator observation can be noted that the operating capacity of generator depends on permanent magnet alternators. For these generators air gap is arranged in perpendicular direction to rotating axis and hence produces magnetic fluxes in parallel direction to rotating axis.

D. How Power is Generated: Wind turbines serve to transform the kinetic energy of wind into power. This process begins when wind contacts the turbine blades and transfers some of its kinetic energy to them, forcing them to rotate. Since the blades are connected to the main shaft through the rotor, the shaft rotates as well, creating mechanical energy. The main shaft is usually connected to a gear box which rotates a parallel shaft at about 30 times the rate of the main shaft. At high enough wind speeds, this amplification creates sufficient rotational speeds for the generator electrical output. Generators generally used in turbines are off-the-shelf and use electromagnetic induction to produce an electrical current. In these generators permanent magnets are arranged surrounding a coil. The shaft connects to the magnet assembly, spinning it around the stationary coil of wire and creating a voltage in the wire. The voltage is what drives the electrical current out of the wire and into power lines to be distributed.

V. CONSTRUCTION OF PROTOTYPE

A. Magnet Selection: The four configurations in commercial list of magnets are based on formation of their material each configuration of magnet consisting with them its own magnetic properties. Neodymium Iron Boron (Nd-Fe-B) is the invention in commercialized magnets which constitute highest magnetic properties compared to other magnets at room temperature.

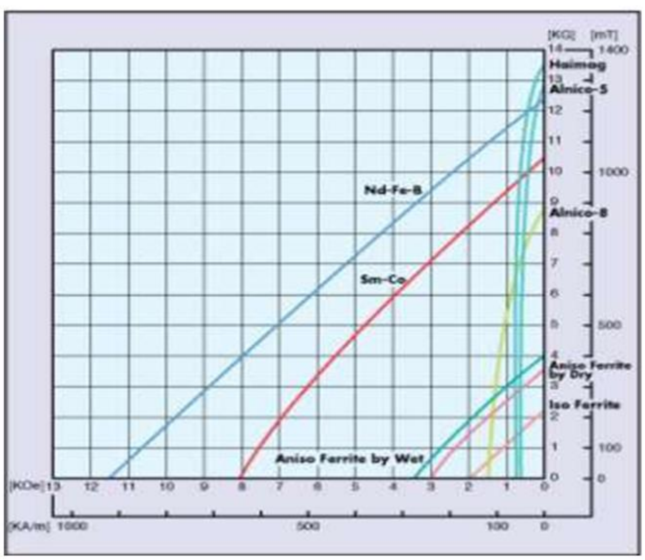

Fig. 6 BH curve of various magnets

From fig.6 B-H curve depicts attractive magnetic characteristic of Nd-Fe-B offering high flux density with the ability of resisting the property of demagnetization. This configuration becomes most important because of levitation of heavy load and rotation at high speeds exhibiting a high force directing downward on the axis If shape of magnets considered where ring or circular, they can be placed on shaft with same poles facing each other enabling repelling force to provide support to weight of turbine which minimizes use of magnets required to fulfill the idea [3]. The permanent magnets selected were the N42 grade Nd-FeB having ring shape which consist of nickel plating for strengthening and protecting the magnet.

B. Magnet Placement: Two ring shaped neodymium (NdFeB) magnets are arranged at middle of shaft by which necessary suspension between stator and rotor is obtained [4]. Similarly disc magnets having parameters 10 mm in diameter and 4 mm height are placed as one North Pole and one South Pole one after the other, along the rotor circumference of 40 cm diameter. These magnets supply the useful flux which is utilized for the power generation.

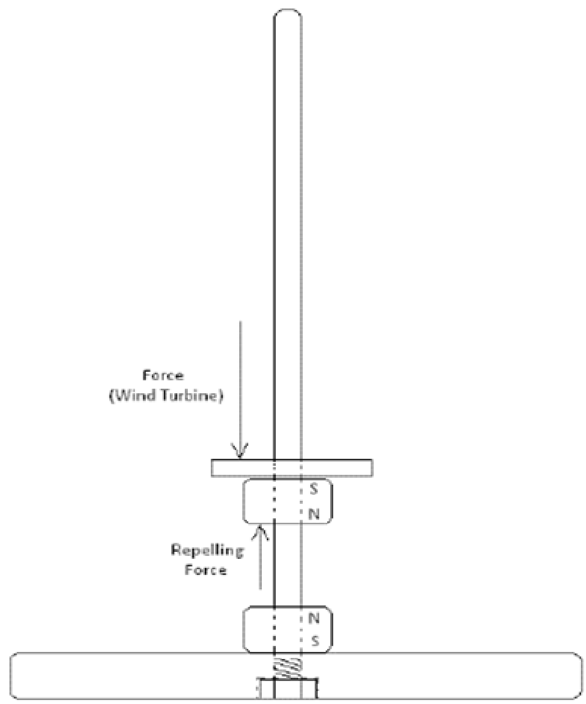

Fig. 7 Magnet Placement of NdFeB Magnets

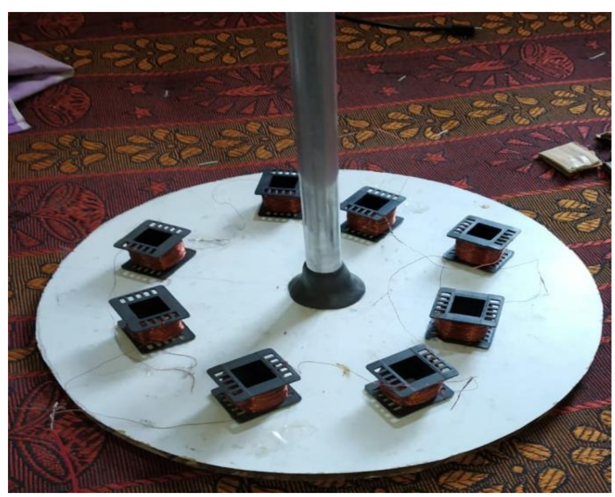

Fig. 8 Coil Arrangement

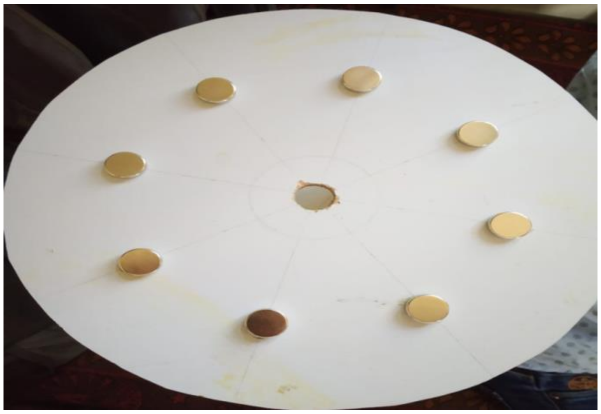

Fig. 9 Magnet Arrangement

C. Blade Design: Savonius type blade design is used because they are rugged and simplistic reducing cost. The manufacture is easier, less maintenance, and durable in harsher environments [4]. This design was obtained from aluminum sheet and due to the flexible nature of the metal sheet, desired shape was obtained. The blade was designed for height of 400mm.

Fig. 10 Blade Arrangement

VI. CONCLUSION

1. The concept of vertical axis wind turbine using magnetic levitation successfully worked. Comparing with traditional horizontal wind turbines, single Maglev turbine having large capacity gives more output.
2. The turbine efficiency is improved by utilization of magnets helping to spin with fast speed with negligible friction as it cancels out the stress on the shaft of the turbine. This modern design of turbine gives more power output with higher efficiency compared to conventional wind turbine. For avoiding the vibration of the rotor, shaft was used.
3. The standard windmills having set of 1000 windmills powers 5 lakhs homes while single maglev wind turbine is capable supplying power to 7.5 lakhs homes. From this observation we can say that a single maglev wind turbine is economical compared to Conventional wind turbine. So the doing less sunny days the hybrid power generation acts as a standalone wind turbine to meet out the demand.
4. The hybrid power generation works efficiently by generating 24V on an average and individually develops a voltage of about 12V as Solar and wind at standalonecondition.

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