IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 09, Issue 5 (May. 2019), ||S (IV) || PP 17-21

Power Generation Using Hybrid System of VAWT and Solar Panels

Ruchika S. Marghade[1], Puja D. Ingle[2], Monu B. Thakre[3], Prof. Piyush Bahad[4]

[1](Department of Electrical Engineering, JIT, RTMNU Nagpur, India)
[2](Department of Electrical Engineering, JIT, RTMNU Nagpur, India)
[3](Department of Electrical Engineering, JIT, RTMNU Nagpur, India)
[4](Department of Electrical Engineering, JIT, RTMNU Nagpur, India)

Abstract: *The principle objective of this paper is Rural Electrification via hybrid system which includes wind and solar energy. The wind turbine designed to generate electricity sufficient enough for a domestic use and solar panels are the most noticeable component of a residential solar electric system. The solar panels are installed outside the home, typically on the roof and convert sunlight into electricity. Hybrid power generation system is the combination of the two energy resources which produces power. It overcomes the limitation of individual system and produces power continuously. In this proposed system solar and wind energy are combined to take advantage of their seasonal dependency. Such a system could give reliable, pollution free power supply at low cost. This system does not need special location for its installation, as these energy resources are available abundantly all over the world. The main objective is to produce the energy in an eco-friendly way by using renewable sources of energy and to gain maximum intensity with solar and vertical axis wind turbine for maximum power generation.*

Keywords: *Vertical Axis, Wind Turbine, Horizontal Axis, Solar Panel*

I. Introduction

Now in today's world scenario competition between the various countries is growing enormously. This leads to increase in the consumption of fossil fuels at very fast rate. One day this non-renewable energy resource will deplete and also increases the pollution problem. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly and it also damages the nature. The nuclear waste is very harmful to human being also. Soon it will be completely vanishes from the earth. So there is another way to generate electricity.

1.1 Solar Energy

Solar energy available on the earth is in abundant manner and throughout the year. Solar energy is freely available. Solar system has high efficiency and very low maintenance cost makes it suitable for the hybrid system for power generation. It only has problem in cloudy condition or in rainy season.

1.2 Wind Energy

The vertical axis wind turbines are purely operates based on the drag force. The vertical axis wind turbines have less efficiency than horizontal axis wind turbines. To overcome these issues the vertical axis wind turbines are the best choice for wind energy generation at low cost.

1.3 Hybrid Power Generation System

Hybrid power generation system is the combination of the two energy resources which produces power. In this proposed system solar and wind energy are combined to take advantage of their seasonal dependency. Such a system could give reliable, pollution free power supply at low cost. This system does not need special location for its installation, as these energy resources are available abundantly all over the world.

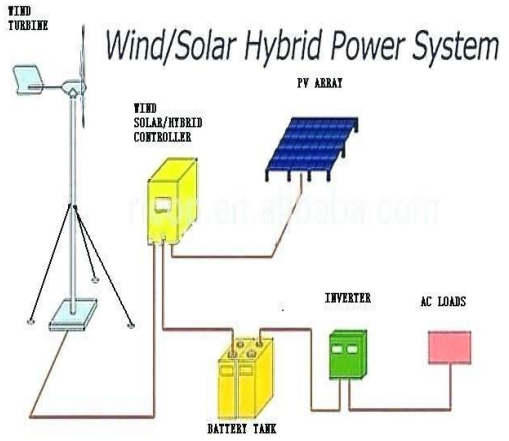

Fig.1: Block Diagram of VAWT and Solar Hybrid Power System

1.4 Description

1.4.1 Solar Panel

Solar panel also called as solar collector is a device which converts the incident radiation on it into the electrical energy. Solar panel consists of solar cells and has same diode as PN junction made from silicon and germanium semiconductor material. When the photon is impinged on the junction producing free electrons and potential gradient is developed across the junction. There are no. of such a solar cells in the solar panel and these solar panels are available in various size and wattage.

1.4.2 Vertical axis wind turbine

There are two types of wind turbine from which power is generated, one is horizontal axis wind turbine and another is vertical axis wind turbine. In this proposed system vertical axis wind turbine is used. Vertical axis wind turbines have various advantages over the horizontal axis wind turbine. The main advantage of VAWT is that it does not require to be pointed out in the direction of wind. Wind coming from both the direction will cut the blades and power is generated. Also it has low cut in speed up to 2-3 m/s. VAWT has also the advantage is that, its gearbox and other assembly can be placed on the ground, also its maintenance is easy as compared to HAWT.

1.4.3 Charge controller

The basic function of the charge controller is to control the output of both wind turbine and solar panel and to save it into battery. At various times different power is coming from both individuals, hence the required voltage is stored in battery is done by using charge controller. It simultaneously charges the battery and also gives power to the load connected in the system. It also control the overcharging of battery along with short-circuit protection. It also control the power required for the load at different time.

1.4.4 Battery

As stated earlier, such a hybrid system can be used as standalone system or it can be used in grid system. When the system is used as a standalone system battery is necessary. Battery size is depending upon the load on the system and the output of the system. To increase the battery capacity it is suitably connected in parallel or in series connection.

1.4.5 Inverter and Load

Inverter is used to convert the DC power into AC power. Though the system uses inverter some DC load does not required it, such as street lights. So as per the application, both types of load arrangement is needed. Inverter must be high rated and quality so to avoid any breakdown in the system and as per requirement of load.

II. Method Of Hybridization

For increasing the output, for fulfilling the demand of consumer there is need to hybridize the system. So for this purpose it is easier to combine solar system and wind system as they are compliment to each other. Following methodology is used for hybrid system.

2.1 SOLAR SYSTEM:

The energy produced in the sun is due to nuclear fusion. During this fusion large quantum of energy is releases and reaches the earth's surface in the form of electromagnetic radiation. Solar energy available on the earth is in abundant manner and throughout the year. Solar energy is freely available. This energy is available at low cost and without pollution. Solar system has high efficiency and very low maintenance cost makes it suitable for the hybrid system for power generation. It only has problem in cloudy condition or in rainy season.

2.2 WIND SYSTEM:

There are two types of wind turbine:

1. Horizontal axis wind turbine
2. Vertical axis wind turbine

In HAWT, the turbine blades rotate only in one direction while in VAWT, the turbine blade rotates in any direction. Due to this reason, it is advantageous to design VAWT over HAWT. As VAWT requires small space and it also gives maximum efficiency. The main advantage of VAWT is that it does not require to be pointed out in the direction of wind.

2.3 DESIGN OF VAWT

There are two types of VAWT:

1. Darrieus type VAWT
2. Savonious type VAWT

In our project, we design Savonious Type With Curved Shape VAWT. The PVC pipes are used to design blades of the turbine and Cycle Wheels are used to fix blades sequentially.

The diameter of wheel is 16 inch and height of turbine is 20 inch. The turbine pipe has diameter of 4 inch. The function of blades to trap air for rotation of turbine.

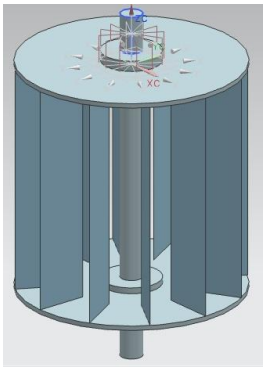

Fig.2: Savonious With Curved Shape Type VAWT

III. Working

The solar panels are used to hybridize the system. There are 4 solar panels each of 12V, 25W are used. These solar panels are installed in inclined manner at 30° to gain maximum intensity from sun to the North direction. These solar panels are connected parallel.

As "Hybrid System" means system made by combining two or more different system.

In this project, both systems i.e. wind energy and solar energy is combined to make hybrid system. The VAWT is combined with PV panels. By using such technique, we can generate maximum amount of power without using non-renewable sources of energy such as coal, fossil fuel etc.

Using individual system we get following results:

From solar panels: 19.45V approximately

From VAWT : 6.24V approximately

If we combine both the system, the voltage obtained is about 22V, 1.1A. The PMDC generator is connected to the turbine which converts rotational energy in to electrical energy. The rating of generator is 12V, 10A.The advantages of this generator is that there is no field winding losses and no field coil losses. A PMDC generator is generally lighter than wound stator machine for given power rating and have better efficiencies.

The output of the generator given to boost converter. The boost converter is works as a step up chopper. The rating of boost converter is 3 to 32V (input) and 5 to 35 V (output). It maintains 12V constant supply and given to charge controller.

The charge controller is voltage or current controller to charge battery and keep electric cells from overcharging. It directs the voltage and current hailing from the solar panels setting off the electric cell. The combine voltage in charge controller is 22V from which 12V from panel, 14.2V output for battery charge and 12V supplied to inverter.

There are 2 lead acid batteries are connected having rating of 12V, 2.5A. The battery is bidirectional connected to charge controller. From charge controller 12V DC is supplied to inverter circuit which converts DC supply to AC supply and using step up transformer 12V DC supply is step up to 230V AC.

In inverter circuit, we also connect trip circuit using two relays so that when there is overvoltage or over current in circuit this relay will trip the inverter side. So that the system will remain protected and safe.

IV. Results

A) Observation Table For Solar Panels:

Sr. No.	Time	Voltage (V)	Current (A)	Power (W)
1	8:00 am	7.51	0.02	0.15
2	9:00am	8.70	0.10	0.87
3	10:00am	15.08	1.12	16.89
4	11:00am	17.10	1.18	20.18
5	12:00noon	17.18	1.12	19.24
6	13:00 pm	17.76	1.14	20.25
7	14:00 pm	17.72	0.83	14.71
8	15:00pm	17.79	0.92	16.36
9	16:00pm	15.08	0.56	8.44
10	17:00pm	6.45	0.17	1.09
11	18:00 pm	6.44	0.11	0.70

Table N0:1: OBSERVATION TABLE FOR SOLAR PANELS

B) OBSERVATION OF VAWT:

Sr.No.	Speed (RPM)	Voltage(V) (DC)	Current (A)	Power (W)
1	10 rpm	2.5V	0.8	20
2	20 rpm	5V	0.73	16.4
3	30 rpm	8.5V	0.62	12.4
4	40 rpm	10V	0.54	9.5
5	50 rpm	12.8V	0.45	6.75
6	60 rpm	15V	0.40	5.12
7	70 rpm	17.6V	0.31	3.1
8	80 rpm	20V	0.25	2.12
9	90 rpm	22.5V	0.21	1.05
10	100rpm	25V	0.15	0.37

Table N0:2: OBSERVATION TABLE FOR SOLAR PANELS

V. Conclusion

In most cities, bridges are a faster route for everyday commute and in need of constant lighting makes this an efficient way to produce energy. Savonius VAWT can also be fabricated by cutting hollow metallic or plastic cylinder. Such a system can be implemented in remote areas as well as in the road divider using VAWT. So this system is cost effective, efficient and non-polluting. It also has long life span with less maintenance. Overall it is a reliable solution for energy crisis across globe.

VI. Future Scope

1. This model can be implemented in rural areas where power cut–off is regular
2. The voltage stability of power systems with a large share of distributed energy resources need to be studied further along with optimization of FACTS devices location
3. By using Power Converting Unit (PCU) this model can be utilized as a grid tie power system
4. Artificial intelligence techniques may also be incorporated in the proposed system to achieve better performance
5. Used widely in different fields like street lightning, telecommunication base large scale billboards and home power.

References

[1]. Ashish S. Ignole, Prof. Bhushan S. Rakhonde, "Hybrid Power Generation System Using Wind Energy and Solar Energy", International Journal of Scientific and Research Publicators, Volume 5, Issue, 3 March 2017, pp. 2250-3153.

[2]. Ashwin Dhote, Prof. Vaibhav Bankar, "Design Analysis and Fabrication of Savonious Vertical Axis Wind Turbine", International Research Journal of Engineering and Technology (IRJET), Volume: 02, Issue 03, Jun-2017, pp. 2048-2054.

[3]. Chetan Sonawane, Manav Velani, Akash Singh and Vikaskumar Tripathi, "Hybrid Power Generation Using Vertical Axis Wind Turbine And Solar Panels" , International Journal Of Advanced Research (IJAR), Issue 9, March 2017,ISSN NO:2320-5407

[4]. Dalwadi , V. Shrinet , "Optimization of solar wind hybrid system for distributed generation ", Proc. Nirma University Internatoional Conference on Engineering , IEEE Press pp 1-4 , Issue 4 June,2011

[5]. Jureczko , M. E. Z. K.M. Pawlak, and A Mezyk, "Optmisation of wind turbine blades " Journal of Material Processing Technology 167.2 (2005) : 463-471 , Issue 7 May, 2010

[6]. Kevin Bullis, "Will Vertical Turbines Make More of the Wind?" Technology Review, April 8, 2013.