Solar Wind Hybrid Power Generation with Switching Control

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ABSTRACT

In recent years, electrical energy has become one of basic need such as food, water, & clothes, etc. Now a day's electrical energy is generated by conventional energy sources. But due larger demand of electricity we have to generate more electricity, and due to this conventional energy sources are depleting day by day. So, to save these sources best alternate source is that renewable or non-conventional energy source. The renewable energy sources are wind, solar, tidal, biomass, etc. Using individually these sources provides less electricity and they are unpredictable. But by making hybrid combination of these sources more electricity is generated and it also insures the continuity of supply. The renewable hybrid energy system can include two or more energy sources. The hybrid of solar and wind is one of the most reliable and significant source of renewable energy. This paper provides additional knowledge about solar wind hybrid system and output is controlled by charge controller. Battery is used to store the energy. This generated energy is utilized for lighting the DC LED lamps. The purpose of this work is the development in solar wind hybrid power system that enhances the renewable energies in sun and wind to generate electricity. The aim is to save the non-renewable energy sources, and also to save the cost.

Keyword :-*LDR, LED, KW, DC, AC, W, V, Amp.*

1. INTRODUCTION

Electricity is most needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Now electrical energy demand is getting increasing day by day. So to fulfill demand we have to generate electrical energy more & more. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity.
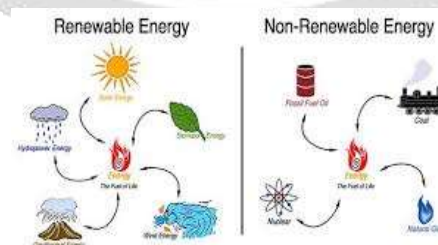

Fig. 2.1 Energy resources

The non-conventional energy resources are good alternative energy resources for the conventional energy resources. They are reliable & economical. Solar and wind are easily available. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season, so we need to overcome this drawback. We can use two energy resources so that any one

of source fails, other source will keep generating the electricity. And in good weather condition we can use both sources to generate electricity.

Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can defined as "Energy system which is designed to generate power by using two energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less wastage and lower cost.

In this proposed system solar and wind power is used for generating power. Solar and wind has good advantages than other than any other non-conventional energy sources. Both the energy sources have greater availability in all areas. It needs lower cost. There is no need to find special location to install this system. We can generate more electricity than our use, then the surplus will be exported back to the grid than we can receive bonus payment for that amount.

1.1 NECESSITY:-

The non-conventional energy resources are good alternative energy resources for the conventional energy resources. They are reliable & economical. Following are some renewable energy sources: Solar, Wind, Geo-thermal & Tidal. Electricity generation from Geo-thermal & Tide resources, they are available at specific locations. Generation of electricity from geo-thermal & tidal is done where they are available & it's needed to transmit electricity where load is located which is further become costly. Also we can generate electricity from bio-mass resources. But the sites are limited such as farm, rural areas. Also electricity generation from hydro sources, it requires very high capital cost. For this site selection is further one of the barriers. On other hand, solar & wind are easily & freely available in large amount. They can be located anywhere at load Centre also.

Solar energy is not available at night, in rainy season, cloudy days. Also there is a problem with wind mill i.e. its low wind speeds. So to combine advantages of solar & wind energy & to avoid limitations, electricity is generated by combining them & system is known as "hybrid system". We can generate more electricity than our use, then the surplus will be exported back to the grid than we can receive bonus payment for that amount.

1.2 OBJECTIVES:-
- **To generate continuous power by using Solar & Wind energy. (Day & night, during power shut down periods).**
- **To make use of this power for our department lightning purpose.**
- **To monitor & control this power as per requirement.**

1.3 ADVANTAGES OF HYBRID SYSTEM:-

- Renewable energy is sustainable and never run out.
- Fuel is freely available in large amount.
- No waste is produced so no pollution.
- Energy is available in day and night even during power off period.
- Saves other conventional energy resources.
- Running cost and maintenance cost is low.
- Silent system.

1.4 LITERATURE REVIEW:-

Solar & wind energy systems are the two renewable energy sources. They are widely used for power generation because of their availability in large amount in free of cost, pollution free and their other advantages. Hybrid solar wind energy system uses above two sources so system efficiency, power reliability are increased. System can be widely used in remote areas. Research & development in this area is still needed to improve performance & to avoid limitations of individual energy system. [1]

To fulfill increasing load demand and to save conventional energy sources, we are using renewable energy sources for power generation. Hybrid energy system is used to overcome the disadvantages of individual renewable energy source. It also overcomes the disadvantages of individual solar & wind energy system. Solar panel generates electricity by converting solar radiation into electricity by photovoltaic effect. [2]

A solar-wind hybrid system is used to achieve greater reliability. But due to the unpredictable nature of solar & wind energy, a battery can be added to our system so as to ensure the continuity of the power supply. We can store the excess power when sources generating energy in large amount. A battery can be used to provide the deficit power when the combined wind turbine and solar panel cannot meet the net power demand of the load. In bad weather conditions, when there is no output power from the hybrid system, a battery ensures the continuity of the supply by providing the deficit or required power to the load. [3]

Hybrid system considers the solar cell, wind turbine and battery, charge controller. When energy is not available then continuity of supply can be maintain with the help of battery. Hybrid system operates as an uninterruptable power supply. Charge controller provides protection to the battery and load. Battery supply continuous power during deficit power is available. [4] Solar energy available during day time because of this it's storage is important. Solar energy stored in batteries in day time and it is used as per requirement. With the help of battery continuity of supply can be maintained. Solar charge controller is a protective device. It gives protection to the battery during under charging & over charging condition because of this life of battery gets increased. Charge controller also monitors the power going into and coming out of the battery. [5]

To improve efficiency of the solar wind hybrid system, losses should be minimized. If the switching operations are not carried out time to time, then a large amount of electricity or energy is wasted. The LEDs should be kept ON whenever required, i.e. when there are less or no lumens available & should be turned off when large amount of lumens by sun are available. We cannot reduce the losses by using timer based control circuit also. Since the set ON & OFF time differs completely during the rainy & cloudy days. Thus, to eliminate the manual operations and to reduce losses, an energy efficient automatic controller using light dependent resistor (LDR circuit with MOSFET) is used. This hybrid system with automatic switching control is highly reliable, energy efficient & economical. [6]

2. BLOCK DIAGRAM:-

We have to shift from conventional to non-conventional energy resources. In this project, two energy resources i.e. wind and solar are combined. Above figure shows a proposed block diagram of a solar-wind charge controller with switching control. We are going to use the electricity for department lightning which is generated from solar-wind hybrid system. The explanation of each block is given as follows:
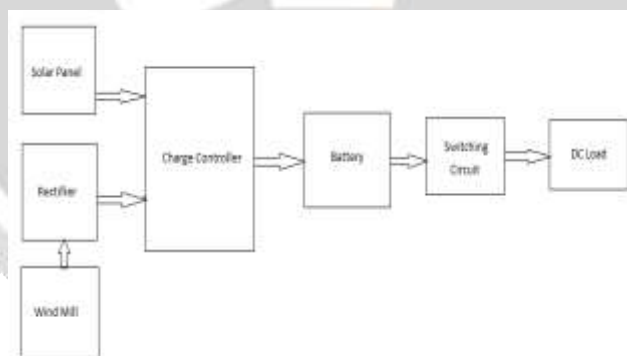
Fig.2.1 Proposed block diagram

2.1 SOLAR PANEL:-
Solar energy is present on the earth continuously and in abundant manner. It is freely available. It is pollution free. It is affordable in cost. It has low maintenance cost. Only problem with solar system it cannot produce energy in bad weather condition. But it has greater efficiency

By using solar panel we are going generate electricity. The generated electricity is in the form of D.C. (Direct current). Solar panel is also known as PV model. The output of solar panel is given to the charge controller.

Solar Panel= 1KW, 34V DC

2.2 WIND MILL :-

We use wind mill to generate electricity from wind energy. The wind energy needs less cost for generation of electricity. Maintenance cost is also low. Wind energy is present almost 24 hours of the day. Initial cost is also less. Generation of electricity from wind depends upon the speed of wind flowing.

By using wind mill we are going to generate electricity. The output of the wind mill is also 3 phase AC. The wind mill is having turbines, these turbines are also known as the blades. These blades will rotate as per the wind available. The rating of our windmill is,

<p align="center">Wind Mill=3 phase, 1KW, 24V AC</p>

2.3 WIND MILL RECTIEIER:-

A charge controller needs 2 DC inputs, one from a solar panel & another from wind turbine. So to get DC supply, 3 phase AC to DC wind mill rectifier is used.

<p align="center">Wind Mill Rectifier = 24V DC</p>

Fig 2.2 Wind Charge Controller

2.3 HYBRID CHARGE CONTROLLER:-

Charge controller is at the heart of every solar-wind system, and is required to monitor & the power going into and coming out of the battery. It must manage the power generated by the solar panel and wind mill to ensure it does not overcharge the battery. The charge controller also ensures that the connected loads don't over-discharge the battery, thereby damaging it. A charge controller, charge regulator or battery regulator limits the rate at which electric current is added to or drawn from electric batteries. It prevents overcharging and may prevent against overvoltage, which can reduce the battery performance or lifespan, & may pose a safety risk. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the battery technology, to protect battery life.

Fig. 2.3 Charge Controller

2.4 BATTERY:-

A battery is used to store the energy. The output of the charge controller is given to the battery. These batteries, used in off-the-grid solar system, can be charged during the day so that the energy is used at night. The rating of the battery is decided by the following calculations

Available battery rating = 100 amp-hrs., 24V.

Fig. 2.4 Battery &it's connections

2.6 SWITCHING CONTROL:-

We are using the switching circuit which is working on both automatic and manual control. For automatic control, we are going to use the Light Dependent Resistor (LDR). A photo resistor (or light-dependent resistor, LDR, or photocell) is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibitsby both automatically or manual switching.
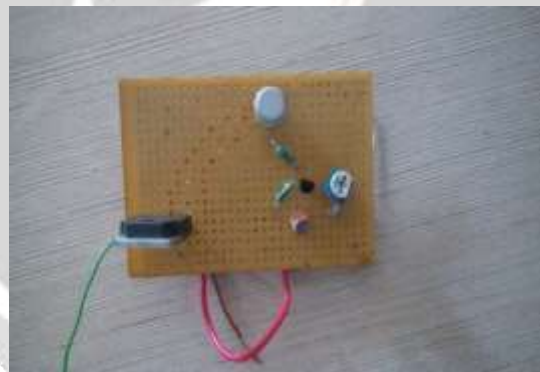
Fig. 2.5 LDR circuit using MOSFET

2.7 DC LOAD:-

The output of our battery is given to switching control. And output of switching control is given to the DC load. The DC load includes LED'S. The LED rating is 5Watt. These LED's are mounted with help of heat sink. These LED's are used for lighting purpose of electrical department.

LED rating= 5W, 12V.

Fig 2.7 Load at corridor & entrance of Department

With the help of all these equipment's, we are doing our project. This all assembly is done for the lighting purpose and to save the electricity. The generated electricity is used for the lighting of our department. Total beams of our department are 15. Each beam contains 2, LED's. These are connected in series. And with the help of switching control circuit we are going to control the LED output as per the requirement. The switching control is operated on both automatic and manual switching control. This will help to save energy and fulfill our requirement.

3. METHODOLOGY:-

3.1 RATING & TESTING:-

Rating of Solar panel:-

1000 watt, 34 volt, 30 Amp

Rating of Wind mill:-

1000 watt, 24 volt, 42 Amp

Rating of Battery:-

Working hrs. = 12 hrs. (approx.)

Battery current = Load current × working hrs.= $6 \times 12 = 76$ Amp

2 batteries of each 12volt. Total voltage is 24 volt and current is 100amp.

Rating of LED:-

5 Watt. (30 LED'S)

Rating of wire gauge:-

Total no. of beams = 15

Current of one LED = 5÷12 = 0.4amp.

Total load current = 15×0.4 = 6amp.

For 6amp. 1sq.mm wire is used.

Rating of heat sink: -

As per the LED rating it is of 5 watt / 10 watt.

Rating of MCB: -

2 MCB's each of 10amp

3.2 TEST RESULT:-

Output voltage of solar=34 volt

Output voltage of wind=24 volt

Actual battery output voltage=24 volt

Charging time of battery=10 hrs.

4. APPLICATION:-

- Electrical Department Corridor Lighting.

5. CONCLUSION:-

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. So the power is utilized where it generated. So that the transmission losses and cost is reduced. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it good, reliable and affordable solution for electricity generation. We have successfully charged the batteries as per requirement (at safe voltage and safe current). Due to charge controller, we have successfully protected batteries from over or under charging or excess load. Our project is useful for department lighting purpose which ensures power availability day and night even during power shut down periods i.e. power supply continuity is maintained.

6. FUTURE SCOPE:-
- Farm houses, guesthouses, hospitals, hostels, laboratories.
- Residential colonies and Departments general lighting.
- Library Lighting, Library corridor lighting.
- Street lighting etc.

7. REFERENCES

[1]. Wei Zhou, chengzhi Lou, Zhongshi, Lin Lu, "IEEE, Applied energy volume 87, issue2, February 2010".

[2]. Ajay S. Tiwari Department of Mechanical Engineering (Sem ME Thermal) Gandhi agar Institute of Technology Gandhi agar, India ajaytivari2631989@gmail.com International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 2 Issue: 5 1074– 1077

[3]. D.Das; Dept. of Electr. &Comput. Eng., Ohio State Univ., Columbus, OH, USA; R.Esmaili; L.Xu; D.Nichols, "31st Annual Conference of IEEE industrial electronic society, 2005.IECON2005".

 [4]. ChaitanyaMarisarla, K. Ravi Kumar Electrical and Electronics Engineering, GVP College of Engineering (A), "International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 3, September 2013 "

 [5]. Wallies Thounaojam1, V Ebenezer2, Avinash Balekundri3 1M.Tech Student, 2Associate Professor, Department of Instrumentation Technology, "International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 5, May 2014)"

[6]. Student, Electrical & Electronics Engineering, K.S.S.E.M, Bengaluru, Karnataka State, India ; #5 Assistant Professor, Electrical & Electronics Engineering, K.S.S.E.M, Bengaluru, Karnataka state, India, "InternationalJournal of Engineering Trends and Technology (IJETT) – Volume 35 Number 10 - May 2016".